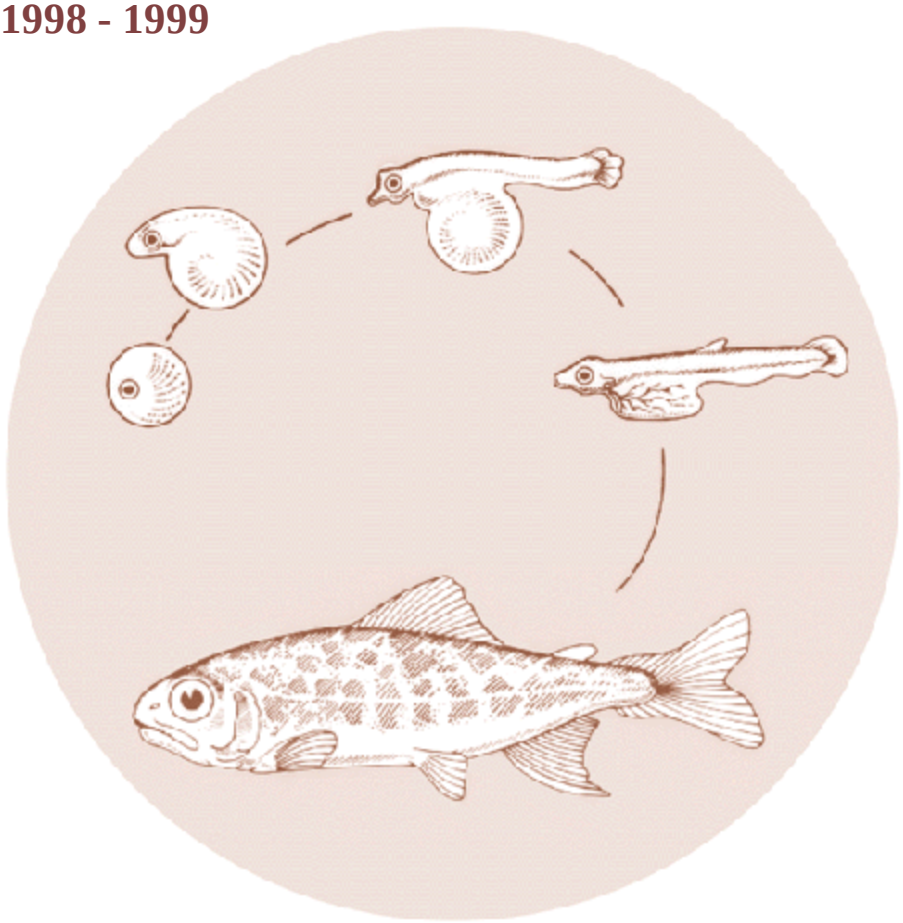
Hood River and Pelton Ladder Evaluation Studies

Annual Report
1998 - 1999



DOE/BP-00000151-1

September 2000

This Document should be cited as follows:

Olsen, Erik, Rod French, "Hood River and Pelton Ladder Evaluation Studies", Project No. 1988-05304, 212 electronic pages, (BPA Report DOE/BP-00000151-1)

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 1998-1999

Prepared by:

Erik A. Olsen

and

Rod A. French

Oregon Department of Fish and Wildlife
P.O. Box 59
Portland, OR 97207

Prepared for:

U.S. Department of Energy
Bonneville Power Administration
Division of Fish and Wildlife
P.O. Box 3621, Portland, OR 97208-3621

Project Number
1988-053-04

Contract Number
00000151-00001

September 2000

This project was funded by the Bonneville Power Administration.

CONTENTS

INTRODUCTION

The Bonneville Power Administration (BPA) funded the development of two master plans which were to outline the rationale, and general approach, for implementing a defined group of projects that would be an integral part of a comprehensive watershed goal to "Protect, enhance and restore wild and natural populations of anadromous and resident fish within the Hood River Subbasin" (Coccoli draft; Figures 1 and 2). The Hood River Production Master Plan (O'Toole and ODFW 1991a; O'Toole and ODFW 1991b) and the Pelton Ladder Master Plan (Smith and CTWSRO 1991) were completed in 1991 and subsequently approved by the Northwest Power Planning Council in 1992. Action items identified in the two master plans, as well as in a later document entitled "Hood River/Pelton Ladder Master Agreement" (ODFW and CTWSRO Undated), were designed to achieve two primary biological objectives: 1) to increase production of wild summer and winter steelhead (*Oncorhynchus mykiss*) to levels commensurate with the subbasins current carrying capacity and 2) re-establishing a self-sustaining population of spring chinook salmon (*Oncorhynchus tshawytscha*). Numerical targets for subbasin escapement, spawner escapement, and subbasin harvest are defined for each of these species in Coccoli (draft).

Several projects are presently funded by the BPA to achieve the numerical objectives for summer and winter steelhead and spring chinook salmon as defined in Coccoli (draft). Collectively they are implemented under the umbrella of what has come to be defined as the Hood River Production Program (HRPP). The HRPP is jointly implemented by the Oregon Department of Fish and Wildlife (ODFW) and The Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO).

Strategies for achieving the HRPP's biological objectives for the Hood River subbasin were initially devised based on various assumptions about 1) subbasin carrying capacity, 2) survival rates for selected life history stages, and 3) historic and current escapements of wild, natural, and hatchery stocks of anadromous salmonids to the subbasin. The Oregon Department of Fish and Wildlife began funding a Monitoring and Evaluation (M&E) project in December 1991 to collect the quantitative biological information needed to 1) more accurately assess the validity of these assumptions and 2) evaluate the proposed hatchery supplementation component of the HRPP. Bonneville Power Administration assumed funding of the M&E project in August 1992.

The M&E project has continued to evolve since its initial inception in 1991; primarily in response to biologists requests for information critical to minimizing the HRPP's impact on indigenous populations of fish. The M&E project was initially confined (i.e., from 1991-1993) to sampling anadromous salmonids escaping to an adult trapping facility operated at Powerdale Dam; which is located at River Mile (RM) 4.5 on the mainstem of the Hood River. Stock specific life history and biological data was collected to 1) monitor subbasin spawner escapements and 2) collect pre-implementation data critical to evaluating the newly proposed HRPP's potential biological impact on indigenous populations of resident fish. The scope of the M&E project was expanded in 1994 to collect the data needed to quantify 1) subbasin smolt production and carrying capacity, 2) smolt to adult survival rates, and 3) the spatial distribution of indigenous populations of summer and winter steelhead, spring and fall chinook salmon, and coho salmon. A creel was incorporated into the M&E project in December 1996 to evaluate the HRPP with respect to its defined subbasin escapement objectives for Hood River stocks of wild and hatchery summer and winter steelhead and for natural and Deschutes stock hatchery spring chinook salmon.

Data collected from 1991-1997 is reported in the following annual progress reports: Olsen et al. (1994), Olsen et al. (1995), Olsen and French (1996), Olsen et al. (1996), and Olsen and French (1999). The annual progress reports document information collected on 1) rearing densities of indigenous fish, 2) subbasin steelhead smolt production, 3) post-release survival of acclimated and direct released hatchery summer and winter steelhead smolts, 4) smolt to adult anadromous salmonid survival rates, 5) jack and adult anadromous salmonid escapements and harvest, 6) spatial distribution of adult anadromous salmonid holding, 7) selected life history patterns and morphological and meristic characteristics of wild, natural, and hatchery resident and anadromous salmonids, and 8) subbasin streamflows.

Data collected from the M&E project will provide the baseline information needed to 1) evaluate various management options for implementing the HRPP and 2) determine any post-project impacts the HRPP has on populations of fish indigenous to the subbasin. Baseline data collected to date has been used extensively to 1) provide a more biologically sound approach as to how and where hatchery smolts are released into the subbasin, 2) develop strict race specific guidelines for collecting hatchery summer and winter steelhead broodstock, 3) develop strict race specific guidelines for passing hatchery

summer and winter steelhead above Powerdale Dam, and 4) begin evaluating the HRPP relative to the programs performance goals and objectives. Information was also used in the preparation of an Environmental Impact Statement (EIS; Bonneville Power Administration 1996a; Bonneville Power Administration 1996b) which was completed in 1997. The Bonneville Power Administration prepared the EIS in compliance with federal guidelines established in the National Environmental Policy Act (NEPA).

The contract periods for fiscal year (FY) 1998 and FY 1999 are 1 October 1997 through 30 September 1998 and 1 October 1998 through 30 September 1999, respectively. Work implemented in FY's 1998 and 1999 includes: 1) estimating steelhead smolt production at selected sites in the Hood River subbasin; 2) monitoring selected life history, morphometric, and meristic characteristics of wild, natural, and hatchery stocks of anadromous salmonids; 3) estimating harvest and escapements of wild, natural, and hatchery stocks of anadromous salmonids; 4) monitoring streamflows at selected sites in the Hood River subbasin; and 5) preparing an annual progress report that summarizes data collected through FY 1999.

METHODS

Juvenile Production

Downstream migrant anadromous salmonids were trapped at rotary-screw traps (i.e., migrant trap) located in the mainstem Hood River (RM 4.5); in the West (RM 4.0), Middle (RM 1.3), and East (RM 1.0) forks of the Hood River; and in Lake Branch (RM 0.1), which is a tributary to the West Fork of the Hood River (Figure 3). Migrant traps were located at sites that would maximize both the flow into the trap and the amount of stream the trap would fish. Because of seasonal variation in streamflow, traps were periodically repositioned in the stream channel in order to optimize trapping efficiency. The mainstem migrant trap fished to a maximum depth of 1.2 meters. Migrant traps in the West, Middle, and East forks of the Hood River and in Lake Branch fished to a maximum depth of 0.8 meters. The migrant traps fished approximately 8%, 9%, 14%, 16%, and 10% of the stream channels width in the mainstem, West Fork (WFk), East Fork (EFk), Middle Fork (MFk), and Lake Branch, respectively.

Each rotary-screw trap funneled downstream migrants into a live box that was sampled on a daily basis. Sampling was usually conducted in the morning

to reduce temperature related stress. All fish were anesthetized with MS 222 (Tricaine Methanesulfonate), sorted by species, examined for fin and maxillary mark combinations, and counted. Counts of downstream migrant rainbow-steelhead (rb-st), cutthroat trout, and bull trout were made for two size categories; they included fish greater than or equal to 150 mm fork length and fish less than 150 mm fork length. Counts of downstream migrant juvenile wild chinook and coho salmon were made for three size categories; they included fish less than 50 mm fork length, fish 50-69 mm fork length, and fish greater than 69 mm fork length. A random sample of migrants was collected for each species of salmonid caught in the migrant trap and sampled for scales, measured to the nearest millimeter fork length, and weighed to the nearest 0.1 gram. Scale samples were mounted on glass slides and sent to the ODFW's research laboratory in Corvallis, Oregon, where experienced ODFW staff analyzed the scales and determined freshwater age using methods described by Borgerson (1992). Data was recorded on a computerized data entry form and keypunched into a computer database.

Downstream migrant salmonids were sampled at the mainstem migrant trap to monitor temporal distribution of migration from the Hood River subbasin. Estimates of migration timing were based on bi-weekly counts at the migrant trap. Bi-weekly counts were not adjusted for seasonal variation in trap efficiency because recapture rates were typically to low to accurately estimate trap efficiency for unique time periods.

Rainbow-steelhead were used to indirectly estimate steelhead smolt migration timing because no accurate methodology exists to visually identify rainbow trout from downstream migrant steelhead smolts. To estimate migration timing for steelhead smolts, it was also necessary to define a cutoff date in which the majority of smolts should have migrated past the trapping facilities. Based on the distribution of bi-weekly catches of migrant rb-st, the ending date for the steelhead smolt migration was fixed at 31 July.

Mark:recapture methodologies were used to estimate numbers of wild, natural, and hatchery produced anadromous salmonid smolts migrating past each downstream migrant trap. Estimates of smolt production for wild and naturally produced salmonids were limited to the upper size category because outmigrant smolts are believed to predominately be the larger size fish. A pooled

Petersen estimate with Chapman's modification (Ricker 1975) was used to estimate numbers of downstream migrants, by species and size category, as follows:

$$\hat{N} = \frac{(M+1)(C+1)}{(R+1)}$$

where

$\hat{N}$ = estimated number of downstream migrants passing the rotary-screw trap,
M = number of migrants marked and released above the rotary-screw trap,
C = total number of migrants captured at the rotary-screw trap, and
R = number of marked migrants recaptured at the rotary-screw trap.

Approximate 95% confidence intervals (C.I.) were calculated as follows (Seber 1973, cited by Lindsay et al. 1986; Ott 1977, cited by Lindsay et al. 1986):

$$95\%\ C.I. = \hat{N} \pm 2\sqrt{\hat{V}(\hat{N})} \quad \textit{and}$$

$$\hat{V}(\hat{N}) = \left(\frac{M^2\ B^2}{R^4}\right) R \left(1 - \frac{R}{M}\right) + \left(\frac{M^2}{R^2}\right) B \left(1 - \frac{B}{\hat{N} - M}\right)$$

where

$\hat{V}(\hat{N})$ = variance of estimated migrant abundance and
B = number of unmarked migrants in the recapture sample (C - R).

Downstream migrants were marked with a panjet needle-less injector. The panjet was used to shoot a narrow high speed stream of colored dye at selected fins. This process permanently marked the fin with a unique color by infusing a small amount of the colored dye below the epidermal layer. The dye color

was changed every two weeks to uniquely mark fish for defined time intervals during the sampling period. Additionally, a small piece of either the top or bottom lobe of the caudal fin was removed from fish sampled at the mainstem migrant trap. This unique mark was applied to fish sampled at the mainstem migrant trap to 1) facilitate the identification of fish marked at the mainstem trap from those marked at all the other traps, and 2) provide an additional means for identifying fish marked at the mainstem migrant trap in cases where a poorly applied color mark was not readily visible. Unique dye color and marked fin combinations were also assigned to each trap so that the origin of recaptures at the mainstem migrant trap could be determined.

Adult Trapping

An upstream migrant adult fish trap (Powerdale Dam trap) was installed at Powerdale Dam in December 1991. Powerdale Dam, which is owned and operated by PacifiCorp, is located at RM 4.5 in the mainstem Hood River (Figure 3). Powerdale Dam trap was installed in the uppermost pool of an existing fish ladder located on the east bank of the mainstem Hood River. The stop-log water intake control of the fish ladder was modified to allow water to flow through a submerged orifice into the ladder. A removable bar grate with one inch spaces between bars blocked the submerged orifice to prevent fish from exiting 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, the submerged fyke was replaced 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. There was no delay in migration timing, or other abnormal fish behavior, observed with the new design.

Beginning in late 1995, and continuing through early 1997, a new trapping facility was constructed at Powerdale Dam. The new trapping facility utilized the existing fish ladder on the east bank of Powerdale Dam to divert upstream migrant jack and adult salmonids into a temporary holding area. Fish are crowded from the temporary holding area into a fish lock where they are then elevated into the working area of the trapping facility. In the working area

of the trapping facility, fish are transitioned from the fish lock to a staging tank; from the staging tank to an anesthetic tank; and from the anesthetic tank to the sampling area. A network of tubes, located in the sampling area, are then used to transfer fish from the working area to either 1) the adult holding pens (primarily used for holding hatchery broodstock), 2) the mainstem Hood River above Powerdale Dam, or 3) a portable fish liberation tank. Prior to transfer, each jack and adult salmonid had a uniquely numbered floy tag inserted below the base of the dorsal fin. All mini-jack spring chinook salmon were tagged with an unmarked colored floy tag.

Disposition of anadromous salmonids, escaping to the Powerdale Dam trap, was determined for each species and race based on stock of origin as identified by unique fin and maxillary mark combinations. With the exception of fish collected for hatchery broodstock, all unmarked anadromous salmonids, and all Deschutes stock hatchery spring chinook salmon, were passed above Powerdale Dam. Guidelines established for implementing the hatchery supplementation program currently prohibit passing progeny of non-indigenous stocks of hatchery salmonids above Powerdale Dam. Hood River stock hatchery winter steelhead are currently passed above Powerdale Dam in numbers designed to maintain a 50:50 ratio between the numbers of wild and hatchery winter steelhead passed above the dam. Excess Hood River stock hatchery winter steelhead, and progeny of non-indigenous hatchery stocks, are either destroyed or are transported to the mouth of the Hood River to be released back into the mainstem of the Hood River. The latter action was implemented based on the premise that jack and adult salmonids released at the mouth of the Hood River would again return to the Powerdale Dam trap. Those fish returning to the Powerdale Dam trap would again be subject to the fishery below Powerdale Dam, thereby, further increasing harvest opportunities in the subbasin. Anadromous salmonids "recycled" through the fishery below Powerdale Dam were marked by inserting a uniquely numbered floy tag below the base of the dorsal fin.

The Powerdale Dam trap was checked on a daily basis from December 1991 through January 1997, except during the winter when low stream temperatures typically slow upstream migration. The new trapping facility, which was fully operational beginning in February 1997, was checked every one to three days depending on the numbers of jack and adult salmonids escaping to the facility. The flexibility to sample the new trapping facility at a lower rate was made possible by the increased capacity for holding adults. Generally, the trap was checked in the morning in order to minimize potential handling stress

associated with sampling fish during the afternoon when water temperatures are typically higher. Prior to handling, all fish were anesthetized in a holding tank charged with CO_2.

Jack and adult salmonids were identified by species, classified by sex, and examined for injuries. Injuries were categorized as either a predator scar, net mark, hook scar, or a scrape. Predator scars included both closed and open wounds. A closed wound was typically an "M" shaped marine mammal scar where scales were missing and the skin was scratched. An open wound was one in which the skin was broken. Net marks were distinguished by a raw, rubbed mark on the leading edge of the dorsal fin. Generally, marks from the net twine could be seen encircling the fish. Hook scars included both fresh and healed wounds. Fresh hook scars were any wound in the area of the mouth in which the skin was either torn or abraded. Healed hook scars were often a missing maxillary or deformed jaw. A wound was classified as a scrape if the skin was either scratched or abraded, or the scales were missing, and the wound did not appear to be the result of a predator.

Spring and fall races of chinook salmon were distinguished based on run timing, external coloration, and general appearance. Summer and winter races of steelhead were distinguished based on fin and maxillary mark combinations, 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. Subsequent to the physical examination, each fish was measured to the nearest 0.5 cm fork length, weighed to the nearest 0.1 kg, and had a numbered floy tag inserted below the base of the dorsal fin. All field data was entered on a computer form and keypunched into a database.

Fecundity was estimated for wild and hatchery summer and winter steelhead from adults used as hatchery broodstock. Females used for hatchery broodstock were air spawned and the number of eggs per female was estimated with a volumetric displacement technique. Estimates were not adjusted to account for potential egg retention.

Scale samples were collected from almost all jack and adult salmonids sampled at the Powerdale Dam trap. Samples were collected from the key scale area on each side of the fish and placed into uniquely numbered scale envelopes. Scale samples were later mounted on gummed cards and sent to the

ODFW's research laboratory in Corvallis, Oregon, where an acetate impression was made of each card. Impressions were viewed by microfiche. Experienced ODFW staff analyzed the impressions and determined origin (wild or hatchery) and life history (freshwater and ocean ages) using methods described by Borgerson (1992).

Summer and winter races of adult steelhead were classified as wild or hatchery fish based on fin and maxillary clip combinations and scale analysis. Scale analysis was used in all cases to determine if unmarked fish were of wild or hatchery origin. Unmarked wild summer and winter steelhead were assumed to be returns from wild production in the Hood River subbasin. Hatchery summer steelhead marked with a single adipose clip were assumed to be returns from subbasin hatchery production releases because all hatchery summer steelhead smolts, released into the Hood River subbasin, are marked with a single adipose clip prior to release (*see* **HATCHERY PRODUCTION**). Hatchery summer steelhead, with mark combinations other than a single adipose clip, were classified as stray hatchery fish.

Unmarked hatchery winter steelhead returning from brood releases, made prior to the 1989 brood release, were assumed to be returns from subbasin hatchery production. This assumption was made because, prior to the 1989 brood release, all hatchery winter steelhead production was released unmarked into the Hood River subbasin. Hatchery production releases in the Hood River subbasin were first marked beginning with the 1989 brood release (*see* **HATCHERY PRODUCTION**). The entire hatchery production release from the 1989 brood, as well as all subsequent hatchery brood releases, were marked prior to release in the Hood River subbasin. With the exception of the 1993 and 1994 brood releases, alternate brood releases were marked with a unique fin and maxillary mark combination. Marked hatchery winter steelhead were classified as either a subbasin or stray hatchery fish based on mark combination and age.

Scale analysis identified a number of unmarked steelhead as hatchery fish and marked steelhead as wild fish (i.e., origin unknown). The latter group includes marked wild and natural strays and Hood River stock wild steelhead which either had deformed fins or had the fins removed by sport fishers. Fin removal, by fishers, has been observed in the Hood River subbasin (personal communication on 11/17/93 with Jim Newton, ODFW, Mid-Columbia District, The Dalles, Oregon). The former group includes steelhead that were either mis-classified as hatchery fish or were unmarked hatchery fish. Unmarked

hatchery steelhead are believed to primarily be returns from subbasin hatchery production releases because of problems associated with poor marking of hatchery smolts; a problem primarily associated with the hatchery winter steelhead program. Numbers of adult steelhead in both of these groups was typically low.

Steelhead of unknown origin were not used in estimating the migration timing, sex ratio, or age structure of wild, subbasin hatchery, and stray hatchery fish. This was done in order to minimize the potential for biasing estimates by incorporating non-indigenous stocks into the sample populations. For purposes of estimating escapement, however, all marked wild steelhead were allocated as wild fish and all unmarked hatchery steelhead were allocated as Hood River subbasin hatchery production. Steelhead with regenerated scales, as well as those for which no scale samples were taken, were classified as wild, if they were unmarked, and as either subbasin or stray hatchery fish, based on mark combination. Steelhead, for which the age was unknown, were allocated into specific age categories using the ratio's observed in the corresponding category of wild, subbasin hatchery, and stray hatchery fish in which they were assigned.

Spring chinook salmon were classified as natural or hatchery fish based on fin and maxillary mark combinations and scale analysis. Scale analysis was used in all cases to determine if a fish was of natural or hatchery origin. Unmarked naturally produced spring chinook salmon were assumed to be returns from natural subbasin production. Unmarked hatchery spring chinook salmon returning from the 1986-90 and the 1993 broods were assumed to be returns from subbasin hatchery production releases. This assumption was made because only a percentage of these brood releases were marked prior to release in the Hood River subbasin. Hatchery production releases from the 1991 brood, and from brood releases subsequent to the 1993 brood release, were entirely marked. Marked hatchery spring chinook salmon were classified as either a subbasin or stray hatchery fish based on mark combination and age. Migration timing, sex ratio, age structure, and escapements were estimated using the same methods described for summer and winter steelhead.

Fall chinook salmon and coho salmon (*Oncorhynchus kisutch*) were classified as either a natural or hatchery produced fish based on fin and maxillary mark combinations and scale analysis. Unmarked fall chinook and coho salmon, classified as a wild fish based on scale analysis, were assumed to be returns

from subbasin natural production. Unmarked and marked fall chinook and coho salmon, classified as a hatchery produced fish based on scale analysis, were assumed to be strays because no hatchery fall chinook or coho salmon are released into the Hood River subbasin. Migration timing, sex ratio, age structure, and escapements were estimated using the same methods described for summer and winter steelhead.

Harvest Estimates

Creel surveys were conducted on the Hood River from 1 January 1998 through 31 December 1999 to estimate harvest of summer and winter steelhead, spring and fall chinook salmon, and coho salmon. Prior to 1 April 1998, the survey area extended from the mouth of the Hood River to the reach of stream which could be visually observed from atop Powerdale Dam; a distance of approximately 0.3 miles above Powerdale Dam. The creel was restricted to this reach of stream because the large number of geographically diverse access points, and low effort, made it logistically difficult, and economically unfeasible, to accurately estimate harvest above Powerdale Dam. Punch card estimates also indicate that the greater percentage of fish (approximately 75% or more) are harvested below Powerdale Dam. The fishery above Powerdale Dam was closed to the harvest of steelhead and salmon on 1 April 1998. Three sites are predominately utilized by fishers to gain access to the Hood River below Powerdale Dam.

Sport angling in the Hood River subbasin was subject to a variety of restrictive regulations in 1998. Steelhead and chinook and coho salmon angling was allowed year-around in the mainstem of the Hood River and its tributaries with the exception of Clear Branch and Pinnacle Creek. These two tributaries to the Middle Fork of the Hood River were closed to all angling in order to protect the indigenous population of bull trout in the Hood River subbasin. Anglers were not allowed to keep unmarked summer and winter steelhead. Summer and winter steelhead with an adipose fin clip and both marked and unmarked spring and fall chinook salmon and coho salmon could be harvested. Trout angling was allowed from 23 May until 31 October 1998 in the mainstem Hood River and all tributaries; again with the exception of Clear Branch and Pinnacle Creek. Angling for steelhead and salmon above Powerdale Dam was closed on 1 April, 1998 in recognition of the Federal Endangered Species Act listings.

Angling was allowed year-around below Powerdale Dam during the 1999 calender year. Anglers were allowed to harvest marked summer and winter steelhead and both marked and unmarked spring and fall chinook salmon and coho salmon with the exception that chinook salmon were not legal to retain from 1 May to 31 July, 1999. Trout season was open in the mainstem of the Hood River and in the East and Middle forks of the Hood River from 22 May to 31 October, 1999 for catch and release only. Trout angling was restricted to artificial flies and lures in all tributaries, and in the mainstem of the Hood River above Powerdale Dam. The West Fork of the Hood River and its tributaries were closed to all angling. Use of bait downstream from Powerdale Dam was restricted to single point hooks #1 or larger (7/16 inch gap) or multiple point hooks #4 or larger (3/9 inch gap) from 27 May to 30 November, 1999. Bag limit in the Hood River subbasin was restricted to a combined catch of two adult steelhead and adult salmon per day. The combined annual bag limit for steelhead and salmon was twenty adults.

Two levels of stratification (day type and two week period) were used in summarizing the data and estimates of catch, catch rate, and effort were determined for both strata. Sampling days were categorized as either a weekend-holiday or week day and total catch was summarized by two week periods (bi-monthly) that encompassed the first through the fifteenth and the sixteenth through the end of each month. Days assigned as holidays for 1998 and 1999 are listed in Tables 1 and 2. With only two exceptions, the total number of days sampled in any given two week period ranged from 40-78% of the weekdays and 40-100% of the weekend-holiday days in 1998, and from 42-89% of the weekdays and 40-80% of the weekend-holiday days in 1999. The sampling rate for weekend days fell below 40% in 1998 for two of the two week time periods.

Effort (i.e., total hours fished) for each sample day (H_i) was estimated by developing a pressure curve, from periodic pressure counts, and calculating the area under the curve as follows:

$$H_i = (1/2) \sum_{k=1}^{r} \left[(T_k - T_{k-1})(C_k + C_{k-1}) \right]$$

where

r = number of pressure counts per day,
C_k = angler count at the k^{th} pressure count, and
T_k = time at the k^{th} pressure count.

Table 1. Holidays summarized as weekend days in 1998.

Day	Holiday
01/01	New Years day
01/19	Martin Luther King day
02/16	Presidents day
05/25	Memorial day
07/03	Fourth of July (holiday)
07/04	Fourth of July
09/07	Labor day
11/11	Veterans day
11/26	Thanksgiving
12/25	Christmas day

Table 2. Holidays summarized as weekend days in 1999.

Day	Holiday
01/01	New Years day
01/18	Martin Luther King day
02/15	Presidents day
05/31	Memorial day
07/04	Fourth of July
07/05	Fourth of July (holiday)
09/06	Labor day
11/11	Veterans day
11/25	Thanksgiving
12/24	Christmas eve (holiday)
12/25	Christmas day
12/31	New Years eve

The first and last pressure counts were considered as zero points and were assumed to be one half hour before sunrise and one half hour after sunset. Pressure counts were conducted three to four times during the day. Times were determined by dividing the sampling day into either three or four equal length periods and conducting a pressure count at the point when angler numbers appeared to be the highest during the period. The direction of surveyor travel for the first pressure count was randomly selected. Subsequent pressure counts were made in the opposite direction of the previous count. Anglers were interviewed throughout the day to obtain catch rate information on both fishers that had completed angling as well as for those that had not completed angling. The catch rate in fish per angler hour on day i (R_i) was estimated by:

$$R_i = \sum_{j=1}^{m_i} f_{ij} \; / \; \sum_{j=1}^{m_i} h_{ij}$$

where

m_i = number of anglers interviewed on the i^{th} day,
f_{ij} = number of fish caught by the j^{th} angler on the i^{th} day, and
h_{ij} = number of hours fished by the j^{th} angler on the i^{th} day.

Total daily catch in numbers of fish on day i (TC_i) was estimated by:

$$TC_i = (R_i)(H_i)$$

Total catch for a given stratum (TC_s) was estimated by:

$$TC_s = (N/n)\sum_{i=1}^{n} TC_i$$

where

N = number of days within a stratum and
n = number of days sampled within a stratum.

Variance for the estimate of total catch in a given stratum [$V(TC_s)$] was estimated by:

$$V(TC_s) = N^2(1-(n/N))(S_b^2/n) + (N/n)\sum_{i=1}^{n}\left[(1-(\sum_{j=1}^{m_i} h_{ij}/H_i))(H_i^2)(S_w^2/m_i)\right]$$

where

$$S_b^2 = \sum_{i=1}^{n} (TC_i - \overline{TC})^2/(n-1) \qquad (i.e., \textit{between day variance}),$$

$$\overline{TC} = \sum_{i=1}^{n} TC_i/n \qquad (i.e. \textit{mean daily catch in stratum}), \textit{and}$$

$$S_w^2 = \sum_{j=1}^{m_i} (f_{ij}/h_{ij} - R_i)^2/(m_i - 1) \qquad (i.e., \textit{within day variance}).$$

Total catch in a given stratum was allocated to defined categories of fish (i.e., wild summer steelhead kept, wild summer steelhead released, subbasin hatchery summer steelhead kept, etc.) based on the proportion that each category of fish was represented in the known catch. The proportion in which a category of fish was represented in the stratum catch (p_s) was estimated as follows:

$$p_s = \sum_{i=1}^{n} \left[\frac{H_i}{\sum_{i=1}^{n} H_i} * p_i \right] \quad (\textit{includes only those days in which fish were caught})$$

where

p_i = the proportion of fish caught on the i^{th} day for a given category of fish.

Daily proportions (p_i) for a given category of fish were estimated as follows:

$$p_i = \sum_{j=1}^{m_i} fc_{ij} \Big/ \sum_{j=1}^{m_i} f_{ij}$$

where

fc_{ij} = number of fish caught by the j^{th} angler on the i^{th} day for a given category of fish.

Variance for the estimate of the proportion of fish caught in a given category, and stratum [$V(p_s)$], was estimated by:

$$V(p_s) = \frac{N - n_p}{N n_p \bar{H}_s^2} * \frac{\sum_{i=1}^{n} (H_i p_i)^2 - 2p_s \sum_{i=1}^{n} (H_i^2 p_i) + p_s^2 \sum_{i=1}^{n} (H_i^2)}{(n_p - 1)}$$

$$+ \frac{1}{N n_p \bar{H}_s^2} * \sum_{i=1}^{n} \left[H_i^2 \frac{(H_i - h_i)}{H_i} * \frac{(p_i)(1 - p_i)}{\sum_{j=1}^{m_i} f_{ij}} \right]$$

where

$\bar{H}_s$ = *mean daily effort for the stratum and*

n_p = *number of days sampled in the stratum when fish were caught* (*i.e., the basis for estimating* p_s).

Variance in the estimate of catch for a given category of fish caught within a given stratum [$V(C_s)$] was derived by:

$$V(C_s) = V(p_s)*(TC_s)^2 + V(TC_s)*(p_s)^2 - V(p_s)*V(TC_s)$$

Bi-monthly and annual estimates of total catch (TC), and the variance associated with each estimate [V(C)], were determined for a given category of fish by summing the corresponding stratum estimates. Approximate 95% confidence intervals (C.I.), for a given category of fish, were calculated as follows:

$$95\%\ C.I. = TC \pm 2\sqrt{V(C)}$$

Number of anglers fishing in each stratum was estimated by dividing total effort in the stratum by the mean estimate of effort for anglers that had completed fishing within the stratum. Bi-monthly and annual estimates of angler numbers were determined by summing the corresponding stratum estimates. Formulas used for estimating harvest and 95% confidence intervals were from Carmichael et al. (1988) and from notes dated 05/28/97 from Mary Buckman, ODFW, Corvallis, Oregon.

Streamflows

Discharge (ft^3/sec) was estimated, using the direct discharge method, at selected sites located in the Hood River subbasin. Estimates were made at sites located in the West (RM 14.3), Middle (RM 1.3), and East (RM 1.0) forks of the Hood River; in Lake Branch (RM 0.1), a tributary to the West Fork of the Hood River; in Tony Creek (RM 0.25), a tributary to the Middle Fork of the Hood River; and in Neal Creek (RM 0.1), a tributary to the mainstem of the Hood River (Figure 3).

A fiberglass tape measure was stretched across the sampling site to define one foot wide cells across the entire wetted area of the stream. The tape measure was oriented perpendicular to the stream at the point of measurement.

A depth and water velocity measurement was taken in the center of each one foot wide cell. Depth was measured to the nearest one inch using a top setting stadia rod. Velocity was measured using a Marsh-McBirney Model 2000 portable flow meter. Velocity was measured at 60% of the water depth when an individual cells water depth was less than and equal to 2.0 feet. When water depth in a cell measured more than 2.0 feet, two velocity measurements were taken per cell; one at 20% of water depth and one at 80% of water depth. To calculate velocity for cells where water depth was greater than 2.0 feet, the velocity taken at 20% of cell depth and the velocity taken at 80% of cell depth were averaged together. Flow for each one foot cell was calculated as velocity times depth. Flow in each cell was calculated and summed to estimate discharge at the sampling site. Estimates of discharge were recorded, along with the water height reading at the corresponding staff gauge maintained at the sampling site. Discharge was estimated for a wide range of staff gauge readings and a regression of the estimated discharge, at given staff gauge readings, was used to calibrate the staff gauge for estimating discharge. Staff gauges were typically read every 1-3 days.

RAINBOW-STEELHEAD

Natural Production

A juvenile migrant trap was operated at RM 4.5 in the mainstem Hood River (i.e., from 1994-1999) to estimate the number of downstream migrant rb-st leaving the Hood River subbasin. Prior to 1 August, the estimated number of rb-st annually migrating past the mainstem migrant trap ranged from 8,075-31,035 (Table 3). Estimates of the number of downstream migrant rb-st are not adjusted for production below the migrant trap and do not include numbers of downstream migrant rb-st from Neal Creek; a major tributary draining into a side channel opposite the migrant trap. Age-2 rb-st migrants ranged from 61-88% of the total estimate (Table 3).

Juvenile migrant traps were operated in the West (i.e., from 1994-1999), Middle (i.e., from 1995-1999), and East (i.e., from 1994-1999) forks of the Hood River and in Lake Branch (i.e., from 1997-1999). Prior to 1 August, the estimated number of downstream migrant rb-st annually migrating past migrant traps located in the West, Middle, and East forks of the Hood River ranged from 849-3,716, 1,050-3,397, and 1,566-3,297, respectively (Table 4). Prior to 1 August, the estimated numbers of downstream migrant rb-st annually

migrating past the migrant trap located in Lake Branch ranged from 855-1,329 (Table 4).

No accurate methodology exists to visually identify downstream migrant rb-st as either steelhead smolts, steelhead pre-smolt migrants, or resident rainbow trout. Consequently, it is difficult at this time to develop a statistical estimate of smolt production for the subbasin. An estimate of subbasin smolt production was developed by adjusting the estimate of downstream migrant rb-st based on information available from adult scale analysis (*see* **ADULT SUMMER STEELHEAD**, **Age Composition, Size, and Sex Ratio**; **ADULT WINTER STEELHEAD**, **Age Composition, Size, and Sex Ratio**) and age specific length frequency of downstream migrant rb-st (*see* **JUVENILE RAINBOW-STEELHEAD**, **Size and Weight**).

Freshwater age-0 migrant rb-st were assumed not to be smolts based on the fact that a sub-yearling smolt life history pattern has never been detected on scale samples collected from adult steelhead escaping to the Hood River subbasin. Numbers of steelhead migrating as freshwater age-1, age-2, and age-3 smolts were determined based on the ratio of rb-st migrants less than and equal to 165 mm fork length and the number greater than 165 mm fork length in the corresponding age category. The 165 mm fork length size break was developed based on the minimum size of age-3 rb-st collected at the mainstem migrant trap in 1994. The minimum size of age-3 downstream migrant rb-st was used to develop the size break based on three primary assumptions: (1) that most freshwater age-3 migrants are steelhead smolts; (2) that physiological changes associated with the smolting process are, in part, initiated by size; and (3) that the size range of freshwater age-3 migrant rb-st in the sample population is an indicator of the size range of downstream migrant steelhead smolts. In 1994, the smallest freshwater age-3 downstream migrant sampled at the mainstem migrant trap was 168 mm fork length (Olsen et al. 1995). Based on this minimum measurement, all downstream migrants greater than 165 mm fork length were assumed to be steelhead smolts.

Annual estimates of the percentage of age-3 rb-st migrants less than 166 mm fork length ranged from 5-19% from 1995-1999 (unpublished data on 3/3/2000 from ODFW, Mid-Columbia District, The Dalles, Oregon). The size range observed in 1994 was used to develop the hypothetical size break at which smoltification occurs, rather than the size ranges observed in subsequent years, because it provides the basis for adjusting the age-3

category to account for the small percentage of this age category which may migrate past the mainstem migrant trap as pre-smolts. This adjustment is made based on the fact that a small percentage of wild adult steelhead have a freshwater age-4 life history pattern (*see* **ADULT SUMMER STEELHEAD**, **Age Composition, Size, and Sex Ratio** and **ADULT WINTER STEELHEAD**, **Age Composition, Size, and Sex Ratio**). Pre-smolt steelhead are believed to rear in either the lower Hood River subbasin, or the mainstem Columbia River, prior to migration. All age-4 migrants were assumed to be steelhead smolts.

Prior to 1 August, the estimated number of steelhead smolts annually migrating past the mainstem migrant trap ranged from 6,313-25,485 smolts (1994-1999; Table 5). The developing relationship between spawner escapements (i.e., females) and smolt production (Table 6) indicates that for certain brood years the Hood River subbasin may have been at, or near carrying capacity. This preliminary hypothesis is based on the number of age-2 smolts produced from the 1996 brood in relation to the number produced from the 1993 brood. The 1996 brood produced 452% more age-2 smolts than the 1993 brood even though the female spawner escapements for the 1993 brood were 198% higher than for the 1996 brood (Table 6). Age specific subbasin smolt production from the 1996 brood was also the highest on record for each of the freshwater age 1-3 age categories even though the 1996 brood spawner escapement above Powerdale Dam was the second lowest on record.

The various physical and environmental factors which currently constrain production of steelhead in the Hood River subbasin are presently unknown, but preliminary data suggests that the primary bottlenecks may be high spring freshets and low summer streamflows. The magnitude and periodicity of these inherently natural events are undoubtedly effected by past and present land management practices on both public and private lands in the Hood River subbasin. No data is available to either compare or contrast the Hood River subbasins current carrying capacity against historical levels.

Preliminary data indicates that brood year specific estimates of smolt-to-adult survival back to the mouth of the Hood River subbasin will probably fall within the range of 4-9% for wild steelhead smolts. This preliminary estimate is based on 1) incomplete brood year specific estimates of subbasin smolt production, 2) adult returns back to the Powerdale Dam trap for the 1991-1993 broods (Table 7), and 3) the assumption that returns to the Powerdale Dam trap are a fairly accurate estimator of subbasin escapement

because unmarked steelhead are not allowed in the creel. The 1993 brood is the first brood in which smolts were estimated for all possible freshwater age categories (Table 6). Wild adult summer and winter steelhead returns from the 1993 brood will not be complete until completion of the 2000-2001 and 1999-2000 run years, respectively. The combined returns of wild adult summer and winter steelhead from the 1989-1991 broods ranged from 321-568 adult steelhead (Table 7).

Prior to 1 August, the estimated number of steelhead smolts annually migrating past migrant traps located in the West, Middle, and East forks of the Hood River ranged from 666-3,008 (1994-1999), 875-2,440 (1995-1999), and 1,044-1,978 (1994-1999), respectively (Table 8). Prior to 1 August, the estimated number of steelhead smolts annually migrating past the migrant trap located in Lake Branch ranged from 475-972 (1997-1999; Table 8).

Size and Weight

Annual estimates of mean fork length, weight, and condition factor are summarized in Tables 9-11 for downstream migrant rb-st, by age category. Mean fork length ranged from 72.7-97.0 mm, 92.0-175.7 mm, 157.9-186.8 mm, 166.8-205.7 mm for age-0, age-1, age-2, and age-3 rb-st, respectively (Table 12). Mean fork length for age-1 and age-2 migrants was typically higher at the mainstem migrant trap than at migrant traps located in the West, Middle, and East forks of the Hood River (Table 12). Mean fork length of age-1 migrants sampled at the mainstem migrant trap averaged 44 mm, 40 mm, and 37 mm greater than the mean fork length of migrants sampled at the West, Middle, and East fork migrant traps, respectively. Mean fork length of age-2 migrants sampled at the mainstem migrant trap averaged 10 mm, 5 mm, and 5 mm greater than the mean fork length of migrants sampled at the West, Middle, and East fork migrant traps, respectively. Mean fork length of age-3 migrants at the mainstem migrant trap was generally the same as in the West, Middle, and East fork migrant traps (Table 12). The previous summaries are based on means calculated from sample sizes greater than two fish.

Length x weight regressions, for downstream migrant rb-st sampled at the mainstem migrant trap in 1998 and 1999, are presented in Figures 4 and 5, respectively. Length frequency histograms, for downstream migrant rb-st sampled at the mainstem migrant trap in 1998 and 1999, are presented by age category in Figures 6 and 7, respectively.

With only two exceptions, mean fork length at the mainstem migrant trap was lower for freshwater age-1 through age-3 categories of downstream migrant wild rb-st, when compared with the mean fork length of both hatchery summer and winter steelhead smolts sampled at the mainstem migrant trap (Table 12; *see* **HATCHERY PRODUCTION**, **Size and Weight**).

Mean condition factor for freshwater age-2 and age-3 downstream migrant wild rb-st sampled at the mainstem migrant trap, was consistently lower than the mean condition factor of both hatchery summer and winter steelhead sampled at Oak Springs Hatchery (Table 11; *see* **HATCHERY PRODUCTION**, **Size and Weight**). Mean condition factor for downstream migrant wild rb-st sampled at the mainstem migrant trap, was similar to that of hatchery summer and winter steelhead smolts that were also sampled at the mainstem migrant trap (Table 11; *see* **HATCHERY PRODUCTION**, **Size and Weight**).

Smolt Migration Timing

Peak steelhead smolt migration was estimated to occur from mid-April to mid-June in both 1998 and 1999 (Figures 8 and 9).

CUTTHROAT TROUT

Natural Production

Prior to 1 August, annual counts from 1994 through 1999 ranged from 2-18 cutthroat trout at the mainstem migrant trap (Table 13). Counts at the migrant trap located in the East Fork of the Hood River indicate that natural production predominately occurs in this tributary. Prior to 1 August, annual counts from 1994 through 1999 ranged from 3-20 cutthroat trout at the migrant trap located in the East Fork of the Hood River (Table 13). Prior to 1 August, the combined annual counts from 1994 through 1999 ranged from 1-5 cutthroat trout at migrant traps located in the West and Middle forks of the Hood River (Table 13).

Four adult cutthroat trout were sampled at the Powerdale Dam trap in 1992 and three were sampled at the trap in 1997 (unpublished data on 03/10/2000 from ODFW, Mid-Columbia District, The Dalles, Oregon). The low numbers of cutthroat trout caught in the mainstem migrant trap, combined with the fact that no adult migrants were caught at the Powerdale Dam trap from 1993-1996

and from 1998-1999, indicates the anadromous form of this species may be at a severely depressed level in the Hood River subbasin.

Size and Weight

Mean fork length, weight, and condition factor was estimated for the combined sample of downstream migrant cutthroat trout captured at traps located throughout the Hood River subbasin. Data is summarized for the years 1994-1999 in Table 14. Annual estimates of mean fork length ranged from 170.1-186.3 mm from 1994-1999 (Table 14).

ADULT SUMMER STEELHEAD

Migration Timing

Wild and subbasin hatchery (Foster/Skamania stock) summer steelhead begin entering the Powerdale Dam trap in the last two weeks of March, and a given run year encompasses two calendar years for both components of the run (Tables 15 and 16). The median migration date occurred from early July to mid-August for the wild run and from early June to mid-July for the subbasin hatchery run (Table 15). Migration to the Powerdale Dam trap was completed by late April to early May of the second calendar year for both the wild and subbasin hatchery components of the run (Table 16).

Harvest, Escapement, and Survival

In 1998 and 1999, sport fishers caught and released an estimated 70 and 79 wild summer steelhead, respectively; harvested an estimated 379 and 208 subbasin hatchery summer steelhead, respectively; and caught and released an estimated 140 and 149 subbasin hatchery summer steelhead, respectively (Tables 17 and 18). Run year specific estimates of harvest ranged from 11-107 "recycled" adult hatchery summer steelhead (Appendix Table F-2). Estimates of the number of caught and released stray hatchery summer steelhead are in Appendix Tables E-1 and E-2. Peak harvest occurred from early April to late October.

Run year specific estimates of harvest for the 1996-1997 through 1998-1999 run years ranged from 350-710 subbasin hatchery summer steelhead (Appendix Table F-1) and exploitation rates ranged from 35-39% (Appendix Table F-3).

Run year specific estimates of exploitation rates on recycled hatchery summer steelhead ranged from 8-35% for the 1996-1997 through 1998-1999 run years (Appendix Table F-2).

Escapements to the Powerdale Dam trap ranged from 79-491 wild, 548-1,725 subbasin hatchery, and 4-18 stray hatchery summer steelhead for the 1992-1993 through 1998-1999 run years (Table 19). The percentage of summer steelhead with predator scars ranged from 27-43% (Appendix Table G-1). The percentage of summer steelhead with net marks and hook scars ranged from 10-15% and 2-4%, respectively (Appendix Table G-1). Disposition of adult summer steelhead collected from the Powerdale Dam trap is documented in **APPENDIX B** for the 1997-1998 through 1999-2000 run years.

All wild and subbasin (Foster stock) hatchery summer steelhead were passed above Powerdale Dam prior to 8 August 1997. No stray hatchery summer steelhead were passed above Powerdale Dam beginning with the 1992-1993 run year. The HRPP discontinued passing Foster stock hatchery summer steelhead above Powerdale Dam beginning on 8 August 1997. Adult Foster stock and stray hatchery summer steelhead removed from the run are transported downriver and released at approximately River Mile (RM) 0.2 in the mainstem of the Hood River (*see* **APPENDIX B**). Foster stock and stray hatchery summer steelhead were removed from the population of summer steelhead passed above Powerdale Dam in order to prevent non-indigenous stocks from escaping to the primary summer steelhead spawning areas in the Hood River subbasin. Adults were released at the mouth of the Hood River based on the assumption that these fish would return to the Powerdale Dam trap, thereby, providing additional harvest opportunities in the sport fishery located below Powerdale Dam. Adult hatchery summer steelhead that were recaptured at the Powerdale Dam trap were again recycled through the sport fishery. The HRPP maintained this policy through the 1998-1999 run year.

Numbers of subbasin and stray hatchery adult summer steelhead recycled through the sport fishery ranged from 29-549 adults for the 1995-1996 through 1998-1999 run years (Table 20). The percentage of adults that returned to the Powerdale Dam trap, after each successive release at the mouth of the Hood River, ranged from 25-65% for adults recycled through the sport fishery from one to five times. The discrepancy between the number of recycled adults recaptured at the Powerdale Dam trap, and the number harvested in the sport fishery, has been fairly high in some years; which leaves a large component of

the recycled adults unaccounted for in the total population of recycled adults. The ultimate destination of these recycled adults is unknown but most are believed to leave the subbasin. This assumption is based on 1) an exploitation rate that has been as low as 19% for recycled adults, 2) the limited amount of spawning observed below Powerdale Dam, 3) the limited number of pre-spawning mortalities reported as having been observed below Powerdale Dam, and 4) the return of tags recovered from adults harvested in other subbasins located in both Oregon and Washington.

Survival from smolt-to-adult return back to the Powerdale Dam trap varied widely among salt water age categories for hatchery production releases of Foster stock summer steelhead (Table 21). Brood year specific estimates of survival back to the Powerdale Dam trap ranged from 0.74-1.52% for the 1990-1993 broods. Survival back to the mouth of the Hood River subbasin was estimated to range from approximately 1.2-2.4% based on the assumption that the fishery below Powerdale Dam randomly harvested from all age categories approximately 37% of the hatchery steelhead entering the Hood River subbasin. The exploitation rate was based on the mean run year specific estimate for the 1996-1997 through 1998-1999 run years (*see* **APPENDIX F**). Preliminary data indicates that Foster stock hatchery summer steelhead may have a smolt-to-adult survival rate (i.e., by year of migration), back to the mouth of the Hood River subbasin, ranging from 50-75% lower than that of wild steelhead (unpublished data on 9/27/2000 from Fish Research, ODFW, Mid-Columbia District, The Dalles, Oregon).

The low post-release survival rate associated with Foster stock hatchery production releases may in part be attributed to the fact that estimates were derived from broods that were directly released into the Hood River subbasin from a hatchery facility located outside of the subbasin. Off station releases are believed to have a much lower post-release survival rate than hatchery smolts that are volitionally released from acclimation facilities located in the targeted subbasin. Several inter-related factors that may negatively impact post-release survival of hatchery smolts include: 1) a high in-basin post-release smolt mortality rate associated with the cumulative effects of stress prior to, and shortly after, release, 2) the percentage of hatchery smolts which residualize, 3) the possible poor homing ability of returning hatchery adults, and 4) any inherent reduction in the genetic fitness of the hatchery stock. While the exact cause, or causes, of the low rate of return are unknown, it is believed that post-release survival will be

improved by 1) developing hatchery broodstock from the indigenous population and 2) volitionally releasing hatchery smolts from acclimation facilities located in the Hood River subbasin. The current recommendation is to acclimate hatchery smolts from one to four weeks prior to release. The HRPP began developing a Hood River stock of hatchery summer steelhead from wild adult summer steelhead escaping to the Powerdale Dam trap in the 1997-1998 run year (1998 brood). Hood River stock hatchery summer steelhead smolts from the 1998 brood were acclimated prior to being volitionally released into the Hood River subbasin (*see* **HATCHERY PRODUCTION**).

Age Composition, Size, Sex Ratio, and Fecundity

Wild summer steelhead migrate mainly as freshwater age-2 and age-3 smolts and return mainly as 2-salt adults (Table 22; *see* **RAINBOW-STEELHEAD**, **Natural Production**). Virtually all subbasin hatchery smolts migrate in the year of release (i.e., freshwater age-1) and return mainly as 2-salt adults (Table 22). An estimated 2.5-9.2% of the wild adults and 0.6-3.2% of the subbasin hatchery adults returned as repeat spawners (Table 22). All but two repeat spawners, sampled from the 1997-1998 and 1998-1999 run years, had only a single spawner check (Tables 23 and 24).

Mean fork length of wild summer steelhead without a spawning check ranged from 51-60 cm for 1-salt adults, 66-73 cm for 2-salt adults, and 73-82 cm for 3-salt adults and was 79 cm for 4-salt adults (Tables 25-27). Mean fork length of subbasin hatchery summer steelhead without a spawning check ranged from 53-58 cm for 1-salt adults, 67-69 cm for 2-salt adults, and 78-80 cm for 3-salt adults and was 79 cm for 4-salt adults (Tables 25-27). The previous summaries are based on means calculated from sample sizes greater than two adults.

Mean weight of wild summer steelhead without a spawning check ranged from 1.6-2.3 kg for 1 salt adults, 3.2-3.8 kg for 2-salt adults, and 4.1-5.3 kg for 3-salt adults (Tables 28-30). Mean weight of subbasin hatchery summer steelhead without a spawning check ranged from 1.6-2.0 kg for 1 salt adults, 2.9-3.4 kg for 2-salt adults, and 4.7-5.3 kg for 3-salt adults (Tables 28-30). The previous summaries are based on means calculated from sample sizes greater than two adults.

Sex ratios varied among age categories and run year for both wild and

subbasin hatchery summer steelhead (Table 31). In general, 2-salt adults returned predominately as females and 3-salt adults predominately as males (Table 31).

Fecundity of wild summer steelhead ranged from 3,510 to 5,010 eggs per female for one 1-salt adults, 3,180 to 4,986 eggs per female for 2-salt adults, and 3,952 to 5,168 eggs per female for 3-salt adults (Table 32).

ADULT WINTER STEELHEAD

Migration Timing

Wild and hatchery adult steelhead that escape to the Powerdale Dam trap are classified as either a summer or winter run steelhead based on a combination of physical characteristics (*see* **METHODS**, **Adult Trapping**). Evaluation of these criteria is often a highly subjective process that can result in the mis-identification of an adult steelheads race. The potential for incorrectly classifying the race of an adult steelhead primarily exists during the time period extending from 1 September through 31 January, when the external physical characteristics of both races can be fairly similar. This problem has been documented on several occasions at the Powerdale Dam trap when coded wire tagged hatchery steelhead were initially classified as Hood River stock winter steelhead and then later identified as hatchery summer steelhead from the coded wire tag. There were two such cases when an adult steelhead was initially classified as a winter run fish and then later identified from the coded wire tag as B-run hatchery summer steelhead that originated from Dworshak National Fish Hatchery.

The ability to accurately differentiate between the two races of steelhead entering the Hood River subbasin is critically important in determining when the winter steelhead run first begins entering the Hood River subbasin. Wild winter steelhead are believed to begin entering the Hood River subbasin around the last two weeks of December and the first two weeks of January. Adult steelhead escaping to the Powerdale Dam trap prior to mid-December, that are classified as winter steelhead, are believed to be mis-classified summer steelhead. To date, only one wild adult steelhead potentially falls into this category (Table 33). Numbers of Hood River stock hatchery winter steelhead, escaping to the Powerdale Dam trap prior to mid-December, have increased in the last two run years (Table 33). The earliest returning Hood River stock

hatchery winter steelhead sampled at Powerdale Dam was documented during the 1998-1999 run year (unpublished data on 9/21/2000 from Fish Research, ODFW, Mid-Columbia District, The Dalles, Oregon). The adult steelhead was collected from the Powerdale Dam trap on 21 September, 1998.

The Hood River stock was initially developed from wild adult steelhead that were collected from the Powerdale Dam trap and classified as winter steelhead. The extent to which wild summer steelhead were inadvertently incorporated into the hatchery broodstock creates the possibility that the hatchery program has produced a certain number of early returning summer/winter hybrids. There is currently no definitive methodology for determining if wild summer steelhead were ever used for hatchery winter steelhead broodstock, but there is one documented case when a hatchery summer steelhead was mis-classified as a winter steelhead and collected for winter steelhead broodstock. The race and origin of the adult summer steelhead was determined from its coded wire tag (unpublished data on 9/21/2000 from Fish Research, ODFW, Mid-Columbia District, The Dalles, Oregon). The hatchery summer steelhead was ultimately not used for winter steelhead broodstock because it died before it could be spawned, but the migration timing of the Hood River stock of hatchery winter steelhead suggests that some level of hybridization does occur in the hatchery winter steelhead program.

Hood River stock hatchery winter steelhead in the 1994-1995 through 1996-1997 run years did not escape to the Powerdale Dam trap in any significant numbers until late January and early February and only two hatchery winter steelhead were recorded prior to December for the 1991-1992 through 1996-1997 run years (Table 33). The latter is significant primarily because hatchery returns from the 1991-1992 through 1993-1994 run years were progeny of Big Creek stock of hatchery winter steelhead; which is an early returning winter steelhead stock. By comparison, seventeen Hood River stock hatchery winter steelhead in the 1998-1999 run year had escaped to the Powerdale Dam trap prior to mid-December.

The winter steelhead run year may encompass two calendar years for both wild and hatchery components of the run (Table 33). The median migration date occurred from early April to early May for wild winter steelhead and from early February to late April for subbasin hatchery winter steelhead. Migration to the Powerdale Dam trap was completed for both wild and hatchery components of the run by mid-July of the second calendar year (Table 33).

The wild run of winter steelhead migrated into the Hood River subbasin later than the subbasin hatchery run for the 1991-1992 through 1994-1995 run years but run timing was similar for both wild and subbasin hatchery components of the run returning in the 1995-1996 through 1998-1999 run years. The shift in run timing for the subbasin hatchery component of the run is attributed to the use of wild Hood River stock winter steelhead as hatchery broodstock. Previous runs of subbasin hatchery winter steelhead were comprised of adults returning from Big Creek stock hatchery winter steelhead releases in the subbasin. The native Hood River stock has a much later run timing than the Big Creek stock of winter steelhead which is an early run hatchery stock. The 1994-1995 run year is the last run year in which adult hatchery winter steelhead returned from Big Creek stock hatchery releases in the Hood River subbasin.

Harvest, Escapement, and Survival

In 1998 and 1999, sport fishers caught and released an estimated 209 and 246 wild winter steelhead, respectively; harvested an estimated 208 and 151 subbasin hatchery winter steelhead, respectively; and caught and released an estimated 94 and 109 subbasin hatchery winter steelhead, respectively (Tables 34 and 35). Run year specific estimates of harvest ranged from 0-27 "recycled" adult hatchery winter steelhead (Appendix Table F-2). Estimates of the number of caught and released stray hatchery winter steelhead are in Appendix Tables E-1 and E-2. Peak harvest occurred from early February to late April.

Run year specific estimates of harvest for the 1996-1997 through 1998-1999 run years ranged from 172-317 subbasin hatchery winter steelhead (Appendix Table F-1) and exploitation rates ranged from 33-39% (Appendix Table F-3). Run year specific estimates of the exploitation rate on recycled hatchery winter steelhead ranged from 0-8% for the 1996-1997 through 1998-1999 run years (Appendix Table F-2).

Escapements to the Powerdale Dam trap ranged from 206-698 wild, 107-638 subbasin hatchery, and 3-23 stray hatchery winter steelhead for the 1991-1992 through 1998-1999 run years (Table 36). The percentage of winter steelhead with predator scars ranged from 23-53% (Appendix Table G-1). The percentage of winter steelhead with net marks and hook scars ranged from 2-7% and 0.8-5%, respectively (Appendix Table G-1). Disposition of adult winter steelhead,

collected from the Powerdale Dam trap, is documented in **APPENDIX C** for the 1997-1998 through 1998-1999 run years.

All wild and hatchery winter steelhead were passed above Powerdale Dam prior to the 1992-1993 run year. The HRPP discontinued passing subbasin (Big Creek stock) and stray hatchery winter steelhead above Powerdale Dam beginning with the 1992-1993 run year. Adult winter steelhead removed from the run were transported downriver and released at approximately RM 0.2 in the mainstem of the Hood River (*see* **APPENDIX C**; Olsen et al. 1999). Big Creek stock and stray hatchery winter steelhead were removed from the population of winter steelhead passed above Powerdale Dam in order to prevent non-indigenous stocks from escaping to the primary winter steelhead spawning areas in the Hood River subbasin. Adults were released at the mouth of the Hood River based on the assumption that these fish would return to the Powerdale Dam trap, thereby, providing additional harvest opportunities in the sport fishery located below Powerdale Dam. Adult winter steelhead recaptured at the Powerdale Dam trap were again recycled through the sport fishery. The HRPP maintained this policy through the 1998-1999 run year.

All Hood River stock hatchery winter steelhead escaping to the Powerdale Dam trap, prior to the 1994-1995 run year, were recycled through the sport fishery (Olsen et al. 1999). Hood River stock hatchery winter steelhead were passed above Powerdale Dam in very limited numbers beginning with the 1994-1995 run year and were passed above Powerdale Dam in numbers designed not to exceed that of the wild run beginning with the 1995-1996 run year (Olsen et al. 1999). Hood River stock hatchery winter steelhead not passed above Powerdale Dam were recycled through the sport fishery below Powerdale Dam along with the stray hatchery winter steelhead. Adults recaptured at the Powerdale Dam trap were again recycled through the sport fishery. The HRPP restricted the number of Hood River stock hatchery winter steelhead passed above Powerdale Dam through the 1998-1999 run year.

Numbers of subbasin and stray hatchery adult winter steelhead recycled through the sport fishery ranged from 83-311 adults for the 1992-1993 through 1998-1999 run years (Table 37). The percentage of adults returning to the Powerdale Dam trap, after each successive release at the mouth of the Hood River, ranged from 19-54% for adults recycled through the sport fishery from one to three times. The discrepancy between the number of adults recaptured at the Powerdale Dam trap, and the number harvested in the sport fishery, has

been fairly high in all years; which leaves a large component of the recycled adults unaccounted for in the total population. Where recycled adults ultimately end up is unknown but most are believed to leave the subbasin. This assumption is based on 1) an exploitation rate that ranged from 0-16% for recycled adults, 2) the limited amount of spawning observed below Powerdale Dam, 3) the limited number of pre-spawning mortalities reported as having been observed below Powerdale Dam, and 4) the return of tags recovered from adults harvested in other subbasins located in both Oregon and Washington (unpublished data on 9/21/2000 from ODFW, Mid-Columbia District, The Dalles, Oregon).

Survival from smolt-to-adult return back to the Powerdale Dam trap varied widely among salt water age categories for hatchery production releases of both the Hood River and Big Creek stocks of winter steelhead (Table 38). Brood year specific estimates of survival ranged from 0.19-1.54% for the 1992-1994 Hood River stock brood releases. Survival back to the mouth of the Hood River subbasin was estimated to range from approximately 0.30-2.4% based on the assumption that the fishery below Powerdale Dam randomly harvested from all age categories approximately 36% of the hatchery steelhead entering the Hood River subbasin. The exploitation rate was based on the mean run year specific estimate for the 1996-1997 through 1998-1999 run years (*see* **APPENDIX F**). Preliminary data indicates that Hood River stock hatchery winter steelhead have a smolt-to-adult survival rate (i.e., by year of migration), back to the mouth of the Hood River subbasin, ranging from 50-75% lower than that of wild steelhead (unpublished data on 9/27/2000 from Fish Research, ODFW, Mid-Columbia District, The Dalles, Oregon).

The low post-release survival rate associated with Hood River stock hatchery production releases may in part be attributed to the fact that estimates were derived from broods that were directly released into the Hood River subbasin from a hatchery facility located outside of the subbasin. Off station releases are believed to have a much lower post-release survival rate than hatchery smolts that are volitionally released from acclimation facilities located in the targeted subbasin. Several inter-related factors that may negatively impact post-release survival of hatchery smolts include: 1) a high in-basin post-release smolt mortality rate associated with the cumulative effects of stress prior to, and shortly after, release, 2) the percentage of hatchery smolts which residualize, 3) the possible poor homing ability of returning hatchery adults, and 4) any inherent reduction in the

genetic fitness of the hatchery stock. While the exact cause, or causes, of the low rate of return are unknown, it is believed that post-release survival will be improved by volitionally releasing hatchery smolts from acclimation facilities located in the Hood River subbasin. The current recommendation is to acclimate hatchery smolts for one to four weeks prior to release. The HRPP began acclimating Hood River stock hatchery winter steelhead beginning with the 1995 brood release (*see* **HATCHERY PRODUCTION**). An estimate of post release survival will be available upon completion of the 1999-2000 run year when complete adult returns will be available for the 1995 brood release.

Age Composition, Size, Sex Ratio, and Fecundity

Wild winter steelhead predominately migrate as freshwater age-2 and age-3 smolts and return mainly as 2- and 3-salt adults (Table 39). Subbasin hatchery winter steelhead migrate as freshwater age-1 and age-2 smolts and return mostly as 2- and 3-salt adults (Table 39). Repeat spawners at the Powerdale Dam trap comprised 2.6-8.9% of the wild winter steelhead run and 0-3.5% of the Hood River stock hatchery winter steelhead run (Table 39). One repeat spawner in the 1997-1998 run year and seven repeat spawners in the 1998-1999 run year had multiple spawning checks (Tables 40 and 41).

Mean fork length of wild adult winter steelhead without a spawning check ranged from 49-54 cm for 1-salt adult, 59-68 cm for 2-salt adults, and 75-80 cm for 3-salt adults (Tables 42-44). Mean fork length for subbasin hatchery adult winter steelhead without a spawning check ranged from 44-57 cm for 1-salt adults, 62-75 cm for 2-salt adults, and 75-80 cm for 3-salt adults (Tables 42-44). The previous summaries are based on means calculated from sample sizes greater than two adults.

Mean weight of wild adult winter steelhead without a spawning check ranged from 1.2-1.6 kg for 1-salt adults, 1.8-3.5 kg for 2-salt adults, and 4.5-5.4 kg for 3-salt adults (Tables 45-47). Mean weight of subbasin hatchery adult winter steelhead without a spawning check ranged from 0.8-1.2 kg for 1-salt adults, 2.4-4.4 kg for 2-salt adults, and 4.5-5.2 kg for 3-salt adults (Tables 45-47). The previous summaries are based on means calculated from sample sizes greater than two adults.

Although sex ratio as a percentage of females varied markedly among age classes, wild adult winter steelhead returned mostly as females (Table 48).

Subbasin hatchery adult winter steelhead mainly returned as males in age category 1/2 and as females in age category 1/3 (Table 48). Both wild and subbasin hatchery repeat spawners returned mainly as females.

Fecundity of wild winter steelhead was estimated at 2,900 eggs per female for one 1-salt adults and ranged from 1,737 to 6,480 eggs per female for 2-salt adults, 2,493 to 6,525 eggs per female for 3-salt adults, and 3,240 to 4,632 eggs per female for 4-salt adults (Table 38). Fecundity of Hood River stock hatchery winter steelhead ranged from 1,590 to 6,201 eggs per female for 2-salt adults, 2,560 to 7,920 eggs per female for 3-salt adults, and was estimated at 5,280 eggs per female for 4-salt adults (Table 49).

JACK AND ADULT SPRING CHINOOK SALMON

Migration Timing

Natural spring chinook salmon begin entering the Powerdale Dam trap in early May and subbasin hatchery spring chinook salmon begin entering the trap in late April (Table 50). Median date of migration for jack and adult salmon (i.e., excluding mini-jack salmon) occurred between the first two weeks of June and the last two weeks of August for the natural run, and between the last two weeks of May and the first two weeks of June for the subbasin hatchery run. Both natural and subbasin hatchery components of the run were completed by late September to early November (Table 50).

Harvest, Escapement, and Survival

In the sampling area, sport fishers harvested an estimated 19 unmarked and subbasin hatchery adult spring chinook salmon in 1998 (Tables 51 and 52). No spring chinook salmon were harvested in 1999 (Tables 53 and 54). Estimates of the number of caught and released stray hatchery spring chinook salmon are in Appendix Tables E-3 and E-4. Spring chinook salmon were harvested from late April through late September in 1998 and from early May through early July in 1999 (Appendix Table F-4). Estimates of harvest are available for previous run years in Appendix Table F-4.

Escapements to the Powerdale Dam trap ranged from 20-96 natural, 37-461 Carson stock hatchery, 0-280 Deschutes stock hatchery, and 0-15 stray hatchery jack and adult spring chinook salmon for the 1992-1999 run years (Table 55). Mini-jack escapements to the Powerdale Dam trap ranged from 0-14 natural and

0-183 Deschutes stock hatchery spring chinook salmon for the 1992-1999 run years (Table 55). The percentage of spring chinook salmon with predator scars ranged from 4-30% (Appendix Table G-1). The percentage of spring chinook salmon with either a net mark or hook scar ranged from 0-5% and 0-3%, respectively (Appendix Table G-1).

Estimates indicate that smolt-to-adult survival is fairly low for both the Carson and Deschutes stocks of hatchery fish released into the Hood River subbasin (Table 43). Post-release survival from smolt to jack and adult return back to the Powerdale Dam trap averaged approximately 0.18% for the Carson stock and ranged from 0.04% to 0.18% (preliminary estimate) for the Deschutes stock. Survival back to the mouth of the Hood River, when adjusted for an estimated 25% exploitation rate, was estimated at 0.25% for the Carson stock and ranged from 0.06% to 0.25% (preliminary estimate) for the Deschutes stock.

Survival from smolt to returning jack and adult salmon back to the Powerdale Dam trap varied widely among age categories for hatchery production releases of both the Carson and Deschutes stocks of spring chinook salmon (Table 56). Brood year specific estimates of survival ranged from 0.011-0.172% for the 1991 and 1993-1994 Deschutes stock brood releases. Brood year specific estimates of smolt to returning jack and adult salmon are unavailable for wild spring chinook salmon.

Age Composition, Size, and Sex Ratio

Scale analysis indicates that naturally produced spring chinook salmon migrate as both subyearling and yearling smolts and return as four year old adults (Table 57). The subyearling smolt life history pattern appears to be unique to the natural Hood River run, which was developed from Carson stock hatchery production releases in the Hood River subbasin (*see* Olsen et al. 1994 and Olsen et al. 1995). What mechanism might cause naturally produced spring chinook salmon to migrate as subyearling smolts in the Hood River subbasin, and how progeny of Deschutes stock hatchery spring chinook salmon will ultimately adapt to the Hood River subbasin, is unknown.

Mean fork length of natural adult spring chinook salmon that migrated as yearling smolts was estimated at 49 cm for age-3 jacks and ranged from 72-87 cm for age-4 adults and 79-95 cm for age-5 adults (Tables 58-60). Mean

fork length for subbasin hatchery produced spring chinook salmon ranged from 52-56 cm for age-3 jacks, 72-83 cm for age-4 adults, and 82-92 cm for age-5 adults (Tables 58-60). The previous summaries are based on means calculated from sample sizes greater than two adults.

Mean weight of natural adult spring chinook salmon that migrated as yearling smolts was estimated at 4.9 kg for age-3 jacks and ranged from 4.2-7.2 kg for age-4 adults and 6.2-9.3 kg for age-5 adults (Table 61-63). Mean weight for subbasin hatchery spring chinook salmon ranged from 1.6-1.9 kg for age-3 jacks, 4.3-5.3 kg for age-4 adults, and 6.7-8.7 kg for age-5 adults (Tables 61-63). The previous summaries are based on means calculated from sample sizes greater than two adults.

Sex ratio as a percentage of females varied widely for age-4 and age-5 adult spring chinook salmon (Table 64). Age-4 and older natural and hatchery adults returned mostly as females (Table 64).

JACK AND ADULT FALL CHINOOK SALMON

Migration Timing

Natural fall chinook salmon begin entering the Powerdale Dam trap from early July to early August and stray hatchery fall chinook salmon begin entering the trap in early to late September (Table 65). Median date of migration occurred between the last two weeks of July and the last two weeks of September for the natural run, and during the month of September for the stray hatchery run. Both natural and stray hatchery components of the run were completed by early November (Table 65).

Harvest and Escapement

Fall chinook salmon were sampled in the creel from late September through late November in 1998 and 1999 (Tables 66 and 67). In the sampling area, sport fishers harvested an estimated 2 and 2 unmarked fall chinook salmon in the 1998 and 1999 run years, respectively (Tables 66 and 67). No stray fall chinook salmon were harvested in either the 1998 or 1999 run years. Estimates of harvest are available for previous run years in Appendix Table F-4.

Escapements to the Powerdale Dam trap ranged from 6-37 natural and 0-6

stray hatchery fall chinook salmon for the 1992-1999 run years (Table 68).

Age Composition, Size, and Sex Ratio

Scale analysis indicates that naturally produced fall chinook salmon primarily migrate as sub-yearling smolts and return as four and five year old adults (Table 69). Mean fork length of natural fall chinook salmon, that migrated as sub-yearling smolts, ranged from 73-90 cm for age-4 adults and was estimated at 88 cm for age-5 adults (Tables 70-72). Mean weight of natural fall chinook salmon that migrated as sub-yearling smolts ranged from 5.9-8.7 kg for age-4 adults and was estimated at 8.4 kg for age-5 adults (Tables 73-75). The previous summaries are based on means calculated from sample sizes greater than two adults.

Sex ratio as a percentage of females varied widely for age-4 and age-5 adult fall chinook salmon (Table 76). Age-4 and older natural adults returned mostly as females (Table 76).

JACK AND ADULT COHO SALMON

Migration Timing

Natural coho salmon begin entering the Powerdale Dam trap as early as the first two weeks of September (Table 77). The median date of migration for natural coho salmon occurred around late September to early October (Table 77). The natural run was completed by late October to early December. The early entry time of natural coho salmon suggests returns may be progeny of hatchery strays (*see* Olsen et al. 1995). No information is available to test this hypothesis because of the lack of any information on the temporal distribution of migration for the original wild run of coho salmon in the Hood River subbasin.

Escapement

Escapements to the Powerdale Dam trap ranged from 0-23 natural and 7-80 stray hatchery coho salmon for the 1992-1999 run years, (Table 78).

Age composition, Size, and Sex Ratio

To date, all natural coho salmon escaping to the Powerdale Dam trap have been adults (Table 79). Mean fork length ranged from 58-70 cm for natural adult coho salmon and from 38-40 cm and 58-72 cm for jack and adult stray hatchery coho salmon, respectively (Tables 80-82). Mean weight ranged from 2.5-4.8 kg for natural adult coho salmon and from 0.7-0.8 kg and 3.0-4.6 kg for jack and adult stray hatchery coho salmon, respectively (Tables 83-85). Sex ratio, as a percentage of females, ranged from 0-64 percent for natural adult coho salmon (Table 86). The previous summaries are based on means calculated from sample sizes greater than two adults.

HATCHERY PRODUCTION

Introduction

The present day HRPP was designed in part based on procedures and guidelines established from a hatchery winter steelhead program first implemented by the Oregon Department of Fish and Wildlife (ODFW) in the fall of 1990. The ODFW's fledgling hatchery winter steelhead program had two primary objectives. They were to 1) collect biological data critical to developing and implementing the HRPP, which at the time was under consideration for BPA funding and 2) determine the feasibility of implementing the subbasins hatchery winter steelhead program with hatchery broodstock collected from the indigenous wild population. The ODFW was successful in achieving both objectives but the hatchery program lacked the facilities to achieve the desired production numbers. The hatchery winter steelhead program was subsequently subsumed by the Hood River Production Program (HRPP) upon its implementation in August 1992. The HRPP provided funding to design, construct, and operate the facilities needed to fully implement the hatchery summer and winter steelhead and spring chinook salmon programs as proposed for the Hood River subbasin in the Hood River master plans (O'Toole and ODFW 1991a, O'Toole and ODFW 1991b, and Smith and CTWSRO 1991). Hatchery facilities that were funded by the HRPP primarily included: 1) an adult collection facility at Powerdale Dam (Figure 3); 2) an adult holding pond and spawning facility (Parkdale facility) located in the Middle Fork Hood River drainage near Parkdale (Figure 3); 3) incubation facilities at the Parkdale facility and at Oak Springs Hatchery (OSH) and Round Butte Hatchery (RBH); 4) juvenile rearing facilities at OSH and Pelton ladder; and 5) acclimation

ponds in the West, Middle, and East forks of the Hood River subbasin. Oak Springs and Round Butte hatcheries and Pelton ladder are satellite hatchery facilities located in the Deschutes River subbasin. Construction of these facilities was completed by the fall of 1998. A description of how the HRPP has evolved into the present day program is provided in Olsen et al. (1994), Olsen et al. (1995), and Olsen et al. (1996).

Broodstock Collection

Indigenous populations of wild summer and winter steelhead in the Hood River subbasin are currently supplemented with hatchery smolts under the umbrella of the HRPP. The hatchery winter steelhead program was the first to be implemented with collection of hatchery broodstock from the 1990-1991 run year. The hatchery summer steelhead program was implemented beginning with the collection of wild summer steelhead from the 1997-1998 run year. The hatchery summer steelhead program was implemented at the later date primarily because the HRPP's hatchery facilities were not yet complete, but because it also provided the opportunity to fully develop the hatchery winter steelhead program before attempting to implement an additional program.

The HRPP implemented the hatchery summer steelhead program using the Hood River subbasins indigenous population of wild summer steelhead for hatchery broodstock. Hatchery broodstock was collected entirely from wild summer steelhead escaping to the Powerdale Dam trap in the 1997-1998 and 1998-1999 run years. The HRPP spawned 7-14 female adult summer steelhead from the 1997-1998 through 1998-1999 run years and collected from 30,218-39,417 eggs (Table 87). The total number of summer steelhead spawned from the 1997-1998 through 1998-1999 run years ranged from 9-25 adults (Table 87). Hatchery broodstock was collected randomly from throughout the entire run.

The precursor to the current hatchery winter steelhead program in the Hood River subbasin was first implemented on a limited scale in the fall of 1990. Hatchery broodstock was collected from both wild and Big Creek stock hatchery winter steelhead escaping to the Powerdale Dam trap in the 1990-1991 run year. The hatchery program discontinued utilizing Big Creek stock hatchery winter steelhead for broodstock after the first year of the program. The HRPP developed the programs current hatchery winter steelhead broodstock entirely from wild winter steelhead escaping to the Powerdale Dam trap in the 1991-1992 through 1994-1995 run years. Hood River stock hatchery winter steelhead

escaping to the Powerdale Dam trap were first incorporated into the hatchery broodstock beginning with the 1995-1996 run year (*see* Olsen et al. 1996). The HRPP continued to utilize Hood River stock hatchery winter steelhead for hatchery broodstock through the 1998-1999 run year. Beginning with the 1991-1992 run year, winter steelhead used for hatchery broodstock have been collected randomly from throughout the entire run, and the number of Hood River stock hatchery winter steelhead collected for broodstock has been limited to a maximum of 50% of the total number collected for the hatchery program.

The number of female adult winter steelhead spawned from the 1990-1991 through 1998-1999 run years ranged from 3-29 adults (Table 88). Estimated egg take for the 1991-1999 broods ranged from 11,858-112,302 eggs (Table 88). The total number of winter steelhead spawned from the 1990-1991 through 1998-1999 run years ranged from 4-62 adults (Table 88).

Production Releases

Numbers of hatchery steelhead smolts released into the Hood River subbasin ranged from 60,993 to 99,973 Foster stock summer steelhead from the 1987-1998 broods and from 38,034 to 62,135 Hood River stock winter steelhead from the 1992-1998 broods (Tables 89 and 90). The first release of Hood River stock hatchery summer steelhead occurred in 1999 with the release of 19,513 smolts from the 1998 brood (Table 89).

Numbers of hatchery salmon smolts released into the Hood River subbasin ranged from 75,205 to 170,004 Deschutes stock spring chinook salmon from the 1991-1997 broods (Table 91). No spring chinook salmon smolts were released into the Hood River subbasin from the 1992 brood (*see* Olsen et al. 1995).

The HRPP releases all hatchery summer and winter steelhead and spring chinook salmon as full term smolts. Annual production releases for summer and winter steelhead and spring chinook salmon are currently maintained at a level that is significantly lower than the HRPP's proposed target levels. The hatchery programs have been operated below the HRPP's proposed target production levels due to the combined problems associated with 1) the low escapements of wild adult summer and winter steelhead and 2) the staggered time frame associated with bringing all the HRPP's hatchery production facilities on line.

Hatchery operation guidelines currently restrict the number of wild summer and winter steelhead that can be collected for hatchery broodstock to a maximum of 25% of the wild run escaping to Powerdale Dam. The low escapements of wild summer and winter steelhead in the 1993-1994 through 1998-1999 run years made it difficult in most run years to collect sufficient numbers of wild adults to achieve the HRPP's target production level and still follow the above guideline. No similar guideline restricted the collection of natural spring chinook salmon for hatchery broodstock because the hatchery guideline only applies to indigenous populations of wild fish. The indigenous population of wild spring chinook salmon was deemed to have gone extinct and one goal of the HRPP is to restore a self sustaining population in the Hood River. The primary problem associated with the hatchery spring chinook salmon program is that the combined escapements of natural and hatchery spring chinook salmon are insufficient to achieve both the annual subbasin spawner escapement objective (Coccoli draft) and still meet the hatchery programs broodstock collection needs.

The chronically low annual escapements of wild summer and winter steelhead and natural and hatchery spring chinook salmon to the Hood River subbasin necessitated the development of interim hatchery production levels that would achieve the biological objectives for the Hood River subbasin (Coccoli draft) while still providing recreational harvest opportunities in sport and tribal fisheries. It was also decided that the interim production levels would need to be designed in such a manner that all three hatchery programs could be implemented while the HRPP's hatchery production facilities were systematically being brought on line. To meet these criteria, the proposed interim production level for the HRPP was set at 60,000 Foster stock summer steelhead; 20,000 Hood River stock summer steelhead; 30,000 Hood River stock winter steelhead; and 125,000 Deschutes stock spring chinook salmon smolts. The HRPP would continue to release Foster stock hatchery summer steelhead smolts under the above scenario until annual production releases of Hood River stock hatchery summer steelhead smolts could be sustained at levels which would result in adult returns sufficient to meet both the harvest and spawner escapement objectives. Foster stock hatchery smolts would be released below Powerdale Dam under the proposal and no returning adults would be passed above Powerdale Dam (*see* **ADULT SUMMER STEELHEAD**, **Migration, Escapement, and Survival**). The HRPP’s proposed target production level at full implementation is 150,000 Hood River stock summer steelhead; 85,000 Hood River stock winter steelhead; and 250,000 Deschutes stock spring chinook salmon smolts (O'Toole

and ODFW 1991a).

Juvenile hatchery summer and winter steelhead are reared at OSH. Hatchery spring chinook salmon were entirely reared at Round Butte Hatchery beginning with the 1993 brood. Juvenile hatchery spring chinook salmon from the 1994 brood were the first to be finish reared in the newly completed Pelton ladder facility. Acclimation facilities were used to hold smolts prior to their volitional release into the Hood River subbasin beginning with the 1998 brood release of Hood River stock summer steelhead (Table 89), the 1995 brood release of Hood River stock winter steelhead (Tables 38 and 90), and the 1994 brood release of Deschutes stock spring chinook salmon (Tables 56 and 91).

Post-Release Survival

A juvenile migrant trap was operated in the mainstem Hood River (RM 4.5) to estimate numbers of downstream migrant hatchery smolts leaving the Hood River subbasin. Estimates ranged from 13,118 to 47,281 summer steelhead smolts and 10,456 to 48,661 winter steelhead smolts from the 1993-1998 brood releases (Table 92). The estimated number of migrants passing the mainstem migrant trap, as a percentage of the total production release, ranged from 35.6% to 84.0% for hatchery summer steelhead smolts and from 27.5% to 93.1% for hatchery winter steelhead smolts (Table 92). The percentages increased markedly beginning with the 1998 brood release of Hood River stock summer steelhead and the 1995 brood release of Hood River stock winter steelhead (Table 92). Both hatchery brood releases were the first to be acclimated prior to their volitional release into the Hood River subbasin, and it is believed that this release strategy may have been the primary factor contributing to the increase.

The recapture rate on smolts that were both marked and released at the mainstem migrant trap was consistently lower for both hatchery summer and winter steelhead than for wild rb-st; with the one exception of hatchery summer steelhead marked and released in 1999 (Appendix Table A-1). The lower recapture rate for hatchery summer and winter steelhead smolts is believed to be caused by a combination of 1) a significantly higher rate of handling mortality on hatchery fish and 2) altered migratory behavior caused by handling stress. This assumption is based on visual observation of the condition of downstream migrant hatchery smolts. Hatchery summer steelhead smolts sampled at the mainstem migrant trap from 1994-1997 generally appeared

to be in much poorer condition than downstream migrant wild rb-st, and both hatchery summer and winter steelhead smolts were generally more susceptible to handling stress (i.e., a higher rate of handling mortality). Both problems were particularly evident with the production releases of Skamania stock hatchery summer steelhead from 1994-1997. In particular, downstream migrant Skamania stock hatchery summer steelhead generally exhibited considerable descaling and many were observed with deformed opercles. The deformed opercle was unique to the Skamania stock hatchery summer steelhead production releases and a typically low but unknown percentage of the hatchery smolts were observed with this deformity in each of the first four years we operated the mainstem and West Fork migrant traps.

A combination of both poor condition, as well as the stress associated with the hauling of hatchery fish for off station release into the Hood River subbasin, is believed to have put hatchery smolts at or near their level of tolerance for stress. The general quality of summer steelhead smolts appears to have benefitted from the use of Hood River stock wild summer steelhead as hatchery broodstock. The improved recapture rates observed in both 1998 and 1999 (Appendix Table A-1) would also indicate that acclimation facilities are helping to minimize stress related problems associated with the transport of subbasin hatchery production from out-of-basin hatchery facilities to the Hood River subbasin. In general, however, the additional stress of trapping and handling at the migrant traps is believed to have increased either 1) the potential handling mortality or 2) the possibility of modifying migration behavior.

Any artificial reduction in the mark:recapture ratio would have the net effect of inflating the population estimate. To minimize the potential for biasing the population estimates for hatchery steelhead, the mark:recapture ratio for downstream migrant wild rb-st was used as the expansion factor for estimating numbers in each hatchery production group. The mark:recapture ratio for downstream migrant wild rb-st was used as the expansion factor based on the assumption that it more accurately reflects trapping efficiency at the mainstem migrant trap. There was also no reason to assume that either hatchery production group should have a lower rate of recapture than the wild rb-st. This assumption was based on the fact that all three groups migrated past the mainstem migrant trap during the same time period. Using the mark:recapture ratio for downstream migrant wild rb-st to estimate numbers of downstream migrant hatchery summer and winter steelhead at the mainstem

migrant trap also represents a more conservative approach for estimating hatchery production leaving the Hood River subbasin.

Size and Weight

Mean length, weight, and condition factor were estimated for two size groups of Hood River stock hatchery winter steelhead reared at Oak Springs Hatchery (OSH). Hatchery winter steelhead production at OSH was graded into the two size groups prior to marking the juveniles in late October. The two groups were classified as medium- and large-sized fish and were comparable to medium- and large-sized groups sampled from previous broods. No juvenile hatchery winter steelhead from the 1996 brood were grouped into a size category comparable to the small-sized group sampled from the 1993 brood. Juveniles in this small-sized group were all progeny of the last hatchery production spawning on 9 June 1993 (Olsen et al. 1995). Juveniles from the last hatchery production spawning in 1993 were markedly smaller than juveniles in the rest of the hatchery production group so they were held separately in a small circular tank and categorized as the small-sized group. No similar situation occurred with the 1996 brood.

Medium- and large-sized groups of hatchery winter steelhead were reared in separate raceways at OSH. Hatchery production was graded into the two size groups to provide hatchery personnel the ability to implement a modified feeding schedule targeting the smaller juveniles in the production group. The modified feeding schedule was designed to accelerate the growth of smaller juveniles so that the entire production group would be more uniformly smolt-sized upon release into the Hood River subbasin.

Hood River stock hatchery summer steelhead smolts (1998 broods) sampled at OSH averaged 190 mm fork length (Table 93). Mean condition factor for Hood River stock hatchery summer steelhead (1998 brood) sampled at OSH (Table 93) was markedly higher in the year of release than for the corresponding calender year estimate for downstream migrant wild rainbow-steelhead sampled at the mainstem migrant trap (*see* **JUVENILE RAINBOW-STEELHEAD**, **Size and Weight**). The mean condition factor at OSH was estimated at 1.17 for the 1998 brood (1999 release year) and was estimated at 0.99 for downstream migrant wild rb-st sampled during the 1999 calender year (Table 11). Mean condition factor for Hood River stock hatchery summer steelhead smolts sampled at the mainstem migrant during the 1999 calender year (1998 brood) was estimated at 0.99

(Table 95).

Hood River stock hatchery winter steelhead smolts (1997-1998 broods) sampled at OSH averaged from 174-195 mm fork length for the medium-sized group and from 189-193 mm fork length for the large-sized (Table 94). Mean condition factor for Hood River stock hatchery winter steelhead (1997-1998 broods) sampled at OSH (Table 94) was markedly higher in the year of release than for corresponding calender year estimates for downstream migrant wild rainbow-steelhead sampled at the mainstem migrant trap (*see* **JUVENILE RAINBOW-STEELHEAD**, **Size and Weight**). The mean condition factor at OSH ranged from 1.08-1.19 for medium- and large-sized groups from the 1997-1998 broods (1998-1999 release years) and ranged from 0.97-0.99 for downstream migrant wild rb-st sampled during the 1998-1999 calender years (Table 11). Mean condition factor for Hood River stock hatchery winter steelhead smolts sampled at the mainstem migrant during the 1998-1999 calender years (1997-1998 broods) ranged from 0.96-1.00 (Table 95). Length x weight regressions for medium- and large-sized groups of hatchery winter steelhead are presented in Figures 10 and 11.

STREAMFLOWS

In 1998, staff gauges were used to monitor streamflows from early April to early November in the West, Middle, and East forks of the Hood River, in Lake Branch, and in Tony and Neal creeks. Estimates of discharge (ft^3/sec) ranged from 7-82 cfs, 53-438 cfs, and 70-423 cfs in the West, Middle, and East forks of the Hood River, respectively (Figure 12). Estimates of discharge ranged from 38-389 cfs, 6-36 cfs, and 11-133 cfs in Lake Branch, Tony Creek, and Neal Creek, respectively (Figure 13).

In 1999, staff gauges were used to monitor streamflows from mid-May to early November in the West, Middle, and East forks of the Hood River, in Lake Branch, and in Tony and Neal creeks. Estimates of discharge ranged from 6-80 cfs, 61-286 cfs, and 99-516 cfs in the West, Middle, and East forks of the Hood River, respectively (Figure 14). Estimates of discharge ranged from 34-219 cfs, 2-47 cfs, and 6-36 cfs in Lake Branch, Tony Creek, and Neal Creek, respectively (Figure 15).

The Oregon Water Resources Department (OWRD) holds an Instream Water Right (IWR) on the East Fork Hood River in trust for the people of Oregon. The IWR was granted for the purpose of supporting aquatic life and minimizing

pollution. The IWR measurement point is slightly upstream of the confluence of the East and Middle forks of the Hood River and establishes a minimum flow for specific time periods of the year (Olsen et al. 1995).

No permanent gauging station exists at the site of the IWR that can be used to monitor whether or not the IWR is being met. Observations made prior to 1994 indicated that the IWR was probably not being met during certain times of the year. A gauging station was installed in the East Fork of the Hood River in 1992, by the OWRD, and jointly monitored by both the OWRD and the ODFW from 1992-1994 (Olsen et al. 1995) and by ODFW from 1996-1999. Data collected to date indicates that the IWR is not always being met, at least during periods when the gauging station was monitored (Figure 16; Olsen et al. 1995). This was particularly the case from 1992-1994 when streamflows during the summer months were typically well below the IWR (Olsen et al. 1995). Flows during the summer months of 1998-1999 fluctuated around the IWR (Figure 16). Full benefits associated with the HRPP may not be completely realized unless the IWR is met on an annual basis.

SUMMARY

This report summarizes the life history and production data collected in the Hood River subbasin during FY 1998 and 1999. Included is a summary of jack and adult life history data collected at the Powerdale Dam trap on eight complete run years of winter steelhead, spring and fall chinook salmon, and coho salmon, and on seven complete run years of summer steelhead. Also included are summaries of 1) the hatchery winter steelhead broodstock collection program; 2) hatchery production releases in the Hood River subbasin; 3) the number of outmigrant wild rainbow-steelhead and hatchery summer and winter steelhead smolts; and 4) streamflow at selected locations in the Hood River subbasin. Data will be used in part to 1) evaluate the HRPP with respect to its impact on indigenous populations of resident and anadromous salmonids, 2) refine spawner escapement objectives to more accurately reflect subbasin carrying capacity, and 3) refine estimates of subbasin smolt production capacity to more accurately reflect current and potential subbasin carrying capacity. Baseline information on indigenous populations of resident and anadromous salmonids will continue to be collected for several years prior to full implementation of the Hood River Production Program.

Figure 1. Map of the Hood River subbasin.

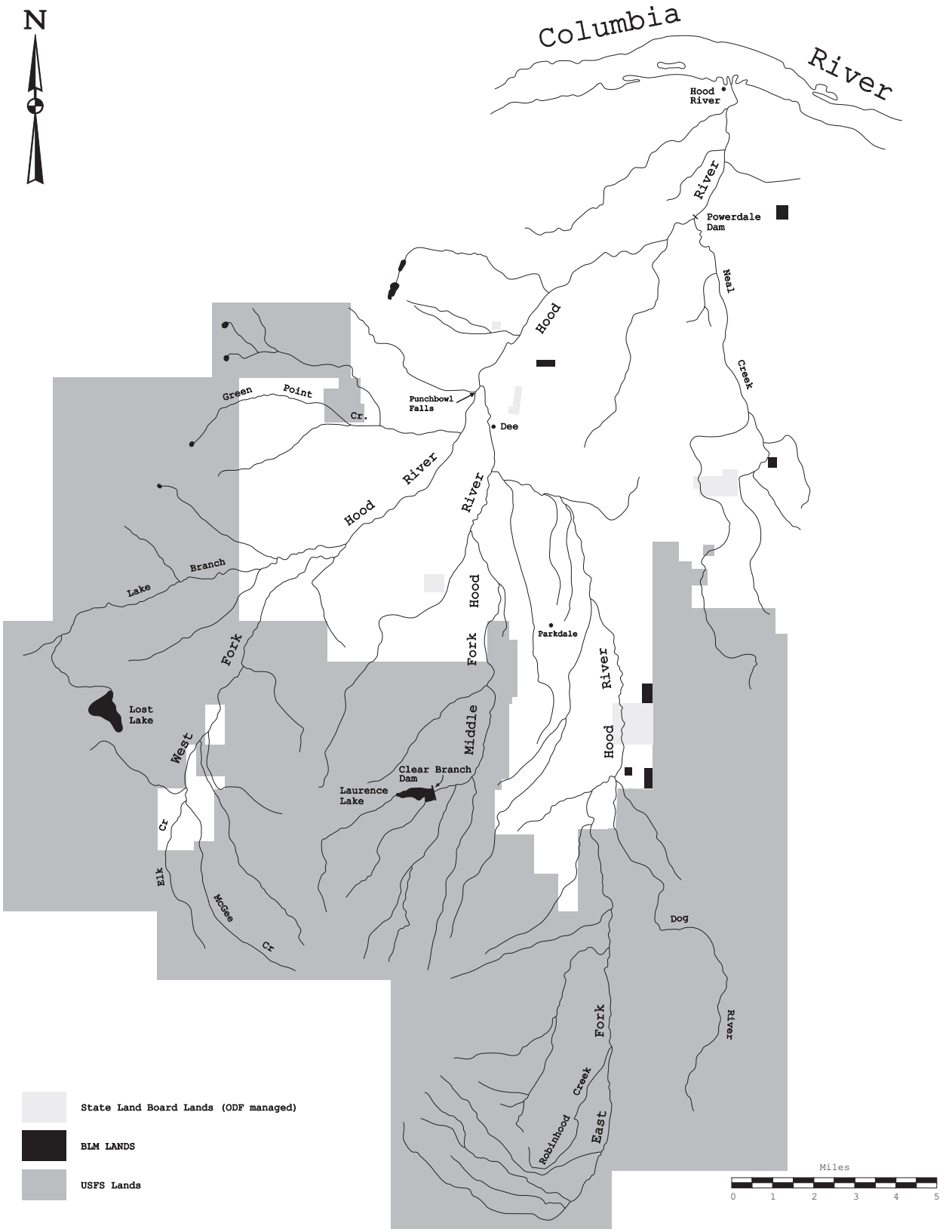


Figure 2. Location of public lands in the Hood River subbasin.

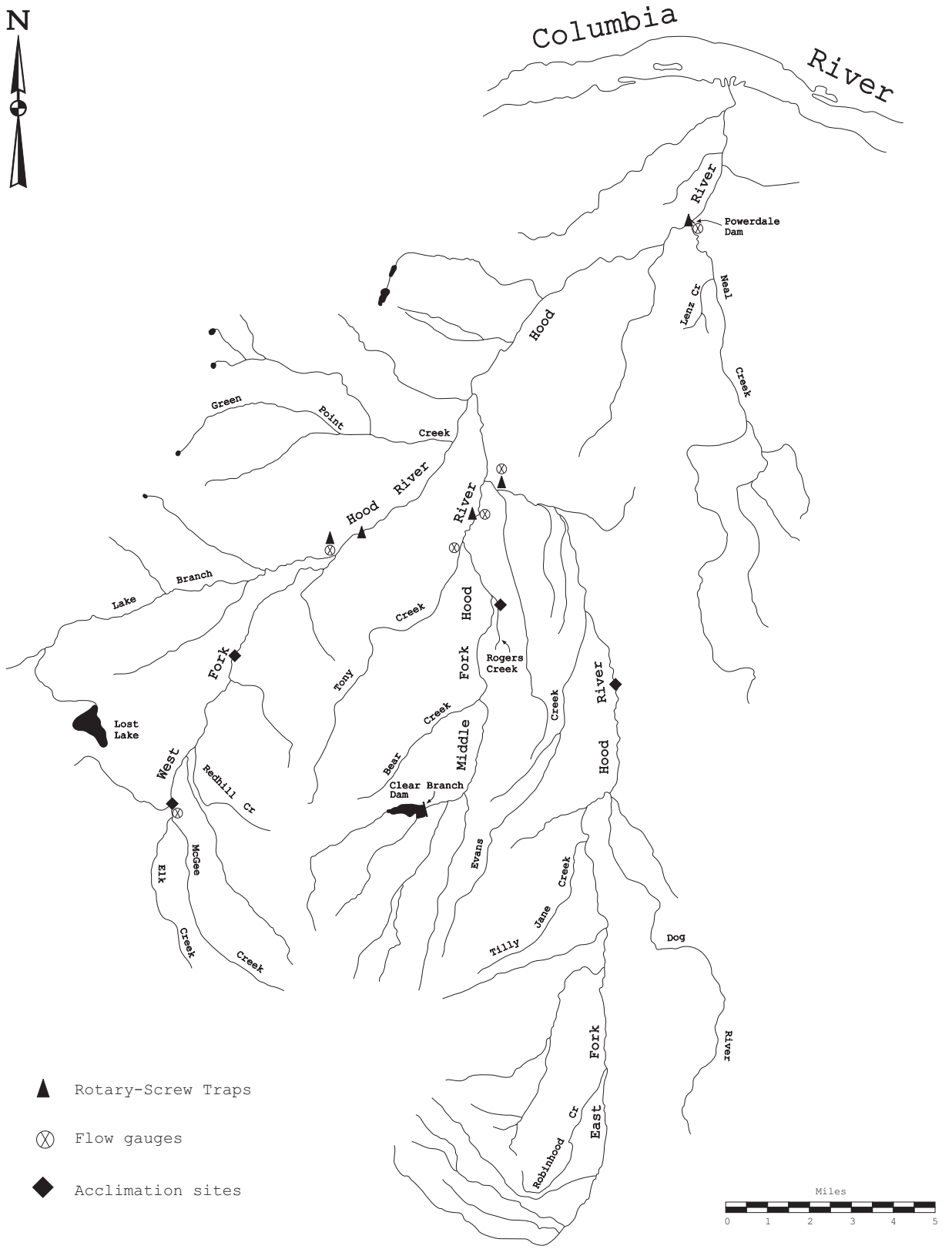


Figure 3. Location of sampling sites in the Hood River subbasin.

Table 3. Estimated number of wild downstream migrant rainbow-steelhead to a migrant trap located at RM 4.5 in the mainstem Hood River, by age category. Estimate is for migrants greater than or equal to 150 mm fork length. (Percent of total migrants is in parentheses. Population estimators and sampling periods are in **APPENDIX A**.)

Year	Estimated number[a] of migrants	95% C.I.	Estimated number by age category[b] Age 1	Age 2	Age 3	Age 4
1994	9,554	4,314 - 14,794	2,201 (23.0)	6,340 (66.4)	1,013 (10.6)	0 (0)
1995	8,075	642 - 15,508	1,799 (22.3)	4,918 (60.9)	1,358 (16.8)	0 (0)
1996	8,742	6,179 - 11,305	1,050 (12.0)	6,164 (70.5)	1,506 (17.2)	22 (0.3)
1997	15,838	10,904 - 20,771	2,102 (13.3)	11,867 (74.9)	1,869 (11.8)	0 (0)
1998	31,035	22,801 - 39,269	1,622 (5.2)	26,852 (86.5)	2,561 (8.3)	0 (0)
1999	23,942	17,212 - 30,672	86 (0.4)	21,004 (87.7)	2,852 (11.9)	0 (0)

[a] Estimates do not include juvenile steelhead migrants from Neal Creek, a major mainstem Hood River tributary draining into a side channel opposite the mainstem migrant trap.

[b] No age 0 migrants have been sampled that were greater than or equal to 150 mm fork length.

Table 4. Estimated number of wild downstream migrant rainbow-steelhead, by age category, to migrant traps located in the West, Middle, and East forks of the Hood River and to Lake Branch, a tributary to the West Fork of the Hood River. Estimate is for migrants greater than or equal to 150 mm fork length. (Percent of total migrants is in parentheses. Population estimators and sampling periods are in **APPENDIX A.**)

Location, year	Estimated number of migrants	95% C.I.	Estimated number by age category				
			Age 0	Age 1	Age 2	Age 3	Age 4
West Fork,[a]							
1994	3,550	1,803 - 5,297	23 (0.7)	1,787 (50.3)	1,693 (47.7)	47 (1.3)	0 (0)
1995	1,474	481 - 2,467	0 (0)	43 (2.9)	1,041 (70.6)	390 (26.5)	0 (0)
1996	849	27 - 1,671	0 (0)	13 (1.5)	562 (66.2)	274 (32.3)	0 (0)
1997	1,724[b]	*c* - 4,208	0 (0)	0 (0)	1,554 (90.1)	170 (9.9)	0 (0)
1998	3,716	352 - 7,080	0 (0)	147 (4.0)	2,301 (61.9)	1,268 (34.1)	0 (0)
1999	2,042	402 - 3,682	0 (0)	21 (1.0)	1,835 (89.9)	186 (9.1)	0 (0)
Middle Fork,							
1995	1,238	549 - 1,927	0 (0)	85 (6.8)	1,026 (82.9)	127 (10.3)	0 (0)
1996	1,050	439 - 1,661	0 (0)	88 (8.3)	700 (66.7)	262 (25.0)	0 (0)
1997	2,673	1,893 - 3,453	0 (0)	16 (0.6)	2,564 (95.9)	93 (3.5)	0 (0)
1998	--	--	--	--	--	--	--
1999	3,397	*c* -10,320	0 (0)	37 (1.1)	2,880 (84.8)	480 (14.1)	0 (0)
East Fork,							
1994	1,625	1,191 - 2,059	9 (0.6)	1,670 (41.2)	872 (53.7)	74 (4.5)	0 (0)
1995	2,240	435 - 4,045	0 (0)	645 (28.8)	1,462 (65.3)	133 (5.9)	0 (0)
1996	--	--	--	--	--	--	--
1997	1,566	1,061 - 2,071	0 (0)	69 (4.4)	1,456 (93.0)	41 (2.6)	0 (0)
1998	1,873	374 - 3,372	0 (0)	59 (3.1)	1,775 (94.8)	39 (2.1)	0 (0)
1999	3,297	1,465 - 5,129	0 (0)	0 (0)	2,877 (87.3)	420 (12.7)	0 (0)
Lake Branch,							
1997	855	*c* - 2,060	0 (0)	0 (0)	646 (75.6)	209 (24.4)	0 (0)
1998	1,329	168 - 2,490	0 (0)	20 (1.5)	952 (71.6)	357 (26.9)	0 (0)
1999	954	641 - 1,267	0 (0)	8 (0.8)	793 (83.2)	145 (15.2)	8 (0.8)

[a] Estimates at the West Fork trap include numbers migrating from Lake Branch.

[b] Estimate derived based on migrants marked at the Lake Branch migrant trap and recaptured at the West Fork trap.

[c] Lower limit computes to less than zero.

Table 5. Estimated number of wild steelhead smolts migrating from the Hood River subbasin, by age category. (Percent of total migrants is in parentheses.)

Year	Estimated number[a] of smolts	Freshwater age			
		Age 1	Age 2	Age 3	Age 4
1994	7,573	1,233 (16.3)	5,327 (70.3)	1,013 (13.4)	0 (0)
1995	6,313	1,138 (18.0)	4,037 (64.0)	1,138 (18.0)	0 (0)
1996	6,789	840 (12.4)	4,700 (69.2)	1,226 (18.1)	23 (0.3)
1997	13,222	1,402 (10.6)	10,091 (76.3)	1,729 (13.1)	0 (0)
1998	25,485	896 (3.5)	22,284 (87.5)	2,305 (9.0)	0 (0)
1999	18,842	86 (0.5)	16,034 (85.1)	2,722 (14.4)	0 (0)

[a] Estimates do not include juvenile steelhead migrants from Neal Creek, a major mainstem Hood River tributary draining into a side channel opposite the mainstem migrant trap.

Table 6. Number of wild and hatchery adult summer and winter steelhead passed above the Powerdale Dam trap and subbasin smolt production in the Hood River subbasin, by brood year.

Brood year	Numbers passed above the Powerdale Dam trap			Smolt production[a]	Freshwater age category			
	Males	Females	Total		Age 1	Age 2	Age 3	Age 4
1990		--		*b*	--	--	--	0
1991		--		*b*	--	--	1,013	0
1992		--		*b*	--	5,327	1,138	23
1993	799	1,769	2,568	6,496	1,233	4,037	1,226	0
1994	530	1,124	1,654	7,567	1,138	4,700	1,729	0
1995	838	1,179	2,017	13,236	840	10,091	2,305	0
1996	432	593	1,025	*c*	1,402	22,284	2,722	--
1997	750	1,232	1,982	*c*	896	16,034	--	--
1998	295	562	857	*c*	86	--	--	--

[a] Estimates do not include juvenile steelhead migrants from Neal Creek, a major mainstem Hood River tributary draining into a side channel opposite the mainstem migrant trap.

[b] Brood year specific estimates of subbasin smolt production cannot be made prior to the 1993 brood.

[c] Brood year specific estimates of subbasin smolt production are incomplete.

Table 7. Combined returns of wild adult summer and winter steelhead to the Powerdale Dam trap, by brood year and freshwater age category. Brood years are bold faced for those years in which brood year specific estimates are complete. Estimates are based on returns from the 1992-1993 through 1998-1999 summer steelhead run years and the 1991-1992 through 1998-1999 winter steelhead run years.

Brood year	Total returns	Freshwater age[a]			
		Age 1	Age 2	Age 3	Age 4
1985	*b*	--	-- (1)	0 (1)	0
1986	*b*	--	0 (16)	17 (7)	2
1987	*b*	0	128 (51)	213 (7)	0
1988	*b*	4	909 (31)	88 (7)	0
1989	568	16 (3)	431 (19)	98 (1)	0
1990	513	9	454 (19)	31	0
1991	321	4	246 (10)	57 (3)	1
1992	*c*	2 (1)	396 (11)	44 (3)	0
1993	*c*	15	321 (21)	50 (2)	--
1994	*c*	2	267 (4)	26	--
1995	*c*	3	183	2	--
1996	*c*	8	55	--	--

[a] Numbers of repeat spawners are summarized in parenthesis. The estimated number of repeat spawners for a given brood year may include adult steelhead that were counted several times as a consequence of having returned to the Powerdale Dam trap in two or more run years.

[b] Complete brood year specific estimates of wild adult steelhead returns cannot be made prior to the 1989 brood.

[c] Preliminary estimates of wild adult steelhead returns by freshwater age category. Estimates do not include potential returns from all possible age categories of wild adult summer and winter steelhead.

Table 8. Estimated number of wild steelhead smolts, by age category, to migrant traps located in the West, Middle, and East forks of the Hood River and to Lake Branch, a tributary to the West Fork of the Hood River. (Percent of total migrants is in parentheses.)

Location, year	Estimated number of smolts	Freshwater age			
		Age 1	Age 2	Age 3	Age 4
West Fork,[a]					
1994	2,210	917 (41.5)	1,270 (57.4)	24 (1.1)	0 (0)
1995	809	14 (1.8)	434 (53.6)	361 (44.6)	0 (0)
1996	666	13 (2.0)	392 (58.8)	261 (39.2)	0 (0)
1997	979	0 (0)	809 (82.6)	170 (17.4)	0 (0)
1998	3,008	29 (1.0)	1,740 (57.8)	1,239 (41.2)	0 (0)
1999	1,053	21 (2.0)	887 (84.2)	145 (13.8)	0 (0)
Middle Fork,					
1995	973	74 (7.6)	772 (79.3)	127 (13.1)	0 (0)
1996	875	44 (5.0)	623 (71.2)	208 (23.8)	0 (0)
1997	2,440	0 (0)	2,347 (96.2)	93 (3.8)	0 (0)
1998	--	--	--	--	--
1999	1,920	37 (1.9)	1,477 (76.9)	406 (21.2)	0 (0)
East Fork,					
1994	1,138	294 (25.8)	771 (67.7)	73 (6.5)	0 (0)
1995	1,784	399 (22.4)	1,253 (70.2)	133 (7.4)	0 (0)
1996	--	--	--	--	--
1997	1,236	41 (3.3)	1,154 (93.4)	41 (3.3)	0 (0)
1998	1,044	39 (3.7)	966 (92.6)	39 (3.7)	0 (0)
1999	1,978	0 (0)	1,618 (81.8)	360 (18.2)	0 (0)
Lake Branch,					
1997	475	0 (0)	361 (76.0)	114 (24.0)	0 (0)
1998	972	0 (0)	674 (69.3)	298 (30.7)	0 (0)
1999	557	0 (0)	442 (79.4)	107 (19.2)	8 (1.4)

[a] Estimates at the West Fork trap include numbers migrating from Lake Branch.

Table 9. Mean fork length (mm) of downstream migrant rainbow-steelhead caught prior to 1 August at migrant traps located in the mainstem Hood River; the West, Middle, and East forks of the Hood River; and in Lake Branch, a tributary to the West Fork of the Hood River. (Sampling periods are in **APPENDIX A**.)

Age, location, year	N	Fork length (mm) Mean	Range	95% C.I.
Age 0,				
mainstem,				
1994	6	78.3	67 - 107	±15.6
1995	1	72	72	--
1996	0	--	--	--
1997	3	72.7	69 - 77	±10.0
West Fork,				
1994	24	97.0	68 - 150	± 9.1
1998	1	69	69	--
Middle Fork,				
1995	1	62	62	--
East Fork,				
1994	72	96.9	63 - 179	± 3.9
1998	2	70.0	68 - 72	±25.4
Age 1,				
mainstem,				
1994	55	166.0	120 - 200	± 4.2
1995	56	171.2	77 - 216	± 6.2
1996	51	175.7	84 - 264	± 7.7
1997	63	154.0	83 - 200	± 8.3
1998	64	143.0	78 - 196	± 9.0
1999	5	139.6	98 - 187	±53.8
West Fork,				
1994	83	166.0	128 - 194	± 2.6
1995	16	107.8	79 - 166	±14.3
1996	7	104.0	76 - 186	±34.1
1997	4	103.5	80 - 149	±49.5
1998	80	110.7	76 - 166	± 4.5
1999	13	96.5	68 - 188	±19.0
Middle Fork,				
1995	25	135.5	81 - 216	±16.6
1996	19	134.1	83 - 180	±15.2
1997	36	107.2	69 - 151	± 6.7
1998	81	96.9	62 - 156	± 4.1
1999	1	212	212	--
East Fork,				
1994	113	153.1	77 - 191	± 4.1
1995	63	145.2	73 - 187	± 7.7
1996	25	136.5	88 - 229	±15.2
1997	210	102.5	67 - 176	± 2.4
1998	238	92.0	64 - 209	± 2.4
1999	38	100.4	69 - 139	± 5.3
Lake Branch,				
1997	22	113.0	71 - 149	± 9.9
1998	55	110.5	67 - 154	± 5.4
1999	21	110.6	75 - 155	± 9.9

Table 9. Continued.

Age, location, year	N	Fork length (mm) Mean	Range	95% C.I.
Age 2,				
mainstem,				
1994	148	180.6	129 - 221	± 2.5
1995	135	180.3	144 - 218	± 2.7
1996	274	177.3	147 - 224	± 1.9
1997	260	178.5	134 - 243	± 2.0
1998	656	177.4	90 - 298	± 1.4
1999	504	176.0	136 - 243	± 1.4
West Fork,				
1994	76	176.9	128 - 232	± 4.5
1995	79	163.1	126 - 194	± 2.6
1996	50	167.5	110 - 204	± 4.9
1997	80	164.2	100 - 194	± 2.9
1998	88	173.6	117 - 255	± 4.5
1999	100	164.6	138 - 221	± 2.8
Middle Fork,				
1995	107	173.5	103 - 249	± 3.8
1996	69	176.8	90 - 205	± 4.7
1997	167	181.4	135 - 245	± 2.3
1998	101	170.2	103 - 229	± 3.4
1999	86	165.3	112 - 194	± 3.0
East Fork,				
1994	97	186.8	142 - 235	± 3.4
1995	78	180.5	140 - 235	± 3.6
1996	19	170.9	138 - 208	± 8.8
1997	110	178.0	136 - 266	± 3.6
1998	129	157.9	74 - 220	± 4.2
1999	159	165.8	112 - 202	± 2.2
Lake Branch,				
1997	42	166.5	136 - 204	± 5.4
1998	58	168.0	114 - 210	± 4.8
1999	117	166.0	92 - 232	± 3.3
Age 3,				
mainstem,				
1994	23	195.0	168 - 214	± 5.1
1995	37	181.1	153 - 202	± 4.4
1996	67	180.9	149 - 246	± 4.2
1997	40	186.1	157 - 223	± 5.9
1998	60	187.8	154 - 228	± 4.3
1999	66	192.2	154 - 255	± 4.6
West Fork,				
1994	2	184.0	160 - 208	± 305
1995	27	185.7	162 - 240	± 8.2
1996	21	185.6	158 - 213	± 6.4
1997	8	190.2	174 - 222	±14.9
1998	43	189.5	160 - 237	± 4.8
1999	9	182.7	157 - 206	±12.7
Middle Fork,				
1995	12	192.8	168 - 234	±11.9
1996	24	184.4	158 - 215	± 7.1

Table 9. Continued.

Age, location, year	N	Fork length (mm) Mean	Range	95% C.I.
Age 3,				
Middle Fork, (cont.)				
1997	6	197.8	168 - 259	±33.1
1998	5	181.0	145 - 209	±33.1
1999	13	179.5	153 - 208	±10.7
East Fork,				
1994	8	200.8	181 - 221	±11.6
1995	7	190.7	176 - 200	± 7.2
1996	3	205.7	178 - 245	±86.9
1997	6	166.8	123 - 201	±33.7
1998	2	175.0	169 - 181	±76.2
1999	21	186.6	157 - 232	± 8.9
Lake Branch,				
1997	11	177.4	158 - 222	±14.9
1998	18	196.3	158 - 271	±15.6
1999	22	173.0	123 - 264	±12.3
Age 4,				
mainstem,				
1996	1	189	189	--
Middle Fork,				
1998	1	237	237	--
Lake Branch,				
1999	1	276	276	--
Total,[a]				
mainstem,				
1994	413	176.4	67 - 221	± 2.0
1995	268	163.6	27 - 218	± 5.5
1996	623	176.9	29 - 264	± 1.6
1997	853	171.0	25 - 281	± 2.3
1998	1,344	176.7	78 - 298	± 1.2
1999	1,072	177.3	91 - 255	± 1.0
West Fork,				
1994	342	152.0	33 - 232	± 4.2
1995	153	144.3	30 - 240	± 7.7
1996	90	163.0	31 - 213	± 7.6
1997	123	163.3	47 - 222	± 3.9
1998	241	154.1	59 - 255	± 4.9
1999	144	159.1	68 - 221	± 4.3
Middle Fork,				
1995	154	161.7	29 - 249	± 6.4
1996	169	130.1	28 - 215	±10.4
1997	350	171.8	69 - 259	± 3.2
1998	200	138.6	62 - 237	± 5.8
1999	106	167.5	112 - 212	± 3.0
East Fork,				
1994	482	141.3	63 - 235	± 3.9
1995	173	155.9	28 - 238	± 6.8
1996	55	147.9	29 - 245	±13.0

Table 9. Continued.

Age, location, year	N	Fork length (mm) Mean	Range	95% C.I.
Total,[a]				
East Fork, (cont.)				
1997	579	128.3	65 - 266	± 3.4
1998	529	107.4	37 - 220	± 3.2
1999	272	157.1	69 - 232	± 3.6
Lake Branch,				
1997	86	156.2	71 - 283	± 7.3
1998	166	147.6	29 - 271	± 6.5
1999	186	161.0	75 - 276	± 4.0

[a] Includes juvenile migrants in which age was unknown.

Table 10. Mean weight (gms) of downstream migrant rainbow-steelhead caught prior to 1 August at migrant traps located in the mainstem Hood River; the West, Middle, and East forks of the Hood River; and in Lake Branch, a tributary to the West Fork of the Hood River. (Sampling periods are in **APPENDIX A**.)

Age, location, year	N	Weight (gms) Mean	Range	95% C.I.
Age 0,				
mainstem,				
1994	6	6.0	3.2 - 13.1	± 3.8
1995	1	4.0	4.0	--
1996	0	--	--	--
1997	3	5.1	3.6 - 5.9	± 3.2
West Fork,				
1994	21	11.4	3.4 - 34.6	± 3.9
1998	1	3.5	3.5	--
Middle Fork,				
1995	1	2.6	2.6	--
East Fork,				
1994	63	10.0	3.2 - 24.1	± 1.1
1998	1	3.4	3.4	--
Age 1,				
mainstem,				
1994	43	44.3	21.1 - 69.8	± 3.2
1995	54	55.4	4.6 - 96.9	± 5.1
1996	45	53.7	7.2 -103.9	± 6.0
1997	63	42.6	5.2 - 82.2	± 5.2
1998	62	35.3	5.0 - 83.1	± 5.3
1999	5	36.1	11.5 - 75.0	±36.9
West Fork,				
1994	62	44.8	21.1 - 68.6	± 2.4
1995	16	15.1	4.5 - 44.9	± 6.4
1996	7	18.1	4.3 - 73.1	±22.5
1997	4	15.2	5.9 - 36.9	±23.2
1998	80	15.8	3.8 - 46.4	± 2.1
1999	13	12.2	2.4 - 58.3	± 8.8
Middle Fork,				
1995	24	32.2	5.3 - 94.9	±11.1
1996	18	28.5	7.2 - 57.6	± 8.3
1997	36	16.4	3.8 - 44.8	± 3.2
1998	78	11.0	2.3 - 39.7	± 1.4
1999	1	99.4	99.4	--
East Fork,				
1994	101	39.0	8.7 - 66.1	± 2.6
1995	57	35.9	4.2 - 62.5	± 4.1
1996	22	27.6	7.8 - 70.3	± 8.1
1997	204	14.0	3.3 - 54.2	± 1.1
1998	233	9.5	2.8 - 95.8	± 1.1
1999	38	12.5	3.6 - 30.5	± 2.1
Lake Branch,				
1997	22	18.4	4.1 - 37.8	± 4.6
1998	53	16.1	3.2 - 34.5	± 2.3
1999	21	16.6	2.5 - 43.8	± 5.1

Table 10. Continued.

Age, location, year	N	Weight (gms) Mean	Range	95% C.I.
Age 2,				
mainstem,				
1994	109	60.7	26.1 - 91.8	± 2.7
1995	133	58.2	27.3 -117.6	± 2.9
1996	242	53.7	26.3 -115.2	± 1.9
1997	259	57.9	24.2 -144.2	± 2.1
1998	656	55.7	6.9 -269.7	± 1.4
1999	504	55.3	24.3 -149.0	± 1.4
West Fork,				
1994	66	57.9	21.3 -133.8	± 4.5
1995	78	42.8	18.6 - 75.5	± 2.1
1996	47	46.6	13.3 - 79.9	± 4.2
1997	80	46.3	11.6 - 76.2	± 2.3
1998	83	53.8	20.4 -146.6	± 4.1
1999	99	44.9	26.7 -120.6	± 2.6
Middle Fork,				
1995	107	54.3	10.5 -151.8	± 4.0
1996	63	54.6	7.9 - 84.1	± 3.8
1997	167	63.4	28.5 -157.8	± 2.5
1998	96	52.6	12.4 -110.3	± 2.9
1999	86	46.4	13.8 - 76.8	± 2.4
East Fork,				
1994	88	65.6	31.2 -151.0	± 4.0
1995	69	59.1	33.8 -129.0	± 4.0
1996	17	43.9	23.5 - 78.4	± 7.3
1997	110	58.0	27.8 -196.0	± 4.2
1998	129	42.1	4.6 - 79.0	± 2.7
1999	155	47.2	17.1 - 82.3	± 1.7
Lake Branch,				
1997	42	47.1	24.6 -102.7	± 5.3
1998	54	48.2	16.0 - 91.7	± 4.3
1999	117	45.9	6.8 -119.0	± 3.1
Age 3,				
mainstem,				
1994	17	75.3	46.7 -100.9	± 7.9
1995	35	56.7	29.6 - 82.7	± 5.0
1996	59	55.2	28.8 -116.2	± 4.0
1997	38	64.3	38.2 -106.6	± 6.0
1998	59	63.3	32.3 -115.0	± 4.5
1999	66	68.8	35.4 -187.7	± 5.8
West Fork,				
1994	2	65.8	43.2 - 88.3	± 286
1995	27	64.5	37.6 -135.4	± 9.6
1996	19	63.6	46.3 - 93.4	± 6.3
1997	8	64.2	45.2 - 99.6	±18.3
1998	38	66.8	38.3 -125.3	± 5.2
1999	8	56.8	34.2 - 83.3	±13.3
Middle Fork,				
1995	11	71.9	54.0 -128.6	±16.1
1996	24	62.1	38.4 - 94.9	± 7.0

Table 10. Continued.

Age, location, year	N	Weight (gms) Mean	Range	95% C.I.
Age 3,				
Middle Fork, (cont.)				
1997	6	75.4	47.6 -167.8	±48.4
1998	5	64.4	24.6 - 98.4	±39.0
1999	13	56.8	34.8 - 78.8	± 9.1
East Fork,				
1994	7	81.6	60.1 -112.0	±14.8
1995	7	67.0	50.0 - 87.0	±10.3
1996	2	66.5	48.9 - 84.1	± 224
1997	6	51.0	18.6 - 88.9	±28.7
1998	2	52.4	44.9 - 59.9	±95.3
1999	21	67.2	37.4 -161.1	±12.5
Lake Branch,				
1997	11	59.1	37.5 -132.3	±20.1
1998	17	79.9	39.1 -217.9	±24.5
1999	21	55.9	27.0 -216.6	±18.0
Age 4,				
mainstem,				
1996	1	60.0	60.0	--
Middle Fork,				
1998	1	135.9	135.9	--
Lake Branch,				
1999	1	229.0	229.0	--
Total,[a]				
mainstem,				
1994	276	56.3	3.2 -100.9	± 2.1
1995	251	52.2	0.1 -117.6	± 2.8
1996	540	54.2	0.9 -126.4	± 1.4
1997	694	55.6	3.6 -236.7	± 1.5
1998	1,328	55.8	5.0 -269.7	± 1.0
1999	1,070	56.2	7.7 -187.7	± 1.0
West Fork,				
1994	258	40.4	2.2 -133.8	± 2.8
1995	145	39.3	0.2 -135.4	± 3.7
1996	81	48.8	4.3 - 93.4	± 4.1
1997	123	45.8	1.2 - 99.6	± 2.5
1998	227	42.1	3.5 -146.6	± 3.3
1999	142	41.9	2.4 -120.6	± 2.7
Middle Fork,				
1995	151	49.4	0.3 -151.8	± 4.2
1996	112	52.2	7.2 - 94.9	± 3.5
1997	349	57.2	3.8 -167.8	± 2.4
1998	192	35.1	2.3 -135.9	± 3.6
1999	106	48.2	13.8 - 99.4	± 2.5
East Fork,				
1994	365	37.3	3.2 -151.0	± 2.8
1995	143	49.1	4.2 -129.0	± 3.2
1996	45	38.8	7.8 - 84.1	± 6.2

Table 10. Continued.

Age, location, year	N	Weight (gms) Mean	Range	95% C.I.
Total,[a]				
East Fork, (cont.)				
1997	552	29.4	3.0 -196.0	± 2.1
1998	522	17.9	0.4 - 95.8	± 1.6
1999	268	43.2	3.6 -161.1	± 2.3
Lake Branch,				
1997	86	43.2	4.1 -196.1	± 5.9
1998	152	40.2	3.2 -217.9	± 4.6
1999	185	44.1	2.5 -229.0	± 3.7

[a] Includes juvenile migrants in which age was unknown.

Table 11. Condition factor of downstream migrant rainbow-steelhead caught prior to 1 August at migrant traps located in the mainstem Hood River; the West, Middle, and East forks of the Hood River; and in Lake Branch, a tributary to the West Fork of the Hood River. (Sampling periods are in **APPENDIX A**.)

Age, location, year	N	Condition factor[a] Mean	Range	95% C.I.
Age 0,				
mainstem,				
1994	6	1.17	1.06 - 1.42	±0.14
1995	1	1.07	1.07	--
1996	0	--	--	--
1997	3	1.31	1.10 - 1.55	±0.57
West Fork,				
1994	21	1.10	0.90 - 1.38	±0.05
1998	1	1.07	1.07	--
Middle Fork,				
1995	1	1.09	1.09	--
East Fork,				
1994	63	1.09	0.86 - 1.64	±0.04
1998	1	1.08	1.08	--
Age 1,				
mainstem,				
1994	43	0.96	0.75 - 1.22	±0.03
1995	54	1.05	0.83 - 1.30	±0.03
1996	45	0.99	0.84 - 1.22	±0.03
1997	63	1.05	0.88 - 1.24	±0.02
1998	62	1.04	0.84 - 1.35	±0.03
1999	5	1.10	0.96 - 1.22	±0.13
West Fork,				
1994	62	0.95	0.74 - 1.08	±0.02
1995	16	1.03	0.88 - 1.20	±0.05
1996	7	1.17	0.98 - 1.26	±0.09
1997	4	1.14	1.12 - 1.15	±0.03
1998	80	1.06	0.87 - 1.33	±0.02
1999	13	1.07	0.67 - 1.33	±0.10
Middle Fork,				
1995	24	1.06	0.84 - 1.20	±0.04
1996	18	1.11	0.96 - 1.26	±0.04
1997	36	1.20	0.92 - 1.32	±0.03
1998	78	1.10	0.86 - 1.64	±0.03
1999	1	1.04	1.04	--
East Fork,				
1994	101	1.04	0.85 - 1.28	±0.02
1995	57	1.01	0.82 - 1.25	±0.02
1996	22	1.03	0.86 - 1.20	±0.04
1997	204	1.17	0.70 - 1.73	±0.02
1998	233	1.08	0.52 - 1.39	±0.01
1999	38	1.14	0.76 - 1.87	±0.06
Lake Branch,				
1997	22	1.12	0.96 - 1.28	±0.04
1998	53	1.07	0.91 - 1.33	±0.02
1999	21	1.05	0.59 - 1.33	±0.09

Table 11. Continued.

Age, location, year	N	Condition factor[a] Mean	Range	95% C.I.
Age 2,				
mainstem,				
1994	109	1.02	0.83 - 1.46	±0.02
1995	133	0.97	0.78 - 1.24	±0.01
1996	242	0.94	0.70 - 1.12	±0.01
1997	259	1.00	0.81 - 1.36	±0.01
1998	656	0.97	0.50 - 1.36	±0.01
1999	504	0.99	0.58 - 1.62	±0.01
West Fork,				
1994	66	0.99	0.84 - 1.39	±0.02
1995	78	0.97	0.73 - 1.17	±0.02
1996	47	0.98	0.82 - 1.09	±0.02
1997	80	1.03	0.85 - 1.26	±0.02
1998	83	0.98	0.78 - 1.24	±0.02
1999	99	0.99	0.82 - 1.23	±0.01
Middle Fork,				
1995	107	1.00	0.64 - 1.75	±0.02
1996	63	0.98	0.81 - 1.15	±0.02
1997	167	1.04	0.81 - 1.36	±0.01
1998	96	1.03	0.90 - 1.25	±0.01
1999	86	1.01	0.83 - 1.34	±0.02
East Fork,				
1994	88	0.98	0.77 - 1.16	±0.02
1995	69	0.99	0.87 - 1.29	±0.01
1996	17	0.88	0.60 - 1.01	±0.05
1997	110	0.99	0.52 - 1.18	±0.02
1998	129	1.02	0.57 - 1.20	±0.01
1999	155	1.01	0.82 - 1.28	±0.01
Lake Branch,				
1997	42	0.98	0.84 - 1.50	±0.03
1998	54	0.98	0.70 - 1.21	±0.02
1999	117	0.97	0.81 - 1.29	±0.02
Age 3,				
mainstem,				
1994	17	1.01	0.82 - 1.27	±0.06
1995	35	0.93	0.81 - 1.17	±0.03
1996	59	0.92	0.73 - 1.13	±0.02
1997	38	0.97	0.73 - 1.25	±0.03
1998	59	0.94	0.78 - 1.15	±0.02
1999	66	0.94	0.77 - 1.13	±0.02
West Fork,				
1994	2	1.02	0.98 - 1.05	±0.47
1995	27	0.97	0.84 - 1.10	±0.03
1996	19	0.96	0.80 - 1.10	±0.04
1997	8	0.90	0.81 - 1.05	±0.06
1998	38	0.95	0.70 - 1.06	±0.02
1999	8	0.93	0.84 - 1.09	±0.06
Middle Fork,				
1995	11	0.94	0.88 - 1.02	±0.03
1996	24	0.97	0.83 - 1.10	±0.03

Table 11. Continued.

Age, location, year	N	Condition factor[a] Mean	Range	95% C.I.
Age 3,				
Middle Fork, (cont.)				
1997	6	0.91	0.68 - 1.02	±0.14
1998	5	1.00	0.81 - 1.08	±0.14
1999	13	0.96	0.88 - 1.09	±0.03
East Fork,				
1994	7	0.96	0.90 - 1.04	±0.04
1995	7	0.96	0.90 - 1.09	±0.06
1996	2	1.01	0.87 - 1.15	±1.81
1997	6	1.01	0.86 - 1.19	±0.13
1998	2	0.97	0.93 - 1.01	±0.51
1999	21	0.99	0.89 - 1.29	±0.04
Lake Branch,				
1997	11	0.99	0.85 - 1.31	±0.10
1998	17	0.96	0.83 - 1.19	±0.04
1999	21	0.95	0.81 - 1.18	±0.04
Age 4,				
mainstem,				
1996	1	0.89	0.89	--
Middle Fork,				
1998	1	1.02	1.02	--
Lake Branch,				
1999	1	1.09	1.09	--
Total,[b]				
mainstem,				
1994	276	1.01	0.75 - 1.46	±0.01
1995	251	0.98	0.34 - 1.65	±0.02
1996	540	0.94	0.69 - 1.31	±0.01
1997	694	1.00	0.72 - 1.55	±0.01
1998	1,328	0.97	0.50 - 1.37	±0.004
1999	1,069	0.99	0.58 - 1.62	±0.01
West Fork,				
1994	258	0.99	0.52 - 1.39	±0.01
1995	145	0.97	0.67 - 1.20	±0.02
1996	81	0.99	0.80 - 1.26	±0.02
1997	123	1.01	0.67 - 1.26	±0.02
1998	227	1.00	0.70 - 1.33	±0.01
1999	142	0.99	0.67 - 1.33	±0.01
Middle Fork,				
1995	151	1.01	0.64 - 1.75	±0.02
1996	112	1.00	0.81 - 1.26	±0.02
1997	349	1.06	0.68 - 1.39	±0.01
1998	192	1.06	0.81 - 1.64	±0.01
1999	106	1.00	0.83 - 1.34	±0.01
East Fork,				
1994	365	1.03	0.70 - 1.64	±0.01
1995	143	1.00	0.82 - 1.29	±0.01
1996	45	0.97	0.60 - 1.20	±0.04
1997	552	1.09	0.52 - 1.73	±0.01

Table 11. Continued.

Age, location, year	N	Condition factor[a] Mean	Range	95% C.I.
Total,[b]				
East Fork, (cont.)				
1998	522	1.06	0.52 - 1.46	±0.01
1999	268	1.03	0.76 - 1.87	±0.01
Lake Branch,				
1997	86	1.01	0.84 - 1.50	±0.03
1998	152	1.01	0.70 - 1.33	±0.01
1999	185	0.97	0.59 - 1.33	±0.02

[a] Condition factor was estimated as (100*weight(gms)/length(cm)^3).
[b] Includes juvenile migrants in which age was unknown.

Table 12. Mean fork length (mm) of downstream migrant rb-st at migrant traps located in the Hood River subbasin, by brood year and freshwater age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables.]

Location, brood year	Freshwater age				
	Age 0	Age 1	Age 2	Age 3	Age 4
mainstem,					
1991	--	--	--	195.0 (23)	--
1992	--	--	180.6 (148)	181.1 (37)	189 (1)
1993	--	166.0 (55)	180.3 (135)	180.9 (67)	--
1994	78.3 (6)	171.2 (56)	177.3 (274)	186.1 (40)	--
1995	72 (1)	175.7 (51)	178.5 (260)	187.8 (60)	--
1996	--	154.0 (63)	177.4 (656)	192.2 (66)	--
1997	72.7 (3)	143.0 (64)	176.0 (504)	--	--
1998	--	139.6 (5)	--	--	--
West fork,					
1991	--	--	--	184.0 (2)	--
1992	--	--	176.9 (76)	185.7 (27)	--
1993	--	166.0 (83)	163.1 (79)	185.6 (21)	--
1994	97.0 (24)	107.8 (16)	167.5 (50)	190.2 (8)	--
1995	--	104.0 (7)	164.2 (80)	189.5 (43)	--
1996	--	103.5 (4)	173.6 (88)	182.7 (9)	--
1997	--	110.7 (80)	164.6 (100)	--	--
1998	69 (1)	96.5 (13)	--	--	--
Middle fork,					
1992	--	--	--	192.8 (12)	--
1993	--	--	173.5 (107)	184.4 (24)	--
1994	--	135.5 (25)	176.8 (69)	197.8 (6)	237 (1)
1995	62 (1)	134.1 (19)	181.4 (167)	181.0 (5)	--
1996	--	107.2 (36)	170.2 (101)	179.5 (13)	--
1997	--	96.9 (81)	165.3 (86)	--	--
1998	--	212 (1)	--	--	--
East fork,					
1991	--	--	--	200.8 (8)	--
1992	--	--	186.8 (97)	190.7 (7)	--
1993	--	153.1 (113)	180.5 (78)	205.7 (3)	--
1994	96.9 (72)	145.2 (63)	170.9 (19)	166.8 (6)	--
1995	--	136.5 (25)	178.0 (110)	175.0 (2)	--
1996	--	102.5 (210)	157.9 (129)	186.6 (21)	--
1997	--	92.0 (238)	165.8 (159)	--	--
1998	70.0 (2)	100.4 (38)	--	--	--
Lake Branch,					
1994	--	--	--	177.4 (11)	--
1995	--	--	166.5 (42)	196.3 (18)	276 (1)
1996	--	113.0 (22)	168.0 (58)	173.0 (22)	--
1997	--	110.5 (55)	166.0 (117)	--	--
1998	--	110.6 (21)	--	--	--

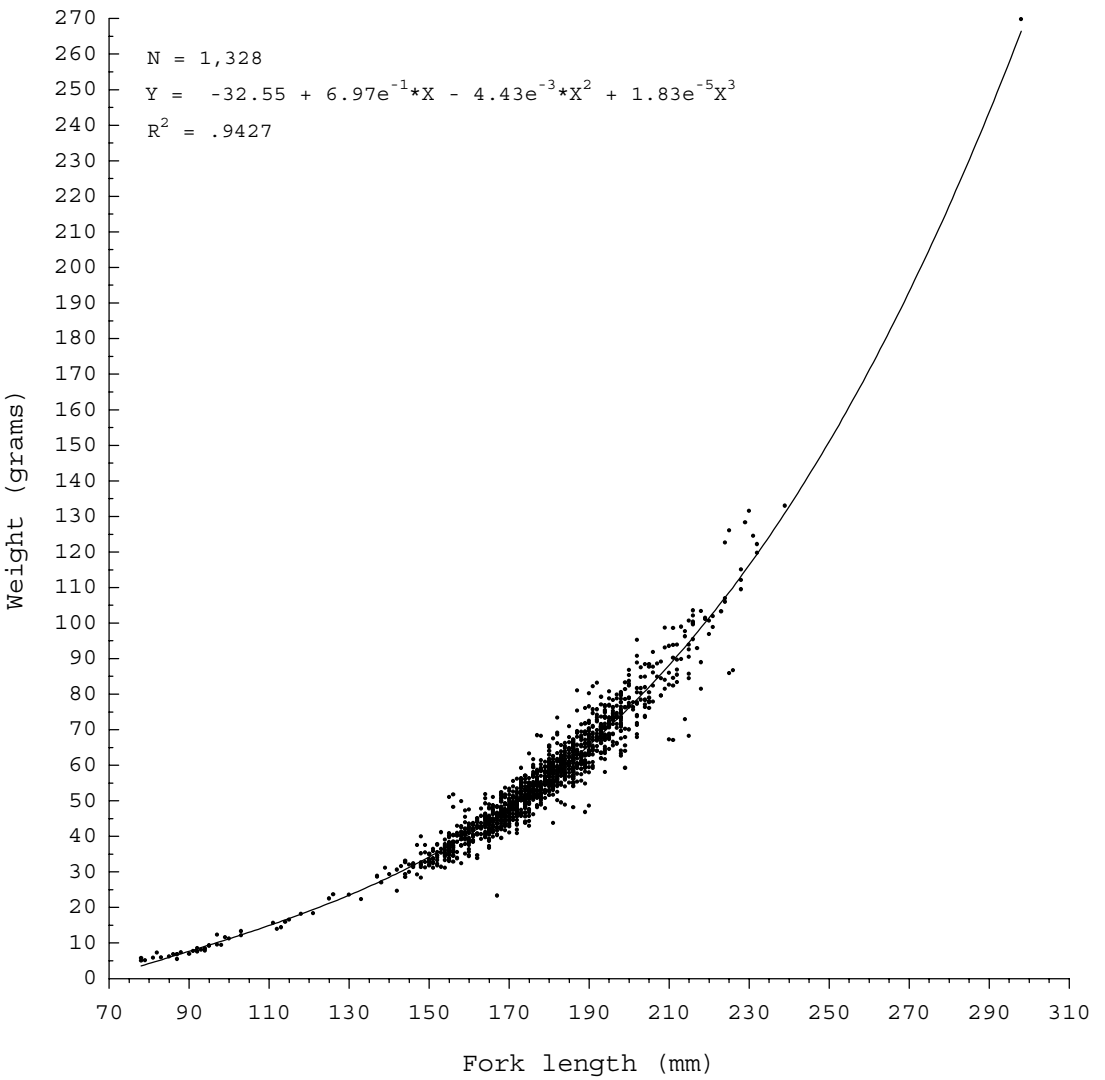


Figure 4. Length x weight regression of downstream migrant wild rainbow-steelhead sampled from 5 April through 31 July 1998 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River.

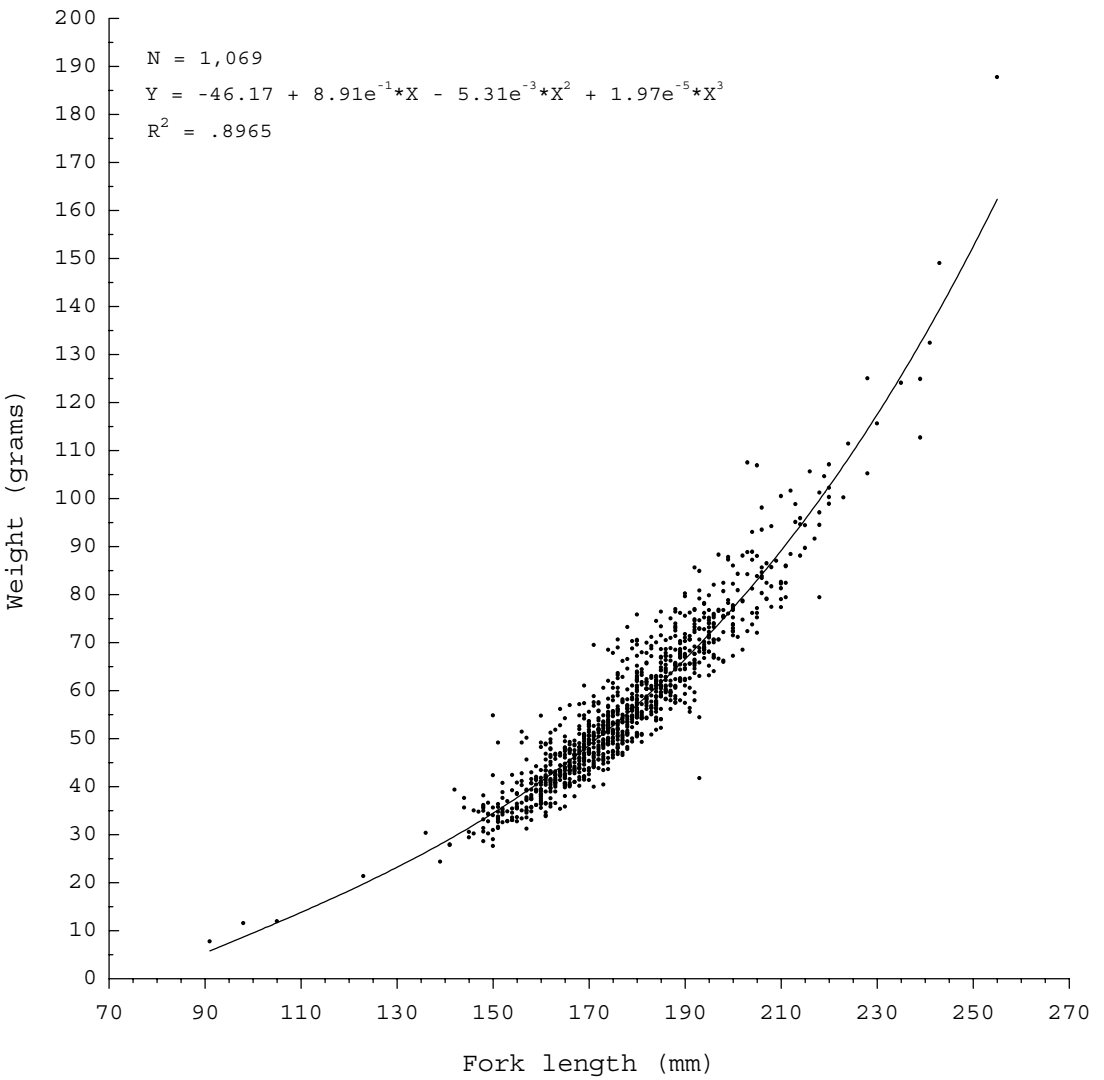


Figure 5. Length x weight regression of downstream migrant wild rainbow-steelhead sampled from 10 April through 31 July 1999 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River.

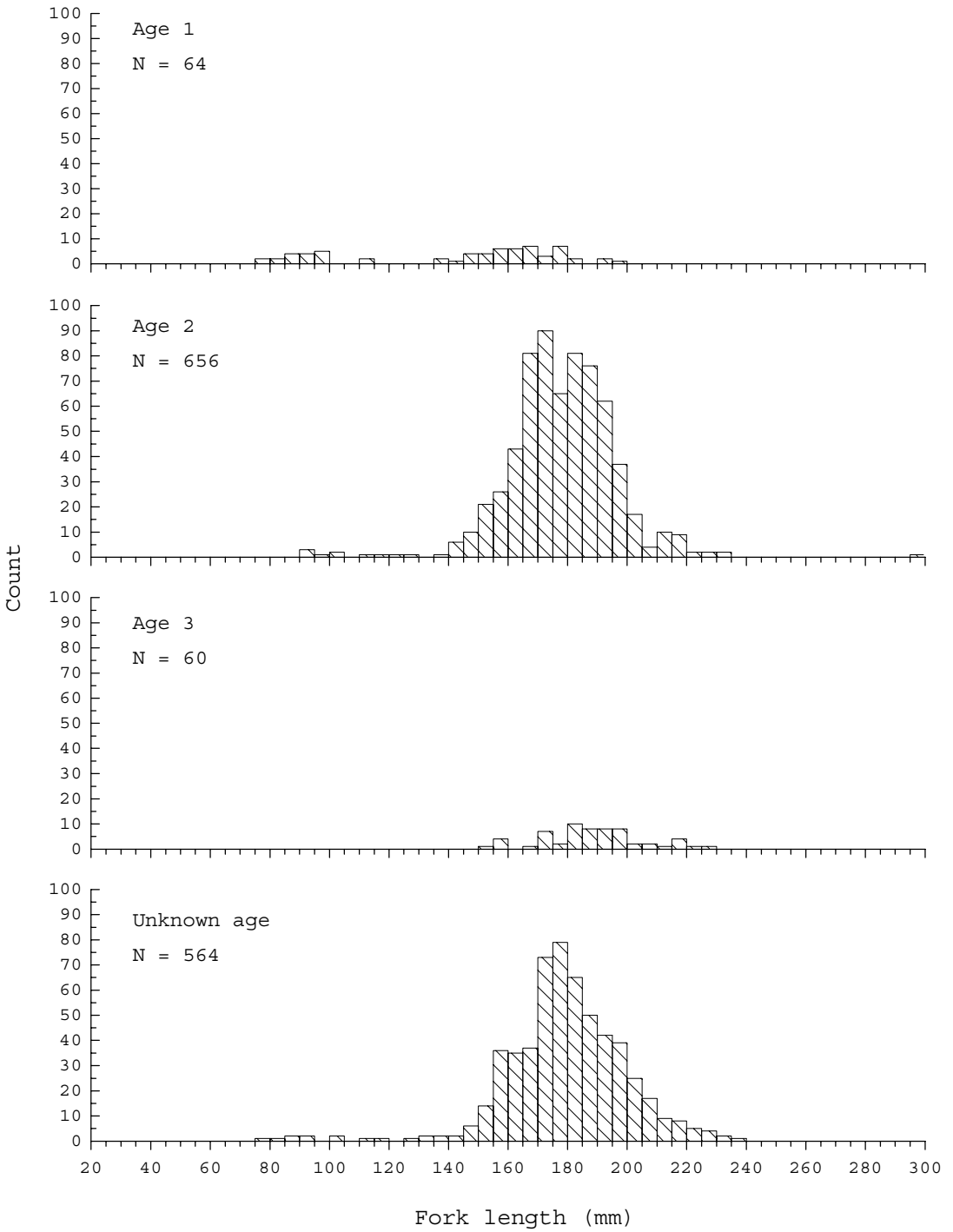


Figure 6. Length frequency histogram of downstream migrant wild rainbow-steelhead sampled from 3 April through 31 July 1998 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River, by age category.

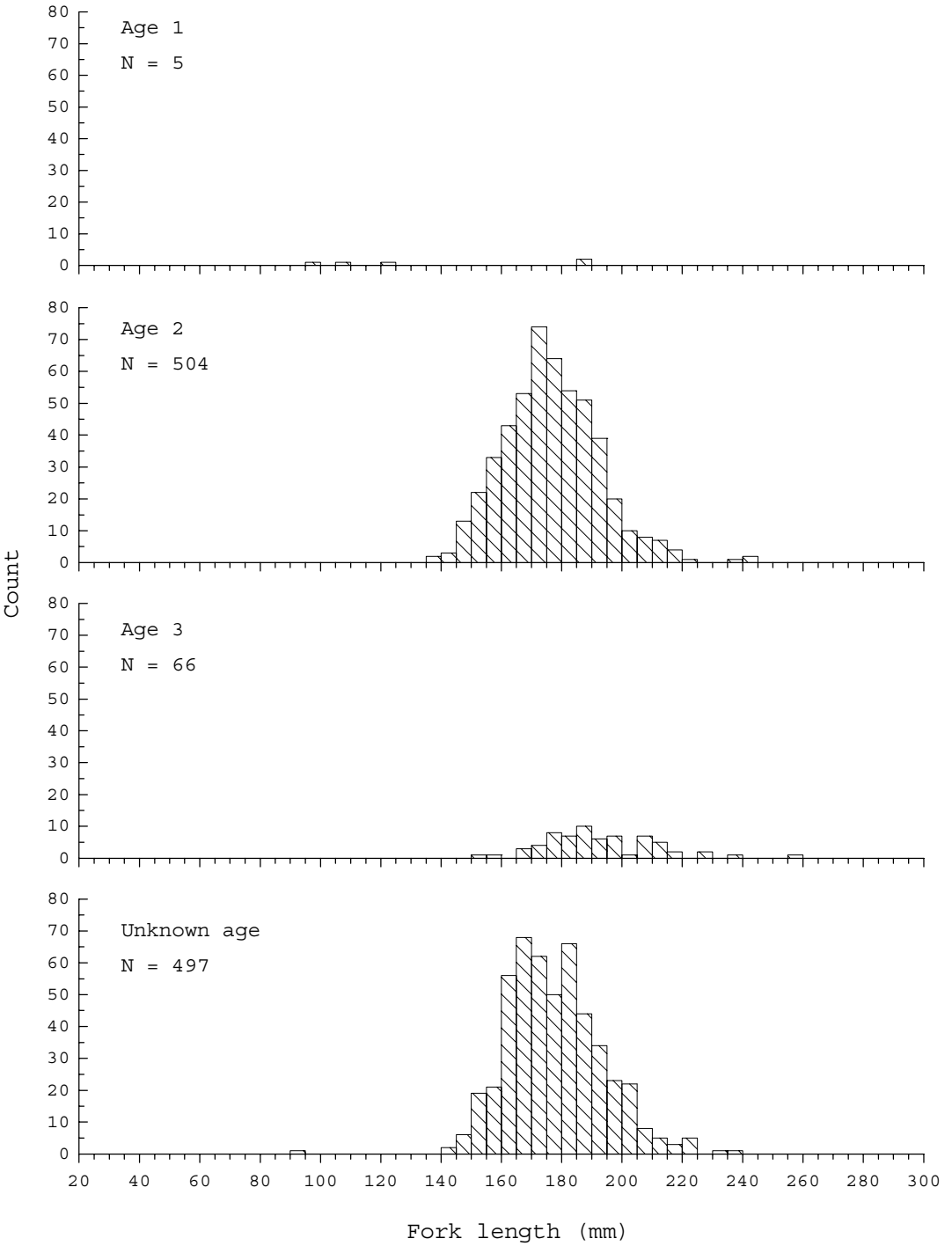


Figure 7. Length frequency histogram of downstream migrant wild rainbow-steelhead sampled from 10 April through 31 July 1999 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River, by age category.

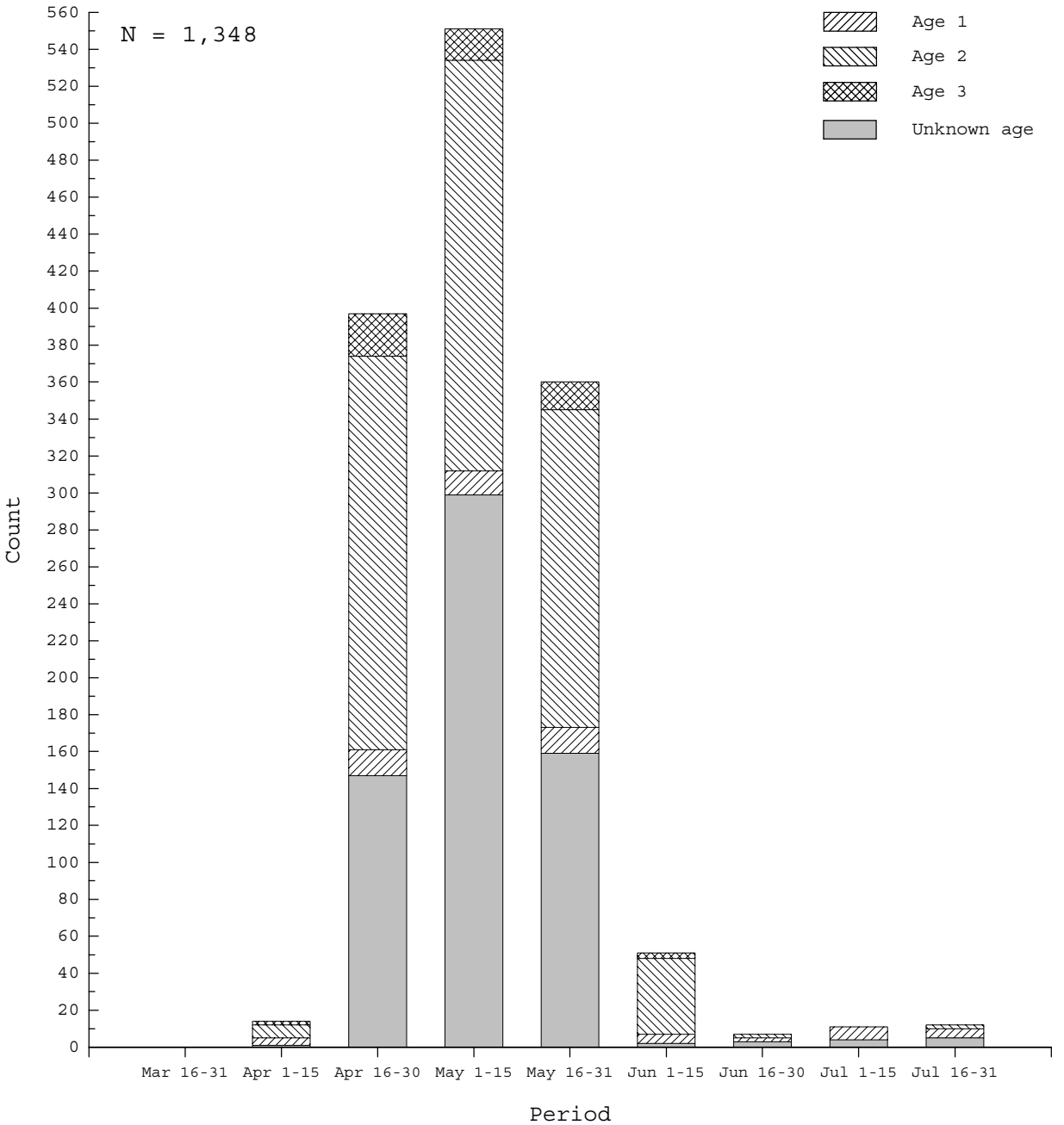


Figure 8. Temporal distribution of downstream migrant wild rainbow-steelhead sampled from 3 April through 31 July 1998 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River. Estimates are not adjusted for trap efficiency.

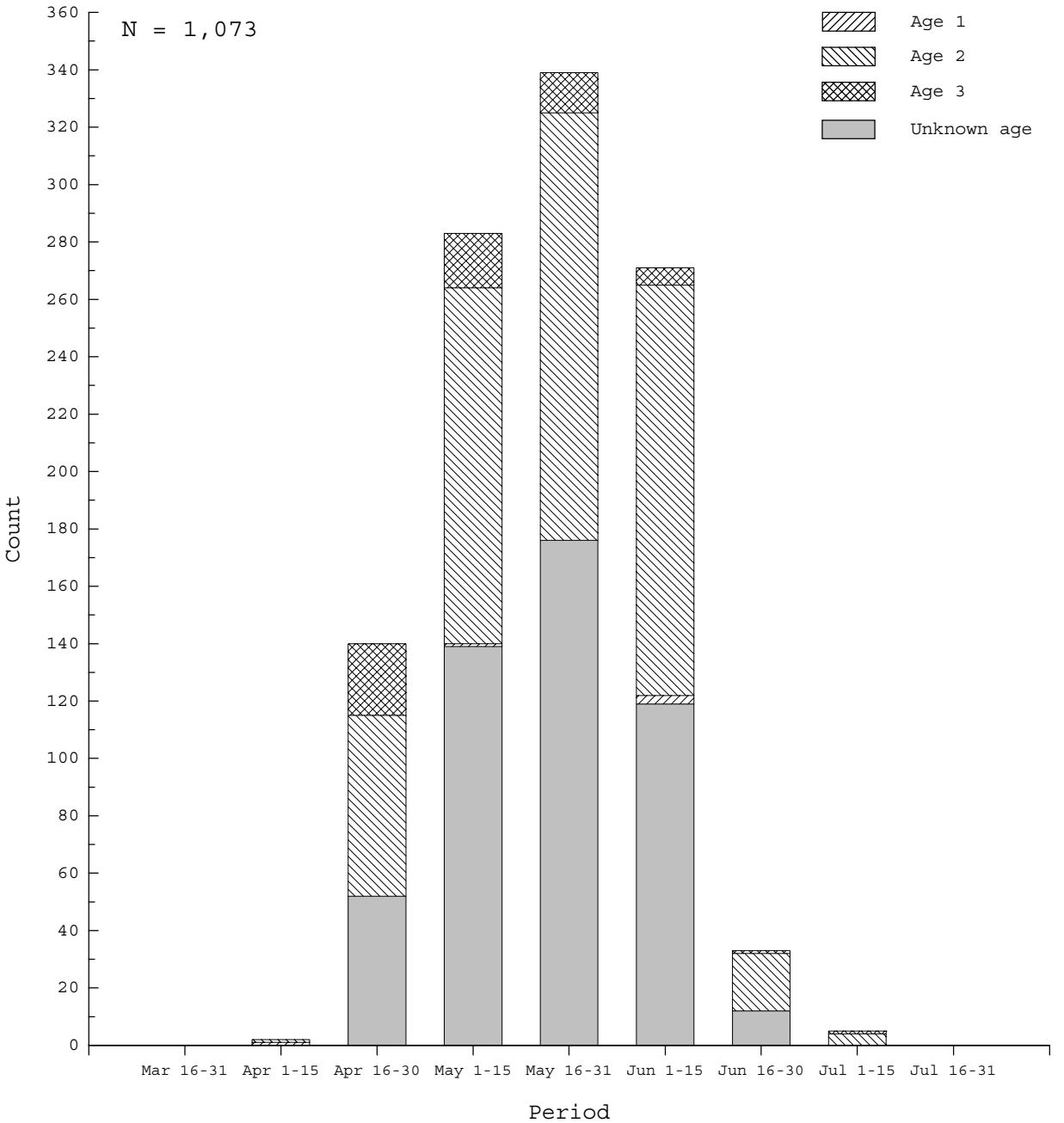


Figure 9. Temporal distribution of downstream migrant wild rainbow-steelhead sampled from 10 April through 31 July 1999 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River. Estimates are not adjusted for trap efficiency.

Table 13. Counts of cutthroat trout at migrant traps located in the mainstem Hood River and in the West, Middle, and East forks of the Hood River, by year. (Sampling periods are the same as for wild rainbow-steelhead [*see* **APPENDIX A**].)

Year	mainstem	West fork	Middle fork	East fork
1994	2	1	--	14
1995	6	0	1	6
1996	14	1	4	6
1997	14	0	1	3
1998	18	0	5	20
1999	14	0	3	13

Table 14. Estimates of mean fork length (FL; mm), weight (gm), and condition factor (CF) for wild downstream migrant cutthroat trout sampled at juvenile migrant traps located in the Hood River subbasin. (Sampling periods are the same as for wild rainbow-steelhead [*see* **APPENDIX A**].)

Statistic, year	N	Mean	Range	95% C.I.
FL (mm),				
1994	15	175.1	142 - 202	± 9.7
1995	11	171.5	148 - 204	± 10.2
1996	24	170.1	97 - 215	± 10.2
1997	16	186.3	159 - 273	± 14.9
1998	43	170.7	124 - 233	± 6.4
1999	28	177.4	125 - 305	± 11.7
Weight (gms),				
1994	12	55.8	29.0 - 89.0	± 12.4
1995	10	50.1	29.6 - 82.3	± 10.6
1996	22	49.0	8.5 - 81.9	± 7.8
1997	16	64.9	40.9 -172.3	± 17.4
1998	43	48.3	19.0 -113.7	± 5.4
1999	28	56.8	20.4 -243.2	± 15.3
CF,[a]				
1994	12	1.00	0.89 - 1.12	± 0.05
1995	10	0.95	0.86 - 1.03	± 0.05
1996	22	0.93	0.81 - 1.16	± 0.04
1997	16	0.95	0.85 - 1.11	± 0.04
1998	43	0.94	0.62 - 1.64	± 0.04
1999	28	0.94	0.84 - 1.04	± 0.02

[a] Condition factor was estimated as $(100*\text{weight(gms)}/\text{length(cm)}^3)$.

Table 15. Bimonthly counts of adult summer steelhead captured at the Powerdale Dam trap by origin and run year. Bimonthly counts are reported for March through December. The bimonthly count in which the median date of migration occurred is boldfaced for completed run years (i.e., the 1992-1993 through 1998-1999 run years).

Origin,	March		April		May		June		July		August		September		October		November		December			
run year	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	Jan-May	Total
Wild,																						
1992-1993	0	1	12	6	7	21	31	68	49	**49**	37	18	17	55	25	24	38	12	2	1	4	477
1993-1994	0	1	10	5	8	21	13	21	25	**26**	14	11	8	5	11	8	1	1	10	0	30	229
1994-1995	0	1	3	4	9	7	22	25	**32**	33	11	1	4	8	2	7	5	0	0	0	9	183
1995-1996[a]	0	0	0	0	2	1	4	6	38	**19**	16	2	5	5	2	8	0	8	0	0	7	123
1996-1997	0	0	0	1	3	3	12	17	31	**32**	14	6	6	5	17	10	7	0	0	1	5	170
1997-1998	0	0	0	0	1	1	1	4	6	6	**14**	2	4	7	9	2	8	0	0	0	0	65
1998-1999	0	0	0	1	3	2	6	13	15	17	**7**	5	5	7	7	4	3	13	1	0	10	119
1999-2000[b]	0	0	1	0	1	5	7	6	19	28	11	5	0	8	8	2	35	8	2	0	--	146
Subbasin hatchery,																						
1992-1993	0	8	48	82	131	190	136	**279**	253	220	136	28	26	55	24	10	15	4	1	4	19	1,669
1993-1994	0	1	13	38	83	120	75	151	**188**	166	114	33	23	8	16	10	0	1	11	0	19	1,070
1994-1995	0	4	13	79	124	164	269	**299**	324	167	26	10	13	17	17	12	12	4	0	0	20	1,574
1995-1996[a]	0	0	4	0	5	12	30	31	**211**	101	52	13	15	5	9	4	1	10	0	2	6	511
1996-1997	0	2	39	29	123	153	**305**	188	259	120	26	15	3	3	9	7	4	0	0	1	7	1,293
1997-1998	0	0	0	11	36	59	23	66	**109**	68	112	21	17	25	9	3	2	0	0	0	3	564
1998-1999	0	2	2	21	20	25	88	60	**111**	103	16	12	19	15	5	7	2	10	0	0	7	525
1999-2000[b]	0	0	3	9	2	31	20	64	75	121	65	20	3	3	7	2	10	1	0	0	--	436
Stray hatchery,																						
1992-1993	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	4	5
1993-1994	0	0	0	1	0	0	2	2	**3**	0	0	2	0	0	1	0	0	0	1	0	1	13
1994-1995	0	0	0	0	0	**2**	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	4
1995-1996[a]	0	0	0	0	0	0	0	1	0	**2**	0	0	0	0	0	0	1	1	0	0	0	5
1996-1997	0	0	0	0	0	0	2	1	2	0	0	2	0	0	**1**	4	1	0	0	0	2	15
1997-1998	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**2**	2	1	0	0	0	0	6
1998-1999	0	0	0	0	0	0	0	0	0	1	0	0	2	**5**	1	0	0	0	0	0	1	10
1999-2000[b]	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	--	2

Table 15. Continued.

Origin,	March		April		May		June		July		August		September		October		November		December			
run year	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	Jan-May	Total
Unknown,																						
1992-1993	1	2	1	0	3	4	1	3	8	4	4	1	**4**	17	2	4	7	0	0	1	3	70
1993-1994	0	0	0	0	1	0	0	8	**15**	3	2	3	1	1	1	0	0	0	0	2	7	44
1994-1995	0	0	1	5	6	11	17	**16**	16	9	1	0	11	0	1	1	2	0	0	0	1	98
1995-1996[a]	0	0	0	0	0	0	1	4	14	**6**	13	0	0	1	0	1	0	5	0	0	1	46
1996-1997	0	0	1	0	2	6	14	5	**14**	17	5	1	3	2	1	3	0	0	0	0	1	75
1997-1998	0	0	1	0	4	4	2	5	**7**	4	9	1	2	1	1	0	2	0	1	0	0	44
1998-1999	0	0	0	4	5	3	3	3	4	**6**	2	0	0	1	2	2	2	3	1	1	3	45
1999-2000[b]	0	0	0	0	0	1	2	2	12	8	2	0	0	1	0	1	3	1	8	0	--	41

[a] Powerdale Dam trap was inoperative from 11-13 Nov 1995 and from 20-24 Nov 1995 because of flood damage and from 28 Nov 1995 - 27 Feb 1996 for modifications to the adult fish ladder.

[b] Preliminary estimates. Summaries are complete through 31 December 1999.

Table 16. Bimonthly counts of adult summer steelhead captured at the Powerdale Dam trap by origin and run year. Bimonthly counts are reported for January through May. The bimonthly count in which the median date of migration occurred is boldfaced for completed run year (i.e., the 1992-1993 through 1998-1999 run years).

Origin,		January		February		March		April		May		
run year	Mar-Dec	01-15	16-31	01-15	16-29	01-15	16-31	01-15	16-30	01-15	16-31	Total
Wild,												
1992-1993	473	0	1	0	0	1	1	0	0	1	0	477
1993-1994	199	16	2	0	1	2	1	2	6	0	0	229
1994-1995	174	0	0	5	1	1	1	1	0	0	0	183
1995-1996	116	0	0	0	0	1	0	1	4	1	0	123
1996-1997	165	0	0	0	4	0	1	0	0	0	0	170
1997-1998	65	0	0	0	0	0	0	0	0	0	0	65
1998-1999	109	7	0	0	0	1	1	0	1	0	0	119
Subbasin hatchery,												
1992-1993	1,650	0	0	0	0	0	3	11	4	1	0	1,669
1993-1994	1,051	4	1	0	0	0	2	5	7	0	0	1,070
1994-1995	1,554	0	4	2	3	6	2	0	3	0	0	1,574
1995-1996	505	0	0	0	0	4	0	1	1	0	0	511
1996-1997	1,286	0	0	0	3	0	1	2	1	0	0	1,293
1997-1998	561	1	0	0	0	1	0	1	0	0	0	564
1998-1999	518	5	0	1	0	0	0	0	1	0	0	525
Stray hatchery,												
1992-1993	1	0	0	0	0	1	**1**	2	0	0	0	5
1993-1994	12	0	0	0	0	0	0	1	0	0	0	13
1994-1995	3	0	0	0	0	0	0	1	0	0	0	4
1995-1996	5	0	0	0	0	0	0	0	0	0	0	5
1996-1997	13	0	0	0	1	0	0	0	1	0	0	15
1997-1998	6	0	0	0	0	0	0	0	0	0	0	6
1998-1999	9	0	0	1	0	0	0	0	0	0	0	10
Unknown,												
1992-1993	67	0	1	1	0	0	0	1	0	0	0	70
1993-1994	37	1	1	0	0	1	0	2	2	0	0	44
1994-1995	97	0	0	0	0	0	0	1	0	0	0	98
1995-1996	45	0	0	0	0	0	0	0	1	0	0	46
1996-1997	74	0	0	0	0	0	1	0	0	0	0	75
1997-1998	44	0	0	0	0	0	0	0	0	0	0	44
1998-1999	42	3	0	0	0	0	0	0	0	0	0	45

Table 17. Estimated harvest of adult summer steelhead in the Hood River sport fishery located from the mouth of the Hood River to 0.3 miles above Powerdale Dam (RM 4.5)[a], 1998. Confidence limits (95%) are in parenthesis.

Period	Wild summer steelhead		Subbasin hatchery summer steelhead		Catch Rate
	Kept	Released[b]	Kept	Released	(hrs/fish)
Jan 1-15	--	2 (3.8)	--	--	217
Jan 16-31	--	--	3 (6.4)	--	263
Feb 1-15	--	3 (4.6)	29 (36.3)	16 (14.8)	23
Feb 16-29	--	1 (2.4)	9 (10.3)	18 (14.0)	35
Mar 1-15	--	--	--	2 (3.5)	658
Mar 16-31	--	--	13 (12.7)	15 (17.8)	72
Apr 1-15	--	--	22 (23.1)	12 (9.1)	54
Apr 16-30	--	--	14 (13.3)	--	57
May 1-15	--	5 (9.9)	38 (25.9)	5 (7.8)	27
May 16-31	--	13 (15.1)	34 (16.9)	--	33
Jun 1-15	--	--	32 (23.5)	--	31
Jun 16-30	--	3 (4.4)	62 (44.2)	--	15
Jul 1-15	--	--	16 (12.3)	--	59
Jul 16-31	--	--	2 (3.2)	--	161
Aug 1-15	--	--	--	--	--
Aug 16-31	--	--	22 (28.7)	12 (11.3)	12
Sep 1-15	--	--	--	--	--
Sep 16-30	--	--	6 (9.2)	15 (19.9)	15
Oct 1-15	--	4 (9.4)	25 (20.7)	6 (6.6)	13
Oct 16-31	--	8 (6.4)	15 (10.9)	3 (3.4)	21
Nov 1-15	--	--	7 (8.1)	10 (12.1)	33
Nov 16-30	--	10 (9.7)	5 (7.2)	14 (9.3)	17
Dec 1-15	--	14 (10.2)	13 (14.3)	7 (8.1)	22
Dec 16-31	--	7 (6.9)	12 (11.1)	5 (7.4)	20
Total	0 (--)	70 (28)	379 (89)	140 (43)	34[c]

[a] The fishery above Powerdale Dam was closed on 1 April, 1998.

[b] Estimate may include wild winter steelhead.

[c] Estimate of mean catch rate is for the period 1 January - 31 December.

Table 18. Estimated harvest of adult summer steelhead in the Hood River sport fishery located from the mouth of the Hood River to Powerdale Dam (RM 4.5), 1999. Confidence limits (95%) are in parenthesis.

Period	Wild summer steelhead		Subbasin hatchery summer steelhead		Catch Rate
	Kept	Released[a]	Kept	Released	(hrs/fish)
Jan 1-15	--	2 (3.7)	6 (5.3)	5 (5.7)	72
Jan 16-31	--	--	--	6 (5.7)	137
Feb 1-15	--	5 (7.8)	6 (7.0)	8 (7.3)	40
Feb 16-29	--	5 (4.7)	4 (6.8)	40 (20.8)	16
Mar 1-15	--	--	8 (8.7)	26 (14.9)	33
Mar 16-31	--	3 (4.7)	3 (4.9)	4 (4.4)	146
Apr 1-15	--	3 (3.0)	12 (8.8)	7 (6.7)	39
Apr 16-30	--	--	11 (10.0)	--	120
May 1-15	--	16 (18.8)	46 (25.5)	3 (6.0)	19
May 16-31	--	8 (8.7)	19 (13.1)	14 (18.4)	27
Jun 1-15	--	4 (6.6)	11 (13.1)	4 (6.6)	40
Jun 16-30	--	2 (3.2)	13 (10.9)	--	48
Jul 1-15	--	--	7 (8.5)	--	77
Jul 16-31	--	8 (9.1)	18 (13.5)	2 (2.7)	21
Aug 1-15	--	--	--	--	--
Aug 16-31	--	--	8 (12.9)	--	21
Sep 1-15	--	5 (6.9)	18 (13.7)	--	24
Sep 16-30	--	--	4 (7.6)	--	59
Oct 1-15	--	--	2 (3.1)	--	188
Oct 16-31	--	--	--	--	--
Nov 1-15	--	--	--	3 (4.3)	55
Nov 16-30	--	5 (6.3)	--	5 (6.3)	21
Dec 1-15	--	12 (12.8)	5 (7.2)	5 (7.5)	17
Dec 16-31	--	1 (2.1)	7 (7.0)	17 (11.4)	35
Total	0 (--)	79 (31)	208 (48)	149 (39)	38[b]

[a] Estimate may include wild winter steelhead.

[b] Estimate of mean catch rate is for the period 1 January - 31 December.

Table 19. Adult 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, stock, run year	Total escapement	Freshwater/Ocean age												Repeat spawners
		1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/2	
Wild,														
Hood River,														
1992-1993	491	--	5	0	--	26	309	48	0	6	78	0	1	18
1993-1994	244	--	1	2	--	11	108	53	3	5	44	7	0	10
1994-1995	220	--	0	0	--	5	81	34	0	2	71	12	0	15
1995-1996	132	--	0	0	--	15	82	18	0	2	11	1	0	3
1996-1997	184	--	2	0	--	7	129	14	0	2	23	2	0	5
1997-1998	79	--	1	0	--	8	42	7	0	1	13	0	0	7
1998-1999	132	--	2	0	--	15	75	13	0	0	16	0	0	11
Subbasin hatchery,														
Foster,														
1992-1993	1,725	48	1,512	150	1	--	0	1	--	--	--	--	--	13
1993-1994	1,099	36	817	236	3	--	0	0	--	--	--	--	--	7
1994-1995	1,635	11	1,360	251	0	--	1	0	--	--	--	--	--	12
1995-1996	548	61	420	59	0	--	1	0	--	--	--	--	--	7
1996-1997	1,351	7	1,251	79	0	--	6	0	--	--	--	--	--	8
1997-1998	594	9	544	37	0	--	0	0	--	--	--	--	--	4
1998-1999	557	26	377	136	0	--	0	0	--	--	--	--	--	18
Stray hatchery,														
Unknown,														
1992-1993	5	3	2	0	--	--	--	--	--	--	--	--	--	0
1993-1994	13	1	10	2	--	--	--	--	--	--	--	--	--	0
1994-1995	4	0	1	3	--	--	--	--	--	--	--	--	--	0
1995-1996	5	2	0	2	--	--	--	--	--	--	--	--	--	1
1996-1997	18	1	16	1	--	--	--	--	--	--	--	--	--	0
1997-1998	6	2	4	0	--	--	--	--	--	--	--	--	--	0
1998-1999	10	1	7	2	--	--	--	--	--	--	--	--	--	0

Table 20. Number of adult summer steelhead captured at the Powerdale Dam trap and transported for release (recycled) at the mouth of the Hood River. Number of recaptures (N), average number of days to return ($\bar{X}$), and percent return (%) are given for each successive recapture at the Powerdale Dam trap. Percent return is estimated after mortalities, adults taken for brood stock, and recycled fish subsequently passed above Powerdale Dam have been subtracted from the previous recapture count.

		Number of successive returns to the Powerdale Dam trap of recycled adult summer steelhead																											
	Total no.	1			2			3			4			5			6			7			8			9		
Run year	of recycles	N	$\bar{X}$	%	N	$\bar{X}$	%	N	$\bar{X}$	%	N	$\bar{X}$	%	N	$\bar{X}$	%	N	$\bar{X}$	%	N	$\bar{X}$	%	N	$\bar{X}$	%	N	$\bar{X}$	%
1995-1996	29	9	26	31	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996-1997	52	22	26	42	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997-1998	144	41	22	28	12	29	32	3	21	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998-1999	549	315	17	57	199	18	65	117	20	60	63	17	56	25	21	40	9	20	36	6	24	67	2	16	33	1	12	50
1999-2000[a]	415	228	14	55	107	10	47	50	9	47	26	8	52	14	7	54	3	7	21	1	6	33	1	7	100	1	4	100

[a] Preliminary estimates. Summaries are complete through 12/31/1999.

Table 21. Adult summer steelhead escapements to the Powerdale Dam trap by origin, brood year, and ocean age category. Brood years are bold faced for those years in which brood year specific estimates of escapement are complete. (Percent return is in parentheses. Estimates are based on returns in the 1992-1993 through 1998-1999 run years.)

Origin, stock, brood year[a]	Smolts	Ocean age 1 salt	Ocean age 2 salt	Ocean age 3 salt	Ocean age 4 salt	Repeat spawners
Wild,						
Hood River,						
1986	--	--	1	0	0	3
1987	--	0	78	55	3	19
1988	--	6	353	65	0	15
1989	--	31	184	37	0	9
1990	--	13	93	20	0	3
1991	--	7	105	14	0	5
1992	--	17	142	7	0	4
1993	--	8	60	13	--	11
1994	--	8	76	0	--	--
1995	--	15	2	--	--	--
Subbasin hatchery,						
Foster,						
1987	79,867	--	--	1 (0.001)	1 (0.001)	--
1988	89,026	--	--	150 (0.17)	3 (0.003)	13 (0.01)
1989	81,795	--	1,512 (1.85)	236 (0.29)	0	7 (0.01)
1990	77,132	48 (0.06)	818 (1.06)	251 (0.33)	0	12 (0.02)
1991	99,973	36 (0.04)	1,361 (1.36)	59 (0.06)	0	12 (0.01)
1992	70,928	11 (0.02)	426 (0.60)	79 (0.11)	0	5 (0.007)
1993	90,042	61 (0.07)	1,251 (1.39)	37 (0.04)	0	19 (0.02)
1994	76,330	7 (0.01)	544 (0.71)	136 (0.18)	--	0 (0)
1995	68,378	9 (0.01)	377 (0.55)	--	--	1 (0.001)
1996	60,993	26 (0.04)	--	--	--	--

[a] Complete brood returns are available beginning with the 1989 wild and 1990 hatchery broods, as determined based on age structure for adult summer steelhead sampled at the Powerdale Dam trap. Estimates of escapement for prior brood years do not include adult returns from all possible age categories.

Table 22. Age composition (percent) of adult summer steelhead sampled at the Powerdale Dam trap by origin, run year, and age category. (Estimates in a given run year may not add to 100% due to rounding error.)

Origin, stock, run year	N	Freshwater/ocean age												Repeat spawners
		1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/2	
Wild,														
Hood River,														
1992-1993	477	--	1.0	0	--	5.2	62.9	9.6	0	1.3	15.9	0	0.2	3.8
1993-1994	223	--	0.4	0.9	--	4.5	44.4	20.6	1.3	2.2	18.4	3.1	0	4.0
1994-1995	177	--	0	0	--	2.3	40.1	13.0	0	0.6	31.1	5.1	0	7.9
1995-1996	122	--	0	0	--	11.5	62.3	13.9	0	1.6	7.4	0.8	0	2.5
1996-1997	170	--	1.2	0	--	3.5	70.6	7.6	0	1.2	11.8	1.2	0	2.9
1997-1998	65	--	1.5	0	--	9.2	55.4	9.2	0	1.5	13.8	0	0	9.2
1998-1999	119	--	1.7	0	--	11.8	56.3	10.1	0	0	11.8	0	0	8.4
Subbasin hatchery,														
Foster,														
1992-1993	1,669	2.8	87.8	8.5	0.1	--	0	--	--	--	--	--	--	0.8
1993-1994	1,069	3.3	74.4	21.4	0.3	--	0	--	--	--	--	--	--	0.7
1994-1995	1,568	0.7	83.2	15.2	0	--	0.1	--	--	--	--	--	--	0.8
1995-1996	510	11.2	76.5	10.8	0	--	0.2	--	--	--	--	--	--	1.4
1996-1997	1,293	0.5	92.7	5.7	0	--	0.5	--	--	--	--	--	--	0.6
1997-1998	563	1.6	91.5	6.2	0	--	0	--	--	--	--	--	--	0.7
1998-1999	525	4.6	68.0	24.2	0	--	0	--	--	--	--	--	--	3.2
Stray hatchery,														
Unknown,														
1992-1993	5	60.0	40.0	0	--	--	--	--	--	--	--	--	--	0
1993-1994	13	7.7	76.9	15.4	--	--	--	--	--	--	--	--	--	0
1994-1995	4	0	25.0	75.0	--	--	--	--	--	--	--	--	--	0
1995-1996	5	40.0	0	40.0	--	--	--	--	--	--	--	--	--	20.0
1996-1997	15	6.7	86.7	6.7	--	--	--	--	--	--	--	--	--	0
1997-1998	6	33.3	66.7	0	--	--	--	--	--	--	--	--	--	0
1998-1999	10	10.0	70.0	20.0	--	--	--	--	--	--	--	--	--	0

Table 23. Mean fork length (cm) of adult summer steelhead with spawning checks in the 1997-1998 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	1/2S.4	2/2S.3	3/1S.3	3/2S.3
Wild,					
Females,					
N	--	--	2	1	1
Mean	--	--	71.50	68.0	69.5
STD	--	--	8.49	--	--
Range	--	--	65.5-77.5	68.0	69.5
Males,					
N	--	--	1	--	--
Mean	--	--	71.5	--	--
STD	--	--	--	--	--
Range	--	--	71.5	--	--
Total,					
N	--	--	3	1	1
Mean	--	--	71.50	68.0	69.5
STD	--	--	6.00	--	--
Range	--	--	65.5-77.5	68.0	69.5
Subbasin hatchery,					
Females,					
N	2	--	--	--	--
Mean	72.75	--	--	--	--
STD	1.06	--	--	--	--
Range	72.0-73.5	--	--	--	--
Males,					
N	1	1	--	--	--
Mean	72.0	75.5	--	--	--
STD	--	--	--	--	--
Range	72.0	75.5	--	--	--
Total,					
N	3	1	--	--	--
Mean	72.50	75.5	--	--	--
STD	0.87	--	--	--	--
Range	72.0-73.5	75.5	--	--	--

Table 24. Mean fork length (cm) of adult summer steelhead with spawning checks in the 1998-1999 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	1/1S.3S.5	1/2S.3	1/2S.4	1/2S.3S.4	1/3S.4	2/2S.3
Wild,							
Females,							
N	--	--	--	--	--	--	6
Mean	--	--	--	--	--	--	73.42
STD	--	--	--	--	--	--	3.12
Range	--	--	--	--	--	--	69.0-76.5
Males,							
N	--	--	--	--	--	--	2
Mean	--	--	--	--	--	--	78.25
STD	--	--	--	--	--	--	1.77
Range	--	--	--	--	--	--	77.0-79.5
Total,							
N	--	--	--	--	--	--	8
Mean	--	--	--	--	--	--	74.62
STD	--	--	--	--	--	--	3.52
Range	--	--	--	--	--	--	69.0-79.5
Hatchery,							
Females,							
N	--	1	5	2	1	--	--
Mean	--	66.0	71.40	69.50	71.5	--	--
STD	--	--	5.89	3.54	--	--	--
Range	--	66.0	66.0-80.5	67.0-72.0	71.5	--	--
Males,							
N	1	--	5	--	--	1	--
Mean	69.5	--	77.70	--	--	82.0	--
STD	--	--	4.86	--	--	--	--
Range	69.5	--	69.5-82.0	--	--	82.0	--
Total,							
N	1	1	10	2	1	1	--
Mean	69.5	66.0	74.55	69.50	71.5	82.0	--
STD	--	--	6.08	3.54	--	--	--
Range	69.5	66.0	66.0-82.0	67.0-72.0	71.5	82.0	--

Table 25. Mean fork length (cm) of adult summer steelhead without spawning checks in the 1997-1998 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	3/1	3/2	Sample mean
Wild,									
Females,									
N	--	1	--	5	27	3	--	5	46
Mean	--	65.0	--	54.80	69.91	76.00	--	71.50	68.80
STD	--	--	--	8.99	2.86	4.92	--	1.22	6.52
Range	--	65.0	--	43.5-65.0	63.5-75.0	70.5-80.0	--	69.5-72.5	43.5-80.0
Males,									
N	--	--	--	1	9	3	1	4	19
Mean	--	--	--	61.5	74.72	78.33	55.0	74.25	73.29
STD	--	--	--	--	7.37	3.51	--	3.33	7.70
Range	--	--	--	61.5	64.0-85.0	75.0-82.0	55.0	71.5-79.0	55.0-85.0
Total,									
N	--	1	--	6	36	6	1	9	65
Mean	--	65.0	--	55.92	71.11	77.17	55.0	72.72	70.12
STD	--	--	--	8.49	4.79	4.03	--	2.65	7.13
Range	--	65.0	--	43.5-65.0	63.5-85.0	70.5-82.0	55.0	69.5-79.0	43.5-85.0
Subbasin hatchery,									
Females,									
N	6	360	14	--	--	--	--	--	382
Mean	56.83	68.43	74.79	--	--	--	--	--	68.51
STD	2.34	3.46	3.46	--	--	--	--	--	3.93
Range	53.5-60.0	60.5-78.0	70.0-81.5	--	--	--	--	--	53.5-81.5
Males,									
N	3	155	21	--	--	--	--	--	181
Mean	60.50	71.65	80.76	--	--	--	--	--	72.55
STD	2.65	3.92	6.50	--	--	--	--	--	5.38
Range	58.5-63.5	60.5-81.5	66.0-94.0	--	--	--	--	--	58.5-94.0
Total,									
N	9	515	35	--	--	--	--	--	563
Mean	58.06	69.40	78.37	--	--	--	--	--	69.81
STD	2.92	3.89	6.19	--	--	--	--	--	4.83
Range	53.5-63.5	60.5-81.5	66.0-94.0	--	--	--	--	--	53.5-94.0

Table 26. Mean fork length (cm) of adult summer steelhead without spawning checks in the 1998-1999 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	3/2	Sample mean
Wild,								
Females,								
N	--	--	--	9	53	9	11	90
Mean	--	--	--	55.50	70.98	70.94	71.00	69.63
STD	--	--	--	8.02	5.41	5.61	5.46	7.25
Range	--	--	--	36.5-63.5	60.0-82.0	60.0-80.0	63.0-84.0	36.5-84.0
Males,								
N	--	2	--	5	14	3	3	29
Mean	--	55.00	--	55.40	73.50	80.33	67.83	69.55
STD	--	1.41	--	6.40	6.75	1.76	2.08	10.23
Range	--	54.0-56.0	--	47.5-62.0	63.5-83.0	78.5-82.0	65.5-69.5	47.5-83.0
Total,								
N	--	2	--	14	67	12	14	119
Mean	--	55.00	--	55.46	71.50	73.29	70.32	69.61
STD	--	1.41	--	7.22	5.76	6.44	5.04	8.03
Range	--	54.0-56.0	--	36.5-63.5	60.0-83.0	60.0-82.0	63.0-84.0	36.5-84.0
Subbasin hatchery,								
Females,								
N	11	248	55	--	--	--	--	323
Mean	55.77	67.35	75.29	--	--	--	--	68.40
STD	2.87	3.41	3.55	--	--	--	--	5.13
Range	52.0-62.0	57.5-77.0	66.5-84.5	--	--	--	--	52.0-84.5
Males,								
N	13	109	72	--	--	--	--	201
Mean	55.73	70.90	79.58	--	--	--	--	73.24
STD	1.72	4.37	4.84	--	--	--	--	7.59
Range	52.5-59.0	59.0-85.0	65.0-91.0	--	--	--	--	52.5-91.0
Total,								
N	24	357	127	--	--	--	--	524
Mean	55.75	68.44	77.72	--	--	--	--	70.26
STD	2.26	4.07	4.81	--	--	--	--	6.62
Range	52.0-62.0	57.5-85.0	65.0-91.0	--	--	--	--	52.0-91.0

Table 27. Mean fork length (cm) of adult summer steelhead without spawning checks by origin, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1994), Olsen et al. (1995), Olsen et al. (1996), Olsen and French (1996), and Olsen and French (1999).]

Origin, stock, brood year	Freshwater/ocean age											
	1/1	2/1	3/1	1/2	2/2	3/2	4/2	1/3	2/3	3/3	1/4	2/4
Wild,												
Hood River,												
1986	--	--	--	--	--	--	64 (1)	--	--	--	--	--
1987	--	--	--	--	--	68 (76)	--	--	82 (46)	79 (7)	--	79 (3)
1988	--	--	54 (6)	--	70 (300)	66 (41)	--	--	80 (46)	79 (9)	--	--
1989	--	57 (25)	53 (5)	69 (5)	68 (99)	70 (55)	--	88 (2)	80 (23)	81 (1)	--	--
1990	--	55 (10)	54 (1)	70 (1)	69 (71)	68 (9)	--	--	80 (17)	81 (2)	--	--
1991	--	51 (4)	57 (2)	--	68 (76)	68 (20)	--	--	78 (13)	--	--	--
1992	--	60 (14)	56 (2)	--	72 (120)	73 (9)	--	--	77 (6)	--	--	--
1993	--	53 (6)	55 (1)	72 (2)	71 (36)	70 (14)	--	--	73 (12)	--	--	--
1994	--	56 (6)	--	65 (1)	72 (67)	--	--	--	--	--	--	--
1995	--	55 (14)	--	55 (2)	--	--	--	--	--	--	--	--
Subbasin hatchery,												
Foster,												
1987	--	--	--	--	--	--	--	--	--	--	90 (1)	--
1988	--	--	--	--	--	--	--	78 (142)	--	--	79 (3)	--
1989	--	--	--	68 (1,466)	--	--	--	80 (229)	--	--	--	--
1990	55 (47)	--	--	67 (795)	75 (1)	--	--	79 (239)	--	--	--	--
1991	53 (35)	--	--	69 (1,305)	66 (1)	--	--	81 (55)	--	--	--	--
1992	53 (11)	--	--	68 (390)	69 (6)	--	--	80 (74)	--	--	--	--
1993	57 (57)	--	--	69 (1,198)	--	--	--	78 (35)	--	--	--	--
1994	53 (7)	--	--	69 (515)	--	--	--	78 (127)	--	--	--	--
1995	58 (9)	--	--	68 (357)	--	--	--	--	--	--	--	--
1996	56 (24)	--	--	--	--	--	--	--	--	--	--	--

Table 28. Mean weight (kg) of adult summer steelhead without spawning checks in the 1997-1998 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	3/1	3/2	Sample mean
Wild,									
Females,									
N	--	1	--	5	27	3	--	5	46
Mean	--	2.5	--	1.88	3.34	4.60	--	3.58	3.26
STD	--	--	--	0.91	0.46	0.78	--	0.24	0.79
Range	--	2.5	--	1.0-3.0	2.5-4.4	3.7-5.1	--	3.2-3.8	1.0-5.1
Males,									
N	--	--	--	1	9	3	1	4	19
Mean	--	--	--	2.2	4.12	4.50	1.6	3.90	3.89
STD	--	--	--	--	1.30	0.92	--	0.43	1.19
Range	--	--	--	2.2	2.6-6.1	3.7-5.5	1.6	3.3-4.3	1.6-6.1
Total,									
N	--	1	--	6	36	6	1	9	65
Mean	--	2.5	--	1.93	3.54	4.55	1.6	3.72	3.44
STD	--	--	--	0.83	0.82	0.76	--	0.36	0.96
Range	--	2.5	--	1.0-3.0	2.5-6.1	3.7-5.5	1.6	3.2-4.3	1.0-6.1
Subbasin hatchery,									
Females,									
N	6	329	14	--	--	--	--	--	351
Mean	1.87	3.20	3.98	--	--	--	--	--	3.21
STD	0.26	0.51	0.65	--	--	--	--	--	0.56
Range	1.5-2.2	2.1-4.5	3.3-5.7	--	--	--	--	--	1.5-5.7
Males,									
N	3	147	20	--	--	--	--	--	172
Mean	2.17	3.63	5.14	--	--	--	--	--	3.78
STD	0.06	0.60	1.29	--	--	--	--	--	0.88
Range	2.1-2.2	2.1-5.2	2.8-7.8	--	--	--	--	--	2.1-7.8
Total,									
N	9	476	34	--	--	--	--	--	523
Mean	1.97	3.33	4.66	--	--	--	--	--	3.40
STD	0.25	0.58	1.21	--	--	--	--	--	0.73
Range	1.5-2.2	2.1-5.2	2.8-7.8	--	--	--	--	--	1.5-7.8

Table 29. Mean weight (kg) of adult summer steelhead without spawning checks in the 1998-1999 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	3/2	Sample mean
Wild,								
Females,								
N	--	--	--	9	52	9	10	88
Mean	--	--	--	2.02	3.75	3.77	3.85	3.62
STD	--	--	--	0.70	0.90	0.91	1.04	1.01
Range	--	--	--	0.5-2.8	2.0-5.7	2.0-5.0	2.8-6.4	0.5-6.4
Males,								
N	--	2	--	5	14	3	3	29
Mean	--	2.00	--	1.80	4.08	5.10	3.20	3.60
STD	--	0.14	--	0.60	0.99	0.50	0.10	1.33
Range	--	1.9-2.1	--	1.1-2.6	2.5-5.5	4.6-5.6	3.1-3.3	1.1-5.6
Total,								
N	--	2	--	14	66	12	13	117
Mean	--	2.00	--	1.94	3.82	4.10	3.70	3.61
STD	--	0.14	--	0.66	0.92	1.01	0.95	1.09
Range	--	1.9-2.1	--	0.5-2.8	2.0-5.7	2.0-5.6	2.8-6.4	0.5-6.4
Subbasin hatchery,								
Females,								
N	11	243	53	--	--	--	--	316
Mean	1.78	3.15	4.31	--	--	--	--	3.31
STD	0.29	0.47	0.71	--	--	--	--	0.73
Range	1.3-2.1	2.0-4.9	2.9-6.0	--	--	--	--	1.3-6.0
Males,								
N	13	107	71	--	--	--	--	198
Mean	1.75	3.65	5.03	--	--	--	--	4.06
STD	0.26	0.69	0.94	--	--	--	--	1.18
Range	1.5-2.3	1.8-5.8	2.7-7.5	--	--	--	--	1.5-7.5
Total,								
N	24	350	124	--	--	--	--	514
Mean	1.76	3.30	4.72	--	--	--	--	3.59
STD	0.27	0.60	0.91	--	--	--	--	1.00
Range	1.3-2.3	1.8-5.8	2.7-7.5	--	--	--	--	1.3-7.5

Table 30. Mean weight (kg) of adult summer steelhead without spawning checks by origin, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1996), Olsen and French (1996), and Olsen and French (1999).]

Origin, stock, brood year	Freshwater/ocean age											
	1/1	2/1	3/1	1/2	2/2	3/2	4/2	1/3	2/3	3/3	1/4	2/4
Wild,												
Hood River,												
1988	--	--	--	--	--	--	--	--	--	5.3 (9)	--	--
1989	--	--	--	--	--	3.6 (54)	--	--	5.2 (23)	5.0 (1)	--	--
1990	--	--	--	--	3.4 (70)	3.4 (9)	--	--	5.1 (17)	5.4 (2)	--	--
1991	--	1.6 (3)	2.0 (2)	--	3.2 (75)	3.2 (20)	--	--	4.9 (13)	--	--	--
1992	--	2.3 (13)	1.8 (2)	--	3.8 (116)	3.7 (9)	--	--	4.6 (6)	--	--	--
1993	--	1.6 (6)	1.6 (1)	4.0 (2)	3.5 (36)	3.7 (13)	--	--	4.1 (12)	--	--	--
1994	--	1.9 (6)	--	2.5 (1)	3.8 (66)	--	--	--	--	--	--	--
1995	--	1.9 (14)	--	2.0 (2)	--	--	--	--	--	--	--	--
Subbasin hatchery,												
Foster,												
1990	--	--	--	--	4.1 (1)	--	--	5.1 (183)	--	--	--	--
1991	--	--	--	3.4 (1,065)	2.9 (1)	--	--	5.3 (51)	--	--	--	--
1992	1.6 (10)	--	--	3.2 (368)	2.9 (5)	--	--	4.9 (72)	--	--	--	--
1993	2.0 (54)	--	--	3.4 (1,139)	--	--	--	4.7 (34)	--	--	--	--
1994	1.8 (7)	--	--	3.3 (476)	--	--	--	4.7 (124)	--	--	--	--
1995	2.0 (9)	--	--	3.3 (350)	--	--	--	--	--	--	--	--
1996	1.8 (24)	--	--	--	--	--	--	--	--	--	--	--

Table 31. Adult summer 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 is in parentheses.)

Origin, stock, run year	Freshwater/ocean age												Repeat spawners
	1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/2	
Wild,													
Hood River,													
1992-1993	--	60 (5)	--	--	72 (25)	79 (300)	28 (46)	--	83 (6)	80 (76)	--	100 (1)	69 (16)
1993-1994	--	0 (1)	50 (2)	--	30 (10)	75 (99)	48 (46)	100 (3)	40 (5)	73 (41)	29 (7)	--	75 (8)
1994-1995	--	--	--	--	75 (4)	79 (71)	48 (23)	--	100 (1)	65 (55)	44 (9)	--	82 (11)
1995-1996	--	--	--	--	64 (14)	70 (76)	41 (17)	--	100 (2)	67 (9)	0 (1)	--	100 (1)
1996-1997	--	50 (2)	--	--	33 (6)	71 (120)	46 (13)	--	100 (2)	70 (20)	50 (2)	--	67 (3)
1997-1998	--	100 (1)	--	--	83 (6)	75 (36)	50 (6)	--	0 (1)	56 (9)	--	--	80 (5)
1998-1999	--	0 (2)	--	--	64 (14)	79 (67)	75 (12)	--	--	79 (14)	--	--	75 (8)
Subbasin hatchery,													
Foster,													
1992-1993	47 (47)	73 (1,466)	34 (142)	0 (1)	--	--	--	--	--	--	--	--	77 (13)
1993-1994	60 (35)	76 (795)	43 (229)	100 (3)	--	--	--	--	--	--	--	--	50 (6)
1994-1995	36 (11)	62 (1,304)	41 (239)	--	--	0 (1)	--	--	--	--	--	--	60 (10)
1995-1996	61 (57)	62 (390)	25 (55)	--	--	100 (1)	--	--	--	--	--	--	33 (6)
1996-1997	43 (7)	63 (1,187)	38 (74)	--	--	33 (6)	--	--	--	--	--	--	60 (5)
1997-1998	67 (9)	70 (515)	40 (35)	--	--	--	--	--	--	--	--	--	50 (4)
1998-1999	46 (24)	69 (357)	43 (127)	--	--	--	--	--	--	--	--	--	59 (17)

Table 32. Mean fecundity[a] of adult summer steelhead by origin, ocean age, and run year. Fish were sampled at the Powerdale Dam trap.

Origin, ocean age, run year	N	Mean fork length (cm)	Fecundity (eggs/female) Mean	Range	95% C.I.
Wild,					
1 Salt,					
1997-1998	1	65.0	5,010	5,010	--
1998-1999	1	60.0	3,510	3,510	--
2 Salt,					
1997-1998	2	69.0	4,322	4,212 - 4,432	± 1,398
1998-1999	7	68.4	3,806	3,180 - 4,986	± 579
3 Salt,					
1997-1998	2	77.5	4,828	4,488 - 5,168	± 4,320
1998-1999	3	74.8	4,254	3,952 - 4,760	± 1,095

[a] Estimates were based on numbers of eggs collected from air spawned fish and may under estimate true fecundity (*see* **Methods**).

Table 33. Bimonthly counts of upstream migrant adult winter steelhead captured at the Powerdale Dam trap, by origin and run year. Counts are boldfaced for the bimonthly period in which the median date of migration occurred in each origin category.

Origin,	September		October		November		December		January		February		March		April		May		June		July		
run year	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-31	01-15	16-29	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	Total
Wild,																							
1991-1992	0	0	0	0	0	0	0	0	0	24	28	32	75	98	**153**	149	88	29	2	0	0	0	678
1992-1993	0	0	0	0	0	0	0	4	0	2	3	0	28	61	99	**78**	86	30	3	2	0	0	396
1993-1994	0	0	0	0	0	0	0	0	4	7	0	6	23	25	77	**128**	76	21	11	0	0	0	378
1994-1995	0	0	0	0	0	0	0	0	0	0	9	0	6	2	55	15	**52**	44	10	1	0	0	194
1995-1996	0	0	0	0	0	0	0	0	0	0	0	0	17	4	93	**40**	69	36	11	0	0	0	270
1996-1997	0	0	0	0	0	0	0	2	1	0	3	13	5	22	52	**72**	68	33	3	0	0	0	274
1997-1998	0	0	0	0	1	0	0	0	1	1	6	0	7	12	23	**107**	36	8	5	1	0	0	208
1998-1999	0	0	0	0	0	0	0	0	13	0	4	2	8	32	47	**121**	22	33	7	2	0	0	291
Subbasin hatchery,																							
1991-1992	0	0	0	0	0	0	0	5	11	94	**54**	42	30	5	2	2	0	0	0	0	0	0	245
1992-1993	0	0	0	0	0	0	2	13	0	31	44	0	**39**	31	17	13	3	0	0	0	0	0	193
1993-1994	0	0	0	0	0	0	0	0	25	31	8	**36**	32	6	3	2	0	0	0	0	0	0	143
1994-1995	0	0	0	0	0	0	0	0	0	6	28	**18**	11	4	22	3	6	1	0	0	0	0	99
1995-1996	0	0	0	0	0	2	0	0	0	0	0	0	19	8	93	**47**	66	21	3	0	0	0	259
1996-1997	0	0	0	0	0	0	0	0	0	1	2	38	20	54	129	**171**	141	51	7	0	0	0	614
1997-1998	0	0	0	0	5	1	0	0	1	0	6	4	26	48	82	**142**	26	5	1	0	0	0	347
1998-1999	0	1	3	6	3	4	0	0	9	0	4	0	6	63	**75**	90	12	23	1	2	0	0	302
Stray hatchery,																							
1991-1992	0	0	0	0	0	0	0	0	0	2	2	1	5	**4**	7	1	0	0	0	0	0	0	22
1992-1993	0	0	0	0	0	0	0	0	0	1	2	0	2	**9**	7	1	0	0	0	0	0	0	22
1993-1994	0	0	0	0	0	0	0	0	1	0	0	0	1	2	**11**	6	0	0	0	0	0	0	21
1994-1995	0	0	0	0	0	0	0	0	0	0	0	1	**1**	1	0	0	1	0	0	0	0	0	4
1995-1996	0	0	0	0	0	0	0	0	0	0	0	0	**3**	1	2	0	0	0	0	0	0	0	6
1996-1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**1**	0	1	0	3
1997-1998	0	0	0	0	0	0	0	0	0	0	1	1	0	**8**	3	4	2	0	0	0	0	0	19
1998-1999	0	0	0	0	0	0	0	0	2	0	0	0	0	**4**	1	0	0	0	0	0	0	0	7

Table 33. Continued.

Origin,	September		October		November		December		January		February		March		April		May		June		July		
run year	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-31	01-15	16-29	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	Total
Unknown,																							
1991-1992	0	0	0	0	0	0	0	0	4	22	7	**9**	6	5	3	9	4	2	0	0	0	0	71
1992-1993	0	0	0	0	0	0	1	4	0	7	7	0	**6**	5	4	2	3	0	0	0	0	0	39
1993-1994	0	0	0	0	0	0	0	0	6	3	0	1	6	**8**	5	5	3	2	0	0	0	0	39
1994-1995	0	0	0	0	0	0	0	1	0	0	5	3	**4**	1	2	2	2	0	0	0	0	0	20
1995-1996	0	0	0	0	0	0	0	0	0	0	0	0	2	1	9	**5**	5	3	0	0	0	0	25
1996-1997	0	0	0	0	0	0	0	0	0	0	0	5	1	6	7	**8**	7	4	1	0	0	0	39
1997-1998	0	0	0	0	0	0	0	0	0	0	0	4	9	5	**11**	11	5	1	0	0	0	0	46
1998-1999	0	0	1	0	0	1	0	0	1	1	0	0	1	2	**7**	7	1	2	0	0	0	0	24

Table 34. Estimated harvest of adult winter steelhead in the Hood River sport fishery located from the mouth of the Hood River to 0.3 miles above Powerdale Dam (RM 4.5)[a], 1998. Confidence limits (95%) are in parenthesis.

Period	Wild winter steelhead		Subbasin hatchery winter steelhead		Catch Rate
	Kept	Released[b]	Kept	Released	(hrs/fish)
Jan 1-15	--	3 (6.9)	9 (10.8)	--	36
Jan 16-31	5 (7.2)	13 (10.6)	2 (3.4)	--	39
Feb 1-15	--	9 (8.9)	13 (11.1)	2 (4.1)	45
Feb 16-29	--	26 (15.4)	14 (11.5)	14 (9.7)	18
Mar 1-15	--	32 (20.3)	29 (17.5)	10 (10.7)	19
Mar 16-31	--	60 (36.9)	66 (44.6)	50 (36.6)	12
Apr 1-15	--	48 (36.7)	38 (28.0)	10 (9.5)	19
Apr 16-30	--	3 (3.1)	8 (9.0)	4 (5.9)	54
May 1-15	--	11 (15.3)	--	--	117
May 16-31	--	4 (4.5)	2 (3.3)	--	260
Jun 1-15	--	--	--	--	--
Jun 16-30	--	--	--	--	--
Jul 1-15	--	--	--	--	--
Jul 16-31	--	--	--	--	--
Aug 1-15	--	--	--	--	--
Aug 16-31	--	--	--	--	--
Sep 1-15	--	--	--	--	--
Sep 16-30	--	--	--	--	--
Oct 1-15	--	--	--	--	--
Oct 16-31	--	--	--	--	--
Nov 1-15	--	--	--	--	--
Nov 16-30	--	--	3 (4.5)	4 (8.2)	72
Dec 1-15	--	--	11 (12.1)	--	68
Dec 16-31	--	--	13 (11.1)	--	38
Total	5 (7.2)	209 (62)	208 (62)	94 (42)	27[c]

[a] The fishery above Powerdale Dam was closed on 1 April, 1998.

[b] Estimate may include wild summer steelhead.

[c] Estimate of mean catch rate is for the period 1 January - 31 May and 16 November - 31 December.

Table 35. Estimated harvest of adult winter steelhead in the Hood River sport fishery located from the mouth of the Hood River to Powerdale Dam (RM 4.5), 1999. Confidence limits (95%) are in parenthesis.

Period	Wild winter steelhead		Subbasin hatchery winter steelhead		Catch Rate
	Kept	Released[a]	Kept	Released	(hrs/fish)
Jan 1-15	--	9 (7.0)	11 (6.7)	7 (6.4)	35
Jan 16-31	--	9 (7.1)	11 (9.3)	8 (6.6)	29
Feb 1-15	--	21 (13.9)	15 (10.1)	11 (10.5)	16
Feb 16-29	--	24 (16.4)	29 (15.6)	10 (8.4)	13
Mar 1-15	--	59 (25.9)	23 (12.6)	2 (2.5)	14
Mar 16-31	--	41 (28.1)	20 (17.3)	34 (22.1)	15
Apr 1-15	--	31 (16.9)	6 (5.8)	13 (9.7)	17
Apr 16-30	--	20 (14.8)	25 (19.9)	4 (6.8)	27
May 1-15	--	17 (13.5)	5 (5.4)	20 (19.7)	30
May 16-31	--	7 (7.1)	--	--	160
Jun 1-15	--	--	--	--	--
Jun 16-30	--	--	--	--	--
Jul 1-15	--	--	--	--	--
Jul 16-31	--	--	--	--	--
Aug 1-15	--	--	--	--	--
Aug 16-31	--	--	--	--	--
Sep 1-15	--	--	--	--	--
Sep 16-30	--	--	--	--	--
Oct 1-15	--	--	--	--	--
Oct 16-31	--	--	--	--	--
Nov 1-15	--	--	--	--	--
Nov 16-30	--	--	2 (3.3)	--	104
Dec 1-15	--	5 (7.5)	1 (2.8)	--	61
Dec 16-31	--	3 (3.7)	3 (4.6)	--	147
Total	0 (--)	246 (53)	151 (38)	109 (36)	24[b]

[a] Estimate may include wild summer steelhead.
[b] Estimate of mean catch rate is for the period 1 January - 31 May and 16 November - 31 December.

Table 36. Adult winter steelhead escapements to the Powerdale Dam trap by origin, stock, 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 age													Repeat spawners
		1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	3/4	4/2	
Wild,															
Hood River,															
1991-1992	698	--	3	4	0	9	424	76	0	1	111	17	0	1	52
1992-1993	412	--	2	6	0	36	174	123	1	1	20	17	0	0	32
1993-1994	405	--	2	6	0	9	274	79	0	1	17	4	0	0	13
1994-1995	206	--	1	1	0	28	107	34	1	3	9	3	1	0	18
1995-1996	280	--	12	1	1	18	183	29	0	1	22	6	0	0	7
1996-1997	289	--	1	1	0	12	199	34	0	3	24	7	0	1	7
1997-1998	227	--	1	0	0	12	134	42	0	3	20	4	0	0	11
1998-1999	301	--	8	0	0	55	156	38	0	2	23	10	0	0	9
Subbasin hatchery,															
Big Creek,															
1991-1992	296	--	276	7	--	--	6	1	--	--	--	--	--	--	6
1992-1993	210	--	65	135	--	--	0	0	--	--	--	--	--	--	10
1993-1994	138	--	--	63	1	--	69	0	--	--	--	--	--	--	5
1994-1995	10	--	--	--	--	--	--	7	--	--	--	--	--	--	3
Mixed,[a]															
1992-1993	6	6	--	--	--	--	--	--	--	--	--	--	--	--	--
1993-1994	15	--	15	--	--	--	--	--	--	--	--	--	--	--	--
1994-1995	8	--	--	2	--	--	6	--	--	--	--	--	--	--	--
Hood River,															
1993-1994[b]	0	0	--	--	--	--	--	--	--	--	--	--	--	--	--
1994-1995	89	11	77	--	--	0	--	--	--	--	--	--	--	--	1
1995-1996	274	10	247	17	--	0	0	--	--	--	--	--	--	--	0
1996-1997	638	7	523	100	0	0	4	--	--	--	--	--	--	--	4
1997-1998	373	2	237	117	0	0	3	1	--	--	--	--	--	--	13
1998-1999	316	11	166	119	1	1	8	--	--	--	--	--	--	--	10

Table 36. Continued.

Origin, stock, run year	Total escapement	Freshwater/ocean age													Repeat spawners
		1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	3/4	4/2	
Stray hatchery,															
Unknown,															
1991-1992	22	0	8	13	--	--	0	--	--	--	--	--	--	--	1
1992-1993	22	0	15	5	--	--	0	--	--	--	--	--	--	--	2
1993-1994	23	1	0	21	--	--	1	--	--	--	--	--	--	--	0
1994-1995	4	1	1	2	--	--	0	--	--	--	--	--	--	--	0
1995-1996	6	0	5	0	--	--	0	--	--	--	--	--	--	--	1
1996-1997	3	0	3	0	--	--	0	--	--	--	--	--	--	--	0
1997-1998	20	1	2	16	--	--	1	--	--	--	--	--	--	--	0
1998-1999	7	0	3	2	--	--	1	--	--	--	--	--	--	--	1

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

[b] The 1993-1994 run year is the first run year in which the Hood River stock (1992 brood) would have had the potential for returning as adults to Powerdale Dam. These fish would have returned as age category 1/1 adults. None were sampled at the Powerdale Dam trap.

Table 37. Number of adult winter steelhead captured at the Powerdale Dam trap and transported for release (recycled) at the mouth of the Hood River. Number of recaptures (N), average number of days to return ($\bar{X}$), and percent return (%) are given for each successive recapture at the Powerdale Dam trap. Percent return is estimated after mortalities, adults taken for brood stock, and recycled fish subsequently passed above Powerdale Dam have been subtracted from the previous recapture count.

		Number of successive returns to the Powerdale Dam trap of recycled adult winter steelhead																	
	Total no.	1			2			3			4			5			6		
Run year	of recycles	N	$\bar{X}$	%	N	$\bar{X}$	%	N	$\bar{X}$	%	N	$\bar{X}$	%	N	$\bar{X}$	%	N	$\bar{X}$	%
1992-1993	226	57	17	25	13	10	24	--	--	--	--	--	--	--	--	--	--	--	--
1993-1994	180	64	15	36	13	10	21	3	6	23	--	--	--	--	--	--	--	--	--
1994-1995	100	25	11	25	6	6	26	3	10	50	--	--	--	--	--	--	--	--	--
1995-1996	88	23	13	26	7	8	35	2	4	29	--	--	--	--	--	--	--	--	--
1996-1997	311	112	14	36	29	10	27	5	6	19	2	4	67	2	4	100	1	2	50
1997-1998	167	89	13	53	47	7	54	19	7	44	6	6	33	--	--	--	--	--	--
1998-1999	83	38	12	46	15	11	43	5	16	33	--	--	--	--	--	--	--	--	--

Table 38. Adult winter steelhead escapements to the Powerdale Dam trap by origin, stock, brood year, and ocean age category. (Percent return is in parentheses. Brood years are bold faced for those years in which brood year specific estimates of escapement are complete. Estimates are based on returns in the 1991-1992 through 1998-1999 run years.)

Origin, stock, brood year[a]	Smolts	Ocean age				Repeat spawners
		1 salt	2 salt	3 salt	4 salt	
Wild,						
Hood River,						
1985	--	--	--	--	--	2
1986	--	--	1	17	0	19
1987	--	--	111	93	1	39
1988	--	1	445	131	1	23
1989	--	10	194	88	1	15
1990	--	37	285	46	0	16
1991	--	12	132	37	1	8
1992	--	29	208	39	0	11
1993	--	21	231	53	0	12
1994	--	15	158	38	0	4
1995	--	14	157	--	--	--
1996	--	55	8	--	--	--
Subbasin hatchery,						
Big Creek,						
1987	28,000	--	--	1 (0.004)	--	2 (0.007)
1988	4,890	--	6 (0.12)	7 (0.14)	--	4 (0.08)
1989	36,038	--	276 (0.77)	135 (0.37)	1 (0.003)	11 (0.02)
1990	20,434	--	134 (0.66)	70 (0.34)	--	7 (0.03)
Mixed,[b]						
1991	4,595	6 (0.13)	21 (0.46)	2 (0.04)	--	0
Hood River,[c]						
1992	48,985	0 (0)	77 (0.16)	17 (0.03)	0	1 (0.002)
1993	38,034	11 (0.03)	251 (0.66)	101 (0.27)	0	12 (0.03)
1994	42,860	10 (0.02)	526 (1.23)	117 (0.27)	1 (0.002)	11 (0.02)
1995	50,896	7 (0.01)	245 (0.48)	119 (0.23)	--	4 (0.01)
1996	59,837	3 (0.005)	166 (0.28)	--	--	--
1997	62,135	11 (0.02)	--	--	--	--

[a] Complete brood returns are available beginning with the 1989 wild and 1990 hatchery broods, as determined based on age structure for adult winter steelhead sampled at the Powerdale Dam trap. Estimates of escapement for prior brood years do not include adult returns from all possible age categories.

[b] Returns from the 1991 brood are progeny of wild x Big Creek stock hatchery crosses.

[c] Beginning with the 1995 brood release, hatchery smolts were volitionally released from acclimation facilities located in the Hood River subbasin. Hatchery smolts were held at the facilities for one to two weeks prior to release.

Table 39. Age composition (percent) of adult winter steelhead sampled at the Powerdale Dam trap by origin, stock, and run year. (Estimates in a given run year may not add to 100% due to rounding error.

Origin, stock, run year	N	Freshwater/ocean age													Repeat spawners
		1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	3/4	4/2	
Wild,															
Hood River,															
1991-1992	662	--	0.5	0.6	0	1.4	60.7	10.7	0	0.2	16.0	2.4	0	0.2	7.4
1992-1993	393	--	0.5	1.5	0	8.7	42.5	29.8	0.3	0.3	4.8	3.8	0	0	7.9
1993-1994	371	--	0.5	1.6	0	2.2	67.7	19.4	0	0.3	4.0	1.1	0	0	3.2
1994-1995	190	--	0.5	0.5	0	13.7	51.1	16.8	0.5	1.6	4.2	1.6	0.5	0	8.9
1995-1996	270	--	4.1	0.4	0.4	6.7	65.2	10.4	0	0.4	7.8	2.2	0	0	2.6
1996-1997	274	--	0.4	0.4	0	4.0	69.3	11.3	0	1.1	8.0	2.6	0	0.4	2.6
1997-1998	207	--	0.5	0	0	5.3	60.4	18.4	0	1.4	8.2	1.0	0	0	4.8
1998-1999	287	--	2.8	0	0	18.1	51.9	12.5	0	0.7	7.3	3.5	0	0	3.1
Subbasin hatchery,															
Big Creek,															
1991-1992	245	--	93.1	2.4	--	--	2.0	0.4	--	--	--	--	--	--	2.0
1992-1993	187	--	31.0	64.2	--	--	0	0	--	--	--	--	--	--	4.8
1993-1994	130	--	--	45.4	--	--	50.8	0	--	--	--	--	--	--	3.8
1994-1995	9	--	--	--	--	--	--	66.7	--	--	--	--	--	--	33.3
Mixed,[a]															
1992-1993	6	100	--	--	--	--	--	--	--	--	--	--	--	--	--
1993-1994	13	--	100	--	--	--	--	--	--	--	--	--	--	--	--
1994-1995	8	--	--	25.0	--	--	75.0	--	--	--	--	--	--	--	--
Hood River,															
1994-1995	82	12.2	86.6	--	--	0	--	--	--	--	--	--	--	--	1.2
1995-1996	259	3.9	90.0	6.2	--	0	0	--	--	--	--	--	--	--	0
1996-1997	611	1.1	82.5	15.1	0	0	0.7	--	--	--	--	--	--	--	0.7
1997-1998	347	0.3	63.4	31.7	0	0	0.9	0.3	--	--	--	--	--	--	3.5
1998-1999	303	3.6	52.1	38.0	0.3	0.3	2.3	--	--	--	--	--	--	--	3.3

Table 39. Continued.

Origin, stock, run year	N	Freshwater/ocean age 1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	3/4	4/2	Repeat spawners
Stray hatchery,															
Unknown,															
1991-1992	22	0	36.4	59.0	--	--	0	--	--	--	--	--	--	--	4.5
1992-1993	22	0	68.2	22.7	--	--	0	--	--	--	--	--	--	--	9.1
1993-1994	21	4.8	0	90.5	--	--	4.8	--	--	--	--	--	--	--	0
1994-1995	4	25.0	25.0	50.0	--	--	0	--	--	--	--	--	--	--	0
1995-1996	6	0	83.3	0	--	--	0	--	--	--	--	--	--	--	16.7
1996-1997	3	0	100	0	--	--	0	--	--	--	--	--	--	--	0
1997-1998	19	5.3	10.5	78.9	--	--	5.3	--	--	--	--	--	--	--	0
1998-1999	7	0	42.9	28.6	--	--	14.3	--	--	--	--	--	--	--	14.3

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

Table 40. Mean fork length (cm) of adult winter steelhead with spawning checks in the 1997-1998 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop.,	Freshwater/ocean age					
statistic	1/2S.3	1/3S.4	1/2S.3S.4	2/1S.2	2/2S.3	3/2S.3
Wild,						
Females,						
N	--	--	--	--	5	1
Mean	--	--	--	--	71.30	67.5
STD	--	--	--	--	0.76	--
Range	--	--	--	--	70.5-72.0	67.5
Males,						
N	--	--	--	1	2	--
Mean	--	--	--	53.5	73.25	--
STD	--	--	--	--	3.18	--
Range	--	--	--	53.5	71.0-75.5	--
Total,						
N	--	--	--	1	7	1
Mean	--	--	--	53.5	71.86	67.5
STD	--	--	--	--	1.73	--
Range	--	--	--	53.5	70.5-75.5	67.5
Subbasin hatchery,						
Females,						
N	3	3	1	--	--	--
Mean	71.67	75.00	72.0	--	--	--
STD	5.11	2.65	--	--	--	--
Range	68.0-77.5	72.0-77.0	72.0	--	--	--
Males,						
N	2	2	--	--	--	--
Mean	69.50	79.75	--	--	--	--
STD	2.83	3.89	--	--	--	--
Range	67.5-71.5	77.0-82.5	--	--	--	--
Total,						
N	5	5	1	--	--	--
Mean	70.80	76.90	72.0	--	--	--
STD	4.06	3.75	--	--	--	--
Range	67.5-77.5	72.0-82.5	72.0	--	--	--

Table 41. Mean fork length (cm) of adult winter steelhead with spawning checks in the 1998-1999 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	1/3S.4	1/2S.3S.4	1/3S.4S.5	1/2S.3S.4S.5	2/2S.3	2/2S.3S.4	3/2S.3	3/2S.3S.4
Wild,									
Females,									
N	--	--	--	--	--	2	1	2	2
Mean	--	--	--	--	--	69.50	78.0	68.50	76.00
STD	--	--	--	--	--	7.78	--	7.78	2.83
Range	--	--	--	--	--	64.0-75.0	78.0	63.0-74.0	74.0-78.0
Males,									
N	--	--	--	--	--	--	--	--	--
Mean	--	--	--	--	--	--	--	--	--
STD	--	--	--	--	--	--	--	--	--
Range	--	--	--	--	--	--	--	--	--
Total,									
N	--	--	--	--	--	2	1	2	2
Mean	--	--	--	--	--	69.50	78.0	68.50	76.00
STD	--	--	--	--	--	7.78	--	7.78	2.83
Range	--	--	--	--	--	64.0-75.0	78.0	63.0-74.0	74.0-78.0
Hatchery,									
Females,									
N	3	1	2	--	--	--	--	--	--
Mean	69.00	85.0	72.00	--	--	--	--	--	--
STD	2.00	--	4.24	--	--	--	--	--	--
Range	67.0-71.0	85.0	69.0-75.0	--	--	--	--	--	--
Males,									
N	1	1	--	1	1	--	--	--	--
Mean	86.5	76.5	--	69.0	69.0	--	--	--	--
STD	--	--	--	--	--	--	--	--	--
Range	86.5	76.5	--	69.0	69.0	--	--	--	--
Total,									
N	4	2	2	1	1	--	--	--	--
Mean	73.38	80.75	72.00	69.0	69.0	--	--	--	--
STD	8.90	6.01	4.24	--	--	--	--	--	--
Range	67.0-86.5	76.5-85.0	69.0-75.0	69.0	69.0	--	--	--	--

Table 42. Mean fork length (cm) of adult winter steelhead without spawning checks in the 1997-1998 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic[a]	Freshwater/ocean age									Sample[b]
	1/1	1/2	1/3	2/1	2/2	2/3	3/1	3/2	3/3	mean
Wild,										
Females,										
N	--	1	--	--	82	22	1	12	1	126
Mean	--	58.0	--	--	64.43	75.73	52.0	64.38	75.5	66.70
STD	--	--	--	--	4.48	4.02	--	4.17	--	6.30
Range	--	58.0	--	--	42.0-74.5	68.0-81.0	52.0	56.0-69.0	75.5	42.0-81.0
Males,										
N	--	--	--	11	43	15	2	5	1	81
Mean	--	--	--	49.95	67.13	81.20	49.25	65.50	74.5	67.05
STD	--	--	--	4.23	3.72	8.26	3.18	4.14	--	10.65
Range	--	--	--	44.0-57.5	60.0-78.5	68.0-96.5	47.0-51.5	62.0-70.5	74.5	44.0-96.5
Total,										
N	--	1	--	11	125	38	3	17	2	208
Mean	--	58.0	--	49.95	65.36	77.80	50.17	64.71	75.00	66.87
STD	--	--	--	4.23	4.41	6.56	2.75	4.06	0.71	8.24
Range	--	58.0	--	44.0-57.5	42.0-78.5	68.0-96.5	47.0-52.0	56.0-70.5	74.5-75.5	42.0-96.5
Subbasin hatchery,										
Females,										
N	--	105	80	--	3	--	--	--	--	195
Mean	--	61.50	75.29	--	64.17	--	--	--	--	67.62
STD	--	3.25	3.71	--	2.02	--	--	--	--	7.58
Range	--	54.0-75.5	66.5-84.5	--	62.0-66.0	--	--	--	--	54.0-84.5
Males,										
N	1	114	29	--	--	1	--	--	--	149
Mean	44.5	62.90	80.14	--	--	86.5	--	--	--	66.61
STD	--	3.78	4.55	--	--	--	--	--	--	8.36
Range	44.5	51.5-77.5	70.5-86.5	--	--	86.5	--	--	--	44.5-86.5
Total,										
N	1	220	110	--	3	1	--	--	--	346
Mean	44.5	62.26	76.54	--	64.17	86.5	--	--	--	67.20
STD	--	3.62	4.47	--	2.02	--	--	--	--	7.91
Range	44.5	51.5-77.5	66.5-86.5	--	62.0-66.0	86.5	--	--	--	44.5-86.5

[a] Statistics for the combined adults in a given age category (i.e., Total) include fish in which the sex was unknown.

[b] 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 43. Mean fork length (cm) of adult winter steelhead without spawning checks in the 1998-1999 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	1/4	2/1	2/2	2/3	3/1	3/2	3/3	Sample mean
Wild,											
Females,											
N	--	3	--	--	11	108	29	--	13	9	182
Mean	--	58.67	--	--	55.68	68.32	74.72	--	66.85	76.11	68.94
STD	--	5.03	--	--	8.58	3.61	5.59	--	3.80	2.71	6.44
Range	--	54.0-64.0	--	--	47.5-72.5	58.5-82.0	59.5-86.5	--	60.0-73.0	71.5-80.0	47.5-86.5
Males,											
N	--	5	--	--	41	41	7	2	8	1	107
Mean	--	58.70	--	--	50.87	69.38	75.21	53.75	71.12	82.0	61.77
STD	--	8.39	--	--	4.41	5.83	11.94	1.77	5.19	--	11.30
Range	--	46.0-69.0	--	--	41.5-62.0	48.5-78.0	49.0-83.0	52.5-55.0	64.0-80.0	82.0	41.5-83.0
Total,											
N	--	8	--	--	52	149	36	2	21	10	289
Mean	--	58.69	--	--	51.88	68.61	74.82	53.75	68.48	76.70	66.29
STD	--	6.89	--	--	5.80	4.34	7.03	1.77	4.76	3.16	9.22
Range	--	46.0-69.0	--	--	41.5-72.5	48.5-82.0	49.0-86.5	52.5-55.0	60.0-80.0	71.5-82.0	41.5-86.5
Subbasin hatchery,											
Females,											
N	--	73	73	--	1	5	--	--	--	--	158
Mean	--	62.92	74.21	--	58.0	72.90	--	--	--	--	68.79
STD	--	3.26	4.38	--	--	2.61	--	--	--	--	6.84
Range	--	55.5-73.0	52.5-85.0	--	58.0	69.5-75.5	--	--	--	--	52.5-85.0
Males,											
N	11	85	42	1	--	2	--	--	--	--	145
Mean	47.36	64.02	78.69	78.5	--	79.50	--	--	--	--	67.63
STD	2.06	3.28	4.97	--	--	9.90	--	--	--	--	9.74
Range	44.0-51.0	57.0-72.5	67.0-89.0	78.5	--	72.5-86.5	--	--	--	--	44.0-89.0
Total,											
N	11	158	115	1	1	7	--	--	--	--	303
Mean	47.36	63.51	75.85	78.5	58.0	74.79	--	--	--	--	68.23
STD	2.06	3.31	5.07	--	--	5.59	--	--	--	--	8.36
Range	44.0-51.0	55.5-73.0	52.5-89.0	78.5	58.0	69.5-86.5	--	--	--	--	44.0-89.0

Table 44. Mean fork length (cm) of adult winter steelhead without spawning checks by origin, stock, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1994), Olsen et al. (1995), Olsen et al. (1996), Olsen and French (1996), and Olsen and French (1999).]

Origin, stock, brood year	Freshwater/ocean age												
	1/1	2/1	3/1	1/2	2/2	3/2	4/2	1/3	2/3	3/3	1/4	2/4	3/4
Wild,													
Hood River,													
1986	--	--	--	--	--	--	60 (1)	--	--	78 (16)	--	--	--
1987	--	--	--	--	--	65 (106)	--	--	76 (71)	80 (15)	--	95 (1)	--
1988	--	--	52 (1)	--	66 (402)	65 (19)	--	77 (4)	77 (117)	78 (4)	--	--	72 (1)
1989	--	49 (9)	55 (1)	62 (3)	66 (167)	65 (15)	--	77 (6)	77 (72)	77 (3)	--	84 (1)	--
1990	--	52 (34)	47 (1)	59 (2)	68 (251)	65 (8)	--	80 (6)	78 (32)	80 (6)	--	--	--
1991	--	50 (8)	54 (3)	58 (2)	67 (97)	67 (21)	63 (1)	78 (1)	79 (28)	79 (7)	88 (1)	--	--
1992	--	54 (26)	48 (1)	76 (1)	68 (176)	68 (22)	--	74 (1)	79 (31)	75 (2)	--	--	--
1993	--	52 (18)	50 (3)	68 (11)	68 (190)	65 (17)	--	88 (1)	78 (38)	77 (10)	--	--	--
1994	--	49 (11)	50 (3)	65 (1)	65 (125)	68 (21)	--	--	75 (36)	--	--	--	--
1995	--	50 (11)	54 (2)	58 (1)	69 (149)	--	--	--	--	--	--	--	--
1996	--	52 (52)	--	59 (8)	--	--	--	--	--	--	--	--	--
Subbasin hatchery,													
Big Creek,													
1987	--	--	--	--	--	--	--	--	76 (1)	--	--	--	--
1988	--	--	--	--	73 (5)	--	--	75 (6)	--	--	--	--	--
1989	--	--	--	64 (228)	--	--	--	77 (120)	--	--	--	--	--
1990	--	--	--	62 (58)	65 (66)	--	--	77 (59)	76 (6)	--	--	--	--
Mixed,[a]													
1991	57 (6)	--	--	67 (13)	65 (6)	--	--	72 (2)	--	--	--	--	--
Hood River,													
1992	--	--	--	65 (71)	--	--	--	77 (16)	--	--	--	--	--
1993	48 (10)	--	--	66 (233)	67 (4)	--	--	80 (92)	86 (1)	--	--	--	--
1994	46 (10)	--	--	66 (504)	64 (3)	--	--	77 (110)	--	--	78 (1)	--	--
1995	44 (7)	--	--	62 (220)	75 (7)	--	--	76 (115)	--	--	--	--	--
1996	44 (1)	58 (1)	--	64 (158)	--	--	--	--	--	--	--	--	--
1997	47 (11)	--	--	--	--	--	--	--	--	--	--	--	--

[a] Returns from the 1991 brood are progeny of wild x Big Creek hatchery crosses.

Table 45. Mean weight (kg) of adult winter steelhead without spawning checks in the 1997-1998 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic[a]	Freshwater/ocean age									Sample[b]
	1/1	1/2	1/3	2/1	2/2	2/3	3/1	3/2	3/3	mean
Wild,										
Females,										
N	--	1	--	--	82	22	1	12	1	125
Mean	--	2.0	--	--	2.81	4.47	1.5	2.68	4.1	3.12
STD	--	--	--	--	0.62	0.86	--	0.55	--	0.93
Range	--	2.0	--	--	0.8-4.4	3.3-6.1	1.5	1.6-3.3	4.1	0.8-6.1
Males,										
N	--	--	--	11	43	15	2	5	1	81
Mean	--	--	--	1.29	3.04	5.29	1.15	2.72	3.2	3.17
STD	--	--	--	0.25	0.59	1.55	0.21	0.73	--	1.47
Range	--	--	--	0.9-1.8	2.0-4.9	2.9-8.7	1.0-1.3	2.1-3.8	3.2	0.9-8.7
Total,										
N	--	1	--	11	125	38	3	17	2	207
Mean	--	2.0	--	1.29	2.89	4.78	1.27	2.69	3.65	3.14
STD	--	--	--	0.25	0.62	1.23	0.25	0.59	0.64	1.17
Range	--	2.0	--	0.9-1.8	0.8-4.9	2.9-8.7	1.0-1.5	1.6-3.8	3.2-4.1	0.8-8.7
Subbasin hatchery,										
Females,										
N	--	105	80	--	3	--	--	--	--	195
Mean	--	2.36	4.36	--	2.70	--	--	--	--	3.24
STD	--	0.41	0.74	--	0.61	--	--	--	--	1.13
Range	--	1.5-4.7	3.0-6.3	--	2.0-3.1	--	--	--	--	1.5-6.3
Males,										
N	1	114	29	--	--	1	--	--	--	149
Mean	1.0	2.39	4.98	--	--	6.3	--	--	--	2.96
STD	--	0.45	0.92	--	--	--	--	--	--	1.25
Range	1.0	1.6-4.2	3.2-6.9	--	--	6.3	--	--	--	1.0-6.9
Total,										
N	1	220	110	--	3	1	--	--	--	346
Mean	1.0	2.38	4.51	--	2.70	6.3	--	--	--	3.12
STD	--	0.43	0.84	--	0.61	--	--	--	--	1.19
Range	1.0	1.5-4.7	3.0-6.9	--	2.0-3.1	6.3	--	--	--	1.0-6.9

[a] Statistics for the combined adults in a given age category (i.e., Total) include fish in which the sex was unknown.

[b] 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 46. Mean weight (kg) of adult winter steelhead without spawning checks in the 1998-1999 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	1/4	2/1	2/2	2/3	3/1	3/2	3/3	Sample mean
Wild,											
Females,											
N	--	3	--	--	11	108	29	--	13	9	182
Mean	--	1.73	--	--	1.95	3.45	4.48	--	3.22	4.52	3.58
STD	--	0.35	--	--	1.00	0.61	0.92	--	0.58	0.52	0.95
Range	--	1.4-2.1	--	--	1.2-4.0	2.2-6.0	2.9-6.5	--	2.3-4.0	3.7-5.3	1.2-6.5
Males,											
N	--	5	--	--	41	41	7	2	8	1	107
Mean	--	1.92	--	--	1.38	3.50	4.47	1.50	3.84	5.9	2.65
STD	--	0.53	--	--	0.36	0.78	1.53	0	1.04	--	1.38
Range	--	1.0-2.3	--	--	0.8-2.8	1.1-5.0	1.2-5.6	1.5	2.6-5.9	5.9	0.8-5.9
Total,											
N	--	8	--	--	52	149	36	2	21	10	289
Mean	--	1.85	--	--	1.50	3.47	4.48	1.50	3.46	4.66	3.23
STD	--	0.45	--	--	0.59	0.66	1.04	0	0.82	0.66	1.21
Range	--	1.0-2.3	--	--	0.8-4.0	1.1-6.0	1.2-6.5	1.5	2.3-5.9	3.7-5.9	0.8-6.5
Subbasin hatchery,											
Females,											
N	--	73	72	--	1	5	--	--	--	--	157
Mean	--	2.78	4.36	--	2.7	4.02	--	--	--	--	3.59
STD	--	0.50	0.61	--	--	0.50	--	--	--	--	0.96
Range	--	1.9-5.2	3.1-6.2	--	2.7	3.3-4.7	--	--	--	--	1.9-6.2
Males,											
N	11	85	42	1	--	2	--	--	--	--	145
Mean	1.06	2.62	4.73	5.4	--	5.20	--	--	--	--	3.21
STD	0.14	0.44	0.89	--	--	1.70	--	--	--	--	1.33
Range	0.9-1.3	1.7-3.6	2.8-6.8	5.4	--	4.0-6.4	--	--	--	--	0.9-6.8
Total,											
N	11	158	114	1	1	7	--	--	--	--	302
Mean	1.06	2.69	4.50	5.4	2.7	4.36	--	--	--	--	3.41
STD	0.14	0.47	0.75	--	--	0.99	--	--	--	--	1.17
Range	0.9-1.3	1.7-5.2	2.8-6.8	5.4	2.7	3.3-6.4	--	--	--	--	0.9-6.8

Table 47. Mean weight (kg) of adult winter steelhead without spawning checks by origin, stock, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1995), Olsen et al. (1996), Olsen and French (1996), and Olsen and French (1999).]

Origin, stock,	Freshwater/ocean age												
brood year	1/1	2/1	3/1	1/2	2/2	3/2	4/2	1/3	2/3	3/3	1/4	2/4	3/4
Wild,													
Hood River,													
1988	--	--	--	--	--	--	--	--	--	4.5 (2)	--	--	3.2 (1)
1989	--	--	--	--	--	2.8 (13)	--	--	4.8 (40)	4.6 (3)	--	6.9 (1)	--
1990	--	--	1.1 (1)	--	3.3 (215)	2.7 (8)	--	5.4 (4)	4.8 (32)	4.9 (5)	--	--	--
1991	--	1.3 (8)	1.4 (2)	2.4 (1)	3.1 (95)	3.0 (21)	2.3 (1)	4.7 (1)	5.1 (27)	5.1 (6)	6.0 (1)	--	--
1992	--	1.6 (26)	1.2 (1)	4.6 (1)	3.2 (172)	3.2 (22)	--	3.5 (1)	5.0 (30)	3.6 (2)	--	--	--
1993	--	1.5 (18)	1.3 (3)	3.2 (11)	3.2 (190)	2.7 (17)	--	6.6 (1)	4.8 (38)	4.7 (10)	--	--	--
1994	--	1.2 (11)	1.3 (3)	2.5 (1)	2.9 (125)	3.5 (21)	--	--	4.5 (36)	--	--	--	--
1995	--	1.3 (11)	1.5 (2)	2.0 (1)	3.5 (149)	--	--	--	--	--	--	--	--
1996	--	1.5 (52)	--	1.8 (8)	--	--	--	--	--	--	--	--	--
Subbasin hatchery,													
Big Creek,													
1990	--	--	--	--	--	--	--	3.9 (1)	4.6 (6)	--	--	--	--
Mixed,[a]													
1991	--	--	--	2.5 (3)	3.0 (6)	--	--	3.8 (2)	--	--	--	--	--
Hood River,													
1992	--	--	--	2.8 (61)	--	--	--	4.7 (15)	--	--	--	--	--
1993	1.2 (10)	--	--	2.9 (230)	3.0 (4)	--	--	5.2 (90)	6.3 (1)	--	--	--	--
1994	1.0 (10)	--	--	2.9 (492)	2.7 (3)	--	--	4.5 (110)	--	--	5.4 (1)	--	--
1995	0.8 (6)	--	--	2.4 (220)	4.4 (7)	--	--	4.5 (114)	--	--	--	--	--
1996	1.0 (1)	2.7 (1)	--	2.7 (158)	--	--	--	--	--	--	--	--	--
1997	1.1 (11)	--	--	--	--	--	--	--	--	--	--	--	--

[a] Returns from the 1991 brood are progeny of wild x Big Creek hatchery crosses.

Table 48. Adult winter steelhead sex ratios as a percentage of females by origin, stock, run year, and age category. Fish were sampled at the Powerdale Dam trap. (Sample size is in parentheses.)

Origin, stock, run year	Freshwater/ocean age													Repeat spawners
	1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	3/4	4/2	
Wild,														
Hood River,														
1991-1992	--	67 (3)	75 (4)	--	0 (9)	58 (402)	63 (71)	--	0 (1)	64 (106)	88 (16)	--	100 (1)	64 (47)
1992-1993	--	50 (2)	67 (6)	--	26 (34)	62 (167)	72 (117)	0 (1)	100 (1)	42 (19)	60 (15)	--	--	87 (31)
1993-1994	--	0 (2)	67 (6)	--	12 (8)	69 (251)	67 (72)	--	0 (1)	60 (15)	75 (4)	--	--	100 (11)
1994-1995	--	0 (1)	100 (1)	--	19 (26)	58 (97)	53 (32)	100 (1)	0 (3)	25 (8)	100 (3)	100 (1)	--	69 (16)
1995-1996	--	45 (11)	100 (1)	0 (1)	22 (18)	65 (176)	68 (28)	--	0 (1)	43 (21)	50 (6)	--	--	57 (7)
1996-1997	--	0 (1)	0 (1)	--	18 (11)	61 (190)	58 (31)	--	67 (3)	68 (22)	71 (7)	--	100 (1)	100 (7)
1997-1998	--	100 (1)	--	--	0 (11)	66 (125)	59 (37)	--	33 (3)	71 (17)	50 (2)	--	--	60 (10)
1998-1999	--	38 (8)	--	--	21 (52)	72 (149)	81 (36)	--	0 (2)	62 (21)	90 (10)	--	--	100 (7)
Subbasin hatchery,														
Big Creek,														
1991-1992	--	36 (228)	100 (6)	--	--	60 (5)	100 (1)	--	--	--	--	--	--	80 (5)
1992-1993	--	21 (58)	74 (120)	--	--	--	--	--	--	--	--	--	--	71 (7)
1993-1994	--	--	66 (59)	--	--	39 (66)	--	--	--	--	--	--	--	50 (4)
1994-1995	--	--	--	--	--	--	100 (6)	--	--	--	--	--	--	100 (3)
Mixed,[a]														
1992-1993	67 (6)	--	--	--	--	--	--	--	--	--	--	--	--	--
1993-1994	--	31 (13)	--	--	--	--	--	--	--	--	--	--	--	--
1994-1995	--	--	100 (2)	--	--	33 (6)	--	--	--	--	--	--	--	--
Hood River,														
1994-1995	10 (10)	52 (71)	--	--	--	--	--	--	--	--	--	--	--	100 (1)
1995-1996	0 (10)	37 (232)	67 (15)	--	--	--	--	--	--	--	--	--	--	--
1996-1997	14 (7)	45 (503)	61 (92)	--	--	25 (4)	--	--	--	--	--	--	--	100 (3)
1997-1998	0 (1)	48 (219)	73 (109)	--	--	100 (3)	0 (1)	--	--	--	--	--	--	67 (12)
1998-1999	0 (11)	46 (158)	63 (115)	0 (1)	100 (1)	71 (7)	--	--	--	--	--	--	--	60 (10)

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

Table 49. Mean fecundity[a] of adult winter steelhead by origin, ocean age, and run year. Fish were sampled at the Powerdale Dam trap.

Origin, ocean age, run year	N	Mean fork length (cm)	Fecundity (eggs/female) Mean	Range	95% C.I.
Wild,					
1 Salt,					
1995-1996	1	58.0	2,900	2,900	--
2 Salt,					
1991-1992	9	62.7	2,982	1,930 - 4,950	± 733
1992-1993	8	66.7	3,620	3,036 - 4,117	± 317
1993-1994	16	67.9	3,268	2,025 - 6,480	± 571
1994-1995	11	66.2	3,222	1,737 - 5,016	± 654
1995-1996	13	68.8	3,780	1,904 - 5,776	± 530
1996-1997	13	68.9	3,657	2,408 - 5,184	± 509
1997-1998	9	65.9	3,963	2,610 - 5,805	± 851
1998-1999	8	67.0	3,537	2,320 - 4,560	± 630
3 Salt,					
1991-1992	5	75.5	3,138	2,752 - 4,080	± 665
1992-1993	7	77.2	4,080	2,856 - 6,398	± 1,189
1993-1994	5	75.4	4,229	2,493 - 5,100	± 1,250
1994-1995	6	74.8	4,332	3,375 - 5,472	± 840
1995-1996	4	76.3	4,836	3,344 - 6,325	± 2,070
1996-1997	4	78.8	5,436	4,275 - 6,525	± 1,643
1997-1998	2	75.3	5,421	4,752 - 6,090	± 8,500
1998-1999	6	74.0	4,376	2,925 - 6,042	± 1,182
4 Salt,					
1991-1992	1	78.0	3,240	3,240	--
1992-1993	1	85.0	4,632	4,632	--
Subbasin hatchery,[b]					
2 Salt,					
1995-1996	4	64.9	2,726	2,025 - 3,878	± 1,326
1996-1997	6	64.7	3,424	2,975 - 4,048	± 523
1997-1998	6	62.9	2,957	1,590 - 4,350	± 941
1998-1999	6	60.9	3,414	2,320 - 6,201	± 1,468
3 Salt,					
1991-1992	1	76.5	2,560	2,560	--
1992-1993	0	--	--	--	--
1993-1994	0	--	--	--	--
1994-1995	0	--	--	--	--
1995-1996	0	--	--	--	--
1996-1997	5	76.6	4,017	3,024 - 4,797	± 942
1997-1998	3	69.0	3,541	2,856 - 3,960	± 1,486
1998-1999	7	74.3	5,034	3,168 - 7,920	± 1,544
4 Salt,					
1997-1998	1	77.0	5,280	5,280	--

[a] Estimates were based on numbers of eggs collected from air spawned fish and may under estimate true fecundity (*see* **Methods**).

[b] Hood River stock.

Table 50. Bimonthly counts of upstream migrant jack and adult spring chinook salmon captured at the Powerdale Dam trap, by origin and run year. Counts are boldfaced for the bimonthly period in which the median date of migration occurred in each origin category. Mini-jack spring chinook salmon are included in parenthesis.

Origin,	April		May		June		July		August		September		October		November		
run year	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-31	Total
Natural,																	
1992	0	0	1	8	5	**11**	4	4	0	0	0	1	0	0	0	0	34
1993	0	0	1	4	3	9	**6**	8	2	6	2	0	0	0	0	0	41
1994	0	0	1	5	0	1	3	**8**	1	2	0	12	0	0	0	0	33
1995	0	0	0	2	4	2	**4**	4	0	0	1	1	0	0	0	0	18
1996	0	0	1	7	**50**	4	9	4	8	6	1	0	0	0	0	0	90
1997	0	0	1	8	**29**	14	5	6(6)	6(4)	0(1)	0	0	0(1)	0	0	0	69(12)
1998	0	0	3	7	18	8(1)	**5**(2)	7	2(2)	2	6	16	3	0	0	0	77(5)
1999	0	0	0	0	1	4	4	1	1	**1**(1)	4	7	0	0	0	0	24
Subbasin hatchery,																	
1992	0	9	77	**145**	75	62	15	4	4	1	2	2	1	0	0	0	397
1993	0	1	25	**205**	89	51	51	15(1)	4	9	5	0	0	0	0	0	455(1)
1994	0	6	33	**165**	28	7	4	17	1	0	1	1	0	0	0	0	263
1995	0	0	0	6	**28**	10	10(1)	1(2)	0	0	1	0	0	0	0	0	56(3)
1996	0	0	0	0	**10**	4	1	0	0	0	0	0	0	0	0	0	15
1997	0	0	1	33	**107**	65	34	6(4)	16(4)	8(1)	0(1)	0	0	0	0	0	270(10)
1998	0	0	1	1	**10**(1)	1(4)	2(6)	0(3)	0	0	0	0	0	0	0	0	15(14)
1999	0	0	0	21	**28**	11(8)	7(95)	6(50)	4(14)	6(14)	0(1)	0	0	0	0(1)	0	83(183)
Stray hatchery,																	
1992	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	1
1993	0	0	0	0	**1**	0	1	0	0	0	0	0	0	0	0	0	2
1994	0	0	0	0	0	0	1	1(3)	**1**	2	0	0	0	0	0	0	5(3)
1995	0	0	0	0	0	0	0	0	0	**1**	0	1	0	0	0	0	2
1996	0	0	0	0	**7**	2	4	0	0	0	1	0	0	0	0	0	14
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	**1**	0	0	1	0	0	0	0	0	0	0	0	2
1999	0	0	0	0	2	0	**1**	0	0(2)	0(3)	2	0	0	0	0	0	5(5)

Table 50. Continued.

Origin,	April		May		June		July		August		September		October		November		
run year	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-31	Total
Unknown,																	
1992	0	3	5	**8**	3	1	0	0	1	0	0	0	0	0	0	0	21
1993	0	0	0	5	0	0	**2**	3	1	0	0	0	0	0	0	0	11
1994	0	0	1	1	0	**1**	0	2	0	0	0	1	0	0	0	0	6
1995	0	0	0	0	5	1	**1**	1	0	3	0	2	0	0	0	0	13
1996	0	0	0	1	2	**3**	1	1	1	3	0	0	0	0	0	0	12
1997	0	0	0	5	**9**	3	1	2	3	0	0	0	0	0	0	0	23
1998	0	0	0	1	0	1	0	**2**	0	0	0	2	1	0	0	0	7
1999	0	0	0	0	0	0	0	2	0	**4**	1	0	0	0	0	0	7

Table 51. Estimated harvest of natural jack and adult spring chinook salmon in the Hood River sport fishery located from the mouth of the Hood River to Powerdale Dam (RM 4.5), 1998. Confidence limits (95%) are in parenthesis.

Period	Unmarked adult spring chinook salmon[a,b]		Unmarked[a] jack spring chinook salmon		Catch Rate
	Kept	Released	Kept	Released	(hrs/fish)
Apr 16-30	1 (0.7)	--	--	--	804
May 1-15	--	--	--	--	--
May 16-31	7 (9.2)	6 (8.8)	--	--	120
Jun 1-15	--	--	--	--	--
Jun 16-30	--	--	--	--	--
Jul 1-15	--	--	--	--	--
Jul 16-31	--	--	--	--	--
Aug 1-15	--	--	--	--	--
Aug 16-31	--	--	--	--	--
Sep 1-15	--	--	--	--	--
Sep 16-30	--	--	8 (12.6)	--	40
Total	8 (9.2)	6 (8.8)	8 (13)	0 (--)	365[c]

[a] Estimates were not adjusted for unmarked stray hatchery adults. Numbers of unmarked strays are assumed to be low based on the fact that few stray hatchery fish are caught at Powerdale Dam.

[b] Estimates were not adjusted for five year old unmarked hatchery spring chinook salmon from the 1993 brood release. Approximately 69% of the 1993 brood was released unmarked (*see* **HATCHERY PRODUCTION, Production Releases**).

[c] Estimate of mean catch rate is for the period 16 April - 30 September.

Table 52. Estimated harvest of subbasin hatchery jack and adult spring chinook salmon in the Hood River sport fishery located from the mouth of the Hood River to Powerdale Dam (RM 4.5), 1998. Confidence limits (95%) are in parenthesis.

Period	Subbasin hatchery adult spring chinook salmon		Subbasin hatchery jack spring chinook salmon		Catch Rate
	Kept	Released	Kept	Released	(hrs/fish)
May 1-15	3 (5.3)	--	--	--	430
May 16-31	--	--	--	--	--
Jun 1-15	--	--	--	--	--
Jun 16-30	--	--	--	--	--
Jul 1-15	--	--	--	--	--
Jul 16-31	--	--	--	--	--
Aug 1-15	--	--	--	--	--
Aug 16-31	--	--	--	--	--
Sep 1-15	--	--	--	--	--
Sep 16-30	--	7 (11.9)	--	--	46
Total	3 (5.3)	7 (12)	0 (--)	0 (--)	724[a]

[a] Estimate of mean catch rate is for the period 1 May - 30 September.

Table 53. Estimated harvest of natural jack and adult spring chinook salmon in the Hood River sport fishery located from the mouth of the Hood River to Powerdale Dam (RM 4.5), 1999. Confidence limits (95%) are in parenthesis.

Period	Unmarked adult spring chinook salmon[a]		Unmarked[a] jack spring chinook salmon		Catch Rate
	Kept	Released	Kept	Released	(hrs/fish)
Apr 16-30	--	--	--	--	--
May 1-15	--	--	--	--	--
May 16-31	--	4 (6.6)	--	--	280
Jun 1-15	--	--	--	--	--
Jun 16-30	--	--	--	--	--
Jul 1-15	--	--	--	--	--
Jul 16-31	--	--	--	--	--
Aug 1-15	--	--	--	--	--
Aug 16-31	--	--	--	--	--
Sep 1-15	--	--	--	--	--
Sep 16-30	--	--	--	--	--
Total	0 (--)	4 (6.6)	0 (--)	0 (--)	1,880[b]

[a] Estimates were not adjusted for unmarked subbasin or stray hatchery fish. All subbasin hatchery brood returns in 1999 were 100% marked prior to release as smolts, and numbers of unmarked strays are assumed to be low based on the fact that few stray hatchery fish are caught at Powerdale Dam.

[b] Estimate of mean catch rate is for the period 16 April - 30 September.

Table 54. Estimated harvest of subbasin hatchery jack and adult spring chinook salmon in the Hood River sport fishery located from the mouth of the Hood River to Powerdale Dam (RM 4.5), 1999. Confidence limits (95%) are in parenthesis.

Period	Subbasin hatchery adult spring chinook salmon		Subbasin hatchery jack spring chinook salmon		Catch Rate
	Kept	Released	Kept	Released	(hrs/fish)
Apr 16-30	--	--	--	--	--
May 1-15	--	5 (5.8)	--	--	252
May 16-31	--	--	--	--	--
Jun 1-15	--	9 (12.2)	--	--	85
Jun 16-30	--	3 (4.9)	--	--	240
Jul 1-15	--	2 (4.5)	--	--	270
Jul 16-31	--	--	--	--	--
Aug 1-15	--	--	--	--	--
Aug 16-31	--	--	--	--	--
Sep 1-15	--	--	--	--	--
Sep 16-30	--	--	--	--	--
Total	0 (--)	19 (15)	0 (--)	0 (--)	396[a]

[a] Estimate of mean catch rate is for the period 16 April - 30 September.

Table 55. Jack and adult spring chinook salmon escapements to the Powerdale Dam trap by origin, stock, 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[a]			Freshwater.total age									
	M	J	A	1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6	3.5
Natural,													
Hood River,[b]													
1992	0	0	37	0	1	23	1	0	0	9	3	0	0
1993	1	0	43	0	1	15	10	1	0	8	8	0	0
1994	0	1	33	1	2	14	5	0	0	5	6	1	0
1995	0	0	20	0	4	1	4	0	0	2	9	0	0
1996	1	1	95	1	4	6	0	1	0	83	1	0	1
1997	14	1	72	0	0	6	1	14	1	24	41	0	0
1998	5	1	80	0	12	14	1	5	1	16	36	1	0
1999	1	3	21	0	2	5	3	1	3	9	2	0	0
Subbasin hatchery,													
Carson,													
1992	0	3	413	--	--	--	--	0	3	395	18	0	--
1993	--	15	446	--	--	--	--	--	15	213	233	0	--
1994	--	--	261	--	--	--	--	--	--	245	16	0	--
1995	--	--	37	--	--	--	--	--	--	--	36	1	--
Deschutes,													
1993	3	--	0	--	--	--	--	3	--	--	--	--	--
1994	--	5	--	--	--	--	--	*c*	5	--	--	--	--
1995	4	--	27	--	--	--	--	4	*c*	27	--	--	--
1996	0	17	2	--	--	--	--	0	17	*c*	2	--	--
1997	11	1	279	--	--	--	--	11	1	279	*c*	--	--
1998	14	2	15	--	--	--	--	14	2	12	3	--	--
1999	183	4	85	--	--	--	--	183	4	84	1	--	--

Table 55. Continued.

Origin, stock, run year	Total escapement[a] M	J	A	Freshwater.total age 1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6	3.5
Stray hatchery,													
Unknown,													
1992	0	0	0	--	0	0	0	0	0	0	0	--	--
1993	0	0	2	--	0	2	0	0	0	0	0	--	--
1994	10	0	0	--	0	0	0	10	0	0	0	--	--
1995	0	3	1	--	0	0	0	0	3	1	0	--	--
1996	0	0	15	--	0	2	1	0	0	12	0	--	--
1997	0	0	6	--	0	0	0	0	0	0	6	--	--
1998	0	1	2	--	1	0	0	0	1	1	0	--	--
1999	5	1	4	--	0	0	0	5	1	4	0	--	--

[a] M = mini-jack salmon, J = jack salmon, and A = adult salmon.

[b] Developed from Deschutes and Carson stock hatchery production releases.

[c] Hatchery returns in this age category would be progeny of the 1992 brood. No hatchery fish were released into the Hood River subbasin from this brood (*see* **HATCHERY PRODUCTION, Production Releases**).

Table 56. Jack and adult spring chinook salmon escapements to the Powerdale Dam trap by origin, stock, brood year, and total age. (Percent return is in parentheses. Brood years are bold faced for those years in which brood year specific estimates of escapement are complete. Estimates are based on returns in the 1992-1999 run years.)

Origin, stock, brood year[a]	Smolt production	Total age				
		Age 2	Age 3	Age 4	Age 5	Age 6
Natural, Hood River,[b]						
1986	--	--	--	--	--	0
1987	--	--	--	--	4	0
1988	--	--	--	32	18	1
1989	--	--	1	23	11	0
1990	--	0	1	19	13	0
1991	--	1	2	3	2	0
1992	--	1	4	89	42	1
1993	--	0	4	30	37	0
1994	--	2	1	30	5	--
1995	--	14	13	14	--	--
1996	--	5	5	--	--	--
1997	--	1	--	--	--	--
Subbasin hatchery, Carson,						
1986	149,939	--	--	--	--	0
1987	134,047	--	--	--	18 (0.01)	0
1988	197,988	--	--	395 (0.20)	233 (0.12)	0
1989	125,432	--	3 (.002)	213 (0.17)	16 (0.01)	1 (.001)
1990	163,295	0	15 (.009)	245 (0.15)	36 (0.02)	0
Deschutes,[c]						
1991	75,205	3 (.004)	5 (.007)	27 (0.04)	2 (0.003)	--
1992[d]	0	--	--	--	--	--
1993	170,004	4 (.002)	17 (0.01)	279 (0.16)	3 (0.002)	--
1994	123,230	0	1 (0.001)	12 (0.01)	1 (0.001)	--
1995	100,719	11 (0.01)	2 (0.002)	84 (0.08)	--	--
1996	123,760	14 (0.01)	4 (0.003)	--	--	--
1997	121,348	183 (0.15)	--	--	--	--

[a] Complete brood returns are available beginning with the 1990 natural and 1989 hatchery broods, as determined based on age structure for jack and adult spring chinook salmon sampled at the Powerdale Dam trap. Estimates of escapement for prior brood years do not include returns from all possible age categories.

[b] Developed from Deschutes and Carson stock hatchery production releases.

[c] Beginning with the 1994 brood release, hatchery smolts were volitionally released from acclimation facilities located in the Hood River subbasin. Hatchery smolts were held at the facilities for approximately two weeks prior to release.

[d] No hatchery fish were released from the 1992 brood (*see* **HATCHERY PRODUCTION, Production Releases**).

Table 57. Age composition (percent) of jack and adult spring chinook salmon sampled at the Powerdale Dam trap by origin, stock, and run year. (Estimates in a given run year may not add to 100% due to rounding error.)

Origin, stock, run year	N	Freshwater.total age 1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6
Natural,										
Hood River,[a]										
1992	34	0	2.9	61.8	2.9	0	0	23.5	8.8	0
1993	41	0	2.4	36.6	24.4	2.4	0	14.6	19.5	0
1994	33	3.0	6.1	42.4	15.2	0	0	15.2	15.2	3.0
1995	18	0	16.7	5.6	16.7	0	0	11.1	50.0	0
1996	90	0	4.4	6.7	0	1.1	0	86.7	1.1	0
1997	72	0	0	8.3	1.4	5.6	1.4	29.2	54.2	0
1998	82	0	13.4	15.9	1.2	6.1	1.2	18.3	42.7	1.2
1999	24	0	8.3	20.8	12.5	4.2	12.5	33.3	8.3	0
Subbasin hatchery,										
Carson,										
1992	397	--	--	--	--	0	0.8	95.0	4.3	0
1993	455	--	--	--	--	--	3.3	46.2	50.5	0
1994	258	--	--	--	--	--	--	93.8	6.2	0
1995	34	--	--	--	--	--	--	--	97.1	2.9
Deschutes,										
1993	1	--	--	--	--	100	--	--	--	--
1994	5	--	--	--	--	*b*	100	--	--	--
1995	25	--	--	--	--	16.0	*b*	84.0	--	--
1996	15	--	--	--	--	0	100	*b*	--	--
1997	275	--	--	--	--	2.2	0	97.8	*b*	--
1998	29	--	--	--	--	48.3	3.4	37.9	10.3	--
1999	261	--	--	--	--	68.2	1.5	29.9	0.4	--

Table 57. Continued.

Origin, stock, run year	N	Freshwater.total age 1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6
Stray hatchery,										
Unknown,										
1992	1	--	0	100	0	0	0	0	0	--
1993	2	--	0	100	0	0	0	0	0	--
1994	10	--	0	0	0	100	0	0	0	--
1995	4	--	0	0	0	0	75.0	25.0	0	--
1996	14	--	0	14.3	0	0	0	85.7	0	--
1997	6	--	0	0	0	0	0	0	100	--
1998	2	--	0	0	0	0	50.0	50.0	0	--
1999	10	--	0	0	0	50.0	10.0	40.0	0	--

[a] Developed from Deschutes and Carson stock hatchery production releases.

[b] Hatchery returns in this age class would be progeny of the 1992 brood. No hatchery fish were released into the Hood River subbasin from this brood (*see* **HATCHERY PRODUCTION**, **Production Releases**).

Table 58. Mean fork length (cm) of jack and adult spring chinook salmon in the 1998 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/Total age 1/3	1/4	1/5	2/2	2/3	2/4	2/5	2/6	Sample mean
Natural,									
Females,									
N	--	4	--	--	--	7	25	1	37
Mean	--	77.12	--	--	--	82.43	84.36	97.5	83.57
STD	--	10.66	--	--	--	5.82	5.33	--	6.69
Range	--	66.0-86.5	--	--	--	75.0-91.0	71.0-95.0	97.5	66.0-97.5
Males,									
N	11	9	1	5	1	8	10	--	45
Mean	60.68	76.89	85.0	29.20	59.5	86.56	90.30	--	72.12
STD	3.46	7.98	--	0.67	--	6.32	4.28	--	19.79
Range	56.0-66.0	67.5-90.5	85.0	28.5-30.0	59.5	78.5-98.0	84.0-97.5	--	28.5-98.0
Total,									
N	11	13	1	5	1	15	35	1	82
Mean	60.68	76.96	85.0	29.20	59.5	84.63	86.06	97.5	77.29
STD	3.46	8.42	--	0.67	--	6.25	5.69	--	16.29
Range	56.0-66.0	66.0-90.5	85.0	28.5-30.0	59.5	75.0-98.0	71.0-97.5	97.5	28.5-98.0
Subbasin hatchery,									
Females,									
N	--	--	--	--	--	8	2	--	10
Mean	--	--	--	--	--	72.50	88.00	--	75.60
STD	--	--	--	--	--	5.79	2.83	--	8.35
Range	--	--	--	--	--	68.0-85.5	86.0-90.0	--	68.0-90.0
Males,									
N	--	--	--	14	1	3	1	--	19
Mean	--	--	--	26.99	56.0	69.67	91.0	--	38.62
STD	--	--	--	3.99	--	7.29	--	--	21.27
Range	--	--	--	19.3-33.0	56.0	62.0-76.5	91.0	--	19.3-91.0
Total,									
N	--	--	--	14	1	11	3	--	29
Mean	--	--	--	26.99	56.0	71.73	89.00	--	51.37
STD	--	--	--	3.99	--	5.99	2.65	--	25.17
Range	--	--	--	19.3-33.0	56.0	62.0-85.5	86.0-91.0	--	19.3-91.0

Table 59. Mean fork length (cm) of jack and adult spring chinook salmon in the 1999 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/Total age 1/3	1/4	1/5	2/2	2/3	2/4	2/5	Sample mean
Natural,								
Females,								
N	--	3	2	--	1	5	1	12
Mean	--	76.67	81.50	--	46.0	74.20	78.0	74.00
STD	--	2.52	9.19	--	--	5.23	--	10.18
Range	--	74.0-79.0	75.0-88.0	--	46.0	68.5-80.0	78.0	46.0-88.0
Males,								
N	2	2	1	1	2	3	1	12
Mean	56.00	77.50	77.0	17.5	51.00	65.00	89.0	62.29
STD	7.07	12.02	--	--	4.24	11.03	--	19.57
Range	51.0-61.0	69.0-86.0	77.0	17.5	48.0-54.0	54.5-76.5	89.0	17.5-89.0
Total,								
N	2	5	3	1	3	8	2	24
Mean	56.00	77.00	80.00	17.5	49.33	70.75	83.50	68.15
STD	7.07	6.28	7.00	--	4.16	8.55	7.78	16.38
Range	51.0-61.0	69.0-86.0	75.0-88.0	17.5	46.0-54.0	54.5-80.0	78.0-89.0	17.5-89.0
Subbasin hatchery,								
Females,								
N	--	--	--	--	1	45	1	47
Mean	--	--	--	--	47.0	71.39	69.0	70.82
STD	--	--	--	--	--	4.32	--	5.53
Range	--	--	--	--	47.0	56.0-80.0	69.0	47.0-80.0
Males,								
N	--	--	--	178	3	33	--	214
Mean	--	--	--	26.59	54.50	73.17	--	34.17
STD	--	--	--	2.81	5.22	3.75	--	17.27
Range	--	--	--	19.5-36.0	48.5-58.0	64.5-81.0	--	19.5-81.0
Total,								
N	--	--	--	178	4	78	1	261
Mean	--	--	--	26.59	52.62	72.14	69.0	40.77
STD	--	--	--	2.81	5.68	4.16	--	21.19
Range	--	--	--	19.5-36.0	47.0-58.0	56.0-81.0	69.0	19.5-81.0

Table 60. Mean fork length (cm) of jack and adult spring chinook salmon by origin, stock, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1995), Olsen et al. (1996), Olsen and French (1996), and Olsen and French (1999).]

Origin, stock, brood year	Freshwater.total age								
	1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6
Natural,									
Hood River,[a]									
1987	--	--	--	86 (1)	--	--	--	85 (3)	--
1988	--	--	81 (21)	91 (10)	--	--	72 (8)	88 (8)	92 (1)
1989	--	71 (1)	82 (15)	96 (5)	--	--	87 (6)	79 (5)	--
1990	--	78 (1)	77 (14)	92 (3)	--	--	72 (5)	95 (9)	--
1991	--	62 (2)	80 (1)	--	66 (1)	--	72 (2)	84 (1)	--
1992	30 (1)	68 (3)	82 (6)	87 (1)	--	--	77 (78)	92 (39)	98 (1)
1993	--	62 (4)	87 (6)	85 (1)	--	--	78 (21)	86 (35)	--
1994	--	--	77 (13)	80 (3)	32 (1)	38 (1)	85 (15)	84 (2)	--
1995	--	61 (11)	77 (5)	--	31 (4)	60 (1)	71 (8)	--	--
1996	--	56 (2)	--	--	29 (5)	49 (3)	--	--	--
1997	--	--	--	--	18 (1)	--	--	--	--
Subbasin hatchery,									
Carson,									
1987	--	--	--	--	--	--	--	89 (17)	--
1988	--	--	--	--	--	--	74 (377)	89 (230)	--
1989	--	--	--	--	--	56 (3)	83 (210)	82 (16)	85 (1)
1990	--	--	--	--	--	52 (15)	75 (242)	92 (33)	--
Deschutes,									
1991	--	--	--	--	28 (1)	52 (5)	75 (21)	--	--
1992[b]	--	--	--	--	--	--	--	--	--
1993	--	--	--	--	26 (4)	52 (15)	76 (269)	89 (3)	--
1994	--	--	--	--	--	--	72 (11)	69 (1)	--
1995	--	--	--	--	24 (6)	56 (1)	72 (78)	--	--
1996	--	--	--	--	27 (14)	53 (4)	--	--	--
1997	--	--	--	--	27 (178)	--	--	--	--

[a] Developed from Deschutes and Carson stock hatchery production releases.

[b] No hatchery fish were released from the 1992 brood (*see* **HATCHERY PRODUCTION, Production Releases**).

Table 61. Mean weight (kg) of jack and adult spring chinook salmon in the 1998 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/Total age 1/3	1/4	1/5	2/2	2/3	2/4	2/5	2/6	Sample mean
Natural,									
Females,									
N	--	4	--	--	--	7	25	1	37
Mean	--	5.95	--	--	--	6.79	7.49	11.7	7.30
STD	--	1.84	--	--	--	1.61	1.43	--	1.70
Range	--	4.0-8.2	--	--	--	5.1-9.9	3.9-11.0	11.7	3.9-11.7
Males,									
N	10	9	1	0	1	8	10	--	39
Mean	2.97	5.92	8.5	--	2.5	7.59	8.92	--	6.25
STD	0.62	1.78	--	--	--	2.07	1.21	--	2.74
Range	2.3-4.0	3.9-8.8	8.5	--	2.5	4.8-11.5	7.0-10.5	--	2.3-11.5
Total,									
N	10	13	1	0	1	15	35	1	76
Mean	2.97	5.93	8.5	--	2.5	7.21	7.90	11.7	6.76
STD	0.62	1.72	--	--	--	1.85	1.51	--	2.34
Range	2.3-4.0	3.9-8.8	8.5	--	2.5	4.8-11.5	3.9-11.0	11.7	2.3-11.7
Subbasin hatchery,									
Females,									
N	--	--	--	--	--	8	2	--	10
Mean	--	--	--	--	--	4.55	8.25	--	5.29
STD	--	--	--	--	--	0.97	1.48	--	1.85
Range	--	--	--	--	--	3.3-6.6	7.2-9.3	--	3.3-9.3
Males,									
N	--	--	--	0	1	3	1	--	5
Mean	--	--	--	--	2.1	4.13	9.5	--	4.80
STD	--	--	--	--	--	1.36	--	--	2.93
Range	--	--	--	--	2.1	2.7-5.4	9.5	--	2.1-9.5
Total,									
N	--	--	--	0	1	11	3	--	15
Mean	--	--	--	--	2.1	4.44	8.67	--	5.13
STD	--	--	--	--	--	1.03	1.27	--	2.17
Range	--	--	--	--	2.1	2.7-6.6	7.2-9.5	--	2.1-9.5

Table 62. Mean weight (kg) of jack and adult spring chinook salmon in the 1999 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/Total age 1/3	1/4	1/5	2/2	2/3	2/4	2/5	Sample mean
Natural,								
Females,								
N	--	3	2	--	1	5	1	12
Mean	--	6.10	7.65	--	1.1	4.58	5.8	5.28
STD	--	1.00	1.63	--	--	1.08	--	1.97
Range	--	5.1-7.1	6.5-8.8	--	1.1	3.6-5.8	5.8	1.1-8.8
Males,								
N	2	2	1	0	2	3	1	11
Mean	2.15	6.15	5.5	--	1.70	3.43	8.2	4.00
STD	0.64	3.04	--	--	0.42	1.86	--	2.53
Range	1.7-2.6	4.0-8.3	5.5	--	1.4-2.0	1.9-5.5	8.2	1.4-8.3
Total,								
N	2	5	3	0	3	8	2	23
Mean	2.15	6.12	6.93	--	1.50	4.15	7.00	4.67
STD	0.64	1.68	1.69	--	0.46	1.42	1.70	2.30
Range	1.7-2.6	4.0-8.3	5.5-8.8	--	1.1-2.0	1.9-5.8	5.8-8.2	1.1-8.8
Subbasin hatchery,								
Females,								
N	--	--	--	--	1	44	1	46
Mean	--	--	--	--	1.3	4.18	3.9	4.11
STD	--	--	--	--	--	0.70	--	0.80
Range	--	--	--	--	1.3	2.2-6.2	3.9	1.3-6.2
Males,								
N	--	--	--	22	3	31	--	56
Mean	--	--	--	0.21	2.07	4.38	--	2.62
STD	--	--	--	0.12	0.51	0.76	--	2.10
Range	--	--	--	0.1-0.5	1.5-2.5	3.0-5.8	--	0.1-5.8
Total,								
N	--	--	--	22	4	75	1	102
Mean	--	--	--	0.21	1.88	4.26	3.9	3.29
STD	--	--	--	0.12	0.57	0.73	--	1.80
Range	--	--	--	0.1-0.5	1.3-2.5	2.2-6.2	3.9	0.1-6.2

Table 63. Mean weight (kg) of jack and adult spring chinook salmon by origin, stock, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1995), Olsen et al. (1996), Olsen and French (1996), and Olsen and French (1999).]

Origin, stock, brood year	Freshwater.total age								
	1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6
Natural,									
Hood River,[a]									
1988	--	--	--	--	--	--	--	--	9.5 (1)
1989	--	--	--	10.1 (5)	--	--	--	6.2 (5)	--
1990	--	--	5.4 (13)	9.4 (3)	--	--	4.9 (5)	9.3 (9)	--
1991	--	2.9 (2)	5.7 (1)	--	--	--	4.6 (2)	7.7 (1)	--
1992	0.3 (1)	4.2 (3)	6.5 (6)	8.1 (1)	--	--	5.4 (78)	8.8 (39)	11.7 (1)
1993	--	2.9 (4)	7.6 (6)	8.5 (1)	--	--	5.7 (21)	7.9 (35)	--
1994	--	--	5.9 (13)	6.9 (3)	0.5 (1)	0.7 (1)	7.2 (15)	7.0 (2)	--
1995	--	3.0 (10)	6.1 (5)	--	--	2.5 (1)	4.2 (8)	--	--
1996	--	2.2 (2)	--	--	--	1.5 (3)	--	--	--
1997	--	--	--	--	--	--	--	--	--
Subbasin hatchery,									
Carson,									
1989	--	--	--	--	--	--	--	6.7 (16)	7.4 (1)
1990	--	--	--	--	--	--	5.3 (235)	8.5 (31)	--
Deschutes,									
1991	--	--	--	--	--	1.6 (5)	4.9 (19)	--	--
1992[b]	--	--	--	--	--	--	--	--	--
1993	--	--	--	--	0.3 (1)	1.9 (14)	5.1 (263)	8.7 (3)	--
1994	--	--	--	--	--	--	4.4 (11)	3.9 (1)	--
1995	--	--	--	--	1.2 (1)	2.1 (1)	4.3 (75)	--	--
1996	--	--	--	--	--	1.9 (4)	--	--	--
1997	--	--	--	--	0.2 (22)	--	--	--	--

[a] Developed from Deschutes and Carson stock hatchery production releases.

[b] No hatchery fish were released from the 1992 brood (*see* **HATCHERY PRODUCTION**, **Production Releases**).

Table 64. Jack and adult spring chinook salmon sex ratios as a percentage of females by origin, stock, run year, and age category. Fish were sampled at the Powerdale Dam trap. (Sample size is in parentheses.)

Origin, stock, run year	Freshwater.total age								
	1.2	1.3	1.4	1.5	2.2[a]	2.3	2.4	2.5	2.6
Natural,									
Hood River,[b]									
1992	--	0 (1)	67 (21)	100 (1)	--	--	25 (8)	67 (3)	--
1993	--	0 (1)	73 (15)	80 (10)	0 (1)	--	67 (6)	50 (8)	--
1994	0 (1)	0 (2)	36 (14)	60 (5)	--	--	60 (5)	40 (5)	100 (1)
1995	--	100 (3)[c]	0 (1)	67 (3)	--	--	100 (2)	67 (9)	--
1996	--	50 (4)[c]	50 (6)	--	0 (1)	--	63 (78)	100 (1)	--
1997	--	--	50 (6)	100 (1)	0 (4)	0 (1)	67 (21)	54 (39)	--
1998	--	0 (11)	31 (13)	0 (1)	0 (5)	0 (1)	47 (15)	71 (35)	100 (1)
1999	--	0 (2)	60 (5)	67 (3)	0 (1)	33 (3)[c]	62 (8)	50 (2)	--
Subbasin hatchery,									
Carson,									
1992	--	--	--	--	--	0 (3)	75 (375)	71 (17)	--
1993	--	--	--	--	--	47 (15)[c]	71 (209)	61 (227)	--
1994	--	--	--	--	--	--	64 (242)	62 (16)	--
1995	--	--	--	--	--	--	--	64 (33)	0 (1)
Deschutes,									
1993	--	--	--	--	0 (1)	--	--	--	--
1994	--	--	--	--	*d*	40 (5)[c]	--	--	--
1995	--	--	--	--	0 (4)	*d*	81 (21)	--	--
1996	--	--	--	--	--	7 (14)[c]	*d*	--	--
1997	--	--	--	--	0 (6)	--	68 (269)	--	--
1998	--	--	--	--	0 (14)	0 (1)[c]	73 (11)	67 (3)	--
1999	--	--	--	--	0 (178)	25 (4)[c]	58 (78)	100 (1)	--

[a] Mini-jacks were either visually identified as males, or assumed to be males, unless otherwise noted by the sampler.

[b] Developed from Deschutes and Carson stock hatchery production releases.

[c] Jacks were classified as females based on visual observation.

[d] Hatchery returns in this age class would be progeny of the 1992 brood. No hatchery fish were released into the Hood River subbasin from this brood (*see* **HATCHERY PRODUCTION, Production Releases**).

Table 65. Bimonthly counts of upstream migrant jack and adult fall chinook salmon captured at the Powerdale Dam trap, by origin and run year. Counts are boldfaced for the bimonthly period in which the median date of migration occurred in each origin category.

Origin,	July		August		September		October		November		December		
run year	01-15	16-31	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	Total
Natural,													
1992	0	0	4	1	2	**7**	1	1	0	0	0	0	16
1993	0	0	**3**	1	2	0	0	0	0	0	0	0	6
1994[a]	0	6	2	0	0	**13**	3	1	0	0	0	0	25
1995[b]	0	**4**	0	1	3	0	0	0	0	0	0	0	8
1996	1	1	0	**7**	3	0	0	1	0	0	0	0	13
1997	0	4	7	**2**	9	2	0	0	0	0	0	0	24
1998	0	0	9	3	**9**	9	4	0	0	0	0	0	34
1999	0	0	3	4	**3**	1	3	1	1	0	0	0	16
Stray hatchery,													
1992	0	0	0	0	2	**1**	2	0	0	0	0	0	5
1993	0	0	0	0	**2**	1	1	0	0	0	0	0	4
1994[a]	0	0	0	0	0	**6**	0	0	0	0	0	0	6
1995[b]	0	0	0	0	**2**	2	0	0	0	0	0	0	4
1996	0	0	0	0	**1**	0	1	0	0	0	0	0	2
1997	0	0	0	0	**2**	0	0	0	0	0	0	0	2
1998	0	0	0	0	1	**1**	2	0	0	0	0	0	4
1999	--	--	--	--	--	--	--	--	--	--	--	--	0
Unknown,													
1992	0	0	0	0	0	0	0	**1**	0	0	0	0	1
1993	--	--	--	--	--	--	--	--	--	--	--	--	0
1994[a]	0	0	0	0	0	3	**3**	1	1	0	0	0	8
1995[b]	--	--	--	--	--	--	--	--	--	--	--	--	0
1996	0	0	0	0	**1**	0	0	0	0	0	0	0	1
1997	0	0	1	0	**2**	0	1	0	0	0	0	0	4
1998	0	0	0	0	0	**2**	0	0	0	0	0	0	2
1999	0	0	0	1	0	0	**1**	0	1	0	0	0	3

[a] Trap was inoperable from 10/27-11/07/94 because of flood damage.

[b] Powerdale Dam trap was inoperative from 11-13 Nov 1995 and from 20-24 Nov 1995 because of flood damage and from 28 Nov 1995 through 27 Feb 1996 for modifications to the adult fish ladder.

Table 66. Estimated harvest of unmarked and stray hatchery jack and adult fall chinook salmon in the Hood River sport fishery located from the mouth of the Hood River to Powerdale Dam (RM 4.5), 1998. Estimates of harvest are combined for jack and adult fish. Confidence limits (95%) are in parenthesis.

Period	Unmarked fall chinook salmon[a]		Stray fall chinook salmon		Catch Rate
	Kept	Released	Kept	Released	(hrs/fish)
Sep 1-15	--	--	--	--	--
Sep 16-30	2 (3.2)	10 (14.1)	--	--	27
Oct 1-15	--	--	--	--	--
Oct 16-31	--	--	--	--	--
Nov 1-15	--	--	--	--	--
Nov 16-30	--	--	--	--	--
Total	2 (3.2)	10 (14)	0 (--)	0 (--)	220[b]

[a] Estimates were not adjusted for unmarked stray hatchery jack and adult fall chinook salmon. Numbers of unmarked strays are assumed to be low based on the fact that few stray hatchery strays are sampled at Powerdale Dam.

[b] Estimate of mean catch rate is for the period 1 September - 30 November.

Table 67. Estimated harvest of unmarked and stray hatchery jack and adult fall chinook salmon in the Hood River sport fishery located from the mouth of the Hood River to Powerdale Dam (RM 4.5), 1999. Estimates of harvest are combined for jack and adult fish. Confidence limits (95%) are in parenthesis.

Period	Unmarked fall chinook salmon[a]		Stray fall chinook salmon		Catch Rate
	Kept	Released	Kept	Released	(hrs/fish)
Sep 1-15	--	--	--	--	--
Sep 16-30	--	--	--	--	--
Oct 1-15	--	--	--	--	--
Oct 16-31	--	--	--	--	--
Nov 1-15	--	--	--	--	--
Nov 16-30	2 (2.9)	2 (2.9)	--	--	52
Total	2 (2.9)	2 (2.9)	0 (--)	0 (--)	413[b]

[a] Estimates were not adjusted for unmarked stray hatchery jack and adult fall chinook salmon. Numbers of unmarked strays are assumed to be low based on the fact that few hatchery strays are sampled at Powerdale Dam.

[b] Estimate of mean catch rate is for the period 1 September - 30 November.

Table 68. Jack and adult fall 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, size, and the ratio of fish of known origin (*see* **METHODS**).

Origin, run year	Total escapement	Freshwater.total age								
		1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	2.6
Natural,										
1992	16	2	2	10	1	1	0	0	0	--
1993	6	0	1	3	2	0	0	0	0	--
1994	37	2	5	23	2	0	1	2	2	--
1995	8	1	0	1	1	0	1	2	2	--
1996	14	0	1	10	0	0	1	2	0	--
1997	28	0	7	9	0	0	2	7	3	--
1998	36	4	11	4	10	0	0	4	3	--
1999	19	1	5	4	1	0	0	6	2	--
Stray hatchery,										
1992	6	1	3	2	0	--	0	0	--	--
1993	4	0	1	2	1	--	0	0	--	--
1994	2	0	0	0	0	--	0	2	--	--
1995	4	0	0	1	0	--	0	3	--	--
1996	2	0	0	0	0	--	1	1	--	--
1997	2	0	0	1	0	--	0	1	--	--
1998	4	0	1	1	1	--	0	1	--	--
1999	0	--	--	--	--	--	--	--	--	--

Table 69. Age composition (percent) of jack and adult fall chinook salmon sampled at the Powerdale Dam trap by origin and run year. (Estimates in a given run year may not add to 100% due to rounding error.)

Origin, run year	N	Freshwater.total age 1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	2.6
Natural,										
1992	16	12.5	12.5	62.5	6.2	6.2	0	0	0	--
1993	6	0	16.7	50.0	33.3	0	0	0	0	--
1994	25	8.0	16.0	48.0	8.0	0	4.0	8.0	8.0	--
1995	8	12.5	0	12.5	12.5	0	12.5	25.0	25.0	--
1996	13	0	7.7	69.2	0	0	7.7	15.4	0	--
1997	24	0	25.0	29.2	0	0	8.3	25.0	12.5	--
1998	34	11.8	29.4	11.8	26.5	0	0	11.8	8.8	--
1999	16	6.2	25.0	18.8	6.2	0	0	31.2	12.5	--
Stray hatchery,										
1992	5	20.0	40.0	40.0	0	--	0	0	--	--
1993	4	0	25.0	50.0	25.0	--	0	0	--	--
1994	6	0	0	66.7	0	--	0	33.3	--	--
1995	4	0	0	25.0	0	--	0	75.0	--	--
1996	2	0	0	0	0	--	50.0	50.0	--	--
1997	2	0	0	50.0	0	--	0	50.0	--	--
1998	4	0	25.0	25.0	25.0	--	0	25.0	--	--
1999	0	0	0	0	0	--	0	0	--	--

Table 70. Mean fork length (cm) of jack and adult fall chinook salmon in the 1998 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/Total age 1/2	1/3	1/4	1/5	2/4	2/5	Sample[a] mean
Natural,							
Females,							
N	3	9	2	6	2	3	25
Mean	45.33	61.11	86.50	87.58	83.75	78.17	71.46
STD	8.95	9.27	10.61	8.31	8.84	19.56	17.81
Range	35.5-53.0	42.0-73.0	79.0-94.0	76.0-97.0	77.5-90.0	56.0-93.0	35.5-97.0
Males,							
N	1	1	2	2	2	--	8
Mean	51.0	61.5	80.00	93.50	86.50	--	79.06
STD	--	--	1.41	4.24	2.12	--	15.35
Range	51.0	61.5	79.0-81.0	90.5-96.5	85.0-88.0	--	51.0-96.5
Total,							
N	4	10	4	9	4	3	34
Mean	46.75	61.15	83.25	87.72	85.12	78.17	73.41
STD	7.84	8.74	7.23	8.25	5.48	19.56	17.08
Range	35.5-53.0	42.0-73.0	79.0-94.0	76.0-97.0	77.5-90.0	56.0-93.0	35.5-97.0
Stray hatchery,							
Females,							
N	--	1	--	1	--	--	2
Mean	--	68.5	--	84.0	--	--	76.25
STD	--	--	--	--	--	--	10.96
Range	--	68.5	--	84.0	--	--	68.5-84.0
Males,							
N	--	--	1	--	1	--	2
Mean	--	--	82.0	--	88.0	--	85.00
STD	--	--	--	--	--	--	4.24
Range	--	--	82.0	--	88.0	--	82.0-88.0
Total,							
N	--	1	1	1	1	--	4
Mean	--	68.5	82.0	84.0	88.0	--	80.62
STD	--	--	--	--	--	--	8.46
Range	--	68.5	82.0	84.0	88.0	--	68.5-88.0

[a] Mean estimates include fall chinook salmon in which the origin, but not the age of the fish, could be determined from the scale sample.

Table 71. Mean fork length (cm) of jack and adult fall chinook salmon in the 1999 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/Total age 1/2	1/3	1/4	1/5	2/4	2/5	Sample mean
Natural,							
Females,							
N	--	3	3	1	3	2	12
Mean	--	64.50	73.33	101.0	76.17	87.50	76.50
STD	--	4.09	7.37	--	3.01	2.12	11.56
Range	--	61.0-69.0	65.0-79.0	101.0	73.0-79.0	86.0-89.0	61.0-101.0
Males,							
N	1	1	--	--	2	--	4
Mean	38.0	64.0	--	--	68.00	--	59.50
STD	--	--	--	--	2.83	--	14.55
Range	38.0	64.0	--	--	66.0-70.0	--	38.0-70.0
Total,							
N	1	4	3	1	5	2	16
Mean	38.0	64.38	73.33	101.0	72.90	87.50	72.25
STD	--	3.35	7.37	--	5.15	2.12	14.07
Range	38.0	61.0-69.0	65.0-79.0	101.0	66.0-79.0	86.0-89.0	38.0-101.0

Table 72. Mean fork length (cm) of jack and adult fall chinook salmon by origin, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1996), Olsen and French (1996), and Olsen and French (1999).]

Origin, brood year	Freshwater.total age								
	1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	2.6
Natural,									
1986	--	--	--	--	86 (1)	--	--	--	--
1987	--	--	--	96 (1)	--	--	--	--	--
1988	--	--	83 (10)	90 (2)	--	--	--	--	--
1989	--	66 (2)	79 (3)	91 (2)	--	--	--	83 (2)	--
1990	42 (2)	52 (1)	82 (12)	89 (1)	--	--	82 (2)	90 (2)	--
1991	--	68 (4)	89 (1)	--	--	57 (1)	79 (2)	--	--
1992	53 (2)	--	82 (9)	--	--	62 (1)	81 (2)	84 (3)	--
1993	47 (1)	62 (1)	90 (7)	88 (9)	--	68 (1)	89 (6)	78 (3)	--
1994	--	78 (6)	83 (4)	101 (1)	--	76 (2)	85 (4)	88 (2)	--
1995	--	61 (10)	73 (3)	--	--	--	73 (5)	--	--
1996	47 (4)	64 (4)	--	--	--	--	--	--	--
1997	38 (1)	--	--	--	--	--	--	--	--
Stray hatchery,									
1988	--	--	78 (2)	76 (1)	--	--	--	--	--
1989	--	64 (2)	71 (2)	--	--	--	--	--	--
1990	44 (1)	70 (1)	80 (4)	--	--	--	78 (2)	--	--
1991	--	--	72 (1)	--	--	--	78 (3)	--	--
1992	--	--	--	--	--	--	82 (1)	--	--
1993	--	--	86 (1)	84 (1)	--	60 (1)	69 (1)	--	--
1994	--	--	82 (1)	--	--	--	88 (1)	--	--
1995	--	68 (1)	--	--	--	--	--	--	--

Table 73. Mean weight (kg) of jack and adult fall chinook salmon in the 1998 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/Total age 1/2	1/3	1/4	1/5	2/4	2/5	Sample[a] mean
Natural,							
Females,							
N	3	9	2	6	2	3	25
Mean	1.53	4.28	8.30	8.43	7.00	6.37	5.74
STD	0.95	3.80	2.97	2.33	2.40	3.81	3.66
Range	0.6-2.5	1.1-13.7	6.2-10.4	5.4-11.6	5.3-8.7	2.0-9.0	0.6-13.7
Males,							
N	1	1	2	2	2	--	8
Mean	1.5	13.1	7.40	9.90	7.50	--	8.02
STD	--	--	1.13	0.71	1.13	--	3.38
Range	1.5	13.1	6.6-8.2	9.4-10.4	6.7-8.3	--	1.5-13.1
Total,							
N	4	10	4	9	4	3	34
Mean	1.52	5.16	7.85	8.44	7.25	6.37	6.27
STD	0.78	4.54	1.91	2.24	1.56	3.81	3.62
Range	0.6-2.5	1.1-13.7	6.2-10.4	5.4-11.6	5.3-8.7	2.0-9.0	0.6-13.7
Stray hatchery,							
Females,							
N	--	1	--	1	--	--	2
Mean	--	4.4	--	8.7	--	--	6.55
STD	--	--	--	--	--	--	3.04
Range	--	4.4	--	8.7	--	--	4.4-8.7
Males,							
N	--	--	1	--	1	--	2
Mean	--	--	6.2	--	7.8	--	7.00
STD	--	--	--	--	--	--	1.13
Range	--	--	6.2	--	7.8	--	6.2-7.8
Total,							
N	--	1	1	1	1	--	4
Mean	--	4.4	6.2	8.7	7.8	--	6.78
STD	--	--	--	--	--	--	1.89
Range	--	4.4	6.2	8.7	7.8	--	4.4-8.7

[a] Mean estimates include fall chinook salmon in which the origin, but not the age of the fish, could be determined from the scale sample.

Table 74. Mean weight (kg) of jack and adult fall chinook salmon in the 1999 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/Total age 1/2	1/3	1/4	1/5	2/4	2/5	Sample mean
Natural,							
Females,							
N	--	3	3	1	3	2	12
Mean	--	3.13	5.87	11.2	5.17	8.30	5.86
STD	--	0.40	1.75	--	0.91	0	2.56
Range	--	2.7-3.5	4.1-7.6	11.2	4.5-6.2	8.3	2.7-11.2
Males,							
N	1	1	--	--	2	--	4
Mean	0.5	3.0	--	--	3.40	--	2.58
STD	--	--	--	--	0.28	--	1.41
Range	0.5	3.0	--	--	3.2-3.6	--	0.5-3.6
Total,							
N	1	4	3	1	5	2	16
Mean	0.5	3.10	5.87	11.2	4.46	8.30	5.04
STD	--	0.34	1.75	--	1.17	0	2.71
Range	0.5	2.7-3.5	4.1-7.6	11.2	3.2-6.2	8.3	0.5-11.2

Table 75. Mean weight (kg) of jack and adult fall chinook salmon by origin, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1996), Olsen and French (1996), and Olsen and French (1999).]

Origin,	Freshwater.total age								
brood year	1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	2.6
Natural,									
1989	--	--	--	9.5 (2)	--	--	--	7.4 (2)	--
1990	--	--	7.0 (12)	9.1 (1)	--	--	6.8 (2)	9.7 (2)	--
1991	--	4.2 (4)	8.9 (1)	--	--	2.5 (1)	5.9 (2)	--	--
1992	2.0 (2)	--	7.1 (9)	--	--	2.9 (1)	5.8 (2)	7.7 (3)	--
1993	1.4 (1)	3.2 (1)	8.7 (7)	8.4 (9)	--	3.7 (1)	8.3 (6)	6.4 (3)	--
1994	--	5.8 (6)	7.8 (4)	11.2 (1)	--	4.9 (2)	7.2 (4)	8.3 (2)	--
1995	--	5.2 (10)	5.9 (3)	--	--	--	4.5 (5)	--	--
1996	1.5 (4)	3.1 (4)	--	--	--	--	--	--	--
1997	0.5 (1)	--	--	--	--	--	--	--	--
Stray hatchery,									
1990	--	--	6.8 (4)	--	--	--	6.4 (2)	--	--
1991	--	--	5.1 (1)	--	--	--	5.9 (3)	--	--
1992	--	--	--	--	--	--	6.9 (1)	--	--
1993	--	--	8.0 (1)	8.7 (1)	--	2.9 (1)	5.0 (1)	--	--
1994	--	--	6.2 (1)	--	--	--	7.8 (1)	--	--
1995	--	4.4 (1)	--	--	--	--	--	--	--

Table 76. Jack and adult fall 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 is in parentheses.)

Origin, run year	Freshwater.total age								
	1.2[a]	1.3	1.4	1.5	1.6	2.3[a]	2.4	2.5	2.6
Natural,									
1992	0 (2)	100 (2)	50 (10)	0 (1)	100 (1)	--	--	--	--
1993	--	0 (1)	100 (3)	100 (2)	--	--	--	--	--
1994	0 (2)	75 (4)	67 (12)	100 (2)	--	0 (1)	100 (2)	100 (2)	--
1995	0 (1)	--	100 (1)	100 (1)	--	100 (1)	50 (2)	0 (2)	--
1996	--	0 (1)	33 (9)	--	--	0 (1)	100 (1)	--	--
1997	--	67 (6)	57 (7)	--	--	50 (2)	33 (6)	33 (3)	--
1998	75 (4)	90 (10)	50 (4)	75 (8)	--	--	50 (4)	100 (3)	--
1999	0 (1)	75 (4)	100 (3)	100 (1)	--	--	60 (5)	100 (2)	--
Stray hatchery,									
1992	100 (1)	100 (2)a	100 (2)	--	--	--	--	--	--
1993	--	0 (1)	50 (2)	100 (1)	--	--	--	--	--
1994	--	--	100 (4)	--	--	--	100 (2)	--	--
1995	--	--	100 (1)	--	--	--	67 (3)	--	--
1996	--	--	--	--	--	100 (1)	100 (1)	--	--
1997	--	--	0 (1)	--	--	--	100 (1)	--	--
1998	--	100 (1)	0 (1)	100 (1)	--	--	0 (1)	--	--
1999	--	--	--	--	--	--	--	--	--

[a] Jacks were classified as females based on visual observation.

Table 77. Bimonthly counts of upstream migrant jack and adult coho salmon captured at the Powerdale Dam trap, by origin and run year. Counts are boldfaced for the bimonthly period in which the median date of migration occurred in each origin category.

Origin,	August		September		October		November		December		
run year	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	Total
Natural,											
1992	0	0	1	**11**	5	4	1	0	0	0	22
1993	0	0	0	0	0	0	0	0	0	0	0
1994[a]	0	0	0	0	**1**	0	0	0	0	0	1
1995[b]	0	0	3	1	**4**	3	0	0	0	0	11
1996	0	0	0	1	**4**	1	0	0	0	0	6
1997	0	0	0	**3**	2	1	0	0	0	0	6
1998	0	0	0	1	**3**	0	0	1	0	0	5
1999	0	0	0	1	**4**	1	3	0	1	0	10
Stray hatchery,											
1992	0	1	6	**37**	12	12	11	0	0	0	79
1993	0	0	0	3	10	**10**	0	3	2	0	28
1994[a]	0	0	3	15	**11**	23	0	0	0	0	52
1995[b]	0	1	0	12	**15**	11	0	0	0	0	39
1996	0	0	0	3	**12**	5	0	0	0	0	20
1997	0	0	0	1	**2**	3	0	0	0	0	6
1998	0	0	0	10	10	**9**	8	7	0	0	44
1999	0	0	0	7	**6**	3	0	0	3	0	19
Unknown,											
1992	0	0	0	**1**	0	1	0	0	0	0	2
1993	0	1	**2**	1	0	0	0	0	1	0	5
1994[a]	0	0	1	0	0	**2**	0	0	0	0	3
1995[b]	0	0	0	0	**1**	0	0	0	0	0	1
1996	0	0	0	0	**1**	0	0	0	0	0	1
1997	0	0	**1**	0	0	0	0	0	0	0	1
1998	0	0	0	0	1	2	**3**	4	0	0	10
1999	0	0	0	0	**1**	0	0	1	0	0	2

[a] Trap was inoperable from 10/27-11/07/94 because of flood damage.

[b] Powerdale Dam trap was inoperative from 11-13 Nov 1995 and from 20-24 Nov 1995 because of flood damage and from 28 Nov 1995 through 27 Feb 1996 for modifications to the adult fish ladder.

Table 78. Jack and adult 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 ratio of fish of known origin (*see* **METHODS**).

Origin, run year	Total escapement	Freshwater.total age 2.2	2.3	3.4
Natural,				
1992	23	--	23	0
1993	0	--	0	0
1994	1	--	1	0
1995	11	--	10	1
1996	6	--	6	0
1997	6	--	6	0
1998	12	--	12	0
1999	11	--	11	0
Stray hatchery,				
1992	80	13	67	--
1993	33	0	33	--
1994	55	3	52	--
1995	40	4	36	--
1996	21	1	20	--
1997	7	0	7	--
1998	47	1	46	--
1999	20	1	19	--

Table 79. Age composition (percent) of jack and adult coho salmon sampled at the Powerdale Dam trap by origin and run year.

Origin, run year	N	Freshwater.total age 2.2	2.3	3.4
Natural,				
1992	22	--	100	0
1993	0	--	--	0
1994	1	--	100	0
1995	11	--	90.9	9.1
1996	6	--	100	0
1997	6	--	100	0
1998	5	--	100	0
1999	10	--	100	0
Stray hatchery,				
1992	79	16.5	83.5	--
1993	28	0	100	--
1994	52	5.8	94.2	--
1995	39	10.3	89.7	--
1996	20	5.0	95.0	--
1997	6	0	100	--
1998	44	2.3	97.7	--
1999	19	5.3	94.7	--

Table 80. Mean fork length (cm) of jack and adult coho salmon in the 1998 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 mean
Natural,			
Females,			
N	--	3	3
Mean	--	62.33	62.33
STD	--	12.57	12.57
Range	--	48.0-71.5	48.0-71.5
Males,			
N	--	2	2
Mean	--	63.50	63.50
STD	--	4.95	4.95
Range	--	60.0-67.0	60.0-67.0
Total,			
N	--	5	5
Mean	--	62.80	62.80
STD	--	9.25	9.25
Range	--	48.0-71.5	48.0-71.5
Stray hatchery,			
Females,			
N	1	6	7
Mean	35.5	65.67	61.36
STD	--	9.19	14.16
Range	35.5	53.5-75.0	35.5-75.0
Males,			
N	--	37	37
Mean	--	67.32	67.32
STD	--	7.60	7.60
Range	--	51.5-78.5	51.5-78.5
Total,			
N	1	43	44
Mean	35.5	67.09	66.38
STD	--	7.74	9.01
Range	35.5	51.5-78.5	35.5-78.5

Table 81. Mean fork length (cm) of jack and adult coho salmon in the 1999 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 mean
Natural,			
Females,			
N	--	6	6
Mean	--	72.17	72.17
STD	--	4.65	4.65
Range	--	66.0-78.5	66.0-78.5
Males,			
N	--	4	4
Mean	--	67.62	67.62
STD	--	7.72	7.72
Range	--	62.0-79.0	62.0-79.0
Total,			
N	--	10	10
Mean	--	70.35	70.35
STD	--	6.11	6.11
Range	--	62.0-79.0	62.0-79.0
Stray hatchery,			
Females,			
N	--	5	5
Mean	--	71.90	71.90
STD	--	4.25	4.25
Range	--	66.0-76.0	66.0-76.0
Males,			
N	1	13	14
Mean	37.5	72.73	70.21
STD	--	9.43	13.07
Range	37.5	53.0-85.0	37.5-85.0
Total,			
N	1	18	19
Mean	37.5	72.50	70.66
STD	--	8.19	11.31
Range	37.5	53.0-85.0	37.5-85.0

Table 82. Mean fork length (cm) of jack and adult coho salmon by origin, brood year, and age category. Fish were sampled at the Powerdale Dam trap. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1994), Olsen et al. (1995), Olsen et al. (1996), Olsen and French (1996), and Olsen and French (1999).]

Origin, brood year	Freshwater.total age 2.2	2.3	3.4
Natural,			
1989	--	58 (22)	--
1990	--	--	--
1991	--	56 (1)	60 (1)
1992	--	65 (10)	--
1993	--	70 (6)	--
1994	--	61 (6)	--
1995	--	63 (5)	--
1996	--	70 (10)	--
Stray hatchery,			
1989	--	58 (66)	--
1990	38 (13)	65 (28)	--
1991	--	69 (49)	--
1992	39 (3)	68 (35)	--
1993	40 (4)	71 (19)	--
1994	36 (1)	64 (6)	--
1995	--	67 (43)	--
1996	36 (1)	72 (18)	--
1997	38 (1)	--	--

Table 83. Mean weight (kg) of jack and adult coho salmon in the 1998 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 mean
Natural,			
Females,			
N	--	3	3
Mean	--	6.30	6.30
STD	--	6.44	6.44
Range	--	1.1-13.5	1.1-13.5
Males,			
N	--	2	2
Mean	--	2.55	2.55
STD	--	0.78	0.78
Range	--	2.0-3.1	2.0-3.1
Total,			
N	--	5	5
Mean	--	4.80	4.80
STD	--	5.01	5.01
Range	--	1.1-13.5	1.1-13.5
Stray hatchery,			
Females,			
N	1	6	7
Mean	0.6	4.93	4.31
STD	--	4.64	4.54
Range	0.6	1.5-14.1	0.6-14.1
Males,			
N	--	37	37
Mean	--	3.34	3.34
STD	--	1.09	1.09
Range	--	1.4-5.8	1.4-5.8
Total,			
N	1	43	44
Mean	0.6	3.56	3.49
STD	--	1.97	2.00
Range	0.6	1.4-14.1	0.6-14.1

Table 84. Mean weight (kg) of jack and adult coho salmon in the 1999 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 mean
Natural,			
Females,			
N	--	6	6
Mean	--	4.47	4.47
STD	--	0.74	0.74
Range	--	3.5-5.5	3.5-5.5
Males,			
N	--	4	4
Mean	--	3.52	3.52
STD	--	1.27	1.27
Range	--	2.6-5.4	2.6-5.4
Total,			
N	--	10	10
Mean	--	4.09	4.09
STD	--	1.04	1.04
Range	--	2.6-5.5	2.6-5.5
Stray hatchery,			
Females,			
N	--	5	5
Mean	--	4.54	4.54
STD	--	0.69	0.69
Range	--	3.7-5.5	3.7-5.5
Males,			
N	1	13	14
Mean	0.7	4.68	4.40
STD	--	1.68	1.93
Range	0.7	1.7-6.8	0.7-6.8
Total,			
N	1	18	19
Mean	0.7	4.64	4.44
STD	--	1.45	1.68
Range	0.7	1.7-6.8	0.7-6.8

Table 85. Mean weight (kg) of jack and adult coho salmon by origin, brood year, and age category. Fish were sampled at the Powerdale Dam trap. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1995), Olsen et al. (1996), Olsen and French (1996), and Olsen and French (1999).]

Origin, brood year	Freshwater.total age 2.2	2.3	3.4
Natural,			
1989	--	--	--
1990	--	--	--
1991	--	1.8 (1)	2.7 (1)
1992	--	3.3 (10)	--
1993	--	3.9 (6)	--
1994	--	2.5 (6)	--
1995	--	4.8 (5)	--
1996	--	4.1 (10)	--
Stray hatchery,			
1989	--	--	--
1990	--	--	--
1991	--	3.7 (49)	--
1992	0.7 (3)	3.5 (35)	--
1993	0.8 (4)	4.1 (19)	--
1994	0.5 (1)	3.0 (6)	--
1995	--	3.6 (43)	--
1996	0.6 (1)	4.6 (18)	--
1997	0.7 (1)	--	--

Table 86. Jack and adult 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 is in parentheses.)

Origin, run year	Freshwater.total age 2.2[a]	2.3	3.4
Natural,			
1992	--	64 (22)	--
1993	--	--	--
1994	--	0 (1)	--
1995	--	50 (10)	100 (1)
1996	--	33 (6)	--
1997	--	0 (6)	--
1998	--	60 (5)	--
1999	--	60 (10)	--
Stray hatchery,			
1992	62 (13)	36 (66)	--
1993	--	21 (28)	--
1994	33 (3)	43 (49)	--
1995	0 (4)	21 (34)	--
1996	0 (1)	58 (19)	--
1997	--	33 (6)	--
1998	100 (1)	14 (43)	--
1999	0 (1)	28 (18)	--

[a] Jacks were classified as females based on visual observation.

Table 87. Summary, by run year, of 1) number of adult summer steelhead used for hatchery broodstock[a], 2) number of family groups represented in the hatchery brood, 3) number of spawnings during the spawning period, 4) egg take, 5) number of smolts produced, and 6) egg to smolt survival for the hatchery summer steelhead program in the Hood River subbasin.

Run year	Numbers spawned			Family groups	Number of spawnings	Total[b] egg take	Number of smolts	Egg to smolt survival
	Females	Males	Total					
1997-1998	7	2	9	10	5	30,218	19,513	64.6%
1998-1999	14	11(3)	25	29	8	39,417[c]	--	--

[a] Hatchery broodstock was collected entirely from the wild (i.e., unmarked) component of the run.

[b] Green egg take.

[c] Egg take was adjusted for the loss of eggs fertilized by three unmarked males classified as hatchery fish based on scale analysis. The three unmarked hatchery males were used for spawning prior to the scale read. Approximately 13,258 eggs were discarded from the estimated total green egg take.

Table 88. Summary, by run year, of 1) number of adult winter steelhead used for hatchery broodstock[a], 2) number of family groups represented in the hatchery brood, 3) number of spawnings during the spawning period, 4) egg take, 5) number of smolts produced, and 6) egg to smolt survival for the hatchery winter steelhead program in the Hood River subbasin.

Run year	Numbers spawned[b]			Family groups	Number of spawnings	Total[c] egg take	Number of smolts	Egg to smolt survival
	Females	Males	Total					
1990-1991[d]	3(2)	1	4	3	2	11,858	4,595	38.8%
1991-1992[e]	18	22(1)	41	57	6	50,748	48,985	96.5%
1992-1993	16	21	37	78	6	62,150	38,034	61.2%
1993-1994	26	28	54	70	8	95,043	42,860	45.1%
1994-1995	18	19	37	47	8	63,790	50,896	79.8%
1995-1996	24(4)	29(12)	53	60	10	85,497	59,837	70.0%
1996-1997	27(10)	27(12)	54	51	8	102,465	62,135	60.6%
1997-1998	21(10)	21(10)	42	37	9	80,620	46,781	58.0%
1998-1999	29(14)	33(13)	62	55	9	112,302	--	--

[a] Hatchery broodstock was collected entirely from the wild (i.e., unmarked) component of the run in the 1991-1992 through 1994-1995 run years. Hood River stock hatchery winter steelhead were incorporated into the hatchery broodstock beginning with the 1995-1996 run year (*see* Olsen and French 1999).

[b] Number of hatchery adults used for broodstock are in parenthesis and included in the totals, by sex.

[c] Green egg take.

[d] Hatchery broodstock was collected from both wild and Big creek stocks of adult winter steelhead (*see* Olsen and French 1999).

[e] One unmarked adult, which was classified as a hatchery fish based on scale analysis, was incorporated into the hatchery broodstock.

Table 89. Hatchery summer steelhead smolt releases in the Hood River subbasin, by brood year[a].

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	4.4	5,830	Hood River
1987	Ad	--	04/11/88	4.6	6,026	Hood River
1987	Ad	--	04/04-05/88	4.7	17,249	Hood River
1987	Ad	--	04/08/88	4.4	5,500	West Fork Hood River
1987	Ad	--	04/04/88	4.5	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	4.7	17,188	West Fork Hood River
1987	Ad	--	04/07/88	5.0	12,350	West Fork Hood River
1988	Ad	--	04/07/89	5.3	12,826	Hood River
1988	Ad	--	04/11/89	5.5	13,630	Hood River
1988	Ad	--	05/02-03/89	4.3	10,213	West Fork Hood River
1988	Ad	--	04/10/89	5.3	19,504	West Fork Hood River
1988	Ad	--	04/06-12/89	5.5	32,853	West Fork Hood River
1989	Ad	--	04/04/90	5.3	4,876	Hood River
1989	Ad	--	04/11/90	6.5	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	5.5	20,306	West Fork Hood River
1989	Ad	--	04/06/90	5.7	14,591	West Fork Hood River
1990	Ad	--	04/29/91	5.4	7,020	Hood River
1990	Ad	--	04/30/91	5.5	14,743	Hood River
1990	Ad	--	04/24/91	5.8	7,013	Hood River
1990	Ad	--	04/22/91	5.2	12,787	West Fork Hood River
1990	Ad	--	04/23/91	5.3	6,943	West Fork Hood River
1990	Ad	--	04/24/91	5.5	6,869	West Fork Hood River
1990	Ad	--	04/23/91	5.6	6,776	West Fork Hood River
1990	Ad	--	04/23/91	5.8	14,981	West Fork Hood River
1991	Ad	--	04/08/92	4.8	5,880	Hood River
1991	Ad	--	04/07/92	5.2	12,870	Hood River
1991	Ad	--	04/06/92	5.4	13,365	Hood River
1991	Ad	--	04/08/92	5.5	6,958	Hood River
1991	Ad	--	04/07/92	4.7	15,082	West Fork Hood River
1991	Ad	--	04/07/92	5.2	15,023	West Fork Hood River
1991	Ad	--	04/06/92	5.4	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	6.0	33,570	West Fork Hood River
1992	Ad	--	05/04/93	6.3	17,955	West Fork Hood River
1992	Ad	--	05/05/93	6.5	19,403	West Fork Hood River

Table 89. Continued.

Broodstock, hatchery, brood year	Fin clip[b] or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released	Release location
Foster,[c] (cont.)						
Oak Springs,						
1993	Ad	--	03/29-31/94	4.6	71,760	West Fork Hood River
1993	Ad	--	03/29/94	4.8	5,880	West Fork Hood River
1993	Ad	--	03/30-31/94	5.2	12,402	West Fork Hood River
1994	Ad	--	04/11/95	4.6	13,600	West Fork Hood River
1994	Ad	--	04/10-11/95	5.3	46,232	West Fork Hood River
1994	Ad	--	04/12/95	5.5	16,498	West Fork Hood River
1995	Ad	--	04/01-11/96	5.2	48,346	West Fork Hood River
1995	Ad	--	04/03/96	5.5	15,017	West Fork Hood River
1995	Ad	--	04/11-12/96	5.9	5,015	West Fork Hood River
1996	Ad	--	04/09/97	5.0	12,745	West Fork Hood River
1996	Ad	--	04/10/97	5.0	5,250	West Fork Hood River
1996	Ad	--	04/10/97	5.1	14,890	West Fork Hood River
1996	Ad	--	04/10/97	5.5	14,850	West Fork Hood River
1996	Ad	--	04/15/97	5.2	9,360	West Fork Hood River
1996	Ad	--	04/16/97	5.0	2,044	West Fork Hood River
1996	Ad	--	04/16/97	5.3	1,854	West Fork Hood River
1997	Ad	--	04/08/98	4.9	12,250	West Fork Hood River
1997	Ad	--	04/08/98	5.4	29,024	West Fork Hood River
1997	Ad	--	04/08/98	5.7	15,518	West Fork Hood River
1997	Ad	--	04/09/98	5.8	8,118	West Fork Hood River
1998	Ad	--	04/07-08/99	6.0	32,697	Below Powerdale Dam (@ RM 4.5)
1998	Ad	--	04/08/99	6.8	17,000	Below Powerdale Dam (@ RM 4.5)
1998	Ad	--	04/08-09/99	5.6	12,521	Below Powerdale Dam (@ RM 4.5)
Hood River,						
Oak Springs,						
1998	LM	--	04/15/99	5.5	15,616	West Fork Hood River
1998	LM	--	05/10/99	6.6	3,897	Near mouth of Hood River

[a] Production releases prior to the 1987 brood are in ODFW and CTWSRO (1990).

[b] Ad = Adipose; LM = Left Maxillary.

[c] The Foster stock was developed from the Skamania stock of summer steelhead.

Table 90. Hatchery winter steelhead smolt releases in the Hood River subbasin, by brood year[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	4.2	4,890	East Fork Hood River
1989	Ad	--	04/12/90	4.7	4,253	Middle Fork Hood River
1989	Ad	--	04/12/90	4.7	7,755	East Fork Hood River
Gnat Creek,						
1987	No mark	--	04/22/88	5.6	28,000	Middle Fork Hood River
1989	Ad	--	05/09/90	5.4	12,015	Middle Fork Hood River
1989	Ad	--	05/09/90	5.4	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	5.2	15,078	East Fork Hood River
Mixed,[c]						
Oak Springs,						
1991	Ad	--	03/31/92	4.6	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	6.0	15,420	East Fork Hood River
1992	Ad-LP	--	04/06/93	5.6	18,340	East Fork Hood River
1993	Ad-LM	--	04/12-13/94	4.5	7,423	East Fork Hood River
1993	Ad-LV;07-05-36	--	04/12-13/94	4.5	6,863	East Fork Hood River
1993	Ad-LV;07-05-37	--	04/12-13/94	4.5	6,189	East Fork Hood River
1993	Ad-LM	--	04/12/94	5.4	2,414	East Fork Hood River
1993	Ad-LV;07-05-38	--	04/12/94	5.4	6,445	East Fork Hood River
1993	Ad-LV;07-05-39	--	04/12/94	5.4	6,531	East Fork Hood River
1993	Ad-LP	--	06/28/94	5.8	2,169	East Fork Hood River
1994	Ad-LV;07-08-63	--	04/19-20/95	5.1	10,534	East Fork Hood River
1994	Ad-LV;07-09-16	--	04/19-20/95	5.1	10,367	East Fork Hood River
1994	Ad-LV;07-09-17	--	04/19/95	5.4	3,426	East Fork Hood River
1994	Ad-LV;07-09-17	--	04/19/95	5.8	7,707	East Fork Hood River
1994	Ad-LV;07-09-18	--	04/19/95	5.4	3,331	East Fork Hood River
1994	Ad-LV;07-09-18	--	04/19/95	5.8	7,495	East Fork Hood River
1995	Ad-LV-RM;07-11-31	--	04/02/96	5.5	5,621	East Fork Hood River
1995	Ad-LV-RM;07-11-31	--	04/01/96	5.7	11,649	East Fork Hood River
1995	Ad-LV-RM;07-11-31	--	04/04/96	5.8	3,508	East Fork Hood River
1995	Ad-LV-RM;07-11-32	--	04/22-24/96	5.0	19,913	East Fork Hood River
1995	Ad-RM	--	04/22-24/96	5.0	3,793	East Fork Hood River
1995	Ad-RM	--	04/02/96	5.5	115	East Fork Hood River

Table 90. Continued.

Broodstock, hatchery, brood year	Fin clip[b] or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released	Release location
Hood River, (cont.)						
Oak Springs,						
1995	Ad-RM	--	04/01/96	5.7	238	East Fork Hood River
1995	Ad-RM	--	04/04/96	5.8	72	East Fork Hood River
1995	Ad-LV-RM;07-11-31	--	04/04/96	5.5	749	Hood River (RM 0.5)
1995	Ad-LV-RM;07-11-31	--	04/04/96	5.7	1,553	Hood River (RM 0.5)
1995	Ad-LV-RM;07-11-31	--	04/04/96	5.8	468	Hood River (RM 0.5)
1995	Ad-LV-RM;07-11-32	--	04/22/96	5.0	2,655	Hood River (RM 0.5)
1995	Ad-RM	--	04/04/96	5.0	505	Hood River (RM 0.5)
1995	Ad-RM	--	04/04/96	5.5	15	Hood River (RM 0.5)
1995	Ad-RM	--	04/04/96	5.7	32	Hood River (RM 0.5)
1995	Ad-RM	--	04/04/96	5.8	10	Hood River (RM 0.5)
1996	Ad-LM	--	04/11/97	5.8	16,791	East Fork Hood River
1996	Ad-LM	--	04/15/97	5.6	10,920	East Fork Hood River
1996	Ad-LM	--	05/05/97	8.3	32,126	East Fork Hood River
1997	Ad-RM	--	04/14/98	5.2	29,510	East Fork Hood River
1997	Ad-RM	--	04/28/98	7.5	31,707	East Fork Hood River
1997	Ad-RM	--	06/04/98	9.0	918	East Fork Hood River
1998	Ad-RV	--	04/15/99	5.6	12,430	East Fork Hood River
1998	Ad-RV	--	05/05/99	5.8	10,572	East Fork Hood River
1998	Ad-RV	--	04/14/99	5.6	9,857	Middle Fork Hood River
1998	Ad-RV	--	05/05/99	6.0	9,816	Middle Fork Hood River
1998	Ad-RV	--	04/08/99	5.6	1,792	Below Powerdale Dam (@ RM 4.5)
1998	Ad-RV	--	05/25/99	8.1	2,314	Near mouth of Hood River

[a] Production releases prior to the 1987 brood are in ODFW and CTWSRO (1990).

[b] Ad = Adipose; LV = Left Ventral; RV = Right Ventral; LP = Left Pectoral; LM = Left Maxillary; RM = Right Maxillary.

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

Table 91. Hatchery juvenile spring chinook salmon releases in the Hood River subbasin by brood year[a].

Life history stage, broodstock, hatchery, brood year	Fin clip[b] 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	9.7	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	Ad;07-42-57	--	03/14/88	11.2	34,548	West Fork Hood River
1986	Ad;07-42-57	--	03/14/88	11.4	14,443	West Fork Hood River
1986	Ad;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	Ad;07-42-58	--	03/09/89	11.0	24,698	West Fork Hood River
1987	No mark	--	03/09/89	11.1	8,568	West Fork Hood River
1987	Ad;07-42-58	--	03/09/89	11.1	28,521	West Fork Hood River
1988	Ad;07-52-23	--	03/13/90	9.4	23,970	West Fork Hood River
1988	No mark	--	03/12-13/90	9.9	42,565	West Fork Hood River
1988	No mark	--	03/13/90	10.0	20,799	West Fork Hood River
1988	Ad;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	Ad;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	Ad;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	Ad;07-55-30	--	03/25/91	9.4	53,614	West Fork Hood River
1989	No mark	--	03/25/91	9.8	29,399	West Fork Hood River
1989	No mark	--	03/25/91	11.2	42,419	West Fork Hood River
1990	No mark	--	04/02/92	9.7	41,647	West Fork Hood River
1990	No mark	--	04/02/92	9.9	62,954	West Fork Hood River
1990	Ad;07-56-59	--	04/02/92	10.2	58,694	West Fork Hood River

Table 91. Continued.

Life history stage, broodstock, hatchery, brood year	Fin clip or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released[c]	Release location
Smolt, (cont.)						
Deschutes,						
Bonneville,						
1991	Ad;07-33-35	--	04/01/93	11.2	11,760	West Fork Hood River
1991	Ad;07-33-35	--	04/01/93	11.3	34,685	West Fork Hood River
1992[d]	--	--	--	--	--	--
Round Butte,						
1991	Ad;07-50-22 R2	--	04/08-09/93	6.7	28,760	West Fork Hood River
1992[d]	--	--	--	--	--	--
1993	Ad;07-05-49	--	04/04-05/95	13.1	13,111	West Fork Hood River
1993	Ad;07-05-49	--	04/03-04/95	13.2	13,211	West Fork Hood River
1993	Ad;07-05-49	--	04/03/95	13.7	12,865	West Fork Hood River
1993	Ad;07-05-49	--	04/04/95	13.8	13,175	West Fork Hood River
1993	No mark	--	04/04-05/95	13.1	29,455	West Fork Hood River
1993	No mark	--	04/03-04/95	13.2	29,682	West Fork Hood River
1993	No mark	--	04/03/95	13.7	28,905	West Fork Hood River
1993	No mark	--	04/04/95	13.8	29,600	West Fork Hood River
1994	Ad-RV;07-11-30	--	04/22-23/96	9.5	40,348	West Fork Hood River
1994	Ad-RV;07-11-30	--	04/10/96	10.0	25,776	West Fork Hood River
1994	Ad-RV;07-11-30	--	04/08/96	10.1	23,354	West Fork Hood River
1994	Ad-RV;07-11-30	--	04/09/96	10.3	23,893	West Fork Hood River
1994[e]	Ad;07-09-38	--	04/22-23/96	9.5	3,509	West Fork Hood River
1994[e]	Ad;07-09-38	--	04/10/96	10.0	2,241	West Fork Hood River
1994[e]	Ad;07-09-38	--	04/08/96	10.1	2,031	West Fork Hood River
1994[e]	Ad;07-09-38	--	04/09/96	10.3	2,078	West Fork Hood River
1995	Ad-LV;09-17-47	--	04/07/97	7.9	33,469	West Fork Hood River
1995	Ad-LV;09-17-47	--	04/08/97	8.2	11,928	West Fork Hood River
1995	Ad-LV;09-18-06	--	04/16/97	8.3	22,315	West Fork Hood River
1995	Ad-LV;09-18-06	--	04/17/97	8.2	10,138	West Fork Hood River
1995	Ad-LV;09-18-06	--	04/17/97	8.6	22,869	West Fork Hood River
1996	Ad-RV;09-22-26	--	04/09/98	9.8	62,049	West Fork Hood River
1996	Ad-RV;09-22-27	--	04/22/98	9.7	53,658	West Fork Hood River
1996	Ad-RV;09-22-27	--	04/22/98	9.7	8,053	West Fork Hood River

Table 91. Continued.

Life history stage, broodstock, hatchery, brood year	Fin clip or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released[c]	Release location
Smolt, (cont.)						
Deschutes,						
Round Butte,						
1997	Ad-LV;09-25-55	--	04/08/99	7.5	35,163	West Fork Hood River
1997	Ad-LV;09-25-56	--	04/20/99	6.7	36,485	West Fork Hood River
1997	Ad-RM;09-25-57	--	04/12/99	6.4	30,164	Middle Fork Hood River
1997	Ad-RM;09-25-57	--	05/05/99	5.9	214	Near mouth of Hood River
1997	Ad-LV;09-25-55/56	--	05/06-11/99	8.3	19,322	Near mouth of Hood River

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

[b] Ad = Adipose; LV = Left Ventral; RV = Right Ventral; RM = Right Maxillary.

[c] Estimates for the 1994-1997 brood releases were adjusted for mortality at downstream migrant screw traps.

[d] No hatchery spring chinook salmon were released from the 1992 brood.

[e] This coded wire tag group was to have been released in its entirety in the Deschutes River but seals broke around the rotary screens, used to prevent movement among cells in Pelton ladder, allowing a small percentage of this tag group to mix with fish destined for release in the Hood River.

Table 92. Estimated numbers of hatchery summer and winter steelhead smolts migrating past a juvenile migrant trap located at RM 4.5 in the mainstem Hood River. (Population estimators and sampling period are in **APPENDIX A.**)

Race, stock, brood year	Hatchery[a] production release	Estimated number of smolts passing the mainstem migrant trap			
		Estimate[b]	95% C.I.	% of production release	
				Estimate	Range
Summer,					
Foster,[c]					
1993	90,042	32,017	14,211 - 49,823	35.6	16 - 55
1994	76,330	47,281	3,162 - 91,400	61.9	4 - 100
1995	68,378	28,277	19,782 - 36,772	41.4	29 - 54
1996	60,993	29,761	20,384 - 39,139	48.8	33 - 64
Hood River,					
1998	15,616	13,118	8,995 - 17,241	84.0	58 - 78
Winter,					
Hood River,					
1993	38,034	10,456	4,712 - 16,201	27.5	12 - 43
1994	42,860	16,344	1,173 - 31,515	38.1	3 - 74
1995	44,909	32,914	23,011 - 42,817	73.3	51 - 95
1996	59,837	48,661	33,252 - 64,069	81.3	56 - 100
1997	62,135	47,530	34,828 - 60,232	76.5	56 - 97
1998	42,675	39,744	29,905 - 49,583	93.1	70 - 100

[a] Estimate represents numbers released above the mainstem migrant trap. A small percentage of non-migrants remaining in the acclimation ponds may have been released below the mainstem migrant trap beginning with the 1998 brood Hood River stock summer steelhead release and the 1995 brood Hood River stock winter steelhead release.

[b] Estimate based on the mark:recapture ratio for wild downstream migrant steelhead (*see* **HATCHERY PRODUCTION, Post-Release Survival**).

[c] The 1996 brood release of Foster stock hatchery summer steelhead smolts was the last brood release of a non-indigenous stock above Powerdale Dam (i.e., the mainstem migrant trap).

Table 93. Estimates of mean fork length (FL; mm), weight (gm), and condition factor (CF) for Hood River stock hatchery summer steelhead smolts sampled at Oak Springs Hatchery prior to being transferred to the Hood River subbasin[a].

Statistic, brood year	N	Mean	Range	95% C.I.
FL (mm),				
1998	246	189.6	109 - 235	± 2.2
Weight (gms),				
1998	244	82.4	12.8 - 152.4	± 2.8
CF,[b]				
1998	244	1.17	0.84 - 1.37	± 0.009

[a] Juveniles were sampled two weeks prior to the first transfer of smolts in mid-April.

[b] Condition factor was estimated as (100*weight(gms)/length(cm)^3).

Table 94. Estimates of mean fork length (FL; mm), weight (gm), and condition factor (CF) for Hood River stock hatchery winter steelhead smolts sampled at Oak Springs Hatchery prior to being transferred to the Hood River subbasin[a]. Estimates are for small-, medium-, and large- sized groups which were ponded separately at the hatchery.

Statistic, size group, brood year	N	Mean	Range	95% C.I.
FL (mm),				
Small,[b]				
1993	130	183.8	115 - 234	± 4.2
Medium,				
1993	192	193.1	82 - 283	± 3.9
1994	207	185.7	116 - 234	± 2.7
1995	*c*			
1996	192	168.2	90 - 225	± 3.7
1997	205	173.8	89 - 218	± 3.1
1998	195	194.9	92 - 268	± 3.6
Large,				
1993	185	200.2	144 - 246	± 2.9
1994	200	196.9	138 - 247	± 2.5

Table 94. Continued.

Statistic, size group, brood year	N	Mean	Range	95% C.I.
FL (mm),				
Large, (cont.)				
1995	208	196.1	93 - 236	± 2.6
1996	203	196.5	118 - 242	± 2.5
1997	199	193.1	91 - 240	± 2.9
1998	200	189.2	125 - 232	± 2.3
Weight (gms),				
Small,[b]				
1993	129	69.5	16.0 - 145.5	± 4.8
Medium,				
1993	192	87.2	6.1 - 236.4	± 4.6
1994	207	72.8	16.5 - 154.0	± 3.1
1995	*c*			
1996	191	53.4	5.7 - 109.8	± 3.3
1997	202	60.7	7.3 - 115.8	± 2.9
1998	195	84.1	7.9 - 190.1	± 4.3
Large,				
1993	185	91.1	33.1 - 168.5	± 3.8
1994	199	86.2	29.6 - 172.1	± 3.2
1995	205	89.6	8.7 - 163.5	± 3.1
1996	202	86.0	18.1 - 164.3	± 3.2
1997	198	88.7	9.9 - 191.1	± 3.5
1998	200	76.2	21.7 - 145.4	± 2.8
CF,[d]				
Small,[b]				
1993	129	1.06	0.88 - 1.22	± 0.006
Medium,				
1993	192	1.15	0.97 - 1.35	± 0.005
1994	207	1.10	0.94 - 1.25	± 0.01
1995	*c*			
1996	191	1.04	0.63 - 1.67	± 0.01
1997	202	1.10	0.90 - 1.35	± 0.009
1998	195	1.08	0.76 - 1.23	± 0.01
Large,				
1993	185	1.10	0.93 - 1.31	± 0.005
1994	199	1.10	0.97 - 1.24	± 0.01
1995	205	1.16	0.95 - 1.37	± 0.01
1996	202	1.10	0.91 - 1.39	± 0.01
1997	198	1.19	1.02 - 1.39	± 0.01
1998	200	1.10	0.97 - 1.31	± 0.008

[a] Juveniles were sampled approximately two days to one week prior to transfer in mid-April.

[b] Juveniles were sampled four days prior to release on 28 June 1994.

[c] Juveniles in this size category were not sampled at Oak Springs Hatchery from this brood release group.

[d] Condition factor was estimated as $(100*\text{weight(gms)}/\text{length(cm)}^3)$.

Table 95. Estimates of mean fork length (FL; mm), weight (gm), and condition factor (CF) for downstream migrant hatchery summer and winter steelhead released into the Hood River subbasin (*see* **HATCHERY PRODUCTION, Production Releases**) and sampled at the mainstem migrant trap.

Race/species, statistic, brood	Sampling period	N	Mean	Range	95% C.I.
Summer steelhead,[a]					
FL (mm),					
1994	04/12-07/06/95	581	208.4	103 - 248	± 1.3
1995	04/06-07/05/96	245	205.0	110 - 258	± 2.3
1996	04/12-06/30/97	331	209.4	124 - 255	± 2.0
1997	--	*b*			
1998	04/16-07/28/99	422	204.2	129 - 262	± 1.5
Weight (gm),					
1994	04/12-07/06/95	574	89.1	25.9 - 154.8	± 1.7
1995	04/06-07/05/96	238	82.3	34.7 - 160.6	± 2.5
1996	04/12-06/30/97	327	90.9	41.1 - 171.0	± 2.6
1997	--	*b*			
1998	04/16-07/28/99	415	86.3	33.0 - 197.7	± 2.0
CF,[c]					
1994	04/12-07/06/95	574	0.97	0.70 - 1.21	± 0.006
1995	04/06-07/05/96	238	0.92	0.53 - 1.18	± 0.01
1996	04/12-06/30/97	327	0.97	0.61 - 1.56	± 0.009
1997	--	*b*			
1998	04/16-07/28/99	415	0.99	0.83 - 1.26	± 0.007
Winter steelhead,[d]					
FL (mm),					
1994	04/20-07/04/95	393	208.1	152 - 261	± 1.5
1995	04/15-07/05/96	304	205.7	151 - 247	± 1.8
1996	04/24-07/07/97	652	191.6	151 - 264	± 1.2
1997	04/16-06/26/98	1,601	201.5	146 - 267	± 0.8
1998	04/16-07/02/99	737	204.0	154 - 261	± 1.1
Weight (gm),					
1994	04/20-07/04/95	384	89.4	29.8 - 198.6	± 2.2
1995	04/15-07/05/96	274	84.7	34.7 - 135.7	± 2.3
1996	04/24-07/07/97	647	71.3	32.2 - 205.2	± 1.5
1997	04/16-06/26/98	1,537	79.8	30.5 - 159.2	± 1.0
1998	04/16-07/02/99	730	86.6	34.3 - 183.2	± 1.5
CF,[c]					
1994	04/20-07/04/95	384	0.98	0.77 - 1.31	± 0.007
1995	04/15-07/05/96	274	0.96	0.80 - 1.28	± 0.008
1996	04/24-07/07/97	647	0.99	0.57 - 1.30	± 0.006
1997	04/16-06/26/98	1,537	0.96	0.65 - 1.47	± 0.004
1998	04/16-07/02/99	730	1.00	0.76 - 1.41	± 0.005

[a] Hatchery production releases, prior to the 1998 brood release, were progeny of Foster stock summer steelhead. Only the progeny of Hood River stock summer steelhead were released above Powerdale Dam beginning with 1998 brood release (*see* **HATCHERY PRODUCTION**).

[b] No hatchery summer steelhead smolts were released above the mainstem migrant trap. All hatchery production (Foster stock) was released below Powerdale Dam (*see* **HATCHERY PRODUCTION**).

[c] Condition factor was estimated as $(100*\text{weight(gms)}/\text{length(cm)}^3)$.

[d] Hood River stock.

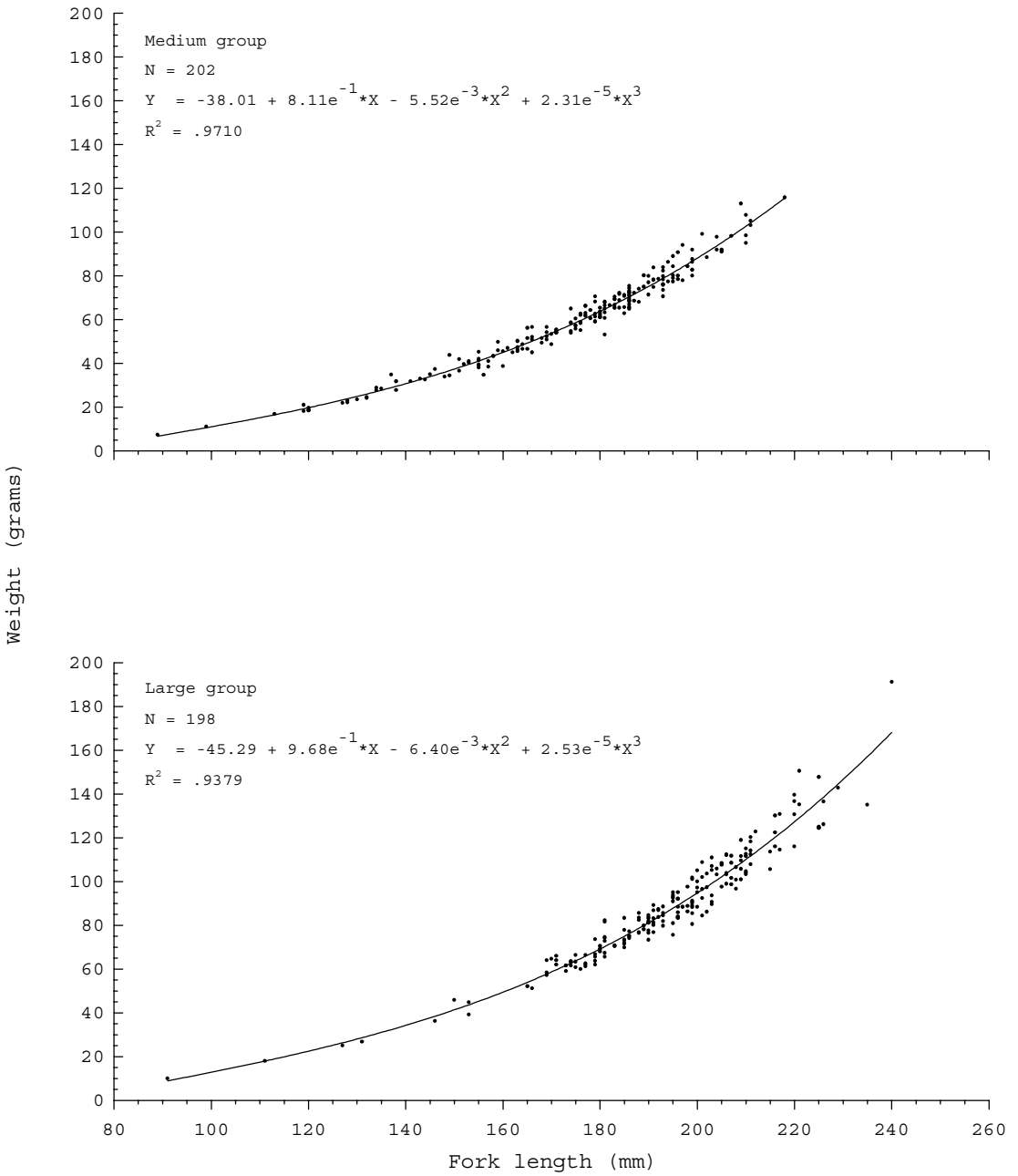


Figure 10. Length x weight regression of the medium- and large- sized groups of Hood River stock hatchery winter steelhead smolts (1997 brood) released into the Hood River subbasin from Oak Springs Hatchery.

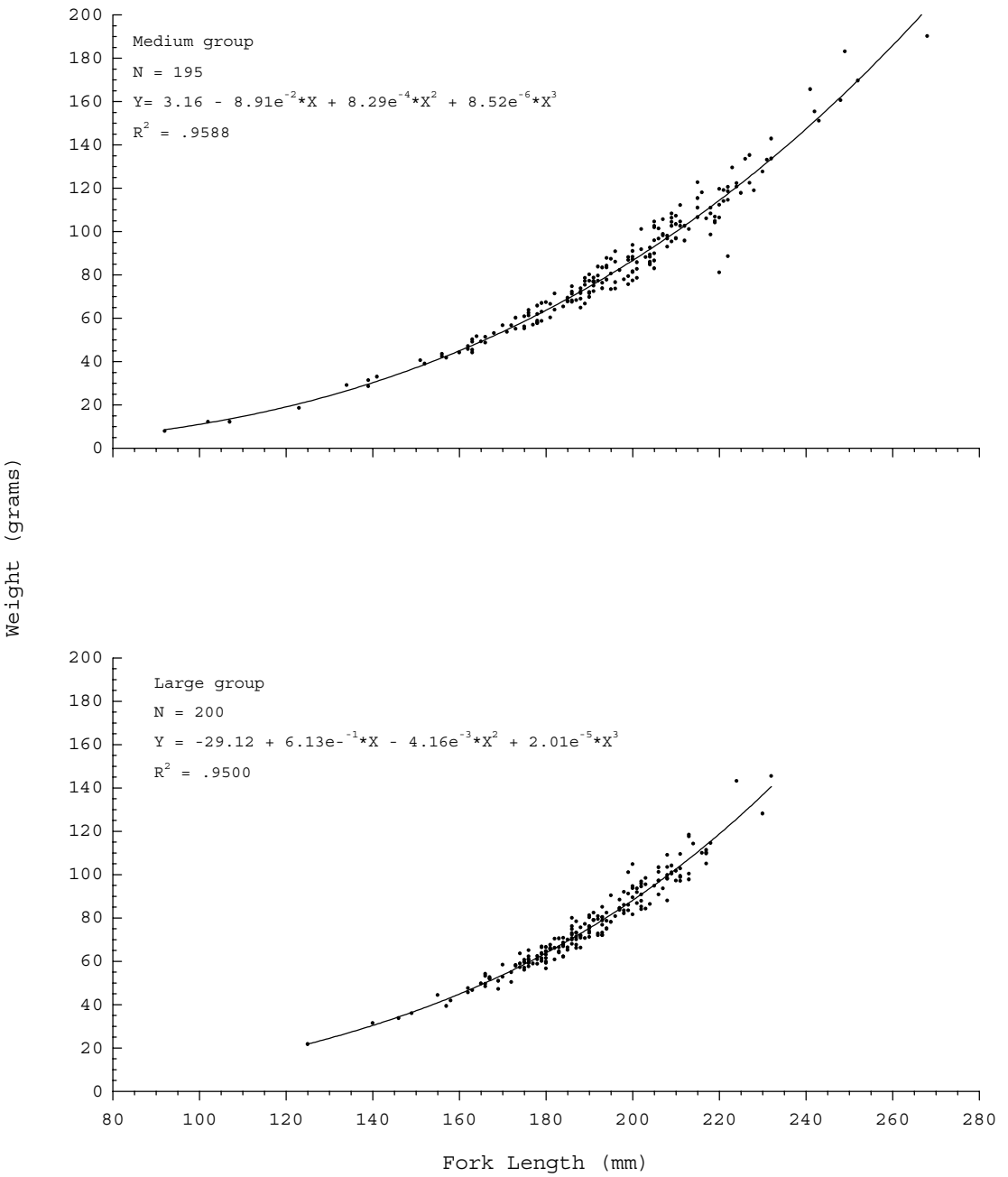


Figure 11. Length x weight regression of the medium- and large- sized groups of Hood River stock hatchery winter steelhead smolts (1998 brood) released into the Hood River subbasin from Oak Springs Hatchery.

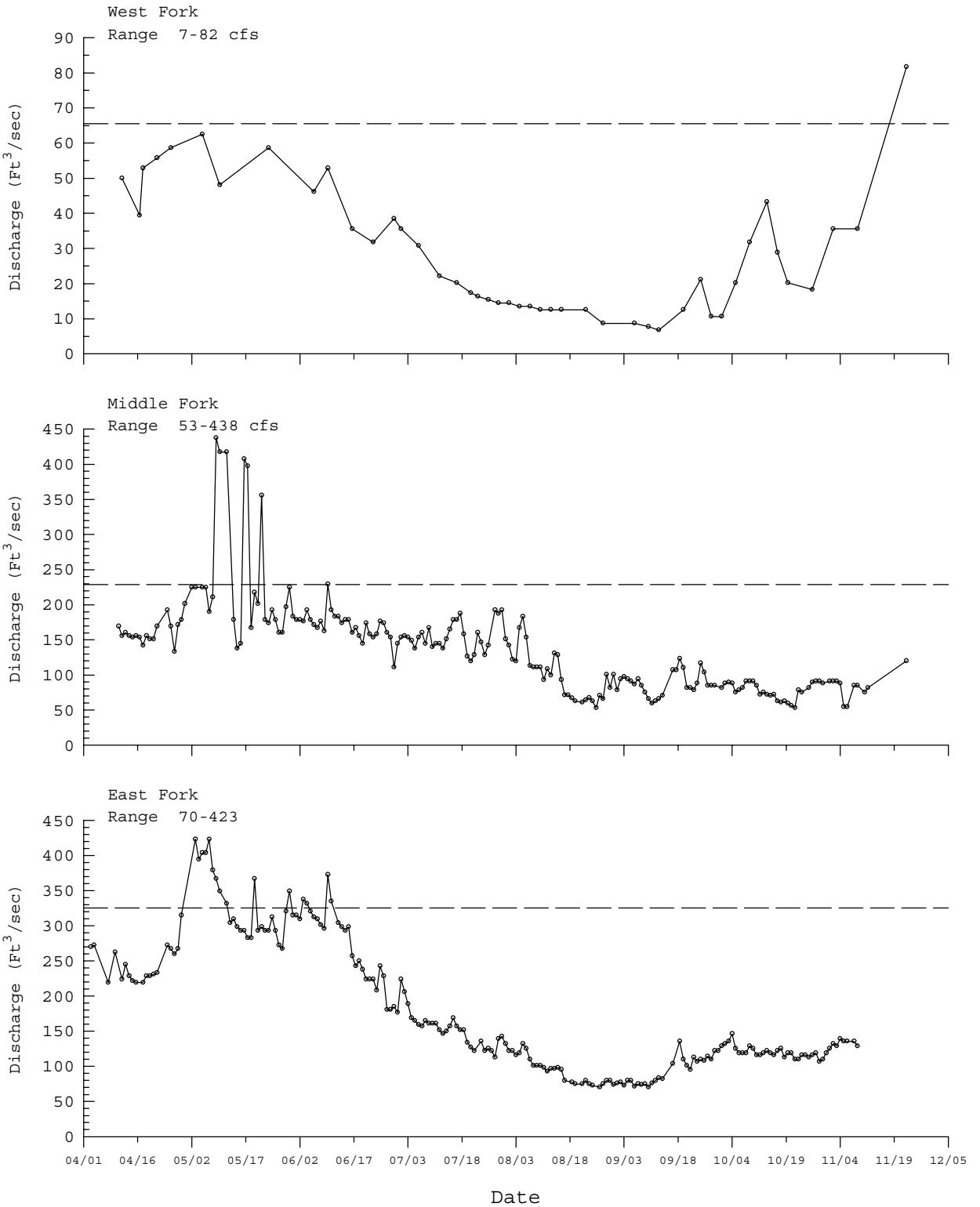


Figure 12. Streamflows in the West, Middle, and East forks of the Hood River, 1998. Streamflows above the dashed line were extrapolated from the calibration curve used to estimate streamflow from the staff gauge readings.

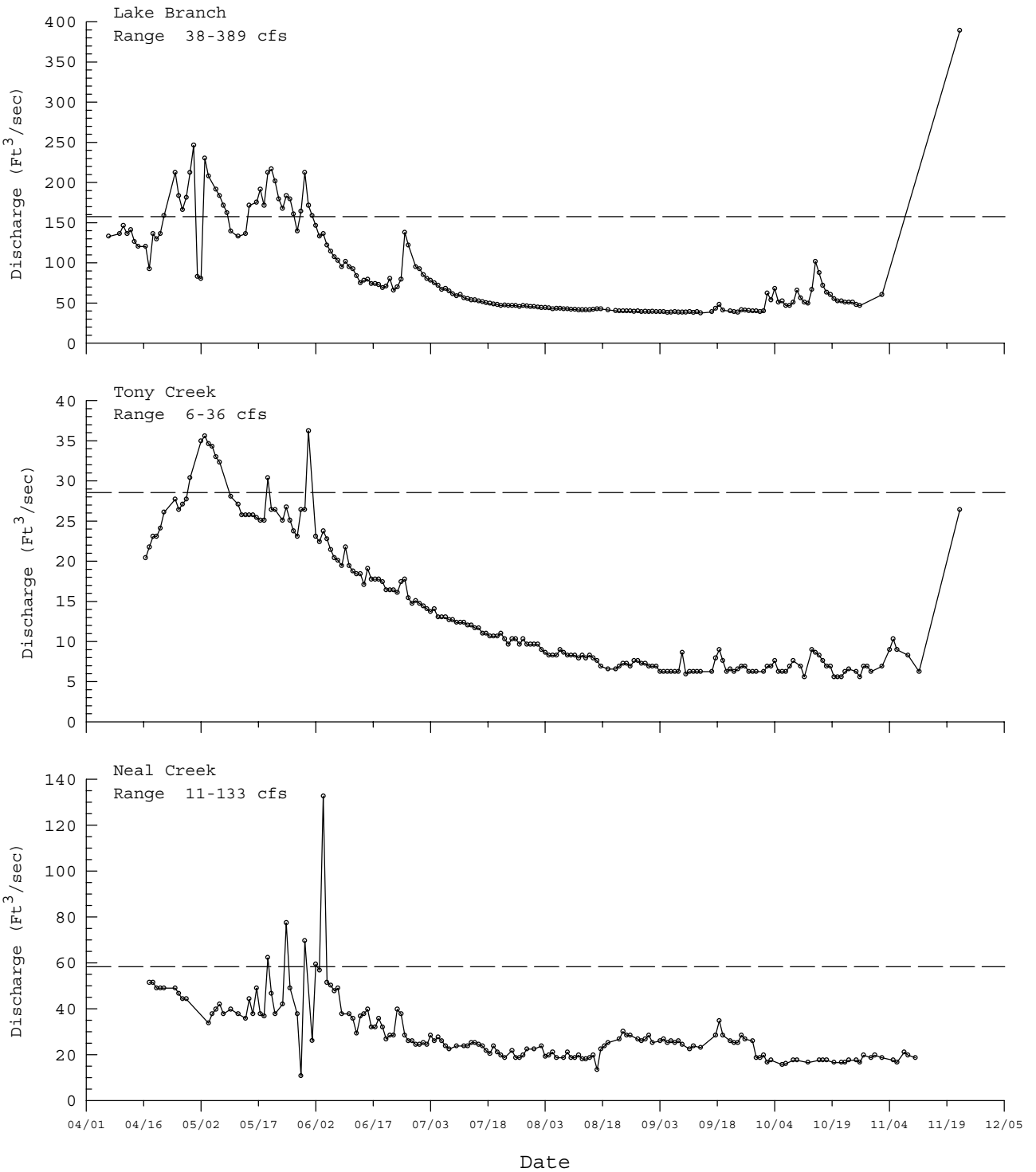


Figure 13. Streamflows in Lake Branch and Tony Creek, which are tributaries to the West and Middle forks of the Hood River, respectively, and in Neal Creek, which is a tributary to the mainstem of the Hood River, 1998. Streamflows above the dashed line were extrapolated from the calibration curve used to estimate streamflow from the staff gauge readings.

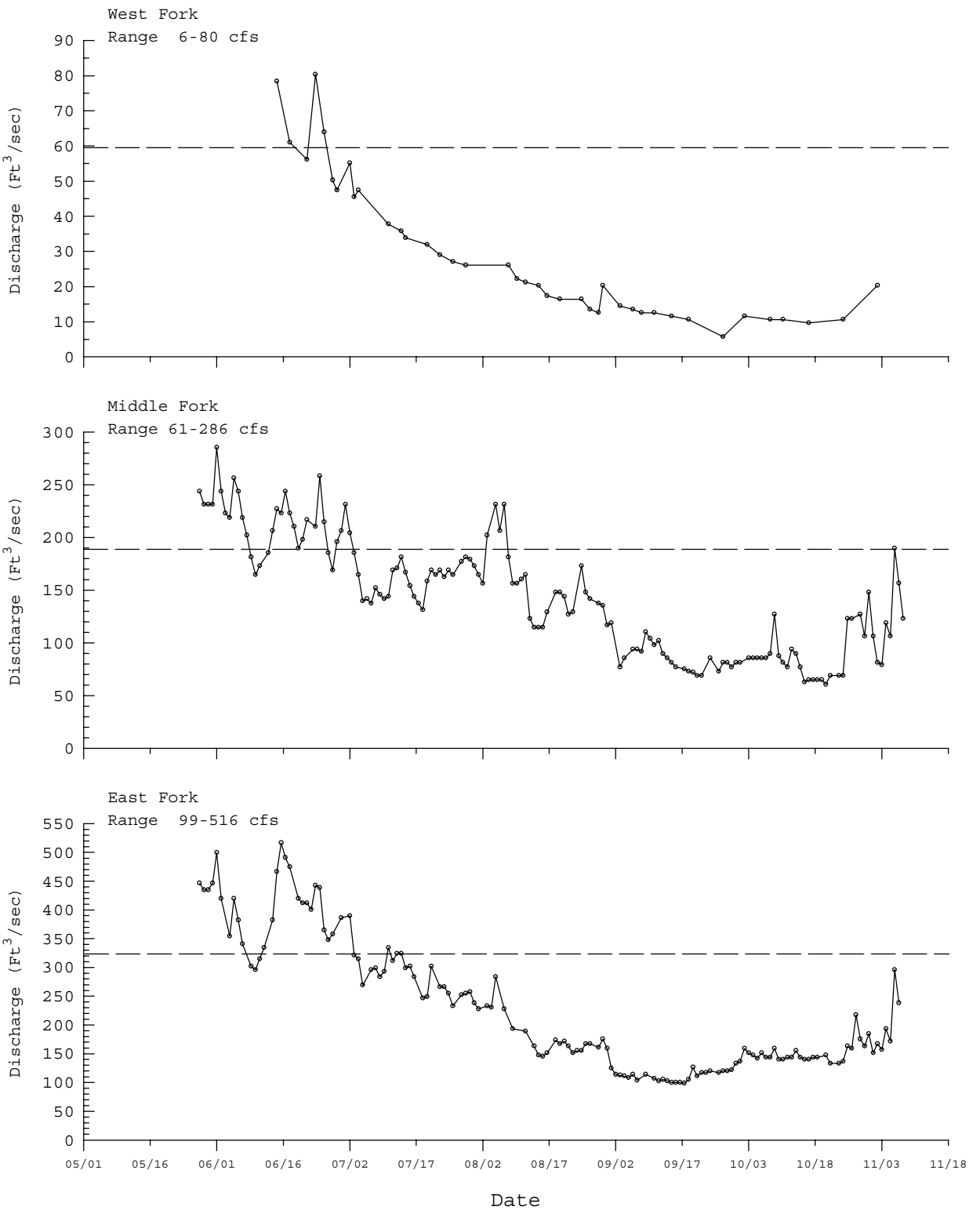


Figure 14. Streamflows in the West, Middle, and East forks of the Hood River, 1999. Streamflows above the dashed line were extrapolated from the calibration curve used to estimate streamflow from the staff gauge readings.

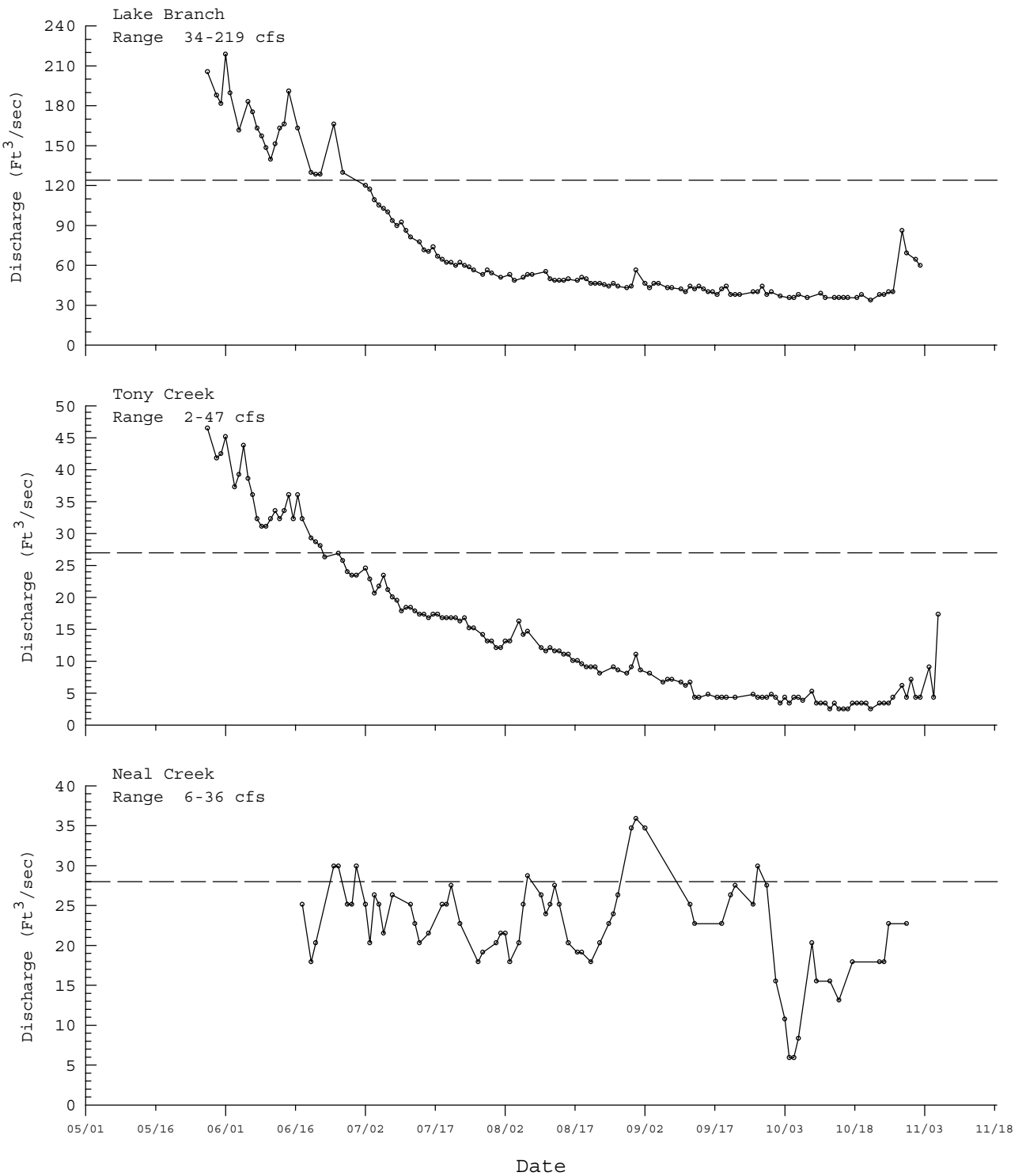


Figure 15. Streamflows in Lake Branch and Tony Creek, which are tributaries to the West and Middle forks of the Hood River, respectively, and in Neal Creek, which is a tributary to the mainstem of the Hood River, 1999. Streamflows above the dashed line were extrapolated from the calibration curve used to estimate streamflow from the staff gauge readings.

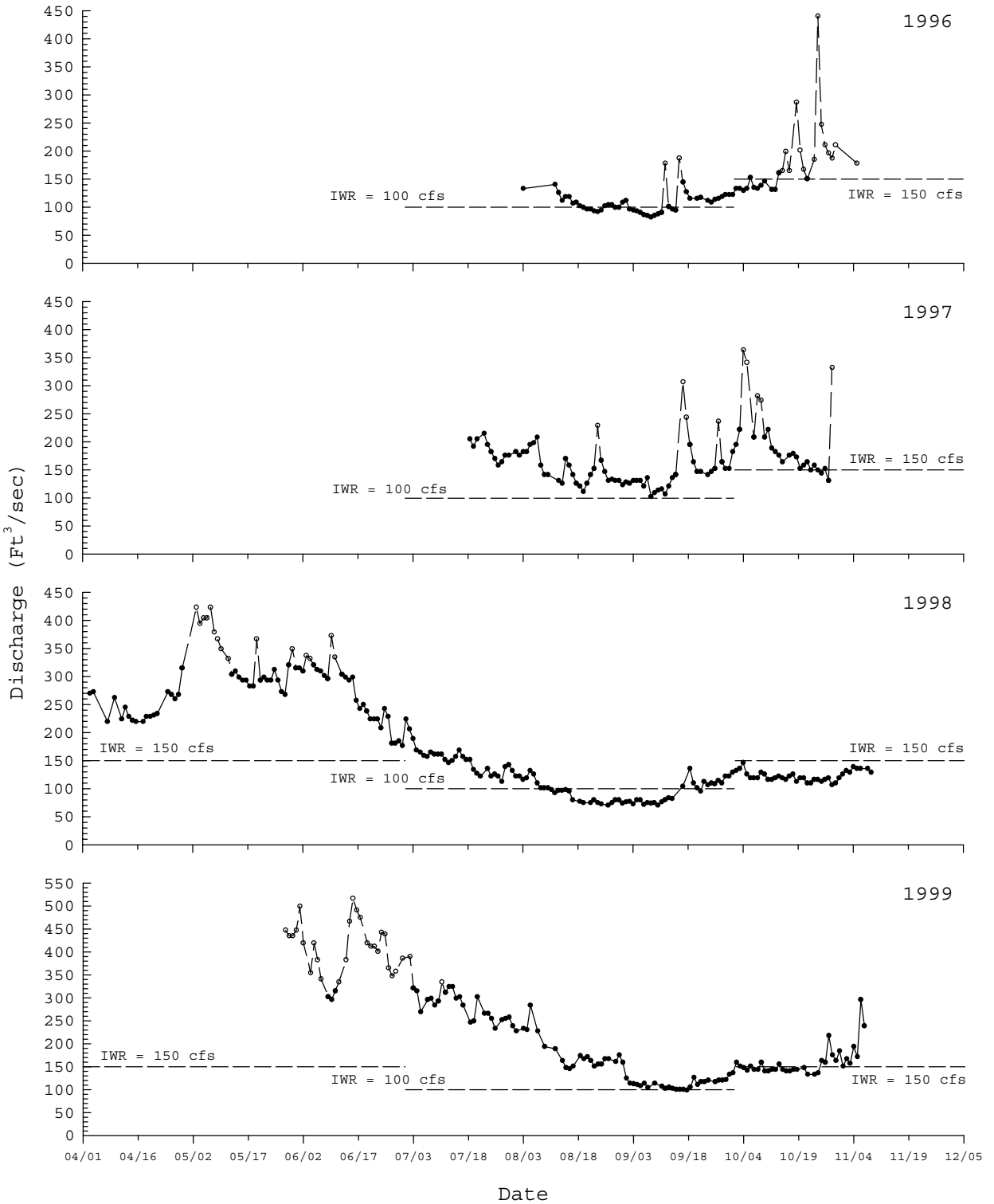


Figure 16. Streamflows in the East Fork of the Hood River in relation to the instream water right (IWR), 1996-1999. Streamflows identified by "o" were extrapolated from the calibration curve used to estimate streamflow from the staff gauge readings.

ACKNOWLEDGMENTS

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 operation and maintenance of the Powerdale Dam trap and for supervision of field personnel operating the Powerdale Dam trap. We thank them for their insight and guidance throughout the study. We also thank trap operators Terry Guisto and Bryon Arrington for working many long hours in keeping the Powerdale Dam trap operational. We gratefully appreciate the contributions of scale readers Lisa Borgerson, Ken Kenaston, and Glen Davenport. We would also like to thank PacifiCorp for allowing us to operate an adult trapping facility at Powerdale Dam and to Steve Pribyl for editing drafts of the report. Finally, we would like to acknowledge the many hatchery and seasonal employees without whom we would know a lot less about indigenous populations of fish in the Hood River subbasin.

REFERENCES

Bonneville Power Administration. 1996a. Hood River fisheries project. Draft environmental impact statement (DOE/EIS-0241). Bonneville Power Administration, Portland, Oregon.

Bonneville Power Administration. 1996b. Hood River fisheries project. Final environmental impact statement (DOE/EIS-0241). Bonneville Power Administration, Portland, Oregon.

Borgerson, L.A. 1992. Scale analysis. Annual Progress Report of the Oregon Department of Fish and Wildlife (Project F-144-R-4) to U.S. Fish and Wildlife Service, Vancouver, Washington.

Carmichael, R.W., B.A. Miller, and R.T. Messmer. 1988. Summer steelhead creel surveys in the Grande Ronde, Wallowa, and Imnaha rivers for the 1987-88 run year. Annual Progress Report of Oregon Department of Fish and Wildlife (Contract No. 1416-0001-87513 [RWG]) to the United States Fish and Wildlife Service, Portland, Oregon.

Coccoli, H., author. draft. Hood River subbasin summary. Planning report prepared for the Northwest Power Planning Council, Portland, Oregon. Located at: Columbia Basin Fish and Wildlife Authority, Portland, Oregon.

Lindsay, R.B., W.J. Knox, M.W. Flescher, B.J. Smith, E.A. Olsen, and L.S. Lutz. 1986. Study of wild spring chinook salmon in the John Day River system. Final report of Oregon Department of Fish and Wildlife (Project No. 79-4; Contract No. DE-A179-83BP39796) to Bonneville Power Administration, Portland, Oregon.

Olsen, E.A., and R.A. French. 1996. Report A: Hood River and Pelton ladder evaluation studies. *in* Oregon Department of Fish and Wildlife and The Confederated Tribes of the Warm Springs Reservation of Oregon. Hood River production program monitoring and evaluation. Annual Progress Report of the Oregon Department of Fish and Wildlife and The Confederated Tribes of the Warm Springs Reservation of Oregon (Project No. 88-053-03 and 88-053-04; Contract No. 89BP00631 and 89RP00632) to Bonneville Power Administration, Portland, Oregon.

Olsen, E.A., and R.A. French. 1999. Hood River and Pelton ladder evaluation studies. Annual Progress Report of the Oregon Department of Fish and Wildlife (Project Number 89-053-04; Contract Number DE-BI79-89BP00632) to Bonneville Power Administration, Portland, Oregon.

Olsen, E.A., R.A. French, and J.A. Newton. 1994. Hood River and Pelton ladder evaluation studies. Annual Progress Report of The Confederated Tribes of the Warm Springs Reservation and Oregon Department of Fish and Wildlife (Projects 89-29, 89-29-01, 89-053-03, 89-053-04, and 93-019; Contracts DE-BI79-89BP00631, DE-BI79-89BP00632, DE-BI79-93BP81756, DE-BI79-93BP81758, DE-BI79-93BP99921) to Bonneville Power Administration, Portland, Oregon.

Olsen, E.A., R.A. French, and A.D. Ritchey. 1995. Hood River and Pelton ladder evaluation studies. Annual Progress Report of the Oregon Department of Fish and Wildlife and The Confederated Tribes of the Warm Springs Reservation (Projects 88-29, 89-29-01, 89-053-03, 89-053-04, and 93-019; Contracts DE-BI79-89BP00631, DE-BI79-89BP00632, DE-BI79-93BP81756, DE-BI79-93BP81758, DE-BI79-93BP99921) to Bonneville Power Administration, Portland, Oregon.

Olsen, E.A., R.A. French, and A.D. Ritchey. 1996. Hood River and Pelton ladder evaluation studies. Annual Progress Report of the Oregon Department of Fish and Wildlife (Projects 88-29, 89-29-01, 89-053-03, 89-053-04, and 93-019; Contracts DE-BI79-89BP00631, DE-BI79-89BP00632, DE-BI79-93BP81756, DE-BI79-93BP81758, DE-BI79-93BP99921) to Bonneville Power Administration, Portland, Oregon.

ODFW (Oregon Department of Fish and Wildlife) and CTWSRO (The Confederated Tribes of the Warm Springs Reservation of Oregon). Undated. Hood River/Pelton ladder master agreement. Project Plan of Oregon Department of Fish and Wildlife and The Confederated Tribes of the Warm Springs Reservation of Oregon (Project 89-029; Contract DE-BI79-93BP81758) to Bonneville Power Administration, Portland, Oregon. (Unpublished draft.)

ODFW (Oregon Department of Fish and Wildlife) and CTWSRO (The Confederated Tribes of the Warm Springs Reservation of Oregon). 1990. Hood River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to the Northwest Power Planning Council, Portland, Oregon.

O'Toole, P. and ODFW (Oregon Department of Fish and Wildlife). 1991a. Hood River production master plan. Final Report of the Confederated Tribes of the Warm Springs Reservation and the Oregon Department of Fish and Wildlife (Project 88-053, Contract DE-BI79-89BP00631) to Bonneville Power Administration, Portland, Oregon.

O'Toole, P. and ODFW (Oregon Department of Fish and Wildlife). 1991b. Hood River production master plan (Appendices). Final Report of the Confederated Tribes of the Warm Springs Reservation and the Oregon Department of Fish and Wildlife (Project 88-053, Contract DE-BI79-89BP00631) to Bonneville Power Administration, Portland, Oregon.

Ott, L. 1977. An introduction to statistical methods and data analysis. Duxbury Press, North Scituate, MA. (As reported in Lindsay et al. 1986.)

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bulletin of the Fisheries Research Board of Canada 191, Ottawa, Ontario.

Seber, G.A.F. 1973. The estimation of animal abundance and related parameters. Hafner Press, New York. (As reported in Lindsay et al. 1986.)

Smith, M. and CTWSRO (The Confederated Tribes of the Warm Springs Reservation of Oregon). 1991. Pelton ladder master plan. Final Report of Oregon Department of Fish and Wildlife and The Confederated Tribes of the Warm Springs Reservation of Oregon (Project 89-029, Contract DE-BI79-89BP01930) to Bonneville Power Administration, Portland, Oregon.

APPENDIX A

Parameters Used to Estimate Rainbow-Steelhead Migrants to Rotary-Screw Traps Located in the Hood River Subbasin

Appendix Table A-1. Number of migrant wild rainbow-steelhead[a] and hatchery summer and winter steelhead marked (M), caught (C), and recaptured (R) at the mainstem migrant. Numbers marked at migrant traps located in the West, Middle, and East forks of the Hood River and subsequently recaptured at the mainstem migrant trap are in parenthesis.

Origin, race, year	Sampling period	M	C	R	Percent recapture
Wild,					
Unknown,[b]					
1994	03/23-07/31/94	346 (480)	412	14 (4)	4.0 (0.8)
1995	03/30-07/31/95	226 (357)	248	6 (5)	2.7 (1.4)
1996	04/03-07/31/96	572 (198)	655	42 (10)	7.3 (5.1)
1997	04/08-07/31/97	728 (666)	868	39 (19)	5.4 (2.9)
1998	04/03-07/31/98	1,235 (460)	1,380	54 (9)	4.4 (2.0)
1999	04/08-07/31/99	1,029 (609)	1,138	48 (11)	4.7 (1.8)
Hatchery,					
Summer,					
1994	03/23-07/31/94	1,110 (214)	1,410	41 (5)	3.7 (2.3)
1995	03/30-07/31/95	1,100 (1,296)	1,470	19 (9)	1.7 (0.7)
1996	04/03-07/31/96	1,083 (1,019)	2,121	42 (27)	3.9 (2.6)
1997	04/08-07/31/97	788 (110)	1,617	24 (0)	3.0 (0)
1998[c]	04/03-07/31/98	4 (12)	5	0 (1)	0 (8.0)
1999	04/08-07/31/99	660 (6)	773	38 (0)	5.8 (0)
Winter,					
1994	03/23-07/31/94	430 (687)	452	15 (6)	3.5 (0.9)
1995	03/30-07/31/95	459 (1,256)	500	3 (23)	0.7 (1.8)
1996	04/03-07/31/96	1,155 (693)	2,479	52 (37)	4.5 (5.3)
1997	04/08-07/31/97	1,154 (374)	2,659	29 (7)	2.5 (1.9)
1998	04/03-07/31/98	1,769 (322)	2,131	71 (9)	4.0 (2.8)
1999	04/08-07/31/99	1,371 (667)	1,824	62 (17)	4.5 (2.5)

[a] Numbers are for downstream migrants greater than or equal to 150 mm fork length.

[b] Race unknown. May include wild summer and winter steelhead and wild rainbow trout.

[c] No hatchery summer steelhead smolts were released above the mainstem migrant trap. Numbers represent residual summer steelhead smolts released in prior years.

Appendix Table A-2. Number of migrant wild rainbow-steelhead greater than or equal to 150 mm fork length that were marked (M), caught (C), and recaptured (R) at downstream migrant traps located in the West, Middle, and East forks of the Hood River and in Lake Branch, a tributary to the West Fork of the Hood River.

Location, year	Sampling period	M	C	R	Percent recapture
West Fork,[a]					
1994	03/25-07/31/94	225	266	16	7.1
1995	03/22-07/31/95	116	125	9	7.8
1996	04/03-07/31/96	66	75	5	7.6
1997[b]	04/08-07/31/97	110 (56)	118	1(3)	0.9 (5.4)
1998[b]	03/26-07/31/98	152 (92)	169	6(1)	3.9 (1.1)
1999	04/03-07/31/99	120 (149)	134	7(6)	5.8 (4.0)
Middle Fork,[c]					
1995	03/21-07/31/95	120	132	12	10.0
1996	04/11-07/31/96	104	119	11	10.6
1997	04/08-07/31/97	302	343	38	12.6
1998	03/25-07/31/98	106	119	1	0.9
1999	04/03-07/31/99	97	103	2	2.1
East Fork,[c]					
1994	04/02-07/31/94	236	287	41	17.4
1995	03/17-07/31/95	127	139	7	5.5
1996	04/03-07/31/96	28	32	0	--
1997	04/08-07/31/97	198	243	30	15.2
1998	03/19-07/31/98	110	134	7	6.4
1999	04/10-07/31/99	206	222	13	6.3
Lake Branch,[a]					
1997	04/08-07/31/97	56	59	3	5.4
1998	03/31-07/31/98	92	99	6	6.5
1999	04/08-07/31/99	149	177	27	18.1

[a] Downstream migrants sampled in the West Fork Hood River drainage may include both wild summer steelhead and wild rainbow trout.

[b] Numbers marked at the migrant trap located in Lake Branch and subsequently recaptured at the West Fork migrant trap are in parenthesis.

[c] Downstream migrants sampled in the Middle and East forks of the Hood River may include both wild winter steelhead and wild rainbow trout.

APPENDIX B

Disposition of Adult Summer Steelhead Collected at Powerdale Dam

Appendix Table B-1. Disposition of adult summer steelhead collected at the Powerdale Dam adult trap from the 1997-1998 run year. Counts of wild and hatchery adults may include marked and unmarked summer steelhead, respectively; origin was determined based on a combination of hatchery mark and scale analysis (*see* **METHODS**). Adult steelhead were allocated to a given category based on disposition at time of first entry to the adult trap. Adult steelhead collected for hatchery broodstock, as well as recycled adults returning to the adult trap, may subsequently have been re-released either above or below Powerdale Dam or become a mortality. Disposition of adult summer steelhead collected in prior run years is presented in Olsen and French (1999).

	Returns to Powerdale Dam		Broodstock collection[a]				Numbers passed above Powerdale Dam		Numbers recycled below Powerdale Dam		Mortalities[b]	
			By origin		By sex							
Period	Wild	Hatchery	Wild	Hatchery[c]	Males	Females	Wild	Hatchery	Wild[d]	Hatchery	Wild	Hatchery
Apr 1-15	--	1	--	--	--	--	--	1	--	--	--	--
Apr 16-30	--	11	--	--	--	--	--	11	--	--	--	--
May 1-15	1	40	--	2(2)	1(1)	1(1)	1	38	--	--	--	--
May 16-31	2	62	--	--	--	--	2	61	--	1	--	--
Jun 1-15	2	24	--	--	--	--	2	24	--	--	--	--
Jun 16-30	5	70	--	--	--	--	5	68	--	--	--	2
Jul 1-15	9	113	2(1)	--	--	2(1)	7	111	--	--	--	2
Jul 16-31	7	71	--	--	--	--	7	70	--	--	--	1
Aug 1-15	16	120	3(1)	1(1)	2(2)	2	12	59	--	59	1	1
Aug 16-31	2	22	1	--	--	1	1	5	--	17	--	--
Sep 1-15	6	17	1	--	--	1	5	--	--	17	--	--
Sep 16-30	8	25	4	--	2	2	4	--	--	25	--	--
Oct 1-15	10	11	1(1)	--	--	1(1)	9	--	--	11	--	--
Oct 16-31	2	5	--	--	--	--	2	--	--	5	--	--
Nov 1-15	9	4	1	--	--	1	7	--	1	4	--	--
Nov 16-30	--	--	--	--	--	--	--	--	--	--	--	--
Dec 1-15	--	1	--	--	--	--	--	--	--	1	--	--
Dec 16-31	--	--	--	--	--	--	--	--	--	--	--	--
Jan 1-15	--	1	--	--	--	--	--	--	--	1	--	--
Jan 16-31	--	--	--	--	--	--	--	--	--	--	--	--
Feb 1-15	--	--	--	--	--	--	--	--	--	--	--	--
Feb 16-29	--	--	--	--	--	--	--	--	--	--	--	--
Mar 1-15	--	1	--	--	--	--	--	--	--	1	--	--
Mar 16-31	--	--	--	--	--	--	--	--	--	--	--	--
Apr 1-15	--	1	--	--	--	--	--	--	--	1	--	--
Apr 16-30	--	--	--	--	--	--	--	--	--	--	--	--
Totals	79	600	13(3)	3(3)	5(3)	11(3)	64	448	1	143	1	6

[a] Pre-spawning mortalities are included in the totals and listed in parenthesis.

[b] Estimate does not include pre-spawning mortalities of hatchery broodstock.

[c] Numbers include unmarked adults which were classified as hatchery fish based on scale analysis. Unmarked adults classified as hatchery fish were not used for hatchery broodstock and were released below Powerdale Dam.

[d] Numbers include marked adults which were classified as wild adults based on scale analysis.

Appendix Table B-2. Disposition of adult summer steelhead collected at the Powerdale Dam adult trap from the 1998-1999 run year. Counts of wild and hatchery adults may include marked and unmarked summer steelhead, respectively; origin was determined based on a combination of hatchery mark and scale analysis (*see* **METHODS**). Adult steelhead were allocated to a given category based on disposition at time of first entry to the adult trap. Adult steelhead collected for hatchery broodstock, as well as recycled adults returning to the adult trap, may subsequently have been re-released either above or below Powerdale Dam or become a mortality.

	Returns to Powerdale Dam		Broodstock collection[a]				Numbers passed above Powerdale Dam		Numbers recycled below Powerdale Dam		Mortalities[b]	
			By origin		By sex							
Period	Wild	Hatchery	Wild	Hatchery[c]	Males	Females	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery
Mar 16-31	--	2	--	--	--	--	--	1	--	1	--	--
Apr 1-15	--	2	--	--	--	--	--	--	--	2	--	--
Apr 16-30	1	25	1	--	1	--	--	--	--	25	--	--
May 1-15	3	25	2	--	--	2	1	--	--	25	--	--
May 16-31	2	28	--	1	1	--	2	--	--	27	--	--
Jun 1-15	6	91	--	--	--	--	6	2	--	88	--	1
Jun 16-30	13	63	2(2)	--	--	2(2)	11	--	--	63	--	--
Jul 1-15	17	113	2(1)	--	--	2(1)	15	--	--	109	--	4
Jul 16-31	17	110	2	1	1	2	15	--	--	109	--	--
Aug 1-15	8	17	3(3)	--	1(1)	2(2)	5	--	--	17	--	--
Aug 16-31	5	12	--	--	--	--	5	--	--	12	--	--
Sep 1-15	5	21	4(3)	--	1(1)	3(2)	1	--	--	21	--	--
Sep 16-30	7	21	1	--	1	--	6	--	--	19	--	2
Oct 1-15	7	8	4	--	2	2	3	--	--	8	--	--
Oct 16-31	6	7	2	--	1	1	4	--	--	7	--	--
Nov 1-15	5	2	--	--	--	--	5	--	--	2	--	--
Nov 16-30	15	11	4	--	2	2	11	1	--	10	--	--
Dec 1-15	2	--	--	--	--	--	2	--	--	--	--	--
Dec 16-31	--	1	--	1	1	--	--	--	--	--	--	--
Jan 1-15	10	5	2	--	--	2	7	--	--	1	1	4
Jan 16-31	--	--	--	--	--	--	--	--	--	--	--	--
Feb 1-15	--	2	--	--	--	--	--	--	--	2	--	--
Feb 16-29	--	--	--	--	--	--	--	--	--	--	--	--
Mar 1-15	1	--	--	--	--	--	1	--	--	--	--	--
Mar 16-31	1	--	1	--	1	--	--	--	--	--	--	--
Apr 1-15	--	--	--	--	--	--	--	--	--	--	--	--
Apr 16-30	1	1	1	--	--	1	--	--	--	1	--	--
Totals	132	567	31(9)	3(0)	13(2)	21(7)	100	4	--	549	1	11

[a] Pre-spawning mortalities are included in the totals and listed in parenthesis.

[b] Estimate does not include pre-spawning mortalities of hatchery broodstock.

[c] Numbers include unmarked adults which were classified as hatchery fish based on scale analysis. The three unmarked adults classified as hatchery fish were mistakenly used for hatchery broodstock (*see* **HATCHERY PRODUCTION, Broodstock Collection**).

Appendix Table B-3. Disposition[a] of adult summer steelhead collected at the Powerdale Dam adult trap from the 1999-2000 run year. Counts of wild and hatchery adults may include marked and unmarked summer steelhead, respectively; origin was determined based on a combination of hatchery mark and scale analysis (*see* **METHODS**). Adult steelhead were allocated to a given category based on disposition at time of first entry to the adult trap. Adult steelhead collected for hatchery broodstock, as well as recycled adults returning to the adult trap, may subsequently have been re-released either above or below Powerdale Dam or become a mortality.

	Returns to Powerdale Dam		Broodstock collection[b]				Numbers passed above Powerdale Dam		Numbers recycled below Powerdale Dam		Mortalities[c]	
			By origin		By sex							
Period	Wild	Hatchery	Wild	Hatchery	Males	Females	Wild	Hatchery	Wild[d]	Hatchery	Wild	Hatchery
Mar 1-15	--	--	--	--	--	--	--	--	--	--	--	--
Mar 16-31	--	--	--	--	--	--	--	--	--	--	--	--
Apr 1-15	1	3	1	--	--	1	--	--	--	3	--	--
Apr 16-30	--	9	--	--	--	--	--	--	--	9	--	--
May 1-15	1	2	1	--	--	1	--	--	--	2	--	--
May 16-31	5	32	2	--	2	--	3	--	--	31	--	1
Jun 1-15	8	21	--	--	--	--	7	--	1	21	--	--
Jun 16-30	6	66	1	--	--	1	5	1	--	64	--	1
Jul 1-15	20	86	4	--	2	2	16	--	--	86	--	--
Jul 16-31	30	128	4	--	--	4	25	--	1	127	--	1
Aug 1-15	11	67	2	--	--	2	9	--	--	67	--	--
Aug 16-31	5	20	--	--	--	--	5	--	--	20	--	--
Sep 1-15	--	3	--	--	--	--	--	--	--	3	--	--
Sep 16-30	9	3	4	--	2	2	4	--	1	2	--	1
Oct 1-15	8	7	1	--	--	1	7	--	--	7	--	--
Oct 16-31	3	2	1	--	--	1	2	--	--	2	--	--
Nov 1-15	37	11	6	--	2	4	30	--	1	11	--	--
Nov 16-30	9	2	1	--	--	1	8	--	--	2	--	--
Dec 1-15	7	3	2	--	1	1	5	--	--	3	--	--
Dec 16-31	0	0	--	--	--	--	--	--	--	--	--	--
Totals	160	465	30(0)	--	9(0)	21(0)	126	1	4	460	--	4

[a] Preliminary estimates. Summaries are complete through 31 December 1999.
[b] Pre-spawning mortalities are included in the totals and listed in parenthesis.
[c] Estimate does not include pre-spawning mortalities of hatchery broodstock.
[d] Numbers include marked adults which were classified as wild adults based on scale analysis.

APPENDIX C

Disposition of Adult Winter Steelhead Collected at Powerdale Dam

Appendix Table C-1. Disposition of adult winter steelhead collected at the Powerdale Dam adult trap from the 1997-1998 run year. Counts of wild and hatchery adults may include marked and unmarked winter steelhead, respectively; origin was determined based on a combination of hatchery mark and scale analysis (*see* **METHODS**). Adult steelhead were allocated to a given category based on disposition at time of first entry to the adult trap. Adult steelhead collected for hatchery broodstock, as well as recycled adults returning to the adult trap, may subsequently have been re-released either above or below Powerdale Dam or become a mortality. Disposition of adult winter steelhead collected in prior run years is presented in Olsen and French (1999).

	Returns to Powerdale Dam		Broodstock collection[a]				Numbers passed above Powerdale Dam		Numbers recycled below Powerdale Dam		Mortalities[b]	
			By origin		By sex							
Period	Wild	Hatchery	Wild	Hatchery	Males	Females	Wild	Hatchery	Wild[c]	Hatchery	Wild	Hatchery[d]
Nov 1-15	1	5	--	--	--	--	1	--	--	5	--	--
Nov 16-30	--	1	--	--	--	--	--	--	--	1	--	--
Dec 1-15	--	--	--	--	--	--	--	--	--	--	--	--
Dec 16-31	--	--	--	--	--	--	--	--	--	--	--	--
Jan 1-15	1	1	--	--	--	--	1	--	--	--	--	1
Jan 16-31	1	--	1(1)	--	--	1(1)	--	--	--	--	--	--
Feb 1-15	6	7	1	2(1)	2(1)	1	5	4	--	--	--	1
Feb 16-29	2	7	--	1(1)	--	1(1)	--	4	2	2	--	--
Mar 1-15	12	30	2(1)	4(1)	3(1)	3(1)	10	9	--	17	--	--
Mar 16-31	14	59	4	4(3)	4	4(3)	10	12	--	36	--	2
Apr 1-15	27	92	8(1)	7(2)	7(2)	8(1)	16	17	1	55	--	3
Apr 16-30	111	153	16(4)	17(3)	14(4)	19(3)	95	87	--	45	--	4
May 1-15	38	31	5(1)	4(1)	2(1)	7(1)	32	25	1	2	--	--
May 16-31	8	6	1	2(1)	2	1(1)	7	4	--	--	--	--
Jun 1-15	5	1	1(1)	--	--	1(1)	4	1	--	--	--	--
Jun 16-30	1	--	--	--	--	--	1	--	--	--	--	--
Totals	227	393	39(9)	41(13)	34(9)	46(13)	182	163	4	163	--	11

[a] Pre-spawning mortalities are included in the totals and listed in parenthesis. Estimates of hatchery adult mortality includes adults sacrificed for coded wire tags.

[b] Estimate does not include pre-spawning mortalities of hatchery broodstock.

[c] Numbers include marked adults which were classified as wild adults based on scale analysis.

[d] Includes adults sacrificed for coded wire tags.

Appendix Table C-2. Disposition of adult winter steelhead collected at the Powerdale Dam adult trap from the 1998-1999 run year. Counts of wild and hatchery adults may include marked and unmarked winter steelhead, respectively; origin was determined based on a combination of hatchery mark and scale analysis (*see* **METHODS**). Adult steelhead were allocated to a given category based on disposition at time of first entry to the adult trap. Adult steelhead collected for hatchery broodstock, as well as recycled adults returning to the adult trap, may subsequently have been re-released either above or below Powerdale Dam or become a mortality. Disposition of adult winter steelhead collected in prior run years is presented in Olsen and French (1999).

	Returns to Powerdale Dam		Broodstock collection[a]				Numbers passed above Powerdale Dam		Numbers recycled below Powerdale Dam		Mortalities[b]	
			By origin		By sex							
Period	Wild	Hatchery	Wild	Hatchery	Males	Females	Wild	Hatchery	Wild[c]	Hatchery	Wild	Hatchery[d]
Sep 1-15	--	--	--	--	--	--	--	--	--	--	--	--
Sep 16-30	--	1	--	--	--	--	--	--	--	1	--	--
Oct 1-15	--	4	--	--	--	--	--	--	--	4	--	--
Oct 16-31	--	6	--	--	--	--	--	--	--	3	--	3
Nov 1-15	--	3	--	--	--	--	--	--	--	--	--	3
Nov 16-30	--	5	--	--	--	--	--	--	--	1	--	4
Dec 1-15	--	--	--	--	--	--	--	--	--	--	--	--
Dec 16-31	--	--	--	--	--	--	--	--	--	--	--	--
Jan 1-15	13	12	2	2	2	2	11	8	--	1	--	1
Jan 16-31	--	1	--	--	--	--	--	1	--	--	--	--
Feb 1-15	4	4	1	--	--	1	3	2	--	2	--	--
Feb 16-29	2	--	1	--	--	1	1	--	--	--	--	--
Mar 1-15	8	7	4	1	4	1	4	5	--	1	--	--
Mar 16-31	33	68	7	5	6	6	26	55	--	7	--	1
Apr 1-15	51	79	5	10	7	8	45	16	1	48	--	5
Apr 16-30	124	94	13	13	10	16	111	67	--	12	--	2
May 1-15	23	12	3	1	2	2	20	11	--	--	--	--
May 16-31	34	24	4	3	2	5	29	20	--	1	1	--
Jun 1-15	7	1	--	--	--	--	7	1	--	--	--	--
Jun 16-30	2	2	1[e]	--	--	--	1	1	--	1	--	--
Totals	301	323	41(0)	35(0)	33(0)	42(0)	258	187	1	82	1	19

[a] Pre-spawning mortalities are included in the totals and listed in parenthesis.
[b] Estimate does not include pre-spawning mortalities of hatchery broodstock.
[c] Numbers include marked adults which were classified as wild adults based on scale analysis.
[d] Includes adults sacrificed for coded wire tags.
[e] Originally collected for summer steelhead broodstock but later determined to be a winter steelhead.

APPENDIX D

Estimates of Anglers and Effort (Hours Fished) in the Hood River Sport Fishery

Appendix Table D-1. Estimated numbers of anglers, hours fished, and mean hours fished in the Hood River sport fishery located from the mouth of the Hood River to 0.3 miles above Powerdale Dam (RM 4.5)[a], 1998.

Period	Anglers	Hours fished	Mean hours fished
Jan 1-15	221	433	2.0
Jan 16-31	354	789	2.2
Feb 1-15	483	1,080	2.2
Feb 16-29	373	984	2.6
Mar 1-15	493	1,315	2.7
Mar 16-31	829	2,028	2.4
Apr 1-15	767	1,837	2.4
Apr 16-30	348	804	2.3
May 1-15	502	1,291	2.6
May 16-31	556	1,558	2.8
Jun 1-15	483	993	2.1
Jun 16-30	335	978	2.9
Jul 1-15	350	937	2.7
Jul 16-31	145	322	2.2
Aug 1-15	120	185	1.5
Aug 16-31	207	401	1.9
Sep 1-15	127	248	2.0
Sep 16-30	152	322	2.1
Oct 1-15	236	445	1.9
Oct 16-31	205	554	2.7
Nov 1-15	227	566	2.5
Nov 16-30	226	503	2.2
Dec 1-15	356	745	2.1
Dec 16-31	207	488	2.4

[a] The fishery above Powerdale Dam was closed on 1 April, 1998.

Appendix Table D-2. Estimated numbers of anglers, hours fished, and mean hours fished in the Hood River sport fishery located from the mouth of the Hood River to Powerdale Dam (RM 4.5), 1999.

Period	Anglers	Hours fished	Mean hours fished
Jan 1-15	357	935	2.6
Jan 16-31	317	823	2.6
Feb 1-15	353	758	2.2
Feb 16-29	295	791	2.7
Mar 1-15	429	1,138	2.7
Mar 16-31	550	1,455	2.6
Apr 1-15	325	857	2.6
Apr 16-30	555	1,323	2.4
May 1-15	501	1,258	2.5
May 16-31	433	1,121	2.6
Jun 1-15	263	762	2.9
Jun 16-30	290	719	2.5
Jul 1-15	234	540	2.3
Jul 16-31	199	582	2.9
Aug 1-15	151	253	1.7
Aug 16-31	101	166	1.6
Sep 1-15	206	559	2.7
Sep 16-30	116	235	2.0
Oct 1-15	179	375	2.1
Oct 16-31	76	112	1.5
Nov 1-15	89	164	1.8
Nov 16-30	97	208	2.1
Dec 1-15	186	365	2.0
Dec 16-31	401	880	2.2

APPENDIX E

Harvest of Stray Hatchery Steelhead and Salmon in the Hood River Subbasin

Appendix Table E-1. Estimated harvest of stray hatchery adult summer and winter steelhead in the Hood River sport fishery located from the mouth of the Hood River to 0.3 miles above Powerdale Dam (RM 4.5)[a], 1998. Confidence limits (95%) are in parenthesis.

Period	Stray hatchery summer steelhead		Stray hatchery winter steelhead		Catch Rate
	Kept	Released	Kept	Released	(hrs/fish)
Jan 1-15	--	--	--	--	--
Jan 16-31	--	--	--	--	--
Feb 1-15	2 (4.1)	--	--	--	540
Feb 16-29	--	--	--	--	--
Mar 1-15	4 (6.1)	--	--	--	329
Mar 16-31	--	--	--	--	--
Apr 1-15	1 (2.0)	--	--	--	1837
Apr 16-30	--	--	--	--	--
May 1-15	--	--	--	--	--
May 16-31	--	--	--	--	--
Jun 1-15	--	--	--	--	--
Jun 16-30	--	--	--	--	--
Jul 1-15	--	--	--	--	--
Jul 16-31	--	--	--	--	--
Aug 1-15	--	--	--	--	--
Aug 16-31	--	--	--	--	--
Sep 1-15	--	--	--	--	--
Sep 16-30	--	--	--	--	--
Oct 1-15	--	--	--	--	--
Oct 16-31	--	--	--	--	--
Nov 1-15	--	--	--	--	--
Nov 16-30	2 (2.4)	--	--	--	252
Dec 1-15	--	--	--	--	--
Dec 16-31	--	--	--	--	--
Total	9 (8.0)	0 (--)	0 (--)	0 (--)	1,602[b]

[a] The fishery above Powerdale Dam was closed on 1 April, 1998.

[b] Estimate of mean catch rate is for the period 1 January - 31 May and 1 November - 31 December.

Appendix Table E-2. Estimated harvest of stray hatchery adult summer and winter steelhead in the Hood River sport fishery located from the mouth of the Hood River to Powerdale Dam (RM 4.5), 1999. Confidence limits (95%) are in parenthesis.

Period	Stray hatchery summer steelhead		Stray hatchery winter steelhead		Catch Rate
	Kept	Released	Kept	Released	(hrs/fish)
Jan 1-15	--	--	--	--	--
Jan 16-31	--	--	--	--	--
Feb 1-15	--	--	--	--	--
Feb 16-29	--	--	--	--	--
Mar 1-15	--	--	--	--	--
Mar 16-31	--	--	--	--	--
Apr 1-15	7 (8.1)	--	--	--	122
Apr 16-30	5 (7.9)	--	--	--	265
May 1-15	2 (3.5)	--	--	--	629
May 16-31	--	--	--	--	--
Jun 1-15	--	--	--	--	--
Jun 16-30	--	--	--	--	--
Jul 1-15	--	--	--	--	--
Jul 16-31	--	--	--	--	--
Aug 1-15	--	--	--	--	--
Aug 16-31	--	--	--	--	--
Sep 1-15	--	--	--	--	--
Sep 16-30	--	--	--	--	--
Oct 1-15	--	--	--	--	--
Oct 16-31	--	--	--	--	--
Nov 1-15	--	--	--	--	--
Nov 16-30	--	--	--	--	--
Dec 1-15	--	--	--	--	--
Dec 16-31	8 (8.3)	--	--	--	110
Total	22 (14)	0 (--)	0 (--)	0 (--)	549[a]

[a] Estimate of mean catch rate is for the period 1 January - 31 May and 1 November - 31 December.

Appendix Table E-3. Estimated harvest of stray hatchery jack and adult spring chinook salmon in the Hood River sport fishery located from the mouth of the Hood River to Powerdale Dam (RM 4.5), 1998. Confidence limits (95%) are in parenthesis.

Period	Stray hatchery adult spring chinook salmon		Stray hatchery jack spring chinook salmon		Catch Rate (hrs/fish)
	Kept	Released	Kept	Released	
May 1-15	--	--	--	--	--
May 16-31	--	--	8 (12.0)	--	195
Jun 1-15	--	--	--	--	--
Jun 16-30	--	--	--	--	--
Jul 1-15	--	--	--	--	--
Jul 16-31	--	--	--	--	--
Total	0 (--)	0 (--)	8 (12)	0 (--)	760[a]

[a] Estimate of mean catch rate is for the period 1 May - 31 July.

Appendix Table E-4. Estimated harvest of stray hatchery jack and adult spring chinook salmon in the Hood River sport fishery located from the mouth of the Hood River to Powerdale Dam (RM 4.5), 1999. Confidence limits (95%) are in parenthesis.

Period	Stray hatchery adult spring chinook salmon		Stray hatchery jack spring chinook salmon		Catch Rate (hrs/fish)
	Kept	Released	Kept	Released	
Apr 16-30	--	--	--	--	--
May 1-15	--	--	--	--	--
May 16-31	--	--	--	--	--
Jun 1-15	--	--	--	--	--
Jun 16-30	--	--	--	5 (5.9)	144
Jul 1-15	--	--	--	--	--
Jul 16-31	--	--	--	--	--
Aug 1-15	--	--	--	--	--
Aug 16-31	--	--	--	--	--
Sep 1-15	--	--	--	--	--
Sep 16-30	--	--	--	--	--
Total	0 (--)	0 (--)	0 (--)	5 (5.9)	1,504[a]

[a] Estimate of mean catch rate is for the period 16 April - 30 September.

APPENDIX F

Run Year Specific Estimates of Steelhead and Salmon Sport Harvest in the Hood River Subbasin

Appendix Table F-1. Estimates of summer and winter steelhead harvest[a] in non-tribal fisheries located from River Mile (RM) 0 to RM 5.0 (i.e., approximately 0.5 miles above Powerdale Dam) in the mainstem Hood River, by run year. Estimates of the number released are in parenthesis. Run years are bold faced for those years in which estimates of harvest are complete.

Species,[b] run year	Period[c]	Harvest		
		Wild	Subbasin hatchery	Stray hatchery
StS,				
1995-1996[d]	1 Jan - 30 Apr	0 (86)	30 (52)	0 (0)
1996-1997	16 Mar - 30 Apr	4 (135)	710 (175)	24 (2)
1997-1998	1 Mar - 30 Apr	0 (123)	350 (245)	30 (3)
1998-1999	1 Mar - 30 Apr	0 (79)	351 (168)	5 (0)
1999-2000[e]	1 Mar - 31 Dec	0 (64)	188 (81)	22 (0)
StW,				
1995-1996[d]	1 Jan - 15 Jun	0 (283)	298 (175)	12 (0)
1996-1997	1 Dec - 30 Jun	0 (206)	317 (235)	11 (0)
1997-1998	1 Nov - 31 May	5 (220)	236 (103)	0 (0)
1998-1999	16 Nov - 31 May	0 (238)	172 (113)	0 (0)
1999-2000[e]	16 Nov - 31 Dec	0 (8)	6 (0)	0 (0)

[a] Annual estimates of harvest, and 95% confidence limits, are presented in previous tables for the 1998 and 1999 calender years (*see* **ADULT SUMMER STEELHEAD; Harvest, Escapement, and Survival**, and **ADULT WINTER STEELHEAD; Harvest, Escapement, and Survival**) and for previous calender years in Olsen and French (1996) and Olsen and French (1999).

[b] StS = summer steelhead and StW = winter steelhead.

[c] The sampling period extends from the first bi-monthly period in which fish are sampled in the creel to a defined ending date of 30 April for summer steelhead and 30 June for winter steelhead; unless summaries are for an incomplete run year.

[d] Incomplete run year. Creel was not implemented until 1 January, 1996.

[e] Incomplete run year. Estimates include harvest through 31 December, 1999.

Appendix Table F-2. Estimated number of recycled summer and winter steelhead harvested in non-tribal fisheries located from River Mile (RM) 0 to RM 4.5 (i.e., Powerdale Dam) in the mainstem Hood River, by run year. The exploitation rate is presented as a percentage of the total number recycled.

Race,[a] run year	Number recycled[b]	Harvest	Exploitation rate (%)
StS,			
1996-1997	52	11	21
1997-1998	196	69	35
1998-1999	1,270	107	8
StW,			
1995-1996[c]	117	9	8
1996-1997	453	0	0
1997-1998	319	27	8
1998-1999	137	6	4

[a] StS = summer steelhead and StW = winter steelhead.

[b] Numbers recycled represent the total count of all fish transported to the mouth of the Hood River. Individual fish may have been transported multiple times.

[c] Estimates based on incomplete run year. Creel was not implemented until 1 January, 1996.

Appendix Table F-3. Exploitation rates for non-tribal summer and winter steelhead fisheries located from River Mile (RM) 0 to RM 5.0 (i.e., approximately 0.5 miles above Powerdale Dam) in the mainstem Hood River, by run year. Estimates are presented as a percentage of total escapement to the Hood River subbasin.

Race,[a] run year	Wild		Subbasin hatchery	
	Kept	Released	Kept	Released
StS,				
1996-1997	2	72	35	9
1997-1998	0	156	37	26
1998-1999	0	60	39	19
StW,				
1996-1997	0	71	33	25
1997-1998	2	95	39	17
1998-1999	0	79	35	23

[a] StS = summer steelhead and StW = winter steelhead.

Appendix Table F-4. Estimates of jack and adult spring and fall chinook salmon harvest[a] in non-tribal fisheries located from River Mile (RM) 0 to RM 5.0 (i.e., approximately 0.5 miles above Powerdale Dam) in the mainstem Hood River, by run year. Estimates of the number released are in parenthesis.

Species,[b] run year	Period[c]	Harvest		
		Unmarked[d]	Subbasin hatchery	Stray hatchery
SpCh,[e]				
1996	1 May - 31 Jul	52 (3)	5 (0)	0 (0)
1997	16 May - 31 Jul	40 (0)	15 (3)	6 (0)
1998	16 Apr - 30 Sep	16 (6)	3 (7)	8 (0)
1999	1 May - 15 Jul	0 (4)	0 (19)	0 (5)
FaCh,				
1996	16 Oct - 30 Nov	26 (16)	--	0 (0)
1997	1 Sep - 15 Dec	90 (132)	--	5 (0)
1998	16 Sep - 30 Sep	2 (10)	--	0 (0)
1999	16 Nov - 30 Nov	2 (2)	--	0 (0)

[a] Annual estimates of harvest, and 95% confidence limits, are presented in previous tables for the 1998 and 1999 calender years (*see* **JACK AND ADULT SPRING CHINOOK SALMON; Harvest, Escapement, and Survival**, **JACK AND ADULT FALL CHINOOK SALMON; Harvest, Escapement, and Survival**, and **APPENDIX E**) and for previous calender years in Olsen and French (1996) and Olsen and French (1999).

[b] SpCh = spring chinook salmon and FaCh = fall chinook salmon.

[c] The first and last days of the sampling period are based on the beginning and ending dates of the bi-monthly period in which the first and last fish, respectively, are recorded in the creel; unless summaries are for an incomplete run year.

[d] Estimates were not adjusted for unmarked stray hatchery fish. An analysis of scale samples collected from unmarked jack and adult salmon sampled at the Powerdale Dam trap indicate the percentage of unmarked stray salmon in the run can vary widely.

[e] Harvest of unmarked jacks in 1996, four year old adults in 1997, and five year old adults in 1998 may include unmarked hatchery spring chinook salmon returning from the 1993 brood release. Approximately 69% of the hatchery smolts released from the 1993 brood were unmarked (*see* **HATCHERY PRODUCTION, Production Releases**).

APPENDIX G

Summary of Injuries Observed on Summer and Winter Steelhead and Spring Chinook Salmon

Appendix Table G-1. Numbers[a] of summer and winter steelhead and spring chinook salmon with predator scars, net marks, hook scars, and scrapes, by run year. (Percentage of total sample is in parentheses.)

Species, run year	N	Predator scars	Net marks	Hook scars	Scrapes
Summer steelhead,					
1993-1994	1,356	576(42)	206(15)	44(3)	383(28)
1994-1995	1,859	803(43)	198(11)	66(4)	210(11)
1995-1996	685	186(27)	83(12)	15(2)	98(14)
1996-1997	1,553	556(36)	175(11)	55(4)	164(11)
1997-1998	679	233(34)	83(12)	29(4)	70(10)
1998-1999	699	221(32)	72(10)	17(2)	61(9)
Winter steelhead,					
1992-1993	650	345(53)	43(7)	12(2)	62(10)
1993-1994	581	223(38)	23(4)	21(4)	62(11)
1994-1995	317	117(37)	8(3)	13(4)	57(18)
1995-1996	560	206(37)	21(4)	26(5)	88(16)
1996-1997	930	274(29)	20(2)	25(3)	79(8)
1997-1998	620	221(36)	17(3)	10(2)	33(5)
1998-1999	624	146(23)	12(2)	5(0.8)	50(8)
Spring chinook,[b]					
1993	506	150(30)	14(3)	5(1)	158(31)
1994	300	88(29)	13(4)	10(3)	54(18)
1995	88	15(17)	4(5)	0	24(27)
1996	130	13(10)	1(0.8)	3(2)	9(7)
1997	359	47(13)	1(0.3)	4(1)	51(14)
1998	100	4(4)	0	2(2)	11(10)
1999	117	12(10)	2(2)	4(3)	6(5)

[a] Numbers for each injury type may not sum to equal the total sample size because a given fish may exhibit multiple injury types.

[b] Estimate does not include mini-jack spring chinook salmon.