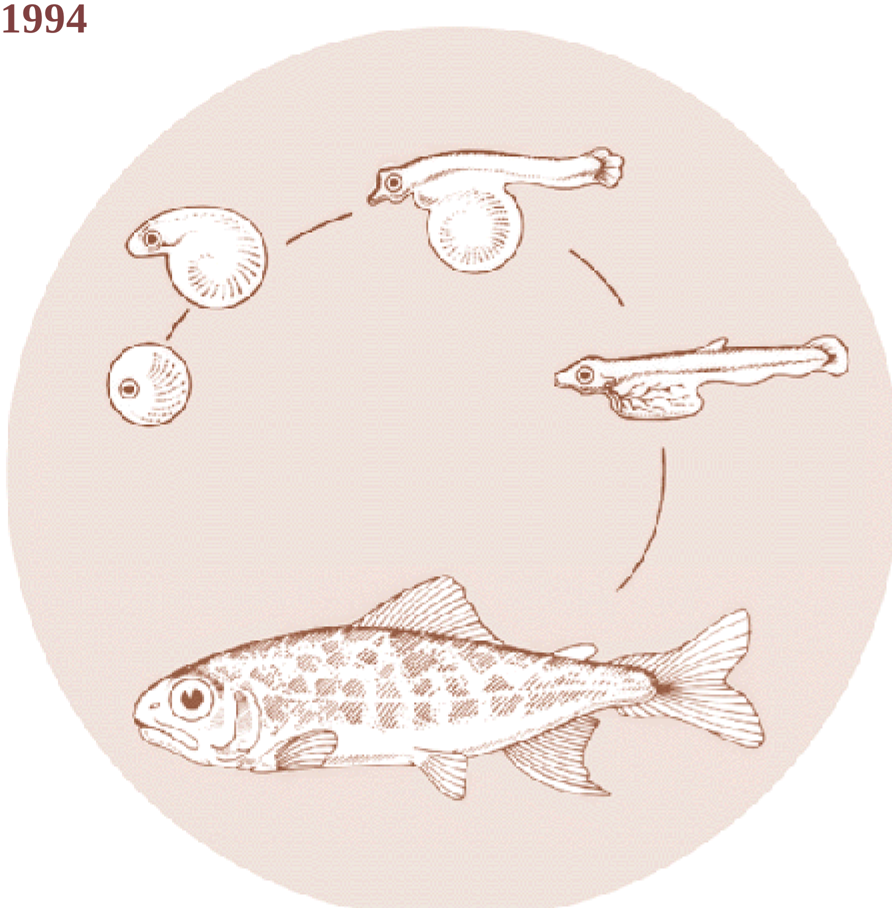
Hood River and Pelton Ladder Evaluation Studies

Annual Report
1994



DOE/BP-81758-1

September 1995

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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 1994

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Project No. 88-029, 89-029-01, 89-053-03, 93-019
Contract No. DE-BI79-89BP00631, DE-BI79-89BP00632,
DE-BI79-93BP81756, DE-BI79-93BP81758, DE-BI79-93BP99921

September 1995

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INTRODUCTION

In 1992. the Northwest Power Planning Council approved the Hood River and Pelton ladder master plans within the framework of the Columbia River Basin Fish and Wildlife Program. The master plans define an approach for implementing a hatchery supplementation program in the Hood River subbasin. The hatchery program as defined in the master plans is called the Hood River Hatchery Production Program (HRPP). The HRPP will be phased in over several years and will be jointly implemented by the Cregon Department of Fish and Wildlife (ODFW) and the Confederated Tribes of the Warm Springs (CTWS) Reservation.

In December 1991. a monitoring and evaluation program was implemented in the Hood River subbasin to collect life history ard production information on stocks of anadromous salmonids return-rig to the Hood River subbasin. The program was implemented to 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 indigenous populations of resident fish. Information collected during the 1992-94 fiscal years will also be used to prepare an environmental impact statement (EIS) evaluating the program's impact on the human environment. It is planned that the EIS will be completed in late 1995 or early 1996. The Bonneville Power Administration (BPA) will prepare the EIS in compliance with federal guidelines established in the National Environmental Policy Act (NEPA).

The EIS is a federal requirement that will need to be completed prior to full implementation of the HRPP. To begin construction on project facilities. it was proposed that the HRPP be implemented in two phases. Phase I would include work that would fall under a "categorical exclusion" from NEPA. and Phase II would include work requiring an EIS prior to implementation. The categorical exclusion defined work that could be implemented without having a significant impact on the human environment and. therefore, would not require an EIS prior to implementation. Phase I work outlined in the categorical exclusion includes (1) construction of a road to the proposed site of the Powerdale Dam adult collection facility. (2) the operation of an adult trap at Powerdale Dam, and (3) implementation of research activities that would have only a minor impact on indigenous populations of fish. Phase II work includes (1) construction of an adult collection facility at Powerdale Dam. (2) construction of adult holding facilities (the proposed site is located adjacent to Rogers Spring Creek. which drains into the Middle Fork Hood River at River Mile 3.4). and (3) installation of acclimation facilities at selected sites in the subbasin.

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

The contract period for FY 94 was 1 October 1993 through 30 September 1994. Work implemented during FY 94 included (1) estimating natural production of juvenile and smolt rainbow-steelhead at selected sites in the Hood River subbasin, (2) monitoring spatial distribution of wild adult anadromous salmonids in the Hood River subbasin, (3) monitoring selected life history characteristics and escapements of wild and hatchery produced anadromous salmonids, (4) preparing an annual report summarizing data collected during FY 94, and (5) continuing activities needed to construct an adult collection facility in the Hood River subbasin. This report summarizes the life history and escapement data collected in the Hood River subbasin and the status work of implemented under Phase I of the HRPP. Life history and escapement data will be used to (1) test the assumptions on which harvest and escapement goals for the Hood River and Pelton ladder master plans are based and (2) develop biologically based management recommendations for implementing the HRPP. Life history and escapement data will continue to be collected during both the development and execution of the Hood River Production Program.

ISSUES OF CONCERN

1. Data indicates that a potentially large percentage of the hatchery winter steelhead production releases in the Hood River subbasin may remain in fresh water (i.e., residualize) for at least one year prior to migration as smolts. This hypothesis is based on the percentage of marked returns with a residual life history pattern. Scale analysis indicated that 51X of the subbasin hatchery winter steelhead trapped at Powerdale Dam from the 1993-94 run year had a residual life history pattern. Estimates for three complete run years ranged from 0-51%.

   Adult returns with a residual life history pattern are currently allocated to a given brood year based on a combination of external marks and scale analysis. Scale analysis is used to determine freshwater and ocean ages and the external mark to verify that total age correctly associates the adult with the proper brood release. Based on these criteria. scale analysis has not always correctly classified the freshwater life history pattern for residualized fish. For the 1993-94 run year. the scale read mis-classified 52% of the adult hatchery winter steelhead as having migrated as yearling smolts rather than as a two year old smolt.

We initially proposed marking all 1994 brood hatchery winter steelhead with an adipose-left ventral mark and a coded-wire tag (Ad-LV-CWT). The adipose clip would identify the adult as hatchery produced and the left ventral fin mark would indicate the adult had been coded-wire tagged as a juvenile. Because of the problem associated with identifying the residual life history pattern on adult scales, we propose clipping one of the maxillaries in addition to the Ad-LV mark. The extra mark would provide a mechanism for verifying the initial scale read without killing the fish to read the coded-wire tag. We propose alternating between Ad-LV. Ad-LV-LM. and Ad-LV-RM marks to uniquely identify three consecutive brood releases.

It is intended that the maxillary mark will be used only on an interim basis until a more accurate methodology can be developed for identifying freshwater life history patterns from adult scales. One proposed method for achieving this goal is to develop a reference scale database for juvenile hatchery winter steelhead released into the Hood River subbasin. The reference scale database should provide a mechanism for more accurately identifying freshwater life history patterns on scale samples collected from returning adults. If the accuracy rate can be significantly improved. then it would not be necessary to mark one of the maxillaries. If the accuracy rate for identifying the residual life history pattern continues to remain low. then it will be necessary to continue clipping a maxillary so that returning hatchery adults can be accurately aged.

2. The Hood River hatchery winter steelhead program at Oak Springs Hatchery currently does not grade out and destroy slower growing juveniles from the production group. Juveniles are graded into small- and large-sized groups and placed into separate ponds. The small group is then put on an increased feeding program to reach smolt size at tne same time as the large group. Both size groups are then released concurrently into the Hood River subbasin. The hatchery winter steelhead program is implemented in this manner to be in compliance with the Oregon Department of Fish and Wildlife's Wild Fish Policy. Not grading out the smaller hatchery fish prior to release as smolts is intended to Create a size distribution in the hatchery production group that more closely mirrors the size distribution of downstream migrant wild winter steelhead smolts. It is also designed to

maintain a greater amount of genetic diversity in the hatchery product. The problem with this approach is that it increases the potential that a percentage of the production release will residualize in the subbasin. The hypothesis that not grading out smaller hatchery winter steelhead from the production group may increase residualism is based on observations at a juvenile migrant trap located in the mainstem Hood River. Wild rainbow-steelhead and hatchery summer and winter steelhead migrants sampled at the mainstem migrant trap were predominately greater than 160 mm fork length (unpublished data on 8/21/95 from Research and Development Section. Oregon Department of Fish and Wildlife. Corvallis. Oregon). which would indicate that size may in part affect the onset of the smolting process in steelhead. Juvenile hatchery winter steelhead which do residualize in the subbasin would have the potential for competing with indigenous populations of both anadromous and resident salmonids prior to migration as smolts.

The intent of the Wild Fish Policy. as it pertains to the Hood River Production Program. is to reduce the impact of the hatchery program such that. in the worse case scenario. the HRPP meets the minimum standards with respect to protecting the genetics of indigenous populations of fish. in part. it was determined that this objective could be achieved by not grading out smaller hatchery winter steeihead from the production group. This strategy has the potential for increasing the number of juvenile hatchery winter steelhead that residualize in the Hood River subbasin. How interaction between wild and residual:zed hatchery fish will uitimately impact indigenous populations is currently unknown. Resolving these two conflicting issues may require either modifying or abandoning the current approach upon full implementation of the HRPP. Guidelines for implementing the hatchery program will need to be developed prior to full implementation of the HRPP. When considering the available options. it will be necessary to address how the HRPP can best achieve the Wild Fish Policy's goal of maintaining the same level of genetic diversity in the hatchery product that is inherent in the wild population.

3. Hatchery spring chinook salmon sampled at Powerdale Dam are identified as subbasin production based on a combination of scale analysis and fin mark. Scale analysis is used to identify unmarked fish as either natural or hatchery produced fish. Hatchery produced fish are then assumed to have originated from subbasin hatchery releases. All adipose-marked spring chinook salmon are assumed to be returns from subbasin hatchery releases because a percentage of the subbasin production releases are adipose-marked prior to release. The inherent problem associated with estimating escapement of subbasin hatchery production using these criteria is that adipose-marked stray hatchery fish are known to enter the trapping facility at Powerdale Dam and that unmarked stray hatchery fish undoubtedly enter the trap as well.

We propose marking all subbasin hatchery spring chinook salmon production to provide the means for visually identifying the origin of returns to Powerdale Dam. All juvenile hatchery spring chinook salmon will be adipose-marked and coded-wire tagged (Ad-CWT); an additional left (LV) or right (RV) ventral mark will be added to allow us to differentiate subbasin hatchery production from stray adipose-marked hatchery fish. Adding an additional mark will not ensure 100% accuracy in identifying stray hatchery fish because there would still be the same inherent problem with differentiating other similarly marked strays or poorly clipped hatchery fish. While the addition of an extra mark does not entirely preclude the mis-classification of stray hatchery spring chinook salmon. it should help minimize the problem. Only two stray hatchery spring chinook salmon have ever been recovered at Powerdale Dam with other than an adipose mark. Also, the greater percentage of marked hatchery spring chinook salmon released into the Columbia River Basin are marked with only a single adipose mark (unpublished data on 2/28/95 from Pacific States Marine Fisheries Commission. Gladstone, Oregon). It would also be possible to differentiate hatchery strays from the three subbasins of primary concern. They include the Klickitat. Little White Salmon. and Wind river subbasins. All three subbasins are located in Washington and drain into the Bonneville pool within an area of less than 15 river miles from the mouth of the Hood River subbasin. Stray mini-jack hatchery spring chinook salmon from the Klickitat River have been recovered in the Hood River subbasin and it is believed that stray hatchery spring chinook salmon released into both the Little White Salmon and Wind river subbasins also have the potential for straying into the Hood River subbasin. Marked hatchery spring chinook salmon released into both the Klickitat and Little White Salmon river subbasins are currently given only an adipose fin mark: there are no plans at this time to add an additional fin mark on future hatchery production releases into these subbasins (personal communication on 3/13/95 with Wolf Dammers. Washington Department of Fish and Wildlife). The left and right ventral marks will be alternated between consecutive broods to facilitate the allocation of jack and adult returns to a given brood release.

4. All adipose-marked spring chinook salmon sampled at the Powerdale Dam trapping facility are classified as subbasin hatchery production because no methodology exists to visually determine if they are stray hatchery fish. The only method available for identifying the origin of hatchery spring chinook salmon at Powerdale Dam is to sample adipose-marked fish to recover the coded-wire tag. in 1994. no hatchery produced spring chinook salmon smolts were released into the Hood River subbasin from the 1992 brood. As a consequence. there exists the opportunity to identify 1992 brood stray adipose-marked age 3_2. 4_2, and 5_2 spring chinook salmon returning in the 1995. 1996. and 1997 run years. respectively. We recommend sampling these fish to recover the coded-wire tags. Information would be used to determine the origin of stray spring

chinook salmon and tc develop recommendations for reducing the number of strays to the subbasin.

Jack (age 3_2) spring chinook salmon can generally be identified based on size while the overlap in the size range of age 4_2 and age 5_2 adult spring chinook salmon makes it difficult to visually differentiate between adult returns in these two age categories. Based on length frequency histograms of adult hatchery returns in the 1992-94 run years. we propose classifying age 4_2 adults as fish less than or equal to 80 cm and age 5_2 adults as fish greater than or equai to 95 cm. These criteria will not eliminate all error in aging adult fish. but will minimize the potential for mis-classification. Data indicates that most overlap in size occurs in the length range from 81 cm to 94 cm fork length. Based on these criteria. the percentage of adult fish that will be mis-classified ranges from 1-14% for age 42 and 0-18% for age 5_2 adults.

5. In 1966. the Oregon Department of Fish and Wildlife began releasing hatchery spring chinook salmon in the Hood River subbasin tc reintroduce a run back to the subbasin. Hatchery broodstock was initially collected from the Carson stock to implement the program. The hatchery program discontinued using the Carson stock after the 1990 brood release and began using the Deschutes stock beginning with the 1991 brood. The Carson stock was replaced with the Deschutes stock because the Deschutes stock has historically performed well in the Deschutes River subbasin and it was felt that Deschutes stock spring chinook salmon would be better suited tc conditions in the Hood River subbasin The iatter assumption was based on a genera; similarity in both the geography and environment of the Deschutes and Hood river subbasins. The rationale for discontinuing the use of Carson stock spring chinook salmon was based on genetic concerns associated with (1) how the stock was initially developed and (2) the degree to which the stock's domestication may have impacted overall fitness.

How well the initial Carson stock releases of hatchery spring chinook salmon have performed in the Hood River subbasin is unknown. Naturally produced progeny of Carson stock spring chinook salmon are recovered at Powerdale Dam, but no information is available tc evaluate how suited the newly developed population is to the Hood River subbasin. Any inherent genetic risks. however. would only be compounded if Deschutes and Carson stock genes are commingled in the newly developing natural population. Elimination of Carson stock genes from the natural population is seen as one alternative for minimizing the genetic risks associated with a hatchery stock that may be mal-adapted for conditions which exist in the Hood River subbasin. To eliminate Carson stock genes from the natural population. we propose blocking four consecutive run years of naturally produced fish from migrating above Powerdale Dam. This will ensure elimination of Carson stock genes from the newly developed spring chinook salmon population in the Hood River subbasin.

6. Radio telemetry data indicates that wild populations of summer and winter steelhead may be spatially segregated in the Hood River subbasin. Preliminary data indicates that adult summer steelhead primarily hold and spawn in the mainstem and West Fork of the Hood River and that adult winter steelhead primarily hold and spawn in the mainstem and East Fork of the Hood River. Limited information is available for the Middle Fork Hood River and Neal Creek. but preliminary data indicates that these streams may be winter steelhead production areas.

If it is determined that wild populations of summer and winter steelhead are spatially segregated. then it may be necessary to re-evaiuate proposed sites for hatchery production releases in the Hood River subbasin. Various options would need to be designed to minimize the genetic risks to any unique populations that may exist in the subbasin. It may be necessary tc limit hatchery summer steelhead releases to the West Fork Hood River and hatchery winter steelhead releases to the East and Middle forks of the Hood River. Re-establishing both populations from their current depressed status might also warrant a re-evaluation of the proposed hatchery spring chinook salmon program in the subbasin. Restricting production releases of hatchery spring chinook salmon to the West Fork Hood River during the initial stages of the HRPP would effectively limit competition between spring chinook salmon and winter steelhead if winter steelhead primarily spawn and rear in the East and Middle forks of the Hood River. After winter steelhead populations are giver several years to recover from their current depressed level. a program could be implemented to release hatchery spring chinook salmon into the East Fork Hood River. Winter steelhead production would then need to be monitored to evaluate how competition between the two species will affect winter steelhead carrying capacity in the subbasin.

The Hood River/Pelton ladder Master Agreement (unpublished report) outlines an approach for implementing the hatchery production component of the HRPP. Recommendations identified in the master agreement propose releasing hatchery summer steelhead in the West and Middle forks of the Hood River. hatchery winter steelhead in the East and Middle forks of the Hood River. and hatchery spring chinook in the West and East forks of the Hood River. These recommendations were developed based on the assumptions that (1) summer and winter steelhead spawn and rear throughout the entire subbasin. (2) spring chinook salmon historically spawned and reared in the West Fork Hood River. and (3) potential spawning and rearing habitat exists for spring chinook salmon in the East Fork Hood River. The radio telemetry data indicates that the above assumptions may not accurately reflect what is occurring in the subbasin and that it may be necessary to re-evaluate how we implement the HRPP.

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) and in the Nest (RM 4.0) and East (RM 1.0) forks 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. To optimize trapping efficiency, traps were periodically repositioned in the stream channel to adjust for seasonal variation in streamflows. The mainstem migrant trap fished to a maximum depth of 1.2 meters, and both the East and West fork migrant traps fished to a maximum depth of 0.8 meters. The migrant traps fished approximately 8%, 9%, and 13% of the stream channels width in the mainstem, West Fork, and the East Fork, respectively.

The rotary-screw traps funnel 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, sorted by species, examined for fin marks, and counted. A random sample of fish were measured to the nearest millimeter fork length and weighed to the nearest gram. Data was recorded on a computerized data entry form and keypunched into a computer database.

Downstream migrant anadromous 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 biweekly counts at tne migrant trap. Biweekly counts were not adjusted for seasonal variation in trap efficiency because a low recapture rate made it impossible to accurately estimate trap efficiency for each biweekly time period.

Rainbow-steelhead were used to indirectly estimate steelhead smolt migration timing because no accurate methodology exists to visually identify rainbow trout from steelhead or to identify downstream migrant steeihead from 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 facility. The ending date for the steelhead smolt migration was fixed at 31 July based on the distribution of biweekly catches of migrant rb-st.

We used mark and recapture methods to estimate the abundance of wild, natural, and hatchery produced anadromous salmonid smolts that migrated from the Hood River subbasin. A pooled Petersen estimate with Chapman's modification (Ricker 1975) was used to estimate numbers of downstream migrants. by species. as follows:

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

where

$\hat{N}$ = estimated number of migrants leaving the hood River subbasin.

M = number of migrants marked and released above the rotary-screw trap.

C = total number of unmarked 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.) for downstream migrants. by species. were calculated by treating marked (R) and unmarked (C-R) migrants in the sample as binomial variables (Seber 1973: Ott 1977):

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

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

where

$\hat{V}(\hat{N})$ = variance cf estimated migrant abundance, and

B = number of unmarked migrants in the recapture sample (C - R)

Downstream migrants were marked by clipping a small portion of the upper (top) or lower (bottom) lobe of the caudal fin. Migrants at the mainstem migrant trap were marked with a top caudal clip and migrants at East and West fork migrant traps were marked with a bottom caudai clip.

Population estimates were made in selected reaches of stream located throughout the Hood River subbasin to estimate rearing abundance of anadromous and resident salmonids. Streams were selected based or two primary criteria: (1) the stream had habitat that was potentially accessible to anadromous salmonids and (2) randomly selected reaches of stream would have a reasonable chance of effect:vely being sampled to estimate population numbers of resident fish. The length of each reach of stream sampled was approximately 60 meters. The 60 meter length ensured that the sampling reach was long enough to include several different habitat types. but not so long that it could not be effectively sampled in one work day. A survey reaches upstream end was generally located just below a riffle and the downstream end was generally located just above a riffle. Both ends of the survey reach were blocked with 3 mm mesh seines to prevent both immigration and emigration of fish.

A three pass removal method was used to estimate population numbers in each sampling reach (Zippin 1958: Seber and Whale 1970;. The population estimate and probability of capture (Seber and Whale 1970) were estimated as follows:

$$\hat{N} = \frac{6X^2 - 3XY - Y^2 + Y(Y^2 + 6XY - 3X^2)^{.5}}{18(X - Y)}$$

$$\hat{p} = \frac{3X - Y - (Y^2 + 6XY - 3X^2)^{.5}}{2x}$$

where

$\hat{N}$ = population size,

$\hat{p}$ = probability of capture,

$X = 2y_1 + y_2$.

$Y = y_1 + y_2 + y_3$.

y_1 = pass 1.

y_2 = pass 2. and

y_3 = pass 3.

The 95% confidence limits (Zippin 1958) were estimated as follows:

$$SE(\hat{N}) = \sqrt{\frac{\hat{N}(\hat{N}-T)T}{T^2 - \hat{N}(\hat{N}-T)\frac{(k\hat{p})^2}{1-\hat{p}}}}$$

$$95\%\ C.I. = \hat{N} \pm 2\ SE(\hat{N})$$

where T = total catch.

Fish were collected using one to three Smith-Root programmable output wave backpack electrofishers. The number of backpack shockers used in a sampling reach was dependent on stream width. Fish collected in each pass were held separately in live boxes. After the final pass. fish were anesthetized and counted by species. Rainbow-steelhead and cutthroat trout were additionally sorted into one of two defined size groups and counts were made for each size group. Size groups were defined as trout less than 85 mm fork length and trout greater than and equal to 85 mm fork length. The 85 mm fork length break point was designed to correspond with the estimated upper size distribution of age-0 trout. A random sample of fork lengths and weights were taken for each species of fish sampled in the stream reach. Fork length was measured to the nearest millimeter and weight to the nearest gram. Data was recorded on a computer form and keypunched into a computer database.

Surface area was estimated for each stream reach sampled for abundance and biomass. Estimates of surface area were derived by dividing the planar area of the stream reach by 11 equidistant paraliel transects of length y_1. y_2. y_3. . . . y_{11} starting at the head of the sampling reach. Lengths were measured to the beginning of the water line on each side of the stream bank. perpendicular to the stream. The 11 equidistant parallel transects formed 10 trapezoids of common height (h). The area of each trapezoid was estimated using the formula: $\frac{1}{2}*(h)*(y_n+y_{(n+1)})$. Surface area for the entire sampling reach was estimated as the sum of the surface areas for the 10 trapezoids.

Bull Trout Surveys

Snorkel surveys were conducted in selected reaches of stream in the Middle Fork Hood

River drainage to monitor bull trout populations (Figures 1 and 20). Four survey reaches were located in Clear Branch. Reach 1 was located from the mouth of Clear Branch to the base of Clear Branch Dam (RM 1.2) and Reaches 2-4 were located from the confluence of Clear Branch and Laurence Lake to RM 5.3. The sampling area was designed to encompass the entire known bull trout rearing area in the Middle Fork Hood River and in Clear Branch. All sampling reaches were designed to be approximately 1.5 km long.

Surveys were conducted by the Mount Hood National Forest beginning in 1992 and with the assistance of personnel or the Hood River/Pelton ladder project beginning in 1994. Objectives cf the survey included determining (1) relative abundance of bull trout populations above Laurence Lake and immediately downstream of Clear Branch Dam. (2) temporal distribution of spawning in Clear Branch and time of residence in Laurence Lake, and (3) factors that might potentially limit production.

Two surveyors equipped with a dry suit. mask, and snorkel conducted each survey working from the bottom to tne top of the survey reach. Surveys were conduced in a manner designed to minimize any disturbance to the fish and tc limit the amount of sediment that was stirred up in the survey reach. Counts were conducted in areas with sufficient depth for underwater observation and were generally done during midday to maximize visibility. Surveyors recorded the number of bull trout in each reach and approximated the size and general location of each fish. Data was recorded on waterproof slates while conducting the survey. and later transferred to field notebooks.

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 Pacific Power and Light (PP&L). is located at RM 4.5 in the mainstem Hood River (Figure 1). 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 has 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.

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

Jack and adult salmonids were removed from the Powerdale Dam trap using a soft mesh landing net. then transferred to a holding tank where they were identified by species. examined for injuries (i.e.. predator scars. net marks. hook scars. and scrapes). and classified by sex. Spring and fall races of chinook saimon were distinguished based on run timing. external coloration. and general appearance. Sumner and winter races of steelhead were distinguished based on fin marks. external coloration. degree of scale tightness and scale erosion. state of sexual maturity relative to the time of year. external parasite load. color of gill filaments. and general appearance. Fish were anesthetized with CO_2 during the physical examination. Subsequent to the physical examination. each fish was measured to the nearest 0.5 cm fork length and weighed to the nearest 0.1 kg, and a random sample of unmarked adult chinook salmon and summer and winter steelhead were radio tagged on a predefined schedule. The radio tagging schedule was designed to ensure that adults were collected from throughout the entire run and in proportions that mirrored migration timing. Field data was entered on a computer form and keypunched into a database.

Fecundity was estimated from wild winter steelhead 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. Estimates of fecundity were made on site subsequent to spawning.

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 aralyzed the impressions and determined origin (wild or hatchery) and life history (freshwater and ocean ages) using methods described by Borgerson et al. (1992).

Summer and winter races of steelhead were classified as wild or hatchery fish based on fin mark and scale analysis. All unmarked summer and winter steelhead classified as wild were assumed to be returns from natural production in the Hood River subbasin. All adipose-marked summer steelhead, as well as all unmarked summer steelhead classified as a hatchery fish from scale analysis, were classified as returns from subbasin hatchery releases. Adipose-marked summer steelhead were classified as Hood River subbasin hatchery fish because all subbasin hatchery production is adipose-marked prior to release as smolts (see HATCHERY PRODUCTION).

Marked and unmarked winter steelhead were classified as Hood River subbasin hatchery fish based on fin mark and age. Hatchery winter sreelhead from the 1989 brood were the first fin-marked fish released into the hood River subbasin. Returning unmarked hatchery winter steelhead from earlier broods were assumed to be Hood River subbasin hatchery fish. Summer and winter steelhead that were not classified as wild or Hood River subbasin hatchery fish were classified as stray hatchery fish. Currently, ail hatchery winter steelhead released in the Hood River subbasin are fin-marked prior to release and, with the exception of a small release group from the 1993 brood, alternate brood releases have been marked with a unique mark combination.

Fin-marked steelhead, classified as wild from scale analysis, were assumed to be stray marked wild fish and were not used in estimating migration timing, sex ratio, or age structure to minimize the potential for biasing estimates by incorporating possible non-native wild stocks in the sample population. The above group cf fish would include marked wild and natural strays and Hood River subbasin wild fish with deformed fins or whose fins were removed by sport fishers. Fin removal, by fishers, has been observed in the Hood River subbasin (personal communication on 11/17/93 with Jim Newton, Oregon Department of Fish and Wildlife, The Dalles, Oregon). To estimate escapements, marked summer and winter steelhead, classified as wild fish from scale analysis, were allocated into the category of wild Hood River subbasin production. In general, recoveries of marked wild fish are low. Sumner and winter steelhead with regenerated scales, or from which no scale samples were taken, were assumed to occur as wild, Hood River subbasin hatchery, and stray hatchery fish in the same proportions as those in the sample population.

Spring chinook salmon were classified as natural or hatchery fish based on fin mark and scale analysis. Unmarked spring chinook salmon, classified as naturally produced from scale analysis, were assumed to be returns from subbasin natural production. All unmarked and adipose-marked spring chinook salmon, classified as hatchery fish from scale analysis, were assumed to be returns from Hood River subbasin hatchery reieases. This assumption was made because a large component of the subbasin hatchery production is released unmarked, and because all marked hatchery fish are released with an adipose mark (see HATCHERY PRODUCTION). No marred spring chinook salmon in the 1992-94 run years were classified as naturally produced. Hatchery spring chinook salmon that had a fin mark combination other than a single adipose mark were classified as a stray hatchery fish. To estimate escapements. spring chinook salmon with regenerated scales. or from which no scale samples were taken. were assumed to occur as natural. Hood River subbasin hatchery, and stray hatchery fish in the same proportions as those in the sample population.

Coho salmon (*Oncorhyncnus kisutch*) were classified as natural or hatchery fish based on fin mark and scale analyses. Natural coho salmon were assumed to be returns from subbasin natural production. Marked and unmarked hatchery coho salmon were assumed to be strays because no hatchery 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. Only one fin-marked coho salmon in the 1992 run year was classified as a wild fish.

Habitat Surveys

With the exception of the Neal Creek drainage. habitat surveys were conducted on potential anadromous salmonid bearing streams located on all private lands and on selected reaches of stream located in the Mount Hood National Forest. Potential anadromous salmonid bearing reaches of stream located in the Neal Creek drainage were surveyed in 1993 by the ODFW.

Stream surveys were organized by reach and channel units. Reaches could vary from as short as 0.5 km to more than 8 km long. Reaches were defined by valley geomorphology. land use. riparian characteristics, and streamflow. Valley geomorphoiogy defined the level of constraint that local landforms such as hillslopes or terraces impose upon the stream channel. The survey described the reaches in terms of hillslope constrained. terrace constrained, and unconstrained stream channels. Within each reach, the stream was described as a sequence of habitat units. Each unit was longer than one active channel width and was an area of relatively homogeneous slope, depth. and flow pattern representing different channel forming processes. The channel could be classified into 22 hierarchically organized types of pools. glides. riffles. rapids. steps. and cascades following the conventions of Bisson et al. (1982). Grant (1986). and Hawkins et a!. (1993). The surveys were conducted by walking the stream from mouth to headwaters using a Hankin and Reeves (1988) protocol to estimate length and width of every habitat unit. in every unit. attributes were estimated or measured to describe gradient. substrate. woody debris. shade. instream cover. and bank stability.

The methodology used and the characteristics described for the stream surveys are not identical to. but are compatible with the surveys conducted by Oregon State University and the U.S. Forest Service (USFS). The information summarized from the survey data are also comparable between agencies and institutions. This compatibility of survey methods and data summary, while allowing each agency to achieve its objectives, prevents a duplication of survey efforts.

Survey data from each stream were summarized in a standard format. This includes a written summary. 7.5-minute topographic maps. tabular and graphical summaries by reach and unit type. and notes and comments written by the field crew during the survey. Summaries will be used individually and in composite to determine overall stream condition and to compare current condition with any available information on historical condition. Information will also be used to determine distribution of fish, abundance of fish populations. potential limiting factors, and carrying capacity. Standards can be developed. based on survey results. for developing objectives and recommendations for protecting existing habitat and fcr developing and implementing habitat improvement projects.

Streamflows

Streamflow measurements were taken in the East Fork Hood River using the direct discharge method. A fiberglass tape measure was stretched across the East Fork Hood River 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 201D portable water current meter. Velocity was measured at 0.6 of the water depth when an individual ceil water depth was less than 2.5 feet. When water depth in a cell measured more than 2.5 feet. two velocity measurements were taken per cell - one at 0.2 of water deptn and one at C.8 of water depth. To calculate velocity for cells where water depth was greater than 2.5 feet. the velocity taken at 0.2 of cell depth and the velocity taken at 0.8 cf 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 equal streamflow.

Genetics Sampling

Whole wild juvenile and adult rainbow-steelhead and cutthroat trout were collected from tne rotary screw traps and from selected reaches of stream in the Hood River subbasin (*see* GENETICS). Sampling reaches were selected in areas where unique populations of steelhead and searun cutthroat (*Oncorhynchus clarki*) are believed to exist in the subbasin.

Whole juvenile Hood River stock hatchery winter steelhead were collected at Oak Springs Hatchery. All whole fish samples were administered a lethal dose of MS 222. flash frozen on dry ice. and immediately transported to Oregon State University (OSU) for storage. Samples were stored in a super cooled freezer at a temperature of -80^{0} Celsius.

Fin samples were taken from a random sample of wild and hatchery adult summer and winter steelhead collected at the Powerdale Dam trap. Samples were approximately two sq cm in size and were taken from the anal fin. Fin samples were initially either frozen or preserved in ethyl alcohol. Frozen fin samples were later preserved in ethyl alcohol.

Whole fish and fir samples will be analyzed at a later date upon collection of the entire sample needed for analysis. Genetics analyses will be used to characterize and identify populations of rainbow-steelhead and cutthroat trout in the Hood River subbasin.

RAINBOW-STEELHEAD

Natural Production

Reaches of stream were sampled at various sites located throughout the Hood River subbasin (Figure 3) to estimate rearing abundance of rainbow trout and steelhead. Because no accurate methodology exists to differentiate between juvenile and adult rainbow trout and steelhead. these two species will be categorized as rainbow-steelhead (rb-st) throughout the rest cf this report.

Rainbow-steelhead were recovered at all sampling sites with the exception of those located in Bear. Tilly Jane, and Robinhood creeks and Dog River (Table 1). Cutthroat trout was the dominant salmonid species in these streams. Greenpoint Creek and lower Lake Branch were the most productive streams sampled based on total biomass of wild rb-st and cutthroat trout (Table 11. Greenpoint Creek was the most productive rb-st stream sampled in the subbasin with an estimate of biomass 74% higher than the next highest estimate.

A juvenile migrant trap was operated at RM 4.5 in the mainstem Hood River to estimate the number of downstream migrant rb-st leaving the Hood River subbasin. An estimated 9.944 rb-st passed the migrant trap from 23 March through 31 July (Table 2). This estimate does not include rb-st production from Neal Creek. which is a major tributary draining into a side channel opposite the migrant trap. Downstream migrant rb-st were predominately freshwater. age-2 fish (64.3%).

No accurate methodology exists to visually identify downstream migrant rb-st as either steelhead smolts, steelhead subsmolt 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 no returning adults have had a subyearling smoltlife history pattern. Numbers of freshwater age-1 and age-2 migrant rb-st were adjusted based on the ratio between the number of rb-st migrants less than or equal to 165 mm fork length and the number greater than 165 mm fork length. The length break was determined based on three primary assumptions: (1) that all 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 accurate estimator of the size range of downstream migrant steelhead smolts.

An estimated 7,345 steelhead smolts (Table 3) migrated past the juvenile migrant trap from 23 March through 31 July based on the above criteria. The age structure of downstream migrant steelhead smolts was estimated as 15.9%, 71.0%, and 13.1% freshwater age-1, age-2, and age-3, respectively (Table 3). The ratio of freshwater age categories was markedly higher for freshwater age-1 and similar for freshwater age-2 and freshwater age-3 migrant smolts when compared with run year specific estimates derived from adult scale analysis (Tables 3 and 4). It is unknown what the under-lying cause might be for the large difference between the two estimates for the freshwater age-1 category. Differences may be attributed to a combination of (1) the criteria used to estimate freshwater age-1 steelhead smolts, (2) brood strength, or (3) a significantly lower smolt-to-adult survival rate for freshwater age-1 smolts than for older age smolts.

Size and Weight

Estimates of mean fork length, weight, and condition factor are summarized for resident rb-st in Tables 5 and 6 and for downstream migrant rb-st by age category in Table 7. Length x weight regressions for resident rb-st are presented in Figures 4-7 and for downstream migrant rb-st in Figure 8. A length frequency histogram for downstream migrant rb-st is summarized by age category in Figure 9.

Mean fork length and condition factor of freshwater age-1 and age-2 downstream migrant rb-st was less than the mean fork length and condition factor of yearling Hood River stock hatchery winter steelhead released into the subbasin (see HATCHERY PRODUCTION. Size and Weight).

Smolt Migration Timing

Peak steelhead smolt migration was estimated to occur during the last two weeks of May (Figure 10). Freshwater age-l steeihead appear to migrate first with most having passed the trapping facility prior to overall peak migration (Figure 10). Freshwater age-2 and age-3 steelhead migrated throughout the entire sampling period. Peak migration for both freshwater age-2 and age-3 steelhead occurred during the last two weeks of May.

JUVENILE CHINOOK SALMON

Natural Production

Various sites and sampling techniques were used to determine abundance and distribution of chinook salmon in the Hood River subbasin. Snorkel surveys were conducted by the USFS at various locations on Mount Hood National Forest lands. Additionally, personnel on the Hood River/Pelton ladder project operated three juvenile migrant traps and sampled selected reaches of stream (Figure 3) with backpack electroshockers. The USFS observed juvenile chinook salmon in late summer of 1994 in the upper West Fork (WFk) Hood River (personal communication with Chuti Ridgley on 10/04/94, Mount Hood National Forest, Parkdale, Oregon). Personnel on the Hood River/Pelton ladder project sampled Juvenile chinook salmon in a reach of stream located in Elk Creek (Figure 3) and at juvenile migrant traps located in the mainstem (RM 4.5) and the West Fork (RM 4.0) of the Hood River (Figure 3). Elk and McGee creeks meet to form the West Fork hood River.

Data collected by the USFS and from the Hood River/Pelton ladder studies indicate that chinook salmon successfully spawn and rear in the West Fork Hood River and that some natural spring chinook salmon production probably occurs in the mainstem Hood River. Juvenile chinook salmon rearing in the West Fork Hood River are believed to be spring chinook salmon based on the assumption that Punchbowl Falls impedes movement of upstream migrant jack and adult fall chinook saimon into the West Fork Hood River. Limited information available from radio-tagged adult fall chinook salmon tends to corroborate this assumption. No radio-tagged fall chinook salmon in the 1993 run year migrated into the WFk Hood River (unpublished data on 3/25/95 from Research and Development Section. Oregon Department of Fish an", Wildlife, Corvallis, Oregon).

Downstream migrant juvenile chinook salmon sampled at the mainstem migrant trap may be comprised of both spring and fall races of chinook salmon. In 1994, it is believed that downstream migrant juvenile chinook salmon were predominately spring chinook salmon. This assumption is based on the low number of adult fail chinook salmon sampled from the i993 run year at Powerdale Dam (i.e., 8 females and 3 males; unpublished data on 3/16/95 from Oregon Department of Fish and Wildlife, The Dalles, Oregon).

Chinook salmon from the 1992 and 1993 broods are not believed to have utilized the East Fork (EFk) Hood River drainage as spawning and rearing habitat based on data collected at the EFk migrant trap. In 1994, no age-1+ chinook salmon smolts from the I992 brood, or age-0+ juvenile chinook migrants from the 1993 brood, were caught at the EFk migrant trap. Age-1+ smolts would have been sampled during the spring and age-0+ migrants during the spring as fry and from late spring to late fall as fingerlings, similar to patterns observed at the mainstem and WFk migrant traps. One juvenile salmon was sampled during the summer in the EFk Hood River and initially classified as a chinook salmon (Table 1: Figure 3). The juvenile salmon was reclassified as a coho salmon based on the data collected at the EFk migrant trap. Radio telemetry data collected in 1994 also indicates that spawning may currently be limited primarily to the mainstem and West Fork Hood River (see JACK AND ADULT SPRING CHINOOK SALMON, Spatial Distribution).

while chinook salmon currently do not appear to utilize the EFk drainage as spawning or rearing habitat, tnere is data to indicate that chinook salmon have, in some years, spawned in the drainage. Juveniie chinook salmon were sampled in the East Fork Irrigation District's (EFID; Figure 1) irrigation ditch in November of 1986, 1987, and 1988 (unpublished data on 3/28/95 from Steve Pribyl, Oregon Department of Fish and Wildlife, mid-Columbia District, The Dalles, Oregon). The mouth of EFID's irrigation ditch is located at RM 6.4 on the EFk Hood River. Juvenile chinook salmon captured in the irrigation ditch are assumed to be spring chinook salmon based on the time of year in which they were caught. Fall chinook salmon typically migrate as subyearling smolts from May through July (Jonasson and Lindsay 1988: and should not have been in the ditch in November unless they were trapped in the ditch and survived through the fall.

It is unknown whether spring chinook salmon currently spawn and rear in the Middle Fork (MFk) Hood River drainage. No migrant traps were operated in the drainage in 1994 to monitor movement of downstream migrants and no juvenile chinook salmon were sampled at sites used to monitor distribution and abundance of anadromous salmonids in the Hood River subbasin (Table 1) Radio telemetry data indicates that adult spring chinook salmon currently may not be spawning in the MFk drainage (see JACK AND ADULT SPRING CHINOOK SALMON, Spatial Distribution:.

Temporal distribution of juvenile downstream migration was monitored at both the mainstem and WFk migrant traps. The mainstem migrant trap was operated from 16 March through 26 October and the WFk migrant trap from 25 March through 30 June and from 15 September through 26 October. The WFk migrant trap was not operated during the summer months because of continued vandalism and low streamflow. Both migrant traps were pulled on 26 October following a major flood event in the Hood River subbasin. Operation of the migrant traps was discontinued after 26 October because widely fluctuating and unseasonably high streamflows persisted for several weeks after this date, making it impossible to accurately monitor migration timing or estimate abundance of the fall migrants.

Fry- and smolt-sized juvenile chinook saimon were sampled at both the mainstem and WFk migrant traps on the first day each trap was operated. Catch at the migrant traps indicates that both timing of emergence and the downstream movement of smolt-sized chinook salmon occurred prior to mid-March (Figure 11). The fact that chinook salmon fry were sampled in the mainstem migrant trap also tends to indicate that spring chinook salmon probably spawn in the mainstem Hood River. Radio telemetry data from adult spring chinook salmon tends to corroborate this observation. Several radio-tagged adult spring chinook salmon remained in the mainstem Hood River throughout the summer and fall (see JACK AND ADULT SPRING CHINOOK SALMON. Spatial Distribution).

Smolt-sized chinook salmon (i.e.. juveniles ≥ 75 mm fork length) migrated past the mainstem migrant trap throughout the sampling period with the greater percentage passing the migrant trap during the fall (Figure 11). An analysis of scale samples collected from naturally produced jack and adult spring chinook salmon indicate that most of the fall migrants may be juvenile spring chinook salmon migrating as subyearling smolts (*see* JACK AND ADULT SPRING CHINOOK SALMON; Age Composition. Size. and Sex Ratio;. More than 60% of the returning naturally produced jack and adult spring chinook salmon sampled at the Powerdale Dam trap had a subyearling smolt life history pattern.

It is believed that a small percentage of the subyearling fall migrant spring chinook salmon may rear in the mainstem Columbia River prior to migration as yearling smolts. This assumption is based on an analysis of scales taken from naturally produced spring chinook salmon with a yearling smolt life history pattern. Several naturally produced adult spring chinook salmon had scale samples with an indistinct annulus and a scale pattern that indicated a high rate of growth prior to migration as a yearling smolt (personal communication on 04/17/95 with Lisa Borgerson. Oregon Department of Fish and Wildlife. Corvallis. Oregon). Adult spring chinook salmon with this unique scale pattern are assumed to have migrated as age-0+ juveniles into the mainstem Columbia River during the fall. It is believed that milder water temperatures in the mainstem Columbia River would account for the indistinct annulus and that growth rates. after the fall migration. are probably much higher in the mainstem Columbia River than in the Hood River subbasin.

An estimate of the number of yearling smolts migrating past the mainstem migrant trap will be summarized in the FY 95 annual report upon completion of the Juvenile scale analysis.

Size and Weight

A random sample of juvenile chinook salmon was measured to the nearest millimeter fork length and the nearest gram at the mainstem and West Fork migrant traps. Length frequency histograms and length x weight regressions were developed at each migrant trap for juvenile chinook salmon migrating during selected time periods (Figures 12-15). The length frequency histogram indicates that migrant juvenile chinook salmon passing the mainstem migrant trap after 16 July are generally bigger than migrants passing the West Fork migrant trap after 15 September. This would indicate that either time of emergence or juvenile growth rates are significantly different between the mainstem and West Fork of the Hood River. Age specific estimates of mean fork length, weight, and condition factor will be summarized in the FY 95 annual report upon completion of the juvenile scale analysis.

JUVENILE COHO SALMON

Natural Production

The indigenous population of coho salmon in the Hood River subbasin is suspected to be extirpated (*see* JACK AND ADULT COHO SALMON. Escapement). Some natural production presently occurs in the subbasin. but data indicates that current production is probably the result of either hatchery strays or returns from naturally produced progeny of hatchery strays (*see* JACK AND ADULT COHO SALMON. Migration Timing). Limited information is available on the spatial distribution of spawning and rearing, but juvenile and adult coho salmon have been sampled at various sites located in the subbasin. Downstream migrant age-0+ juvenile and smolt coho salmon were sampled at migrant traps located in both the mainstem and East Fork of the Hood River (Figure 3). Age-0+ juveniles were sampled in both Neal Creek and in Lenz Creek. a tributary to Neal Creek (Figure 3 and Table 1). Age-0+ juveniles have historical-y been recovered in the East Fork Irrigation Ditch (EFID; Figure 1; unpublished data on 5/8/95 from Oregon Department of Fish and Wildlife. Mid-Columbia G-strict. The Dalles. Oregon) while conducting salvage efforts for saving salmonids trapped in the irrigation ditch. The mouth of EFID is located at RM 6.4. which indicates that in some years natural production does occur in the upper EFk Hood River drainage. Adult coho salmon have also been observed in Dog River (personal communication with Chuti Ridgley, Mount Hood National Forest, Parkdale, Oregon), a tributary to the East Fork (EFk) Hood River at RM 9.9 (Figure 1). No age-0+ juveniles were sampled in Dog River in 1994 (Table 1).

The mainstem migrant trap caught coho salmon smolts migrating in the spring and age-0+ juveniles migrating in the fall (Figure 16). The East Fork migrant trap primarily caught coho salmon smolts migrating in the spring (Figure 16). A total of 86 juvenile coho salmon were sampled in the mainstem migrant trap and 81 juvenile coho salmon in the EFk migrant trap. Juvenile coho salmon were sampled in the mainstem migrant trap from 23 March through 26 October 1994, and in the EFk migrant trap from 2 April through 26 October 1994.

A mark and recapture program was implemented to estimate coho salmon smolt production in the Hood River subbasin. Because no marked juvenile coho salmon were recaptured at the mainstem migrant trap, it was not possible to estimate juvenile migrants using the standard methodology. An estimate was developed for the number of coho salmon migrants greater than or equal to 75 mm fork length based on the ratio of marked to unmarked chinook salmon sampled from the same size range. These criteria were used to approximate the number of juvenile coho salmon passing the mainstem migrant trap based on (1) the assumption that trapping efficiency is the same for similarly sized chinook and coho salmon, and (2) less than 4% of the juvenile coho salmon sampled at the trap were estimated to be less than 75 mm in fork length.

An estimated 3,129 juvenile coho salmon greater than or equal to 75 mm fork length passed the mainstem migrant trap from 23 March through 26 October 1994 (Table 8). An estimated 462 coho salmon were estimated to have migrated prior to 30 June; the remaining 2,667 migrated after 1 July (Table 8). The estimate for the mainstem migrant trap does not include coho salmon migrants from Neal Creek, a major tributary draining into a side channel opposite the mainstem migrant trap.

Size and Weight

Mean fork length, weight, and condition factor are summarized in Table 9 for juvenile coho salmon sampled at the mainstem and East Fork migrant traps. Estimates are summarized in Table 10 for juveniles sampled in the Middle Fork Hood River and in Lenz and Neal creeks. A length frequency histogram is presented in Figure 17 for juvenile coho salmon sampled at the mainstem and East Fork migrant traps.

CUTTHROAT TROUT

Natural Production

Cutthroat trout were recovered in eight of a total 19 reaches of stream sampled in the subbasin (Table 1; Figure 3). No rainbow-steelhead were found in four of the eight reaches of stream. Robinhood and Bear creeks were the most productive cutthroat trout streams sampled, based on total biomass (Table 1). Robinhood Creek was the most productive cutthroat trout stream sampled in the subbasin with an estimate of biomass 72% higher than the next highest estimate.

Few cutthroat trout were captured in the mainstem migrant trap and no adult cutthroat trout were captured in the Powerdale Dam trap (unpublished data on 4/17/95 from Research and Development Section, Oregon Department of Fish and Wildlife, The Dalles, Oregon). The low number of cutthroat trout caught in the mainstem migrant trap, and the fact that no adult migrants were caught in the Powerdale Dam trap, indicates the anadromous form of this species may be at a depressed level in the Hood River subbasin.

Size and Weight

Estimates of mean fork length, weight, and condition factor are summarized for resident cutthroat trout in Tables 11 and 12. Length x weight regressions for resident cutthroat trout are presented in Figures 18 and 19.

BULL TROUT

It is currently believed that the Hood River subbasin supports two populations of bull trout. Both populations are located in the Middle Fork Hood River drainage and are believed to be descended from the same founding population. One population occurs above Clear Branch Dam and the other below the dam (Figures 1 and 20).

Clear Branch Dam provides storage for both irrigation and hydroelectric uses. Prior to construction of Clear Branch Dam in 1968-69, there was unrestricted movement of bull trout in Clear Branch. Clear Branch Dam was constructed with no facilities for passing fish, and as a consequence, acts as a total barrier to upstream migrants and as a barrier to downstream migrants when the spillway is closed. The spillway is primarily open only during the spring. It is believed that the spillway effectively negotiates downstream migrants past the dam, but no evaluation has been conducted to test this hypothesis (personal communication on 4/10/95 with Jim Newton, Oregon Department of Fish and Wildlife, Mid-Columbia District. The Dalles. Oregon). The Mount Hood National Forest (MHNF) is currently proceeding with plans for an adult migrant trap to be located at the base of Clear Branch Dam.

In addition to lacking facilities for fish passage. Clear Branch Dam is also believed to have altered the temperature regime below the dam to the extent that available bull trout spawning habitat has been restricted in both Clear Branch (below the dam) and the Middle Fork Hood River (personal communication on 12/15/94 with Steve Pribyl. Oregon Department of Fish and Wildlife. The Dalles. Oregon). This assumption is based on data that show temperatures below Clear Branch Dam. at RM 10.1 on the M-ddle Fork Hood River, remained above 10° Celsius from early July through mid-October in 1994 (unpublished data on 12/05/94 from Mount Hood National Forest. Parkdale. Oregon). McPhail and Murray (1979) report that less than 20% of bull trout eggs hatch at temperatures ranging from $8\text{-}10^{\circ}$ Celsius. Water temperatures after mid-October may be more conducive to the survival of eggs.

Bull trout were sampled above Clear Branch Dam in both Clear Branch and in Pinnacle Creek (Figure 20). Surveys conducted in Clear Branch indicate that the population above the dam may have an adfluvial life history pattern (i.e.. spawn in streams and rear in lakes). Adult bull trout have beer observed in Clear Branch from mid-June through mid-October (Table 13). This would indicate that bull trout may be holding in Clear Branch for several months prior to spawning. Bull trout generally spawn in late summer or early fall (Pratt 1992). Redds that were believed to be constructed by bull trout were observed in Clear Branch in mid- to late September 1994 (unpublished data on 12/05/94 from Mount Hood National Forest. Parkdale. Oregon). Snorkel surveys indicate bull trout are more abundant above Clear Branch Dam than below tie dam (Figures 21 and 22).

Bull trout were sampled in Pinnacle Creek while conducting fish distribution surveys for the Hood River/Pelton ladder project. A total of eight bull trout were sampled on 1 September 1994. Mean fork length was estimated at 101.5 mm; fork length ranged from 90-129 mm. The ODFW's aquatic inventory crew sampled Pinnacle Creek three times in the summer of 1990. but no bull trout were found (personal communication on 12/15/94 with Steve Pribyl. Oregon Department of Fish and Wildlife. The Dalles. Oregon). Why no bull trout were recovered in Pinnacle Creek prior to 1 September is unknown. It may be that adults in Pinnacle Creek exhibit a life history pattern similar to adults in Clear Branch or that a passage problem exists at a road culvert near the confluence with Laurence Lake.

The bull trout population below Clear Branch Dam is believed tc have either a fluvial (i.e.. spawn in small streams and rear in larger streams) or resident life history pattern. Limited life history information is available for the population below Clear Branch Dam. but data indicates that some movement occurs within the subbasin and possibly outside of the subbasin. Uniquely marked bull trout have been observed at both the sampling area below Clear Branch Dam (Reach 1) and at the Powerdale Dam trap (Table 13 and 14). One bull trout captured and tagged at the Powerdale Dam trap on 6 June 1992 was observed by a snorkeller near the base of Clear Branch Dam on 22 August 1992. An adult captured on 1 June 1993 at the Powerdale Dam trap was recaptured at the Powerdale Dam trap on 23 May 1994. Between the date of first and second capture. the bull trout grew 5 cm (Table 14). Another tagged bull trout was recaptured on 2 May 1995 at RM 0.75 by a sport fisher (personal communication on 5/22/95 with Steve Pribyl. Mid-Columbia District. Oregon Department of Fish and Wildlife, The Dalles. Oregon). The bull trout measured 41 cm fork length when first captured at Powerdale Dam on 26 June 1994. One other tagged bull trout was also recaptured in the mainstem Columbia River by a sport fisher (memo dated 4/25/95 from Steve Pribyl. Mid-Columbia District. Oregon Department of Fish and Wildlife. The Dalles. Oregon). The bull trout measured 37.5 cm fork length when first captured on 20 July 1994 at the Powerdale Dam trap. The bull trout was recaptured on 24 April 1995 in the mainstem Columbia River downstream from Drano Lake.

In addition to observations in the primary sampling areas below Clear Branch Dam and at the Powerdale Dam trap. bull trout have been observed at other sites in the subbasin. One bull trout measuring 253 mm fork length was captured in the mainstem migrant trap (see METHODS. Juvenile Production). The fish was sampled on 14 June 1994. One other bull trout was sampled on 25 July 1994 in Compass Creek, a tributary to Coe Branch (Figure 20). The bull trout measured 229 mm fork length. The bull trout found in Compass Creek may be significant since the creek is located high in the subbasin and has water temperatures that may be suitable for successful bull trout spawning. There are currently no identified barriers that would block movement of bull trout from the Middle Fork Hood River into Compass Creek. One irrigation/hydroelectric diversion in Coe Branch (RM 1.25) may. during certain times of the year. create an obstacle to movement into Compass Creek.

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 during the last two weeks of July for the wild run and from the last two weeks of June to the first two weeks of July for the subbasin hatchery run. 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)

Escapement and Survival

Estimates of summer steelhead escapements to the Powerdale Dam trap ranged from 237-483 wild. 1.133-1.682 subbasin hatchery. and 19-56 stray hatchery fish for the 1992-93 and 1993-94 run years (Table 17). The percentage of summer steelhead with predator scars ranged from 42-43X (Appendix Table B-1:. The percentage of summer steelhead with net marks and hook scars ranged from 11-15% and from 3-4%. respectively (Appendix Table B-1). All wild and subbasin hatchery summer steelhead returning to the Powerdale Dam trap are released above Powerdale Dam.

Based on estimates of age structure at Powerdale Dam (see ADULT SUMMER STEELHEAD. Age Composition. Size. and Sex Ratio). no complete brood year specific estimates of escapement will be available for either wild or subbasin hatchery components of the run until completion of the 1995-96 run year. Preliminary estimates of post-release survival from smolt-to-adult return at the Powerdale Dam trap indicate that survival may be fairly low for subbasin hatchery summer steelhead (Table 18). Data indicates that the post-release survival rate back to the Powerdale Dam trap is probably averaging somewhere around 2% and. when adjusted fcr fisheries below the dam (exploitation rate was assumed to be at least 30%). will average somewhere around 3.1% back to the mouth of the Hood River. Estimates of post-release survival ranged from 0.4-6.6% and averaged 3.6% back to the mouth of the Deschutes River for the 1978-80 brood production releases of Deschutes stock hatchery summer steelhead in the Deschutes River subbasin (Olsen et al.. undated). While estimates of post-release survival back to the mouth of the Hood River are not much less than the average estimate for the Deschutes River subbasin. the difference would probably be more profound if estimated survival rates to the Descnutes River were adjusted to account for mortality between the mouth of the hood and Deschutes river subbasins. Post-release survival back to the Deschutes River subbasin is subject to any mortality associated with (1) mainstem Columbia River fisheries located between the mouth of the Hood and Deschutes rivers. and (2) the negotiation of one additional dam (i.e.. The Dalles Dam).

Low post-release survival is believed to be the result of a high stress-related mortality that occurs shortly after smolts are released in the subbasin (see HATCHERY PRODUCTION. Post-release Survival). It is anticipated that post-release survival rates can be improved significantly by acclimating hatchery smolts for one to four weeks prior to release in the subbasin. Acclimation facilities will be developed at selected sites in the subbasin upon full implementation of the Hood River Production Program.

Age Composition. Size. and Sex Ratio

Wild summer steelhead migrate mainly as freshwater age-2 and age-3 smolts and return mainly as Z-salt adults (Table 19). Subbasin hatchery smolts all migrated in the year of release (i.e.. freshwater age-l) and returned mainly as 2-salt adults (Table 19). An estimated 3.6% of the wild adults and 0.7-0.8% of the subbasin hatchery adults returned as repeat spawners (Table 19). Only one repeat spawner was sampled in the 1993-94 run year with more than one spawner check (Table 20).

Mean fork length of wild summer steelhead without a spawning check ranged from 53-57 cm for l-salt adults. 64-70 cm for 2-salt adults. and 79-88 cm for 3-salt adults and was 79 cm for 4-salt adults (Tables 21 and 22). Mean fork length of subbasin hatchery summer steelhead without a spawning check ranged from 53-55 cm for l-salt adults. 67-68 cm for 2-salt adults. 78-80 cm for 3-salt adults. and 79-90 cm for 4-salt adults (Tables 21 and 22).

Sex ratios varied among age categories and run year for both wild and subbasin hatchery summer steelhead (Table 23) In general. 2-salt adults returned predominately as females and 3-salt adults predominately as males (Table 23).

Spatial Distribution

Twenty-eight unmarked summer steelhead. randomly selected from throughout the 1994-95 run year. were tagged with radio transmitters. Five radio-tagged summer steelhead remained in the mainstem Hood River throughout the sampling period (Figures 23-32). A total of 19 summer steelhead moved into the WFk Hood River. one into the lower EFk Hood River. and three tagged fish were never found. One summer steelhead. detected in the WFk Hood River. moved into Lake Branch in early August. but was later detected in the upper WFk Hood River (Figures 23-32). All radio-tagged summer steelhead were classified as wild based on scale analysis.

ADULT WINTER STEELHEAD

Migration Timing

Winter steelhead begin entering the Powerdale Dam trap as early as the first two weeks of December and a given run year may encompass two calendar years for both components of the run (Table 24). The median migration date occurred in April for wild winter steelhead and from early February to early March for subbasin hatchery winter steelhead. Migration to the

Powerdaie Dam trap was completec. in the second calendar year. by early to late June for the wild run and by -ate April to early May for the subbasin hatchery run (Table 24). In all three run years sampled. the wild run of winter steelhead migrated into the Hood River subbasin later than the subbasin hatchery run. Differences in migration timing are primarily attributed to the fact that hatchery broodstock was historically taken from the Big Creek stock cf winter steelhead. The Big Creek stock is typically classified as an early-run hatchery stock. Upon full implementation of the HRPP. the hatchery program will collect hatchery broodstock from throughout the entire run of wild adults entering the Powerdale Dam trap. Progeny of these brood releases should have a run timing more similar tc the native run.

Escapement and Survival

Estimates of winter steeihead escapements to the Powerdale Dam trap ranged from 400-693 wild. 140-289 Big Creek stock hatchery. 7-14 mixed-stock hatchery. and 27-34 stray hatchery fish for the 1991-92 through 1993-94 run years (Table 25). The percentage of winter steelhead witr predator scars ranged from 38-53% (Appendix Table B-1). The percentage of winter steelhead with either a net mark or hook scar ranged from 3-7% and from 2-4%. respectively (Appendix Table B-1). No Hood River stock hatchery winter steelhead (1992 brood) were sampled during the 1993-94 run year. Hatchery adults returning from the 1992 brood release would have been I-salt adults in the 1993-94 run year.

Based on estimates of age structure at Powerdale Dam (see ADULT WINTER STEELHEAD. Age Composition. Size, and Sex Ratio). no complete brood year specific estimates of escapement will be available for either wild or subbasin hatchery components of the run until completion of the 1994-95 run year. Preliminary estimates of post-release survival from smoit-to-aduit return to the Powerdale Dam trap indicate that survival may be fairly low for the Big Creek stock of hatchery winter steelhead (i.e.. around 1.5%; Table 26) when compared with estimates of post-release survival for Deschutes stock hatchery summer steelhead released in the Deschutes River subbasin (see ADULT SUMMER STEELHEAD. Escapement and Survival).. Low post-release survival for the Big Creek stock is believed to be the result of a high stress related mortality that occurs shortly after smolts are released in the subbasin (see HATCHERY PRODUCTION. Post-Release Survival). It is anticipated that post-release survival rates can be improved significantly by acclimating hatchery smolts for one to four weeks prior tc release in the subbasin. Acclimation facilities will be developed at selected sites in the subbasin upon fuil implementation of the HRPP.

Prior to the 1991-92 run year. all wild and hatchery winter steelhead were passed above Powerdale Dam. Beginning with the 1991-92 run year. all stray and Big Creek stock hatchery winter steelhead. caught in the Powerdale Dam trap. were transported downriver an@ released at the mouth of the Hood River. This program was estabiished to prevent non-indigenous stocks from spawning above Powerdale Dam. in accordance with guidelines established in the ODFW's Wild Fish Policy, and to increase harvest opportunities on returning hatchery adults. Stray and Big Creek stock hatchery fish are identified based on fin marks.

Adult Hood River stock hatchery winter steelhead returning from the 1993 brood release are first expected tc return as l-salt adults in the 1994-95 run year. These are the first returns of subbasin hatchery winter steelhead that will be passed above Powerdale Dam since the current hatchery program was implemented in the winter of 1991. The number that are passed above Powerdale Dam will be regulated in accordance with guidelines established in the Wild Fish Policy. Passage abcve Powerdale Dam is prohibited under the current hatchery program for adult returns from the 1992 brood release cf Hood River stock hatchery winter steelhead. Hatchery broodstock for the 1992 brood release were collected from the early segment of the run and progeny are not considered to be genetically similar to the wild stock. Passage above Powerdale Dam is also prohibited under the current hatchery program for adult returns from the 1991 brood release because progeny were from the wild x Big Creek stock of hatchery winter steelhead (*see* HATCHERY PRODUCTION).

Age Composition, Size, and Sex Ratio

Most wild winter steelhead migrate as freshwater age-2 and age-3 smolts and return mainly as 2- ard 3-salt adults (Table 27). Most subbasin hatchery fish migrated in the year of release (freshwater age-l) and returned mostly as 2- and 3-salt adults with the exception of the 1993-94 run year (Table 27). In the 1993-94 run year. a large percentage of subbasin hatchery winter steelhead returned as age-212 adults. Repeat spawners comprised 3-7.9% of the wild winter steelhead run and 2-3.8% of the subbasin hatchery winter steelhead run sampled at the Powerdale Dam trap (Table 27). Few repeat spawners in the 1993-94 run year had more than one spawning check (Table 28).

Scale analysis initially mis-classified 52% of the age-2/2 hatchery adults in the 1993-94 run year as age-112 adults. However. because all fish had an AD-LM mark combination. they were later re-classified as age-2/2 adults. The AD-LM fin mark combination was usec to identify the adult hatchery winter steelhead as returns from the 1990 brood release of Big Creek stock hatchery smolts (*see* HATCHERY PRODUCTION). Returns were classified as age-2/2 adults rather than age-1/3 adults because mean fork length and size range were typical of 2-salt adults and scale analysis had initially indicated that all adults had a 2-salt ocean life history pattern. Adults were determined not to be stray hatchery winter steelhead based on fin mark allocation information available in the Pacific

States Marine Fisheries Commission (PSMFC) database. There were no records in PSMFC's database indicating that any AD-LM marked hatchery winter steelhead were released in the Columbia River Basin from the 1988-92 broods (unpublished data on 07/26/94 from Pacific States Marine Fisheries Commission. Gladstone, Oregon).

Why the number of Big Creek stock hatchery winter steelhead with a residual life history pattern was higher in the 1993-94 run year than in previous run years is unknown. The fact that Big Creek stock hatchery releases residualized in the Hood River subbasin may be moot based on the fact that the hatchery program no longer utilizes Big Creek stock winter steelhead for hatchery broodstock. The question of whether future hatchery releases will also exhibit a similar residual life history pattern is unknown.

The current hatchery program collects broodstock entirely from the wild Hood River stock and has discontinued the practice of grading out smaller juveniles prior to release. Smaller fish were historically graded out of the production group so that the production release would be more uniformly at a typical smolt size. Because the hatchery program will not be grading out the smaller juveniles in the production group. it is anticipated that a significant percentage of the hatchery production releases may residualize in the subbasin. The 1992 brood release of hatchery winter steelhead smolts represents the first ungraded hatchery production release into the Hood River subbasin.

The change in hatchery practices is designed to increase size variation in the hatchery production reiease (see HATCHERY PRODUCTION) with the intent that increased size variation will result in increased genetic diversity in the hatchery product. The consequence of this hatchery practice is that the smaller hatchery fish may not migrate as smolts. but will remain in the subbasin to compete with indigenous populations of fish. This assumption appears to be corroborated by the size distribution of hatchery winter steelhead smolts migrating past the mainstem migrant trap (see METHODS. Juvenile Production). Prior to 14 May 1995. the mainstem migrant trap captured 14 wild rainbow-steelhead less than 160 mm fork length wh-le capturing only one 1994 brood hatchery winter steelhead less than 160 mm fork length (unpublished data on 4/19/95 from Oregon Department of Fish and Wildlife. Mid-Columbia District. The Dalles. Oregon). Hatchery winter steelhead from the 1994 brood were released on 19-20 April 1995 and ranged in size from 116-247 mm fork length (unpublished data on 4/19/95 from Oregon Department of Fish and Wildlife, Mid-Columbia District, The Dalles. Oregon). It is unknown how effective any residualized hatchery juveniles will be at competing with wild fish or what percentage will actually survive through the first winter (see HATCHERY PRODUCTION).

Mean fork length of wild adult winter steelhead without a spawning check ranged from

58 cm to 68 cm for Z-salt adults and 76 cm to 80 cm for 3-salt adults (Tables 29 and 30). Mean fork length for subbasin hatchery adult winter steelhead without a spawning check was 57 cm for l-salt adults and ranged from 62 cm to 73 cm for 2-salt adults. and 75 cm to 77 cm for 3-salt adults (Tables 24 and 30).

Mean weight of wild adult winter steelhead without a spawning check ranged from 2.4 kg to 3.3 kg for 2-salt adults and 4.5 kg to 5.4 kg for 3-salt adults (Table 31). Mean weigh: of age-1/2 hatchery adult winter steelhead from the 1991 brood reiease of wild x Big Creek stock hatchery cross was 2.5 kg (Table 31).

Although sex ratio as a percentage of females varied markedly among age classes. wild adult winter steelhead returned mostly as females (Table 32). Subbasin hatchery adult winter steelhead mainly returned as males in age category 1/2 and as females in age categories 1/1 and 1/3 (Table 32). Both wild and subbasin hatchery repeat spawners returned mainly as females.

Fecundity estimates for wild winter steelhead ranged from 1.930 to 6.480 eggs per female for 2-salt adults and from 2.493 to 6.398 eggs per female for 3-salt adults (Table 33).

Spatial Distribution

Twenty-eight unmarked winter steelhead. randomly selected from throughout the 1993-94 run year, were tagged with radio transmitters. Twelve radio-tagged winter steelhead remained in the mainstem Hood River throughout the sampling period (Figures 33-36). A total of nine winter steelhead moved into the EFk Hood River. four into the lower WFk Hood River. one into the lower MFk Hood River, one into Neal Creek. and one tagged fish was never found. Two winter steelhead. detected in the WFk Hood River. moved into Greenpoint Creek by 21 April. Both radio tags were later recovered in Greenpoint Creek during the summer. One of the four radio-tagged winter steelhead detected in the lower WFk Hood River moved out of the WFk and was later detected in the EFk Hood River. All radio-tagged winter steelhead were classified as wild based on scale analysis.

One non-radio tagged winter steelhead was observed by snorkellers on 9 June 1994 in Clear Branch approximately 10 feet above the mouth of Coe Branch (telephone communication on 12/08/94 with Chuti Ridgley. Mount Hood National Forest. Parkdale. Oregon). Whether this observation was an anomaly is unknown. The adult winter steelhead was collected for hatchery broodstock on 5 May 1994 and held through 27 May 1994 in Rogers Spring Creek when it was released unspawned above Powerdale Dam. Rogers Spring Creek is located at RM 3.4 on the MFk Hood River. The fact that it was held as hatchery broodstock for 16 days in the MFk

Hood River drainage could potentially have effected its homing ability. Its observed location would indicate. however. that the entire MFk Hood River is accessible to adult winter steelhead.

JACK AND ADULT SPRING CHINOOK SALMON

Migration Timing

Natural jackand adult spring chinook salmon begin entering the Powerdale Dam trap early in May: subbasin hatchery jack and adult spring chinook salmon begin entering the trap late in April (Table 34). Median date of migration occurred between the last two weeks of June and the last two weeks of July for the natural run. and during the last two weeks of May for the subbasin hatchery run. Both natural and subbasin hatchery components of the run were completed by late September to early October (Table 34).

Escapement and Survival

Estimates of escapement to the Powerdale Dam trap ranged from 34-44 natural. 261-461 Carson stock hatchery. 3-5 Deschutes stock hatchery. and 1-10 stray hatchery spring chinook salmon for the 1992-94 run years (Table 35). The percentage of spring chinook salmon with predator scars ranged from 28-30% (Appendix Table B-i). The percentage of spring chinook salmon with either a net mark or hook scar ranged from 3-4X and from 1-3%. respectively (Appendix Table B-1).

Numbers of stray hatchery spring chinook salmon increased markedly in 1994 primarily because this was the first year in which one age category of spring chinook salmon could be differentiated as a stray fish. Historically all adipose-marked and coded-wire tagged (Ad-CWT) spring chinook salmon were assumed to be from Hood River releases unless scale analysis classified them as a stray marked wild fish. This assumption was made because there was no way of identifying their origin without recovering the coded-wire tag. In 1994. Ad-CWT mini-jack spring chinook salmon were sampled at the Powerdale Dam trap. This group of fish could be identified as stray spring chinook salmon based on the fact that in 1994 no hatchery production releases were made in the Hood River subbasin. To identify subbasin of origin. several of the Ad-CWT mini -jack salmon were sampled to recover the coded-wire tag. Most of the mini-jacks were from 1992 brood hatchery releases in the Klickitat River subbasin (Table 36). One mini-jack salmon was from 1992 brood hatchery releases made in Youngs River and Youngs Bay (Table 36).

Based on age structure at Powerdale Dam (see JACK AND ADULT SPRING CHINOOK SALMON. Age

Composition. Size. and Sex Ratio). no complete brood year specific estimates of escapement will be available for the natural component of the run until completion of the 1996 run year. Complete brood year specific estimates of escapement are available for the 1989 brood release of Carson stock hatchery spring chinook salmon.

Preliminary estimates of post-release survival from smolt-to-adult return to the Powerdale Dam trap indicate that survival may be fairly low for subbasin hatchery production (Table 37). Data indicates that the post-release survival rate back to the Powerdale Dam trap is probably averaging somewhere around 0.18% and. when adjusted for fisheries below the dam (exploitation rate was assumed to be at least 30%). will average somewhere around 0.26% back to the mouth of the Hood River. Estimates of post-release survival ranged from 0.78% to 2.39% and averaged 1.63% back to the mouth of the Deschutes River for the 1979-83 brood releases of slow incubated Pelton ladder releases of yearling Deschutes stock hatchery spring chinook salmon in the Deschutes River subbasin (Lindsay et al. 1989). Not only is post-release survival back to the mouth of the Hood River markedly lower than in the Deschutes River subbasin. but the difference would probably be more profound if estimated survival rates to the Deschutes River were adjusted to account for mortality between the mouth of the Hood and Deschutes river subbasins. Post-release survival back to the Deschutes River subbasin is subject to any mortality associated with (1) mainstem Columbia River fisheries located between the mouth of the Hood and Deschutes rivers. and (2) the negotiation of one additional dam (i.e.. The Dalles Dam).

Low post-release survival is believed to be the result of a high stress-related mortality that occurs shortly after smolts are released in the subbasin. It is anticipated that post-release survival rates can be improved significantly by acclimating hatchery smolts for one tc four weeks prior to release in the subbasin. Acclimation facilities will be developed at selected sites in the subbasin upon full inplementation of the HRPP.

Age Composition. Size, and Sex Ratio

Scale analysis indicates that naturally produced spring chinook salmon primarily migrate as subyearling smolts and return as four year old adults (Table 38). 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. This assessment is based on the fact that no known wild or naturally produced populations of spring chinook salmon in Oregon subbasins. located above Bonneville Dam. exhibit this life history pattern. Juvenile spring chinook salmon in the Deschutes. John Day. Grande Ronde. and Imnaha river subbasins predominately migrate as yearling smolts (Olsen et al. 1994). Because of this unique life history pattern. it was initially hypotnesized that scale analysis may have mis-classified either stray hatchery spring chinook saimon or wild fall chinook salmon as naturally produced spring run fish (Olsen et al. 1994). Data collected in 1994 at the mainstem migrant trap (see METHODS. Juvenile Production) indicates that our initial analysis of adult scales may accurately depict the juvenile life history pattern for the naturally produced population (see JUVENILE CHINOOK SALMON. Natural Production). The mainstem migrant trap was operatea from March through October to estimate numbers of downstream migrants and the temporal distribution of migration. Although Juvenile chinook salmon were sampled throughout the entire sampling period, the greater percentage of the population passed the migrant trap during the fall. Whether fall migrants were subyearling spring chinook salmon smolts is unknown. but it uculc tend to corroborate the juvenile life history pattern identified from Jack and adult scale analysis.

What mechanism might cause naturally produced spring chinook salmon to migrate as subyearling smolts in the Hood River subbasin is unknown. This unique life history pattern could be the result of a combination of environmental and biological factors. One proposed hypothesis is that progeny of Carson stock spring chinook salmon may not be genetically suited for either the physical or environmental conditions that exist in the Hood River subbasin.

The Carson stock of spring chinook salmon was originally developed from hatchery broodstock collected at Bonneville Dam. The hatchery program was implemented at Carson National Fish Hatchery (CNFH). which is located in the Wind River. Washington. Jack and adult returns to CNFH have provided the basis for maintaining the hatchery program in the Wind River subbasin (Howell et al. 1985). An analysis of scale samples collected from naturally produced progeny of Carson stock spring chinook salmon in the Wind River show the typical yearling smolt life history pattern (personal communication on 12/30/94 with Wolf Dammers. Washington Department of Fish and Wildlife). While naturally produced progeny of Carson stock spring chinook salmon in the Wind River subbasin do not have a subyearling smolt life history pattern. there is some question as tc how the Carson stock will adapt to conditions in the Hood River subbasin. It was determiner! that the Hood and Wind river subbasins were sufficiently dissimilar both geographically and environmentally to warrant replacing the Carson stock with the Deschutes stock of spring chinook salmon. The decision to use the Deschutes stock was primarily based on the geographic proximity between the Hood and Deschutes river subbasins and the fact that the Deschutes stock has historically performed well in the Ceschutes River subbasin.

How progeny of Deschutes stock hatchery spring chinook salmon will ultimately adapt to the Hood River subbasin is unknown. A subyearling smolt life history pattern might occur in naturally produced progeny of Deschutes stock hatchery spring chinook salmon. but it is not anticipated. Almost all wild jack and adult spring chinook salmon in the Deschutes River subbasin had a yearling smolt life history pattern (Lindsay et al. 1989). The fact that natural juvenile spring chinook salmon currently appear to be exhibiting a subyearling smolt life history pattern in the Hood River subbasin potentially may be an artifact of using Carson stock spring chinook salmon as hatchery broodstock rather than any environmental or physical factors that are unique to the subbasin. Eliminating any potential genetic risks associated with having used the Carson stock as hatchery broodstock could easily be achieved by blocking several run years of naturally produced fish from passing above Powerdale Dam. Implementation of this program will effectively eliminate all Carson stock genes from the natural population and would ensure that the subbasin's natural population would be predominately the result of Deschutes stock hatchery production releases in the subbasin.

Mean fork length of natural adult spring chinook salmon that migrated as yearling smolts ranged from 72 cm to 87 cm for age-4 adults and 79 cm to 88 cm for age-5 adults (Tables 39-42). Mean fork length for subbasin hatchery produced jack and adult spring chinook salmon ranged from 52 cm to 56 cm for age-3 adults. 74 cm to 83 cm for age-4 adults. and 82 cm to 89 cm for age-5 adults (Tables 39-42).

Mean weight of natural adult spring chinook salmon that migrated as yearling smolts was 4.9 kg for age-4 adults and 6.2 kg for age-5 adults (Table 43). Mean weight for subbasin hatchery jack and adult spring chinook salmon was 1.6 kg for age-3 adults. 5.3 kg for age-4 adults. and 6.7 kg for age-5 adults (Table 43).

Sex ratio as a percentage of females varied widely for age-4 and age-5 adult spring chinook salmon (Table 44). Age-4 and older natural and hatchery adults returned mostly as females (Table 44).

Spatial Distribution

Twenty-seven unmarked adult spring chinook salmon. randomly selected from throughout the 1994 run year, were tagged with radio transmitters. Six radio-tagged spring chinook salmon remained in the mainstem Hood River throughout the sampling period (Figures 37-44). A total of 18 spring chinook salmon moved into the WFk Hood River. one into the lower EFk Hood River. and two tagged fish were never found. Scale analysis identified three of the radio-tagged spring chinook salmon as naturally produced adults and 23 as subbasin hatchery produced adults. One unmarked spring chinook salmon had a regenerated scale and could not be identified as either a natural or hatchery adult. Two of the natural spring chinook salmon moved into the WFk Hood River and the third into the EFk Hood River to approximately RM 1.0.

JACK AND ADULT COHO SALMON

Higration Timing

In the 1992 run year. natural coho salmon entered the Powerdale Dam trap in the first two weeks of September (Table 45). No natural coho salmon were recovered in the 1993 run year and only one natural coho salmon was recovered in 1994 (Table 45). The median date of migration for natural coho salmon occurred in the last two weeks of September and migration was completed by early November in 1992 (Table 45). The early entry time of natural coho salmon suggests returns may be progeny of hatchery strays. Oregon's coastal stocks of wild coho salmon. as well as those in the Clackamas River subbasin. do not enter fresh water until about early to late October, and their peak migration does not occur until around November through January (telephone communication on 11/18/93 with A. McGie. ODFW. Corvallis. Oregon). 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

For the 1992-94 run years, estimates of coho salmon escapement ranged from 0-22 natural and from 32-81 stray hatchery fish (Table 46).

Age composition, Size, and Sex Ratio

All natural coho salmon returned as adults (Table 47). Mean fork length was 58 cm for natural adult coho salmon in the 1992 run year (1989 brood: Tables 48 and 49). Mean fork length for stray hatchery jack and adult coho salmon ranged from 38 cm to 39 cm and from 58 cm to 64 cm. respectively. Mean weight for stray hatchery jack and adult coho salmon was 0.7 kg and 3.7 kg. respectively (Table 50). Sex ratio as a percentage of females was 64% for natural adult coho salmon in the 1992 run year (1989 brood: Table 51).

HATCHERY PRODUCTION

Production Releases

Numbers of hatchery steelhead smolts released into the Hood River subbasin ranged from 70.928 to 99.973 summer steelhead and from 4.595 tc 48.985 winter steelhead for the 1987-93 broods (Tables 52 and 53). There were 90.042 summer and 38.034 winter steelhead from the 1993 brood released into the Hood River subbasin in 1994. Numbers of hatchery spring chinook salmon smolts released into the Hood River subbasin ranged from 75.205 to 197.988 smolts for the 1986-91 broods (Table 54). No spring chinook salmon smolts were released into the Hood River subbasin in 1994. A malfunction in the chillers killed most of the 1992 brood hatchery spring chinook salmon production at Round Butte Hatchery (RBH). As a consequence. Round Butte Hatchery could not meet both its mitigation goal for the Deschutes River and still implement the hatchery program for the Hood River subbasin. Hatchery spring chinook salmon production programmed fcr the Hood River subbasin was. therefore. reallocated to the Deschutes River subbasin. The spring chinook salmon hatchery production program in the Hood Giver subbasin will be continued in 1995 with release of the 1993 brood.

All hatchery fish are released into the Hood River subbasin as full term smolts. Target production goals for the current hatchery program in the Hood River subbasin are 60.000 Foster stock summer steeihead. 30.000 Hood River stock winter steelhead. and 125.000 Deschutes stock spring chinook salmon snolts. Target production goals for both summer steelhead and spring chinook salmon have typically been achieved or exceeded. Hatchery summer and winter steelhead are reared at Oak Springs hatchery and hatchery spring chinook salmon are reared at Bonneville Hatchery. Bonneville Hatchery will be used to rear hatchery spring chinook salmon until Pelton ladder facilities are fully operational. All hatchery spring chinook salmon destined for release in the Hood River subbasin will then be reared in Pelton ladder prior to release in the Hood River subbasin. It is anticipated that construction of the Pelton ladder facilities will be completed prior to September 1995 (see ENGINEERING. Powerdale Dam).

The Hood River Production Program wili initially collect hatchery spring chinook salmon broodstock from Deschutes stock hatchery jacks and adults returning to Pelton trap. Pelton trap is located at the base of Pelton re-regulating dam (RM 100). on the Deschutes River. and is operated by RBH. Round Butte Hatchery is a Portland General Electric (PGE) funded hatchery facility operated by the ODFW to mitigate for hydroelectric caused losses in the Deschutes River subbasin. The hatchery's first priority is to collect the hatchery broodstock needed to achieve mitigation goals in the Deschutes River. Because the HRPP has a lower priority. it may not always be possible to achieve the hatchery production goal for the Hood River subbasin. The ability tc achieve the HRPP's spring chinook salmon production goal for the Hood River subbasin will primarily be dependent on the number of jack and adult returns tc Peiton trap. The inability tc achieve the spring chinook salmon production goals for both hatchery programs was a problem for both the 1991 and 1992 brood releases.

Returns to Pelton trap were insufficient in 1991 to achieve the hatchery production goals for both the Hood and Deschutes river subbasins. For RBH to achieve its mitigation goal for the Deschutes River subbasin. it was necessary to reallocate some of the 1991 brood release targeted for the Hood River subbasin to the Deschutes River subbasin. In 1992. jack and adult returns to Pelton trap were sufficient to achieve hatchery production goals for both subbasins until the mishap at RBH. Again, for the hatchery to fulfill mitigation requirements for the 1992 brood release in tne Deschutes River subbasin. it was necessary to reallocate all of the Hood River subbasin hatchery production to the Deschutes River subbasin.

The ability to achieve the hatchery production goal in the Hood River subbasin will remain uncertain as long as it is necessary to collect hatchery broodstock entirely from the Deschutes River subbasin. Upon completion of the adult collection facility in the Hood River subbasir. and fuil implementation of the HRPP. all hatchery broodstock will ultimately be collected at the Powerdale Dam trap. Returns tc the Powerdale Dam trap should be sufficient tc achieve the target production goal of the HRPP on an annual basis.

The current hatchery production goal for Hood River stock winter steelhead is 30.000 smoits. This goal was exceeded for the 1992 and 1993 brood releases. The hatchery program fell far short cf tne target production goal for the 1991 brood release. The target production goal for the 1991 brood release was missed because of a high pre-spawning mortality rate attributed to poor water quality at the adult holding facility located in a tributary to Neal Creek. The facility in Neal Creek was replaced with a facility located in Rogers Spring Creek. a tributary to the Middle Fork of the Hood River. Pre-spawning mortality has not been a problem at the new site.

The fertilization rate for wild winter steelhead used for hatchery broodstock was markedly lower in 1994 than in previous years (i.e.. 1991-93). What may have caused the low fertilization rate is unknown. The hatchery program is being reviewed and several modifications in the methodology for collecting and spawning winter steelheaa have been discussed. The approach currently taken is to collect hatchery broodstock at random from throughout the entire run. To ensure that the entire run is represented in the hatchery broodstock. twice the necessary broodstock needed to meet the production goal is collected at the Powerdale Dam trap. When one fish is collected for hatchery broodstock. a second is also collected as a backup. After the first fish is successfully spawned. the backup fish is released above Powerdale Dam. If a low fertilization rate continues to be a chronic probiem. it may be necessary tc hold the second fish to supplement egg take from the first fish. The second fish would be spawned if the fertilization rate for the first fish does not achieve a predefined level. This approach will ensure that both the hatchery production goal. and the objective cf representing the entire run in the hatchery broodstock. are achieved.

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. An estimated 38,262 summer and 12,201 winter steelhead smolts passed the mainstem migrant trap during the sampling period (Table 553. Estimates represent 42.5% and 32.1% of the total hatchery summer and winter steelhead production releases. respectively. The disposition of hatchery production that did rot migrate past the mainstem migrant trap is unclear. There is evidence to indicate that at least some of the hatchery steelhead production may remain (i.e.. residualize) in the subbasin for an additional year prior to migration as smolts. Residualized hatchery juveniles were caught in the migrant traps (one known hatchery summer steelhead in the West Fork migrant trap). and hatchery juvenile summer and winter steelhead were caught at various sites in the subbasin (*see* JUVENILE RAINBOW-STEELHEAD. Natural Production:. The latest recovery was a hatchery juvenile summer steelhead sampled on 22 September 1994 in Lake Branch. a tributary to the West Fork Hood River.

Life history patterns identified on adult hatchery steelhead scales indicate that juvenile hatchery steelhead that do not successfully migrate in the year of release likely either (1) die shortly after release as smolts due to stress related mortality: (2) remain in the subbasin to compete with indigenous populations through the fall but fail to survive through the winter: or (3) residualize and remain as a resident fish in the subbasin. This assumption is based on the fact that no adult hatchery summer steelhead. and a highly variable percentage of adult hatchery winter steelhead. have been observed with a freshwater age-2 life history pattern. In the case of hatchery winter steelhead. it appears that overwinter survivai may be one of the primary limiting factors that determine the number of residualized hatchery juveniles that survive to migrate as smolts.

An estimate of the number of hatchery steelhead that remain to compete with indigenous populations of fish cannot be determined at this time. Numbers are believed to be low based on a qualitative assessment of the health of downstream migrant hatchery steelhead smolts sampled at each of the migrant traps. A small percentage of the hatchery juvenile summer steelhead were observed with deformed opercles. whichwould indicate they were probably not what would typically be considered a healthy smolt. It also appeared that both the summer and winter steelhead hatchery smolts were more susceptible to stress associated with trapping and handling than here the wild steelhead smolts. Hatchery steelhead were periodically found dead in the migrant trap and several died shortly after being counted and live-boxed. Few wild juvenile steelhead were found dead in the migrant trap and sampling mortality was also low. This would indicate that hatchery juveniles may be at or near their level of tolerance for stress and that any additional stress significantly increased the probability of mortality. Based on these observations. it uould appear that post-release survival for the hatchery production releases may be fairly low.

While the extent to which hatchery steelhead may be competing with indigenous populations of fish is unknown. it is likely that the problem may only be exacerbated by proposed hatchery guidelines. The hatchery steelhead program has historically graded out the smaller juveniles from the production group so that only smolt-sized juveniles are released into the subbasin. Guidelines established for the HRPP currently propose discontinuing this practice and replacing it with a program for releasing all of the hatchery steelhead production into the subbasin (see HATCHERY PROOUCTION. Size and Weight). Release of pre-smolt-sized steelhead will likely increase the potential that some hatchery juveniles will remain in the subbasin to compete with indigenous populations of fish. Future hatchery guidelines will need to be established to minimize any potential impact. Potential scenarios include the following proposed actions: (1) the volitional release of smolts from acclimation facilities and the removal of non-migrants. (2) the volitional release of smolts from acclimation facilities and the rearing of non-migrants an additional year prior to release as two year old smolts. and (3) the volitional release of smolts from acclimation facilities and the release of non-migrants in the lower mainstem Hood River.

Size and Weight

Mean length. weight. and condition factor were estimated for small-. medium-. and large-sized groups of Hood River stock hatchery winter steelhead reared at Oak Springs Hatchery. The small-sized group of fish were all progeny of the last hatchery production spawning or 9 June 1993. Juveniies in the small-sized group were reared in a small circular pond at Oak Springs Hatchery (OSH). The rest of the hatchery production was graded into medium- and large-sized groups prior to tagging in late October. Each size group was reared in a separate raceway at OSH. Hatchery winter steelhead production was segregated into medium- and large-sized groups to facilitate coded-wire tagging and to provide hatchery personnel the ability to implement a modified feeding schedule targeting the smaller sized juveniles in the production group. The modified feeding schedule was designed to accelerate the growth of smaller juveniles so that the ungraded production group would be more uniformly smolt-sized upon release in the subbasin.

Mean fork length ranged from 184-200 mm for the three size groups (Table 56). The high degree of variation in size. both within and among groups. is in part an artifact of the time of spawning. Broodstock is currently collected from throughout the run and juveniles from later spawned fish have a progressively shorter period of growth prior to ponding. In particular. the small group of fish were progeny of hatchery broodstock spawned late in the year. The fact that mean fork length was even closely similar between each size group was primarily due to adjustments made in feeding schedules and time of release. Small- and medium-sized groups were both placed on an increased feeding schedule. The small-sized group was also not released until late June to get the juveniles closer to a more typical smolt size.

Mean weight ranged from 69.5 gm to 91.1 gm and mean condition factor from 1.06 to 1.15. Mean condition factor for hatchery steelhead product-on was consistently higher than for downstream migrant freshwater age-1 through age-3 wild rainbow-steelhead sampled at the mainstem migrant trap (*see* JUVENILE RAINBOW-STEELHEAD. Size and Weight). Estimates of mean condition factor for freshwater age-1 through age-3 wild rainbow-steelhead ranged from 0.96 to 1.02 (Table 7). Length x weight regressions for each size group of hatchery winter steelhead are presented in Figure 45.

ENGINEERING

Power-dale Dam

The final design for the proposed Powerdale Dam fish facilities are 90% complete. Copies cf the engineering drawings were provided for review to representatives from BPA (Jay Marcotte and Jerry Bauer). the Confederated Tribes of the Warm Springs Reservation (Jim Griggs and Patty O'Toole). National Marine Fisheries Service (Steve Rainey). Pacificorp (Mark Sturtevant). and the ODFW. Drawings included an itemized list of design changes that were made after the 60% drawings were distributed for review. An itemized list of proposed project design changes were deveioped during initial review of the current drawings. These design changes have not beer incorporated into the current drawings.

Work is progressing on the preparation of project bid documents. It is anticipated that if the current schedule is met. construction of the Powerdale Dam fish facilities will begin in September 1995. Any delay in the acquisition of an easement fcr an access road could impact the current construction schedule for the fish facility.

Access Road

The proposed access road to the site of the proposed Powerdale Dam fish facility is in the final design stage. The proposed road alignment between Highway 35 and the edge of the Hood River canyon was modified during initial layout at the request of the affected landowner. The realignment was designed to minimize potential impacts to the adjacent orchard. The new route for the access road will skirt the outer fringe of the orchard rather than pass through the middle of the orchard. The next step in the development of the access road will be to receive final concurrence from affected landowners and proceed with acquiring an easement fcr the access road. It is anticipated that if the current schedule is met. road construction will begin in June 1995. Any delay in the acquisition of the road easement could have a ripple effect that would impact the proposed schedule for construction of both the access road and the Powerdale Dam fish facility.

Pelton Ladder

The Pelton ladder component cf the Hood River/Pelton ladder project provides for the construction of additional rearing facilities in Pelton ladder. The Pelton ladder project provides funding to construct three new cells for finish rearing hatchery spring chinook salmon in Pelton ladder prior to release as smolts in the Hood River subbasin. The new cells would be located above three existing cells that are used to finish rear hatchery spring chinook salmon prior to release as smolts in the Deschutes River subbasin. During the initial stages of the HRPP. hatchery spring chinook salmon reared in the upper new cell would be used for evaluating any impact the new hatchery facilities have on the existing hatchery program in Pelton ladder. The lower two new cells would be used to begin implementing the HRPP. Experimental groups would be released from the upper cell for three to five years after which time the upper cell would then be used to rear hatchery spring chinook salmon for release in the Hood River subbasin. During the evaluation phase of the Pelton ladder project. approximately 125.000 hatchery spring chinook salmon would be reared in the lower two cells and 93.000 hatchery spring chinook salmon would be reared in the upper cell. upon full implementation of the HRPP. the three new cells would be used to rear approximately 250.000 hatchery spring chinook salmon for release as smolts in the Hood River subbasin.

Modifications to Pelton ladder are near completion with the primary exception of each cell's rotary screens. which are scheduled to be fabricated and installed in Pelton ladder in FY 95. The only other minor modification required is tne installation of bird screens.

The purchase and installation of emergency pumps in Pelton ladder is currently under negotiation: it is unknown whether they will be installed in FY 95.

Hatchery broodstock was collected at Pelton trap from the 1994 run of spring chinook salmon in anticipation that the new production facilities in Pelton ladder would be fully functional in FY 95. The Hood River Production Program proposes utilizing one of the newly constructed cells to rear an experimental study group for release in the Deschutes River subbasin. The study group hill be used to evaluate how size at time of release affects post-release survival. Comparisons will be made against post-release survival rates for juvenile hatchery fish reared in the lower three cells of Pelton ladder. The lower three cells are used to rear hatchery spring chinook salmon production destined for release in tie Deschutes R-ver subbasin. The experimental study group of hatchery spring chinook salmon will initially be reared at Round Butte Hatchery and transferred tc Pelton ladder in November 1995 if modifications to the ladder are ccmpletec on time. It is anticipated. that when transferred from Round Butte Hatchery to Pelton ladder. the experimental study group will be comprised of approximately 93.000 juvenile hatchery spring chinook salmon at a size of 12 fish to the pound. Hatchery production in the lower three cells will be released at a size of eight fish to the pound.

HABITAT

Surveys

Habitat surveys were conducted on selected reaches of stream in the Hood River subbasin (Figure 46). Surveys were primarily conducted on private lands. but included approximately 7.5 miles of upper Lake Branch. which is located on lands managed by the Mount Hood National Forest (MHNF: Figures 2 and 46). Oniy those reaches of stream potentially accessible to anadromous salmonids were surveyed in FY 94. Habitat surveys conducted in FY 94 were designed to provide quantitative information on the condition of stream habitat on private lands. All anadronous salmonid bearing streams located on national forest lands were previously surveyed by the MHNF. Data collected on both public and private lands will be summarized in FY 95.

Habitat stream inventory data will be used to evaluate the relative condition of anadromous salmonid habitat in the Hood River subbasin. Data will be summarized in conjunction with the natural production data (see JUVENILE RAINBOW-STEELHEAD. Natural Production: JUVENILE CHINOOK SALMON. Natural Production: CUTTHROAT TROUT, Natural Production) to estimate carrying capacity for the Hood River subbasin. Subbasin carrying capacity wiil be estimated in FY 95 using either the Northwest Power Planning Council's Tributary Parameters Model or some other similar computer model.

Instream Water Rights

The Oregon Water Resources Department (OWRD) holds an instream water right on the East Fork Hood River in trust for the people of Oregon. This instream water right was granted for the purpose of supporting aquatic life and minimizing pollution. The instream water right 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 (Table 57).

No permanent gaging station exists at the site of the instream water right measuring point to determine if the instream water right is being met. Observations made in past years indicated that the instream water right was probably not being met during certain times of the year. A gaging station was installed in 1992 by the OWRD and jointly monitored by both the OWRD and the ODFW on a periodic schedule from 1992 through 1994. Data collected to date indicates that the instream water right is not being met at least during periods when the gaging station was monitored (Figure 47). Full benefits associated with the HRPP may not be completely realized unless the instream water right is met.

GENETICS

Resident and anadromous salmonids were sampled at selected sites in the Hood River subbasin (Table 58) to collect tissue. organ. and fin samples for electrophoretic and mtDNA analysis. Final samples needed for genetic analysis will be collected in FY 95. Samples will be analyzed in FY 95 and FY 96. Information will be used to characterize and identify populations of rainbow-steelhead and cutthroat trout in the Hood River subbasin.

SUMMARY

This report summarizes the life history and production data collected in the Hood River subbasin through FY94. Included is a summary of jack and adult life history data collected at the Powerdale Dam trap on three complete run years of winter steelhead. spring chinook salmon, and coho salmon and on two complete run years of summer steelhead. Also included are summaries of the spatial distribution of radio-tagged adult summer and winter steelhead and spring chinook salmon and the life history and production data on rearing populations of resident and anadromous salmonids. The data will be used as baseline information for (1) evaluating the HRFP. (2) evaluating the HRPP's impact on indigenous populations of resident and anadromous salmonids. and (3) preparing an EIS. 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.

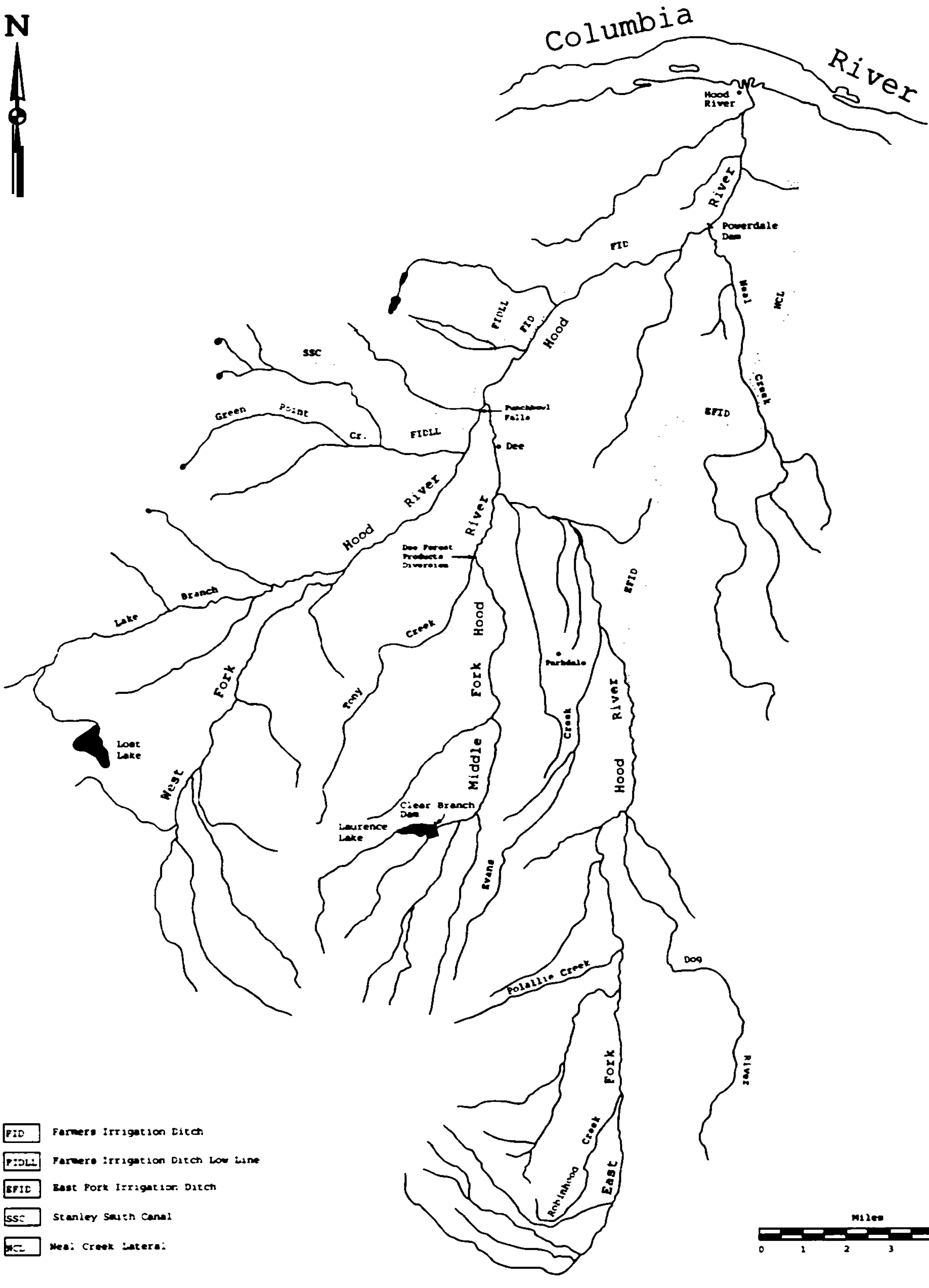


Figure 1. Map of the Hood River subbasin.

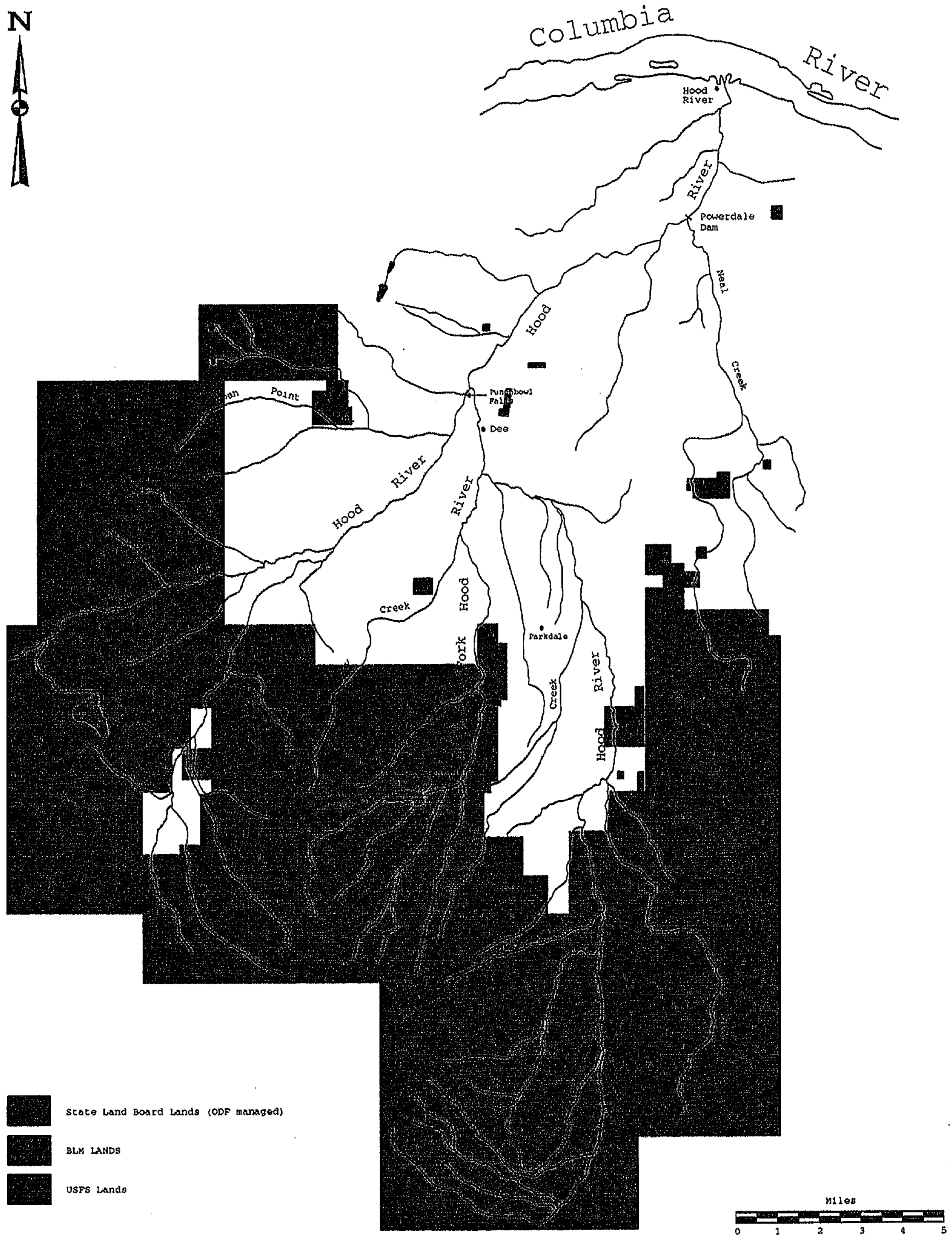


Figure 2. Location of public lands in the Hood River subbasin.

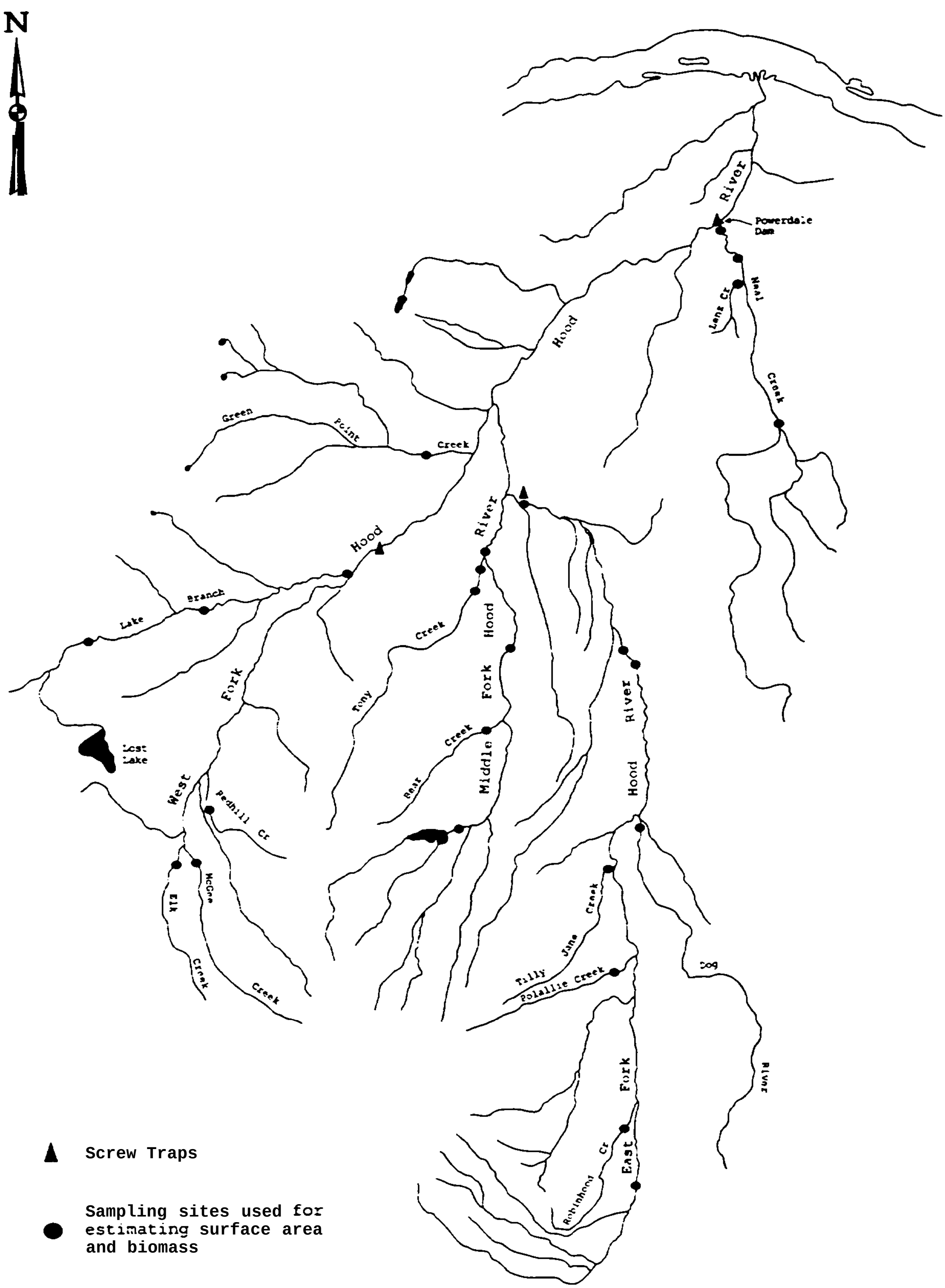


Figure 3. Location of sampling sites in the Hood River subbasin

Table 1. Estimates of surface area ($m^2/100$ m), density (fish/1000 m^2), and blanass (grams/100m^2) for both salmonids[a] and non-salmonids[a] sampled at selected sites in the Hood River subbasin, 1994. (Estimates for hatchery produced steelhead are in parentheses. Sampling dates, reach lengths, and removal numbers for each pass are presented in Appendix Tables A-1 and A-2 for rb-st and cutthroat trout.)

Location, sampling area	River mile	m^2/100 m	Fish/1000 m^2 ChSp	Rb-St <85mm	Rb-St >=85mm	Cutthroat <85mm	Cutthroat >=85mm	Coho	Brook trout	Cot	Total	Grams/100 m^2 ChSp	Rb-St	Ct	Coho	Brook trout	Cot	Total
Mainstem,																		
Neal Cr	0.2	679.6	..	--	--	--	--	--	--	--	--	--	--	--	--	..	--	--
Neal Cr	1.5	507.0	0	20	68(9)	0	0	85	0	2.456	2,629	0	246(124)	0	90	0	709	1.045
Neal Cr	5.0	493.1	0	297	122(7)	0	3	0	0	544	966	0	285(--)	14	0	0	253	552
Lent Cr	0.5	252.2	0	0	7	0	0	7	0	0	14	0	23	0	10	0	0	33
West Fork,																		
Greenpoint Cr	1.0	972.6	0	346	285	0	0	0	0	207	838	0	745	0	0	0	201	946
Lake Branch	0.2	1.294.7	0	397	142(1)	0	0	0	0	1.237	1.777	0	429(14)	0	0	0	829	1.258
Lake Branch	4.0	1.200.3	0	23[b]	100	0	0	0	0	861	984	0	352	0	0	0	703	1.055
Lake Branch	7.0	702.7	0	31	38	0	0	0	21	892	982	0	87	0	0	31	389	507
Red Hill Cr	1.0	341.6	0	34[b]	73	0	0	0	0	0	107	0	260	0	0	0	0	260
McGee Cr	0.5	720.7	0	50	80	0	0	0	0	62	192	0	157	0	0	0	49	206
Elk Cr	0.5	600.3	15	46	58	0	0	0	0	135	254	8	204	0	0	0	96	308
Middle Fork,																		
MFk HDR	1.8	044.0		—	--	--	--	—	--	--	--	..	--	--	--	—	..	—
MFk HDR	4.5	992.9	0	45	22	0	0	0	0	64	131	0	79	0	0	0	35	114
MFk HDR	9.5	795.0		—	--	--	--	..	--	—	—		--	--	—	--	--	..
Tony Creek	0.7	551.7	--	--	--	—	--	--	—	—	--	--	—	--	--	--	--	--
Tony Creek	1.0	595.9	0	17	53	40	84	0	0	199	401	0	113	161	0	0	117	391
Bear Cr[c]	0.6	645.4	0	0	0	55	224	0	0	0	279	0	0	372	0	0	0	372
East Fork,																		
EFk HDR[d]	0.5	1.337.1	1[e]	80	89(4)	9	1	1	0	188	369	1[e]	338(46)	6	1	0	125	471
EFk HDR[d]	5.5	707.1	0	198	45(5)	0	0	0	0	509	752	0	179(24)	0	0	0	414	593
EFk HDR	5.9	1.475.0	--	—	--	—	..	--	—	--	—		—	..	--	—	..	--
EFk HDR	20.2	887.0	0	0	2	0	4	0	0	2	8	0	11	14	0	0	3	28
Dog River[c]	0.7	1.106.4	0	0	0	30	45	0	0	98	173	0	0	119	0	0	59	178
Tilly Jane Cr	0.1	420.5	0	0	0	40	111	0	16	404	571	0	0	167	0	2	279	440
Robinhood Cr	1.0	327.9	0	0	0	152	239	0	0	457	848	0	0	640	0	0	231	871

a ChSp = spring chinook, Rb-St = rainbow-steelhead, Cot = Cottid, Ct = cutthroat trout.

b Population estimates for the lower size category were determined by subtracting the estimate for the larger size category from the estimated total population.

c Population estimates for each size category of cutthroat trout were determined by multiplying the estimated total population by the ratio of each size category in the random length sample.

d Estimates of density and biomass for hatchery produced steelhead are based on total count. No population estimates were made for hatchery steelhead.

e May be a coho salmon mis-classified as a spring chinook salmon. This assumption is based on the fact that no juvenile spring chinook salmon were ever sampled in the East Fork migrant trap.

Table 2. Estimated number of downstream migrant rainbow-steelhead in the mainstem Rood River. by age category. (Estimate is for the period 23 March through 31 July 1994. Percent of total migrants is in parentheses.)

Location	Estimated number of migrants	95% C.I.	Estimated number by age category			
			Age 0	Age 1	Age 2	Age 3
Mainstem (RM 4.5)[a]	9.944	4.539 - 15.350	251 (2.5)	2.340 (23.5)	6.392 (64.3)	961 (9.7)

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

Table 3. Estimated number of steelhead smolts migrating from the Rood River subbasin. by age category. (Estimate is for the period 23 March through 31 July 1994. Percent of total migrants is in parentheses.)

Location	Estimated number ofsnolts	Freshwater age		
		Age 1	Age 2	Age 3
mainstem (RM 4.5)[a]	7.345	1.170 (15.9)	5.214 (71.0)	961 (13.1)

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

Table 4. Freshwater age structure (percent) of wild adult summer and winter steelhead sampled at the Powerdale Dan trap by race and run year. (Estimates do not include repeat spawners.)

Race. run year	N	Freshwater age			
		Age 1	Age 2	Age 3	Age 4
Sumner.					
1992-93	466	1.1	80.9	17.8	0.2
1993-94	228	1.3	73.7	25.0	0
Winter.					
1991-92	642	1.1	78.7	20.1	0.2
1992-93	375	2.1	88.0	9.9	0
1993-94	387	2.1	92.5	5.4	0

Table 5. Estimates of mean fork length (mm) and weight (gms) for rainbow-steelhead sampled at selected sites in the tbod River subbasin. 1994. (Sampling dates are in Appendix Table A-1.)

Location. sampling area	River mile	Fork length (mm)				Weight (gms)			
		N	Mean	Range	95% C.I.	N	Mean	Range	95% C.I.
Mainstem.									
Neal Cr	1.5	27	126.6	67-203	±16.0	27	28.2	3.7- 86.7	± 9.3
Neal Cr	5.0	105	74.3	42-165	± 6.0	104	7.1	0.8- 47.8	± 1.8
Lenz Cr	0.5	1	144	144	—	1	32.7	32.7	--
West Fork.									
Greenpoint Cr	1.0	212	97.6	44-215	± 4.4	212	13.6	1.1-101.7	± 2.1
Lake Branch	0.2	254	80.3	46-242	± 3.4	253	8.0	0.8-173.1	± 2.0
Lake Branch	4.0	57	140.2	70-285	±10.6	55	31.4	3.0-118.2	± 6.1
Lake Branch	7.0	18	88.9	38-209	±22.5	18	13.8	0.5- 96.0	ill.4
Red Hill Cr	1.0	15	124.4	81-205	61.3	15	29.2	5.7-109.4	i16.3
McGee Cr	0.5	48	90.9	51-197	± 8.9	48	11.9	1.7- 93.1	± 4.6
Elk Cr	0.5	27	85.4	35-228	±20.5	27	15.8	0.3-131.9	±11.5
Middle Fork.									
MFk HDR	4.5	25	92.4	58-176	±15.5	25	13.7	2.0- 60.2	± 6.4
Tony Creek	1.0	19	98.7	41-148	±19.0	19	14.7	1.0- 37.6	± 6.3
East Fork.									
EFk HDR	0.5	97	102.8	45-200	± 8.6	97	19.3	1.3- 86.7	± 4.5
EFk HDR	5.5	72	78.4	52-162	± 6.7	71	7.0	1.1- 38.1	± 2.2
EFk HDR	20.2	1	167	167	--	1	53.2	53.2	--

Table 6. Estimates of mean condition factor for rainbow-steelhead sampled at selected sites in the Hood River subbasin, 1994. (Sampling dates are in Appendix Table A-1.)

Location, sampling area	River mile	Condition factor[a]			
		N	Mean	Range	95% C.I.
Mainstem,					
Neal Cr	1.5	27	1.09	0.96-1.24	± 0.03
Neal Cr	5.0	104	1.14	0.83-2.32	± 0.04
Lenz Cr	0.5	1	1.10	1.10	--
West Fork,					
Greenpoint Cr	1.0	212	1.09	0.70-1.92	± 0.01
Lake Branch	0.2	253	1.05	0.61-1.69	± 0.01
Lake Branch	4.0	55	1.06	0.74-1.57	± 0.03
Lake Branch	7.0	18	1.01	0.77-1.25	± 0.06
Red Hill Cr	1.0	15	1.14	0.98-1.27	± 0.05
McGee Cr	0.5	48	1.14	0.97-1.42	± 0.03
Elk Cr	0.5	27	1.06	0.51-2.08	± 0.10
Middle Fork,					
MFk HDR	4.5	25	1.19	0.96-1.59	± 0.06
Tony Creek	1.0	19	1.06	0.83-1.45	± 0.07
East Fork,					
EFk HDR	0.5	97	1.16	0.75-1.65	± 0.02
EFk HDR	5.5	71	1.04	0.48-1.45	± 0.04
EFk HDR	20.2	1	1.14	1.14	--

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

Table 7. Estimates of mean fork length (mm). weight (gm). and condition factor (CF) for downstream migrant rainbow-steelhead. by age category and for the sample mean. Estimates are for rainbow-steelhead sampled fran 23 March through 31 July 1994 at the mainstem migrant trap.)

Statistic. age	N	Mean	Range	95% C.I
Fork length (mm).				
Age 0	6	78.3	67 - 107	± 15.6
Age 1	56	165.4	120 - 200	± 4.3
Age 2	153	180.3	129 - 221	± 2.4
Age 3	23	196.0	168 - 214	± 5.1
Total[a]	420	176.3	67 - 221	± 2.0
Weight (gms).				
Age 0	6	6.0	3.2 - 13.1	± 3.8
Age 1	44	43.8	21.1 - 69.8	± 3.3
Age 2	114	60.4	26.1 - 91.8	± 2.6
Age 3	17	76.9	46.7 - 100.9	± 7.9
Total[a]	283	56.3	3.2 - 100.9	± 2.1
CF.[b]				
Age 0	6	1.17	1.06 - 1.42	± 0.14
Age 1	44	0.96	0.75 - 1.22	± 0.03
Age 2	114	1.02	0.83 - 1.46	± 0.02
Age 3	17	1.00	0.82 - 1.27	± 0.06
Total[a]	283	1.01	0.75 - 1.46	± 0.01

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

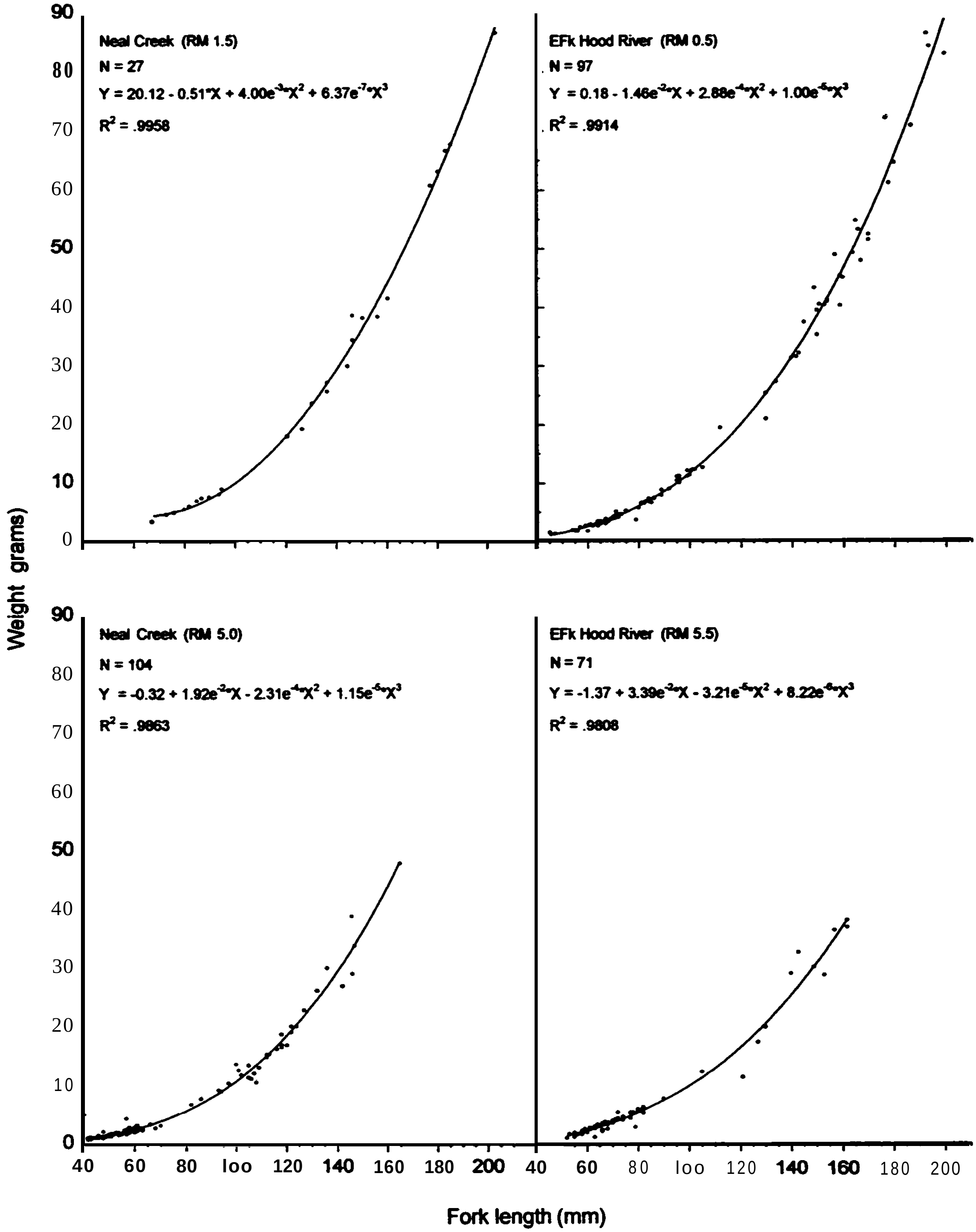


Figure 4. Length x weight regression of rainbow-steelhead sampled at selected sites in Neal Creek and the East Fork (EFk) Hood River. 1994.

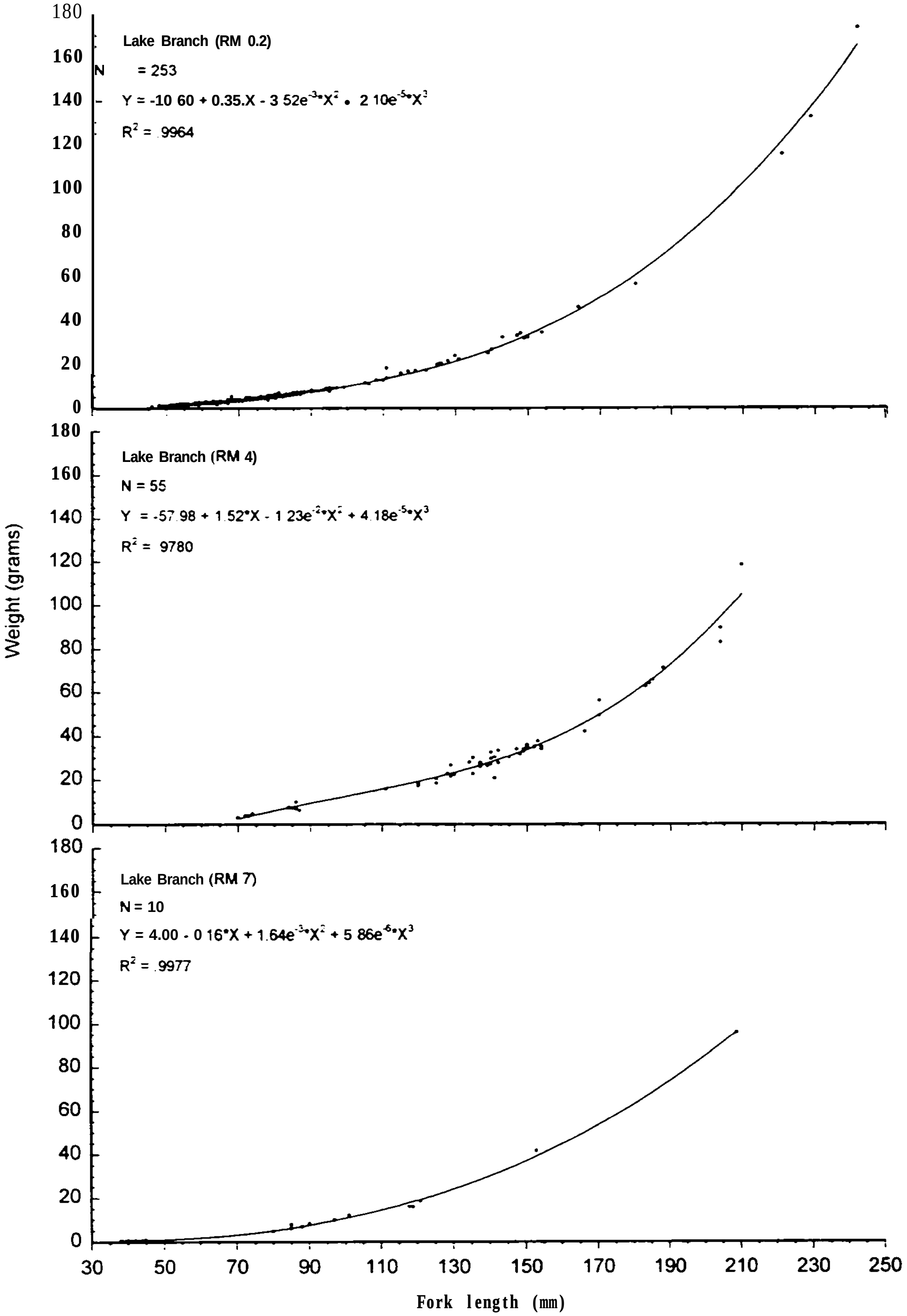


Figure 5. Length x weight regression of rainbow-steelhead sampled at selected sites in Lake Branch, 1994.

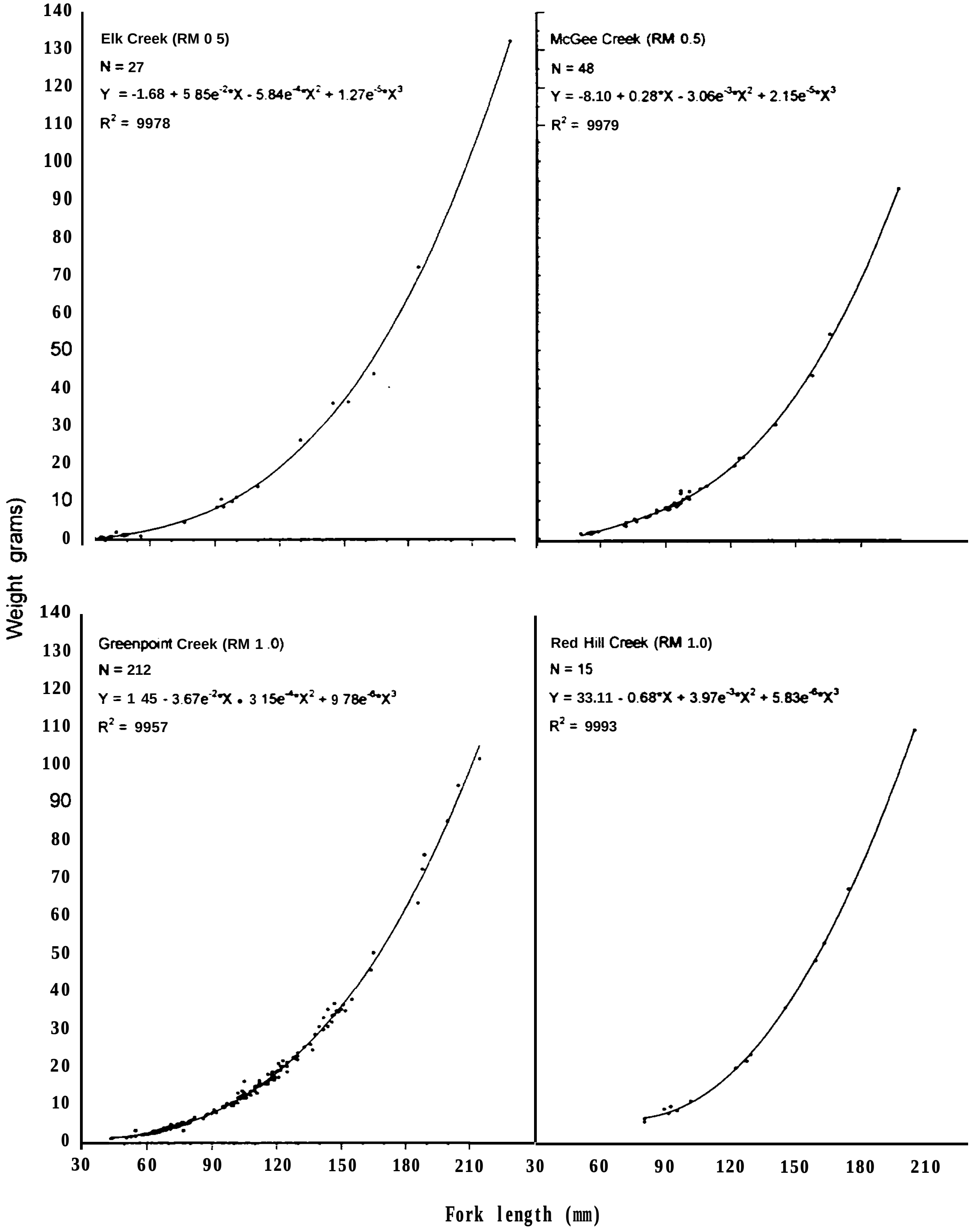


Figure 6. Length x weight regression of rainbow-steelhead sampled at selected sites in Elk, McGee. Greenpoint, and Red Hill creeks. 1994.

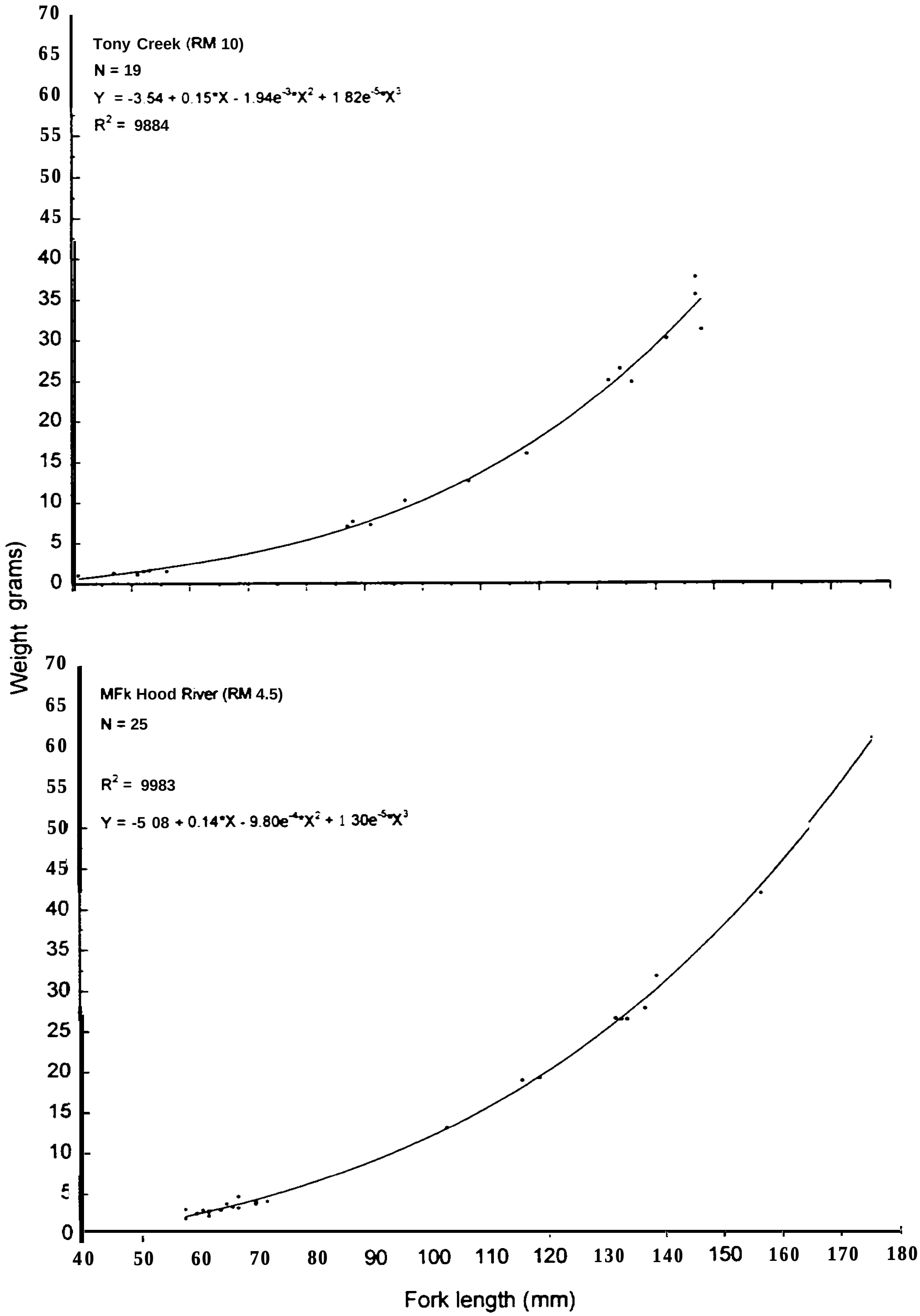


Figure 7. Length x weight regression of rainbow-steelhead sampled at selected sites in Tony Creek and the Middle Fork (MFk) Hood River, 1994.

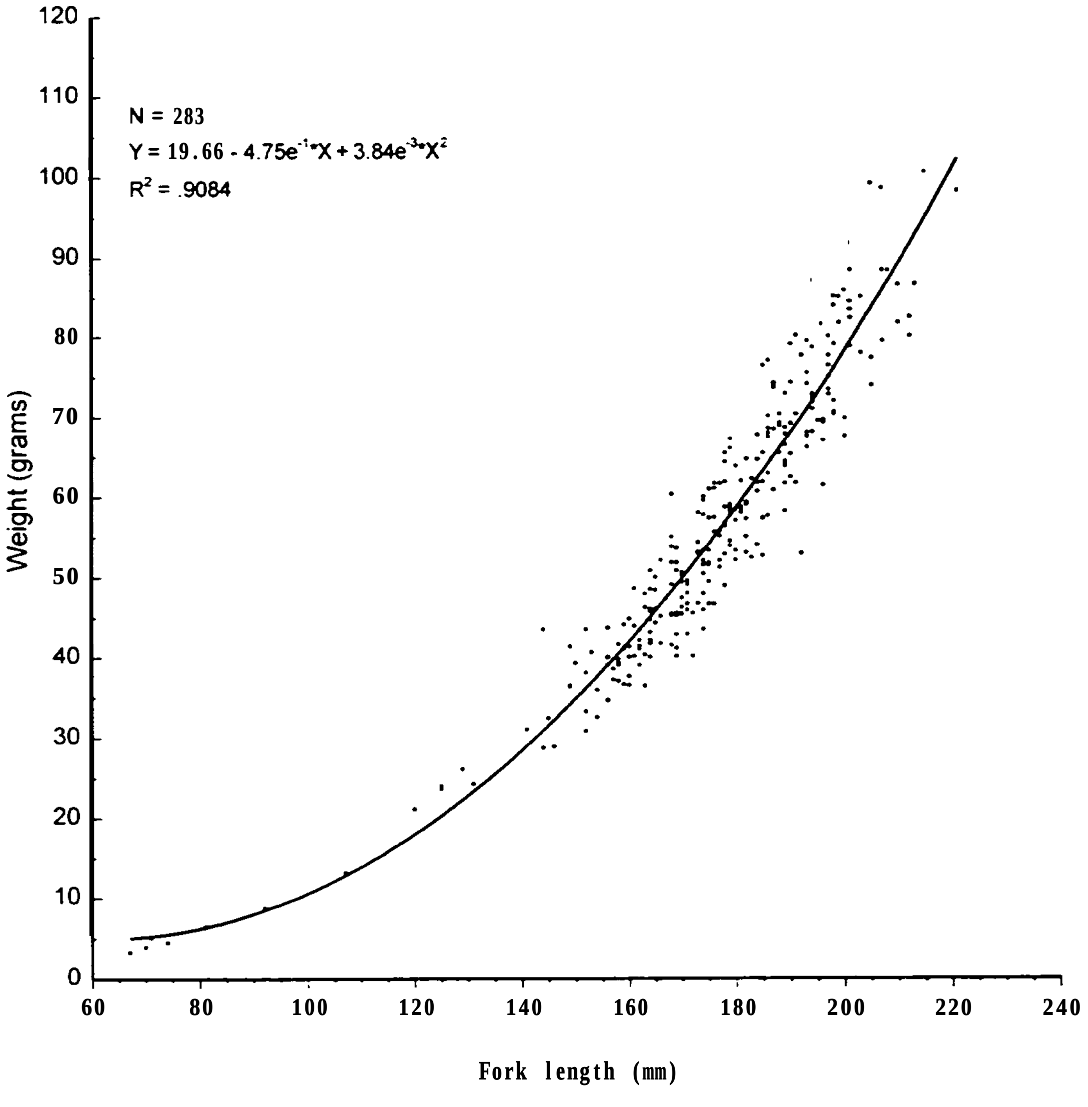


Figure 8. Length x weight regression of downstream migrant rainbow-steelhead sampled from 23 March through 31 July 1994 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River.

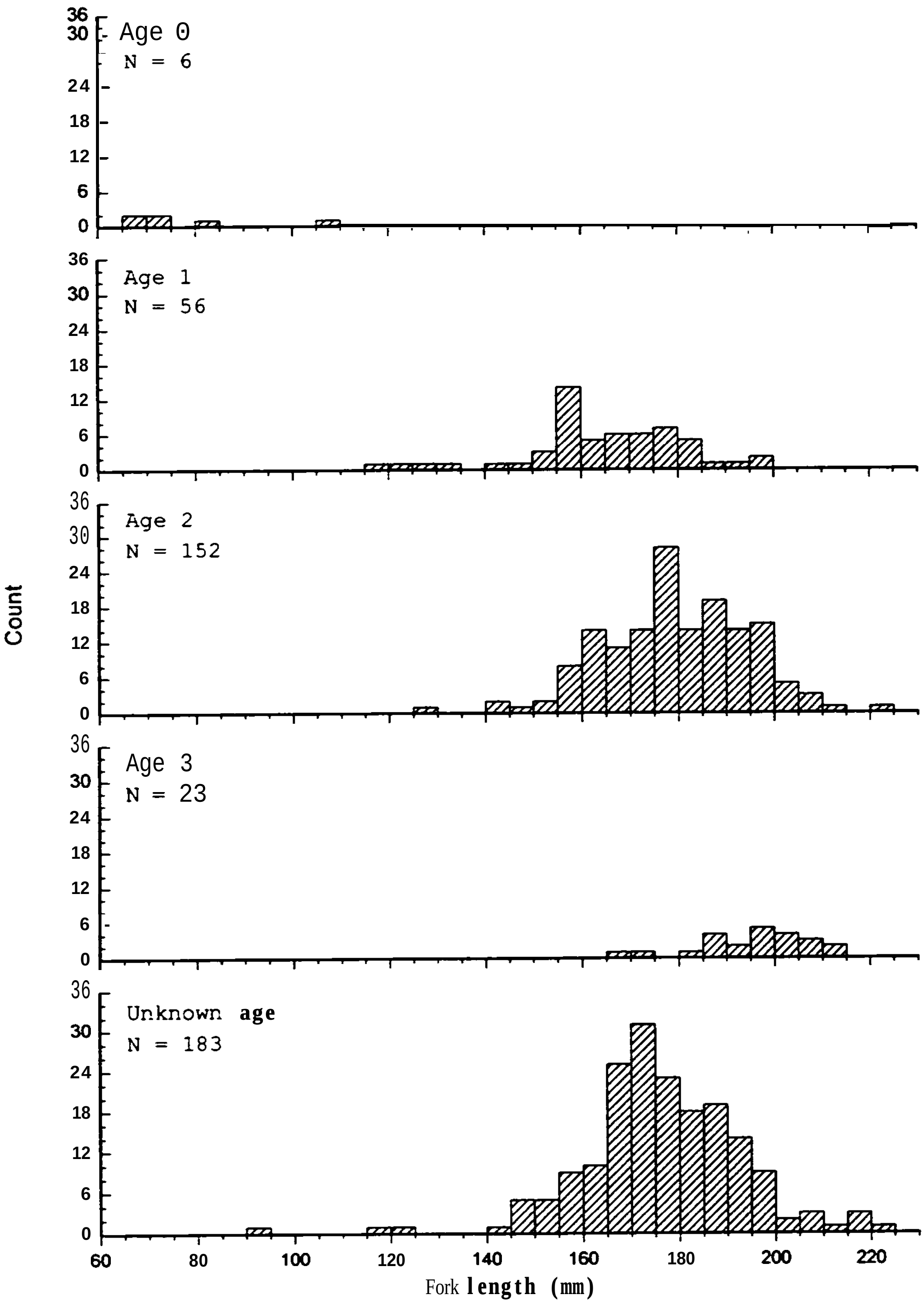


Figure 9. Length frequency histogram of downstream migrant rainbow-steelhead sampled from 23 March through 31 July 1994 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River. by age category.

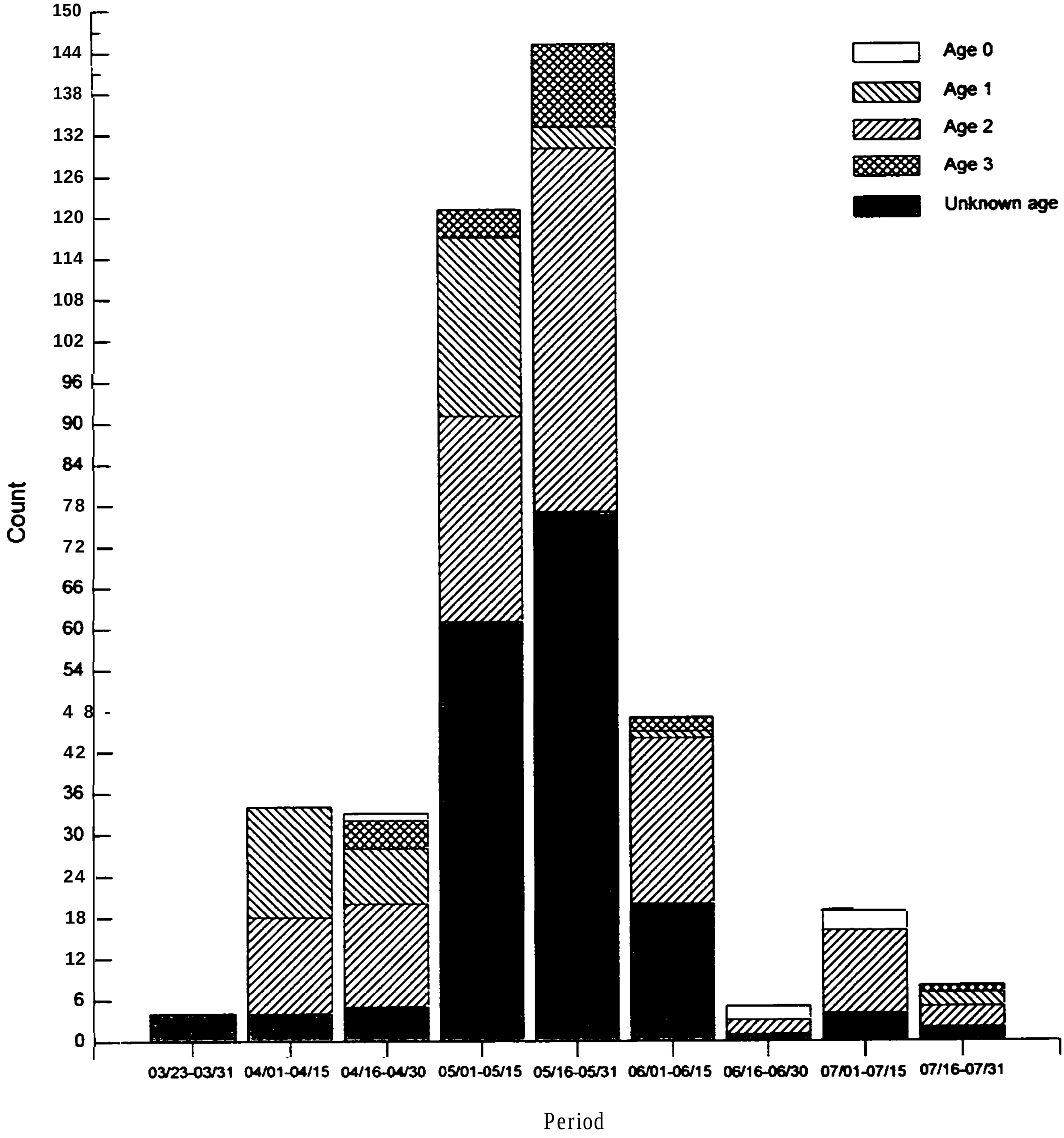


Figure 10. Temporal distribution of downstream migrant rainbow-steelhead sampled from 23 March through 31 July 1994 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River. Estimates are not adjusted for trap efficiency.

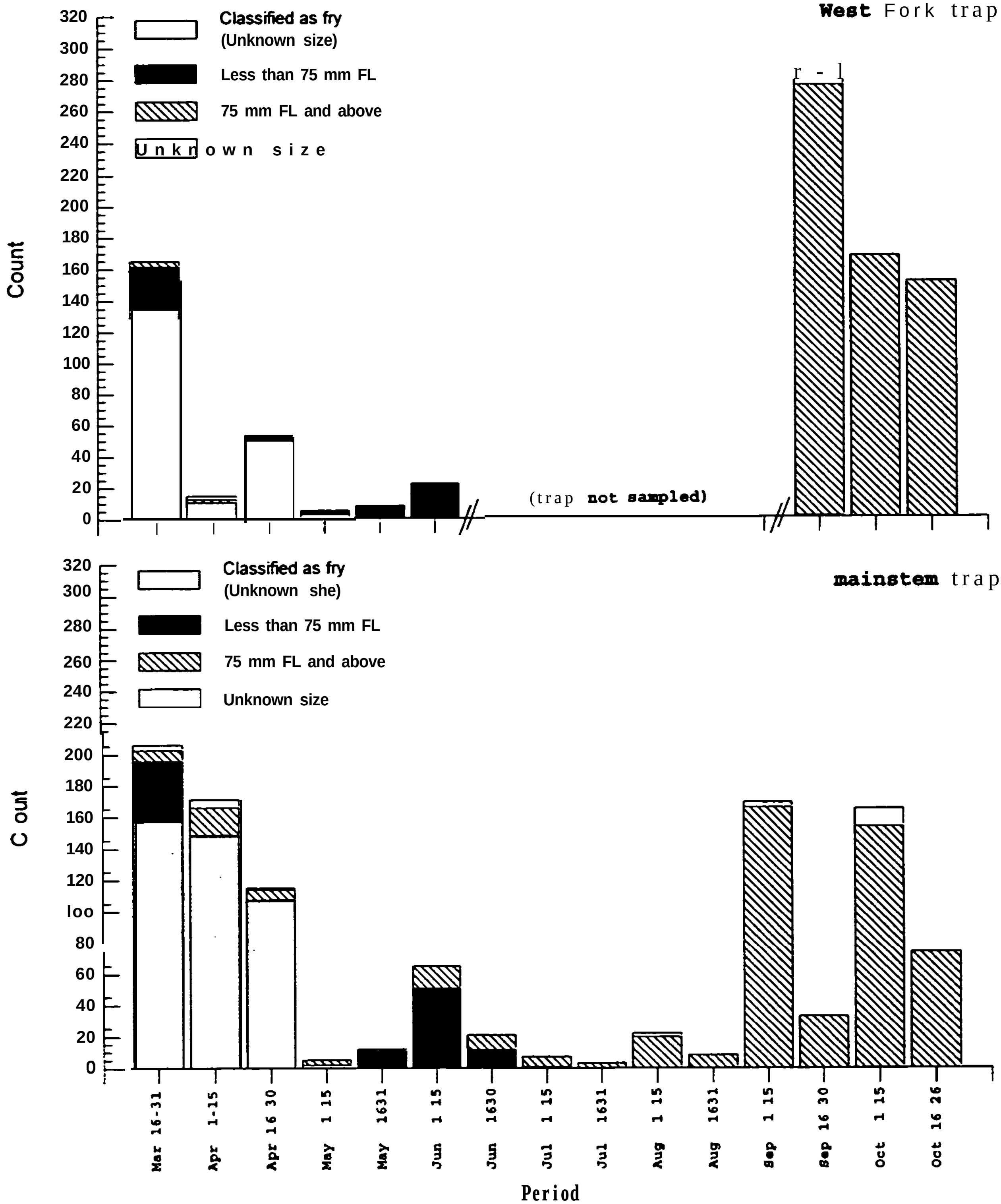


Figure 11. Migration timing of downstream migrant juvenile chinook salmon at migrant traps located in the mainstem (RM 4.53 and West Fork (RM 4.0) of the Hood River. 1994. (Estimates are for the period 16 March through 26 October at the mainstem migrant trap and the periods 25 March througn 30 June and 15 September through 26 October at the West Fork migrant trap. Estimates are not adjusted for trap efficiency.)

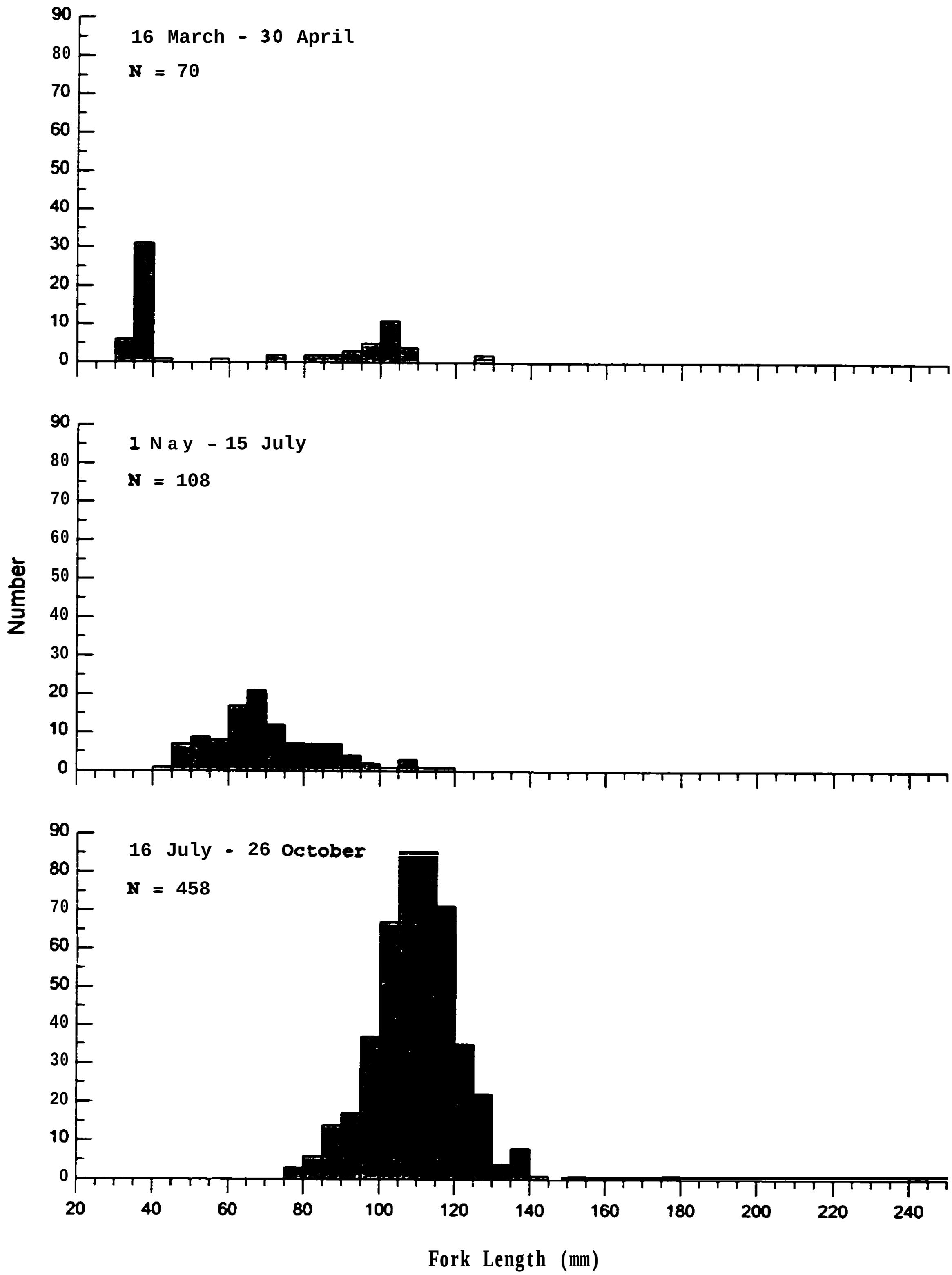


Figure 12. Length frequency histogram of downstream migrant juvenile chinook salmon sampled from the mainstem (RM 4.5) Hood River migrant trap. 1994. (Estimates are for the periods 16 March through 30 April. 1 May through 15 July, and 16 July through 26 October.)

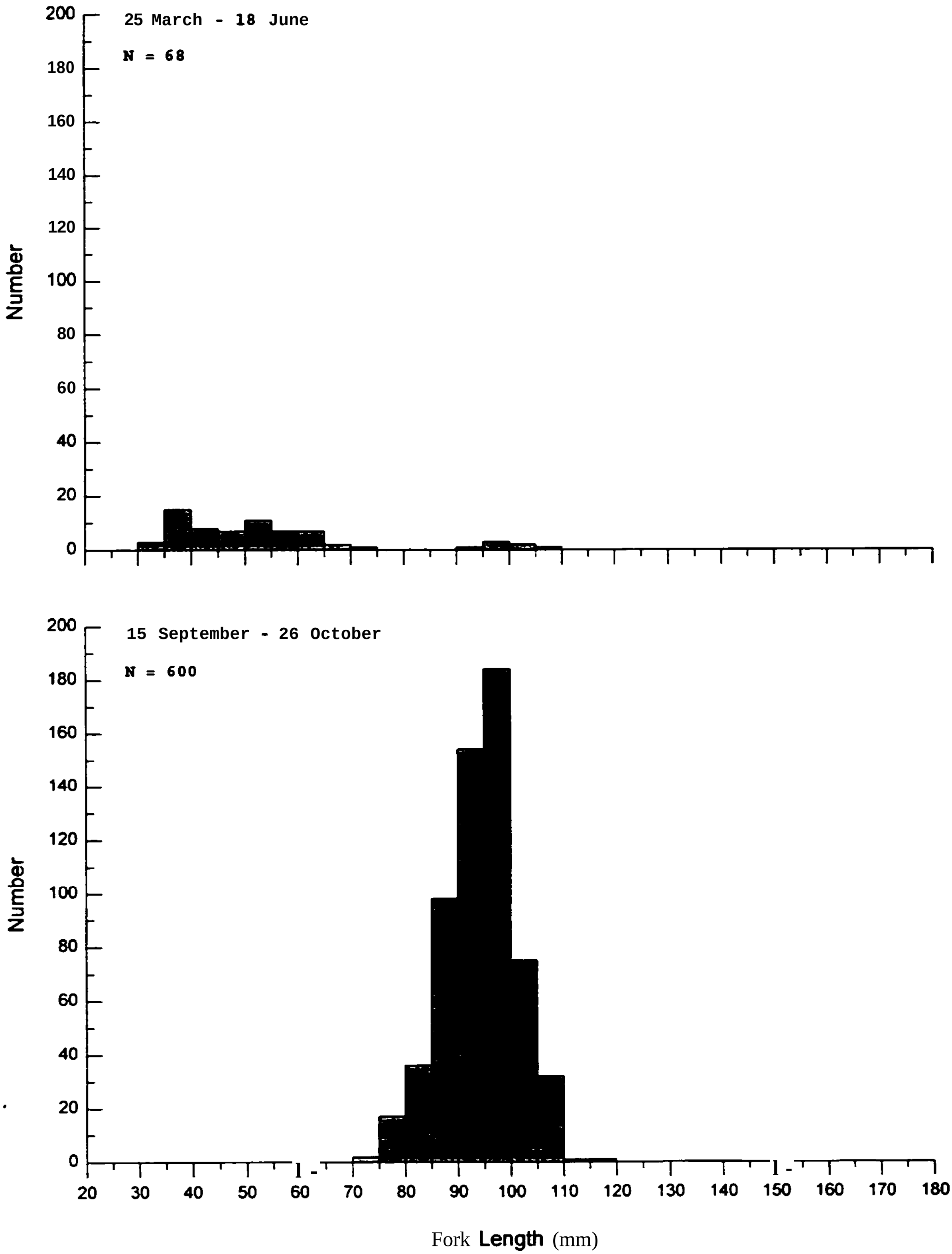


Figure 13. Length frequency histogram of downstream migrant juvenile chinook salmon sampled from the West Fork (RM 4.0) Hood River migrant trap. 1994. (Estimates are for the periods 25 March through 18 June and 15 September through 26 October.)

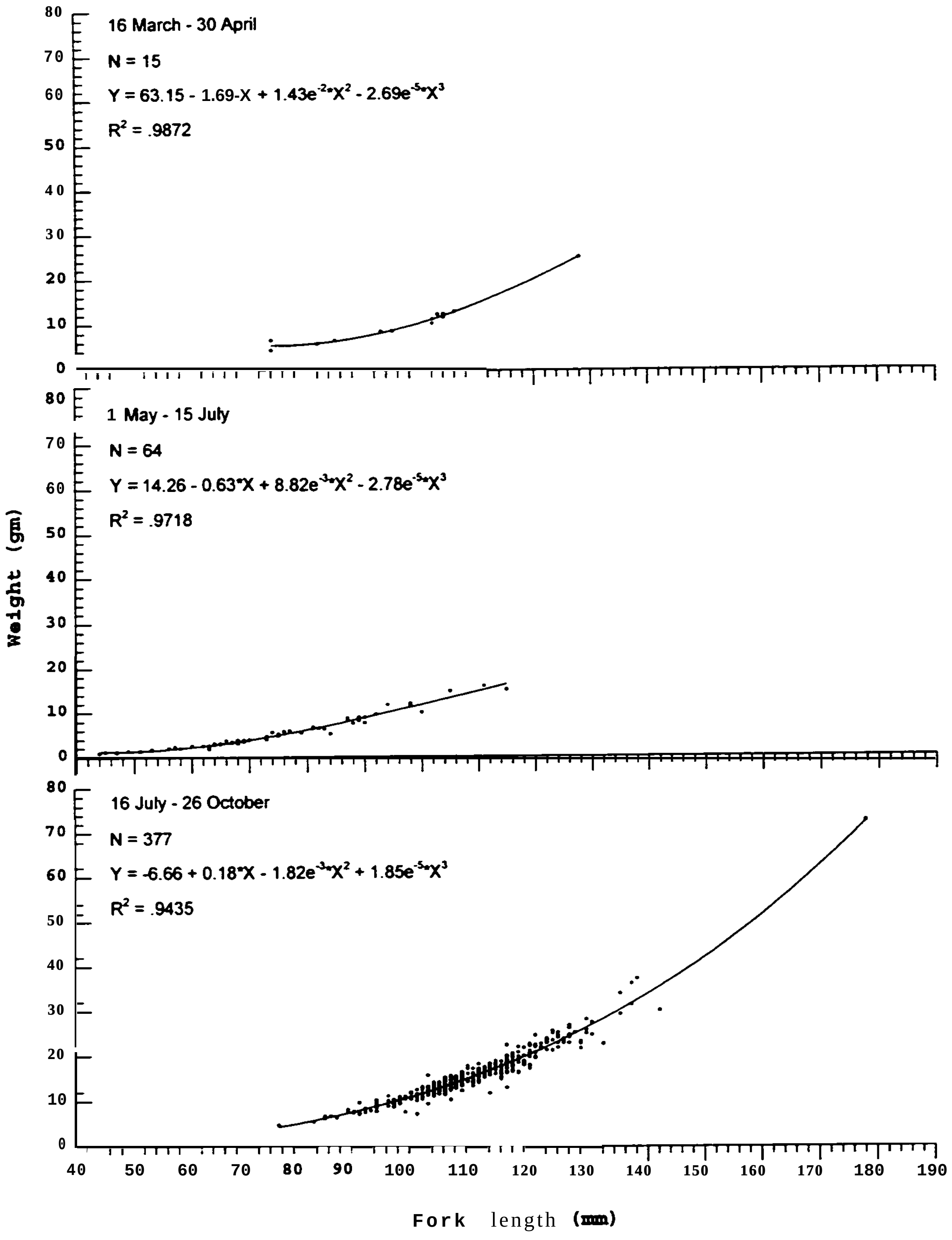


Figure 14. Length x weight regression of downstream migrant juvenile chinook salmon sampled in the mainstem (RM 4.5) Hood River migrant trap, 1994. (Estimates are for the periods 16 March through 30 April. 1 May through 15 July. and 16 July through 26 October.)

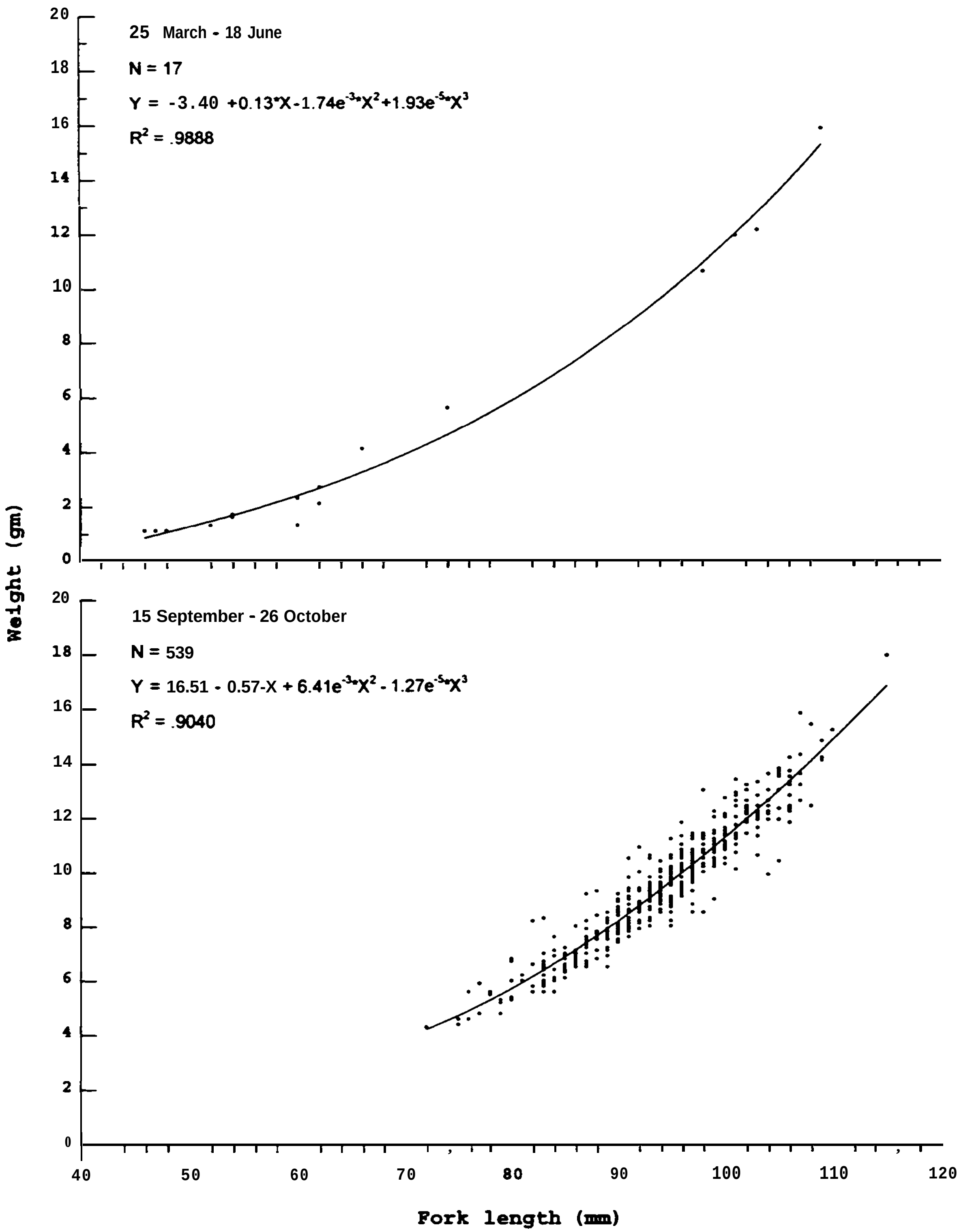


Figure 15. Length x weight regression of downstream migrant juvenile chinook salmon sampled in the West Fork (RM 4.0) Hood River migrant trap, 1994. (Estimates are for the periods 25 March through 18 June and 15 September through 26 October.)

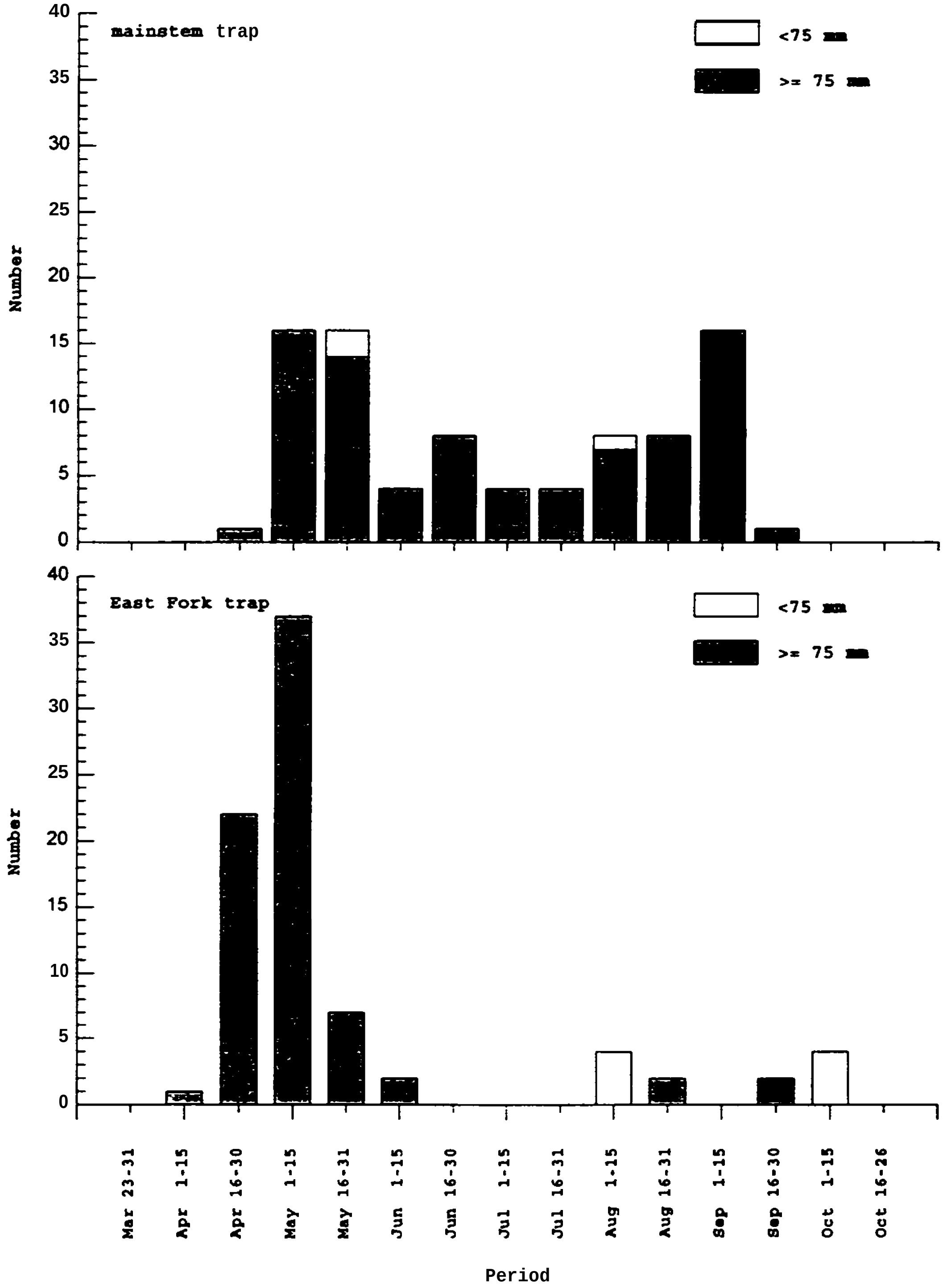


Figure 16. Migration timing of downstream migrant juvenile coho salmon sampled at migrant traps located in the mainstem (RM 4.5) and East Fork (RM 1.0) of the Hood River. 1994. (Estimates are for the period 23 March through 26 October at the mainstem migrant trap and the period 2 April through 26 October at the East Fork migrant trap. Estimates are not adjusted for trap efficiency.)

Table 8. Estimated numbers of downstream migrant juvenile coho salmon passing a migrant trap in the mainstem hood River (RM 4.5). (Estimate is for juveniles greater than or equal to 75 mm fork length migrating past tie migrant trap during the period 23 March through 26 October 1994)

period	Number captured	Estimated number cf migrants[a]	Percent recaptures[b]
03/23-06/30	43	462	9.3%
07/01-10/26	40	2.657	1.5:

[a] Estimates are based on the ratio of marked to unmarked chinook salmon sampled fran the same size range at the mainstem migrant trap (see JUVNILE COHO SALMON Natural Production).

[b] The percent recapture rate was estimated from the marked to unmarked ratio of juvenile chinook greater than or equal to 75 mm fork length sample at the mainstem migrant trap during the specifieC time pericd.

Table 9. Estimates of mean fork length (mm). weight (gm). and condition factor (CF) for downstream migrant juvenile coho salmon sampled at migrant traps located in the mainstem (RM 4.5) and East Fork (RM 1.0) of the Hood River. (Estimates are for migrants sampled during the period 23 March through 26 October 1994.)

Statistic. location	N	Mean	Range	95% C.I
Fork length (mm).				
mainstem	65	106.5	48 - 158	± 4.42
East Fork	61	120.4	54 - 187	± 5.56
Weight (g).				
mainstem	80	15.7	4.6 - 41.3	± 1.72
East Fork	80	20.6	1.6 - 38.0	± 2.03
CF.[a]				
mainstem	80	1.16	0 54 - 1.46	± 0.03
East Fork	80	1.09	3 46 - 1.34	± 0.01

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

Table 10. Estimates of mean fork length (mm), weight (gm), and condition factor (CF) for juvenile coho salmon sampled at selected sites in the Hood River subbasin, 1994.

Statistic, location	River mile	Sampling date	N	Mean	Range	95% C.I
Fork length (mm),						
Lenz Creek	0.5	09/02/94	1	106	106	± --
Neal Creek	1.5	09/26/94	25	97.1	85 - 111	± 2.81
MFk Hood River	0.5	09/08/94	1	97	97	± --
Weight (g),						
Lenz Creek	0.5	09/02/94	1	14.3	14.3	± --
Neal Creek	1.5	09/26/94	25	10.5	6.5 - 15.9	± 1.09
MFk Hood River	0.5	09/08/94	1	9.8	9.8	± --
CF,[a]						
Lenz Creek	0.5	09/02/94	1	1.20	1.20	± --
Neal Creek	1.5	09/26/94	25	1.13	0.99 - 1.25	± 0.03
MFk Hood River	0.5	09/08/94	1	1.07	1.07	± --

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

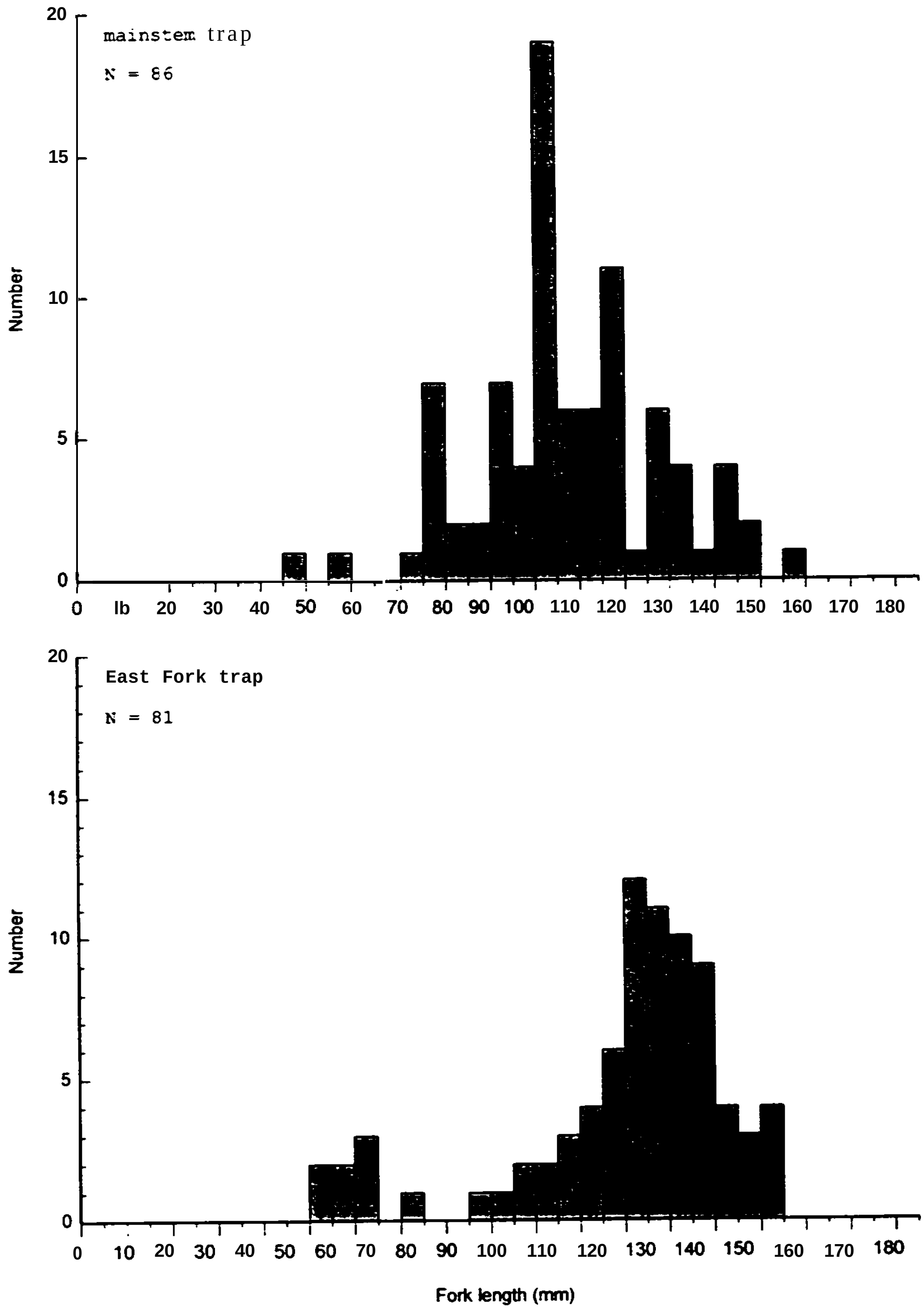


Figure 17. Length frequency histogram of downstream migrant juvenile coho salmon sampled at migrant traps located in the mainstem (RM 4.5) and East Fork (RM 1.0) of the Hood River. (Estimates are for migrants sampled during the period 23 March through 26 October 1994.)

Table 11 Estimates of mean fork length (mm) and weight (gms) for cutthroat trout sampled at selected sites in the Hood River subbasin. (Sampling dates are in Appendix Table A-2.)

Location, sampling area	River mile	Fork length (ml)				Weight (gms)			
		N	Mean	Range	95% C.I.	N	Mean	Range	95% C.I.
Mainstem,									
Neal Cr	5.1	1	155	165	--	1	47.2	47.2	--
Middle Fork,									
Tony Creek	1.0	24	87.8	48-178	±15.3	24	10.7	1.3-53.8	6.6
Gear Creek	1.0	75	104.1	58-190	± 6.1	74	13.3	2.4-73.1	±2.8
East Fork,									
EFk HDR	0.5	4	84.0	68-114	--	4	7.2	3.7-15.3	--
EFk HDR	20.2	2	152.5	134-171	--	2	35.0	26.7-45.2	--
Dog River	0.7	30	101.6	42-203	±12.9	30	15.9	0.9-90.9	±6.9
Tilly Jane Cr	0.1	25	101.3	44-165	±10.7	25	12.2	1.1-42.9	±4.0
Robinhood Cr	1.0	54	104.2	39-200	±12.2	54	18.6	0.4-85.0	±5.8

Table 12. Estimates of mean condition factor for cutthroat trout sampled at selected sites in the Hood River subbasin. (Sampling dates are in Appendix Table A-2.)

Location, sampling area	River mile	Condition factor[a] N	Mean	Range	95% C.I.
Mainstem,					
Neal Cr	5.0	1	1.05	1.05	--
Middle Fork,					
Tony Creek	1.0	24	1.08	0.87-1.28	± 0.05
Bear Creek	0.6	74	1.00	0.55-1.42	± 0.03
East Fork,					
EFk HDR	0.5	4	1.09	1.03-1.18	± 0.10
EFk HDR	20.2	2	1.01	0.90-1.11	--
Dog River	0.7	30	1.15	0.92-2.19	± 0.08
Tilly Jane Cr	0.1	25	1.01	0.70-1.29	± 0.05
Robinhood Cr	1.0	54	1.02	0.62-1.22	± 0.04

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

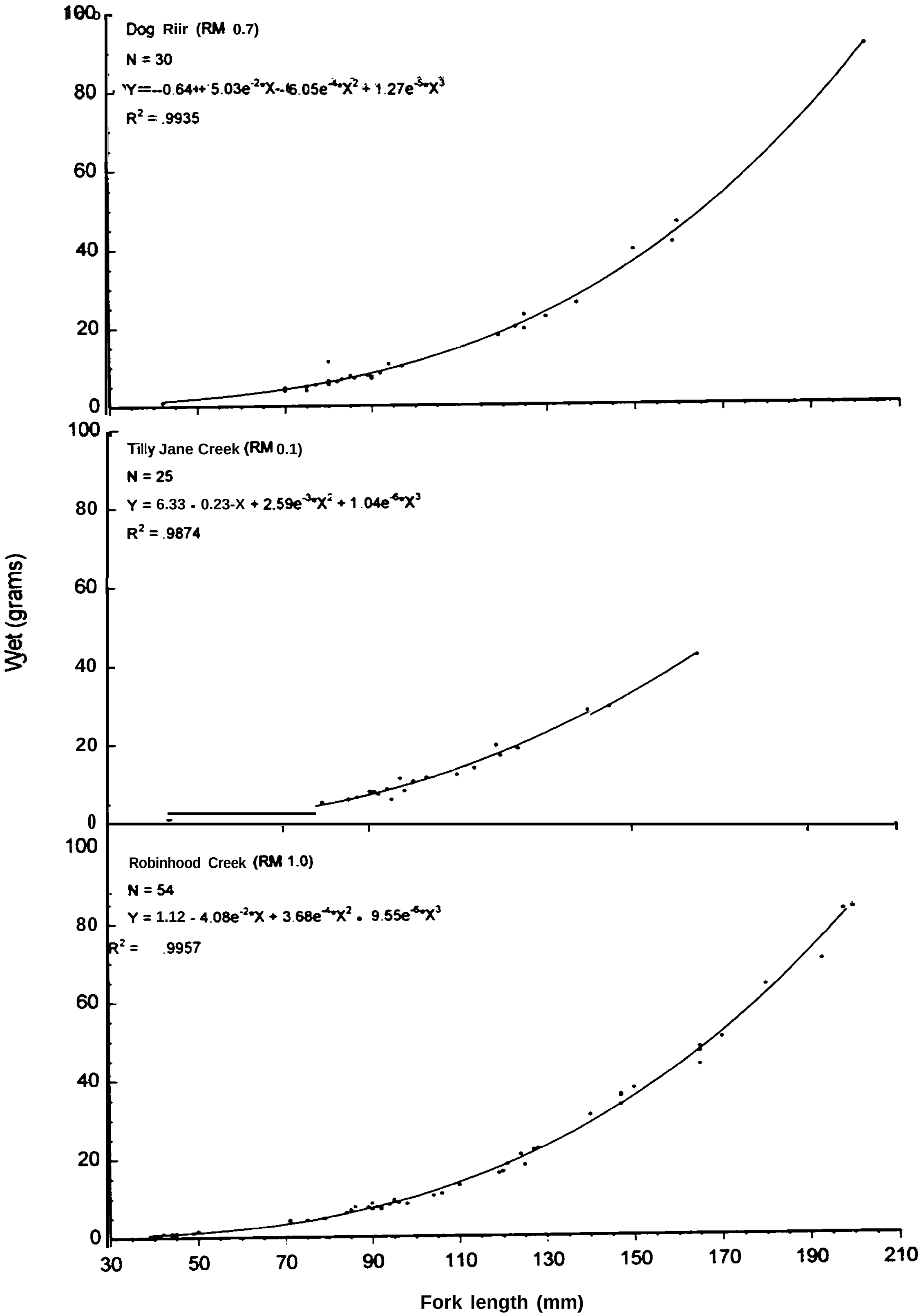


Figure 18. Length x weight regression of cutthroat trout sampled at selected sites in Dog River and in Tilly Jane and Robinhood creeks, 1994.

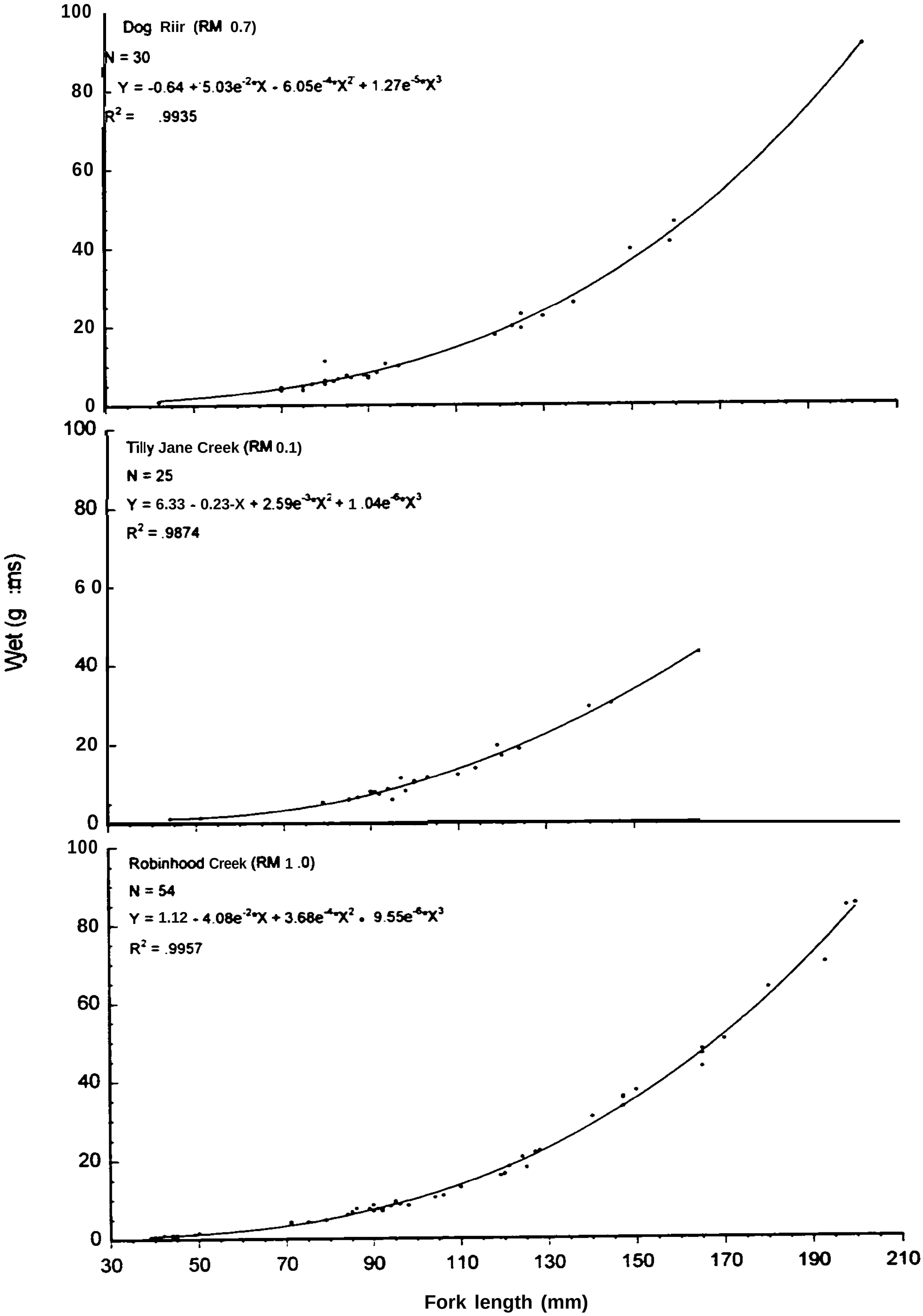


Figure 18. Length x weight regression of cutthroat trout sampled at selected sites in Dog River and in Tilly Jane and Robinhood creeks, 1994.

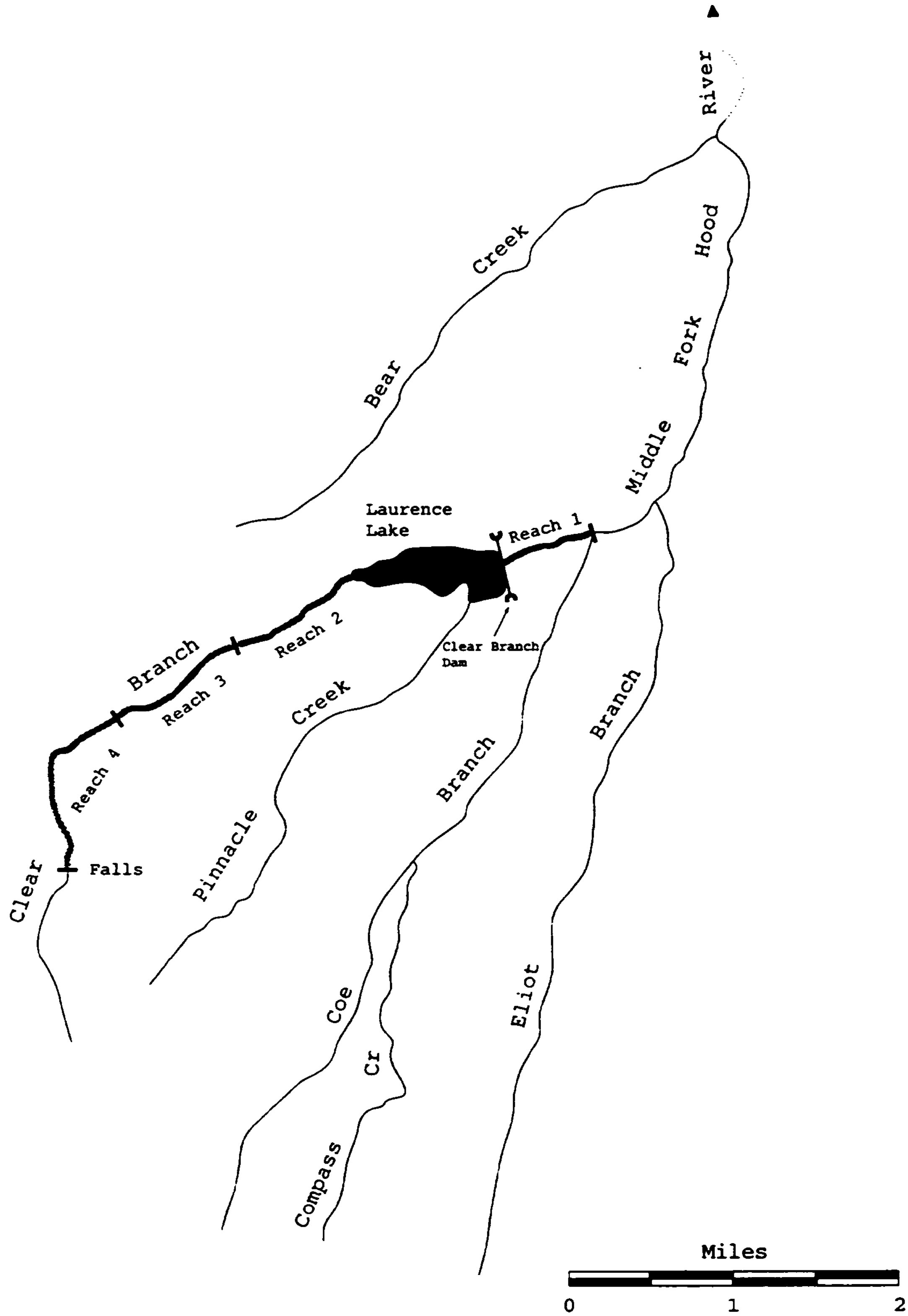


Figure 20. Location of sampling sites used to monitor trout populations in Clear Branch

Tabie 13. Mean number of bull trout observed in selected reaches of stream located in Clear Branch, by size category. (unpublished data from Mount Hood National Forest on 12/05/94, Parkdale, Oregon)

Year, period	Reach 1			Reach 2			Reach 3			Reach 4		
	No of surveys	Mean >20cm	Mean ≤20cm	No. of surveys	War >20cm	Mean ≤20cm	No. of surveys	Mean >20cm	Mean ≤20cm	No. of surveys	Mean >20cm	Mean ≤20cm
1992.												
Aug 01-15	3	--	--		5.3	12.0	1	9.0	2.0	1	1.0	4.0
Aug 16-31	1	1.0	0	2	2.5	1.0	2	3.c	2.0	2	5.0	0.5
Sep 01-15	.	1.0	0	2	0.5	1.0	2	1.5	0.5	2	2.5	2.0
Sep 16-30	2	1.5	0.5	2	2.0	0.5	2	3.5	2.0	2	2.5	0.5
Oct 01-15		0	0	1	0	0	1	C	0	1	0	0
1993.												
Jul 01-15	2	0	0	2	12.0	4.0	2	3.0	0.5	2	2.0	0
Jul 16-31	2	0	0	2	10.0	0	1	2.0	2.0	2	2.0	0.5
Aug 01-15	1	0	0	2	13.0	1.0	2	13.5	7.0	2	4.0	3.0
Aug 16-31	1	0	0	2	10.5	5.0	0	--	--	1	12.0	2.0
Sep 01-15	1	0	0	1	7.0	3.0	0	--	--	2	7.0	9.5
Sep 16-30	1	2.0	0	2	a.0	2.c	2	9.5	3.0	0	--	--
Oct 01-15	0	--	--	3	8.0	9.3	0	--	--	0	--	--
1994.												
Jun 16-30	1	2.0	0	2	6.0	0.5	0	--	--	0	--	--
Jul 01-15	0	--	--	1	1.5	2.5	1	2.0	1.0	0	--	--
Jul 16-31	1	0	0		2.0	5.0	1	2.0	3.0	0	--	--
Aug 01-15	1	0	0	1	2.0	2.0	1	0	1.0	1	0	0
Aug 16-31	1	0	0	1	0	0	1	0	1.0	1	0	0
Sep 01-15	1	0	0	1	2.0	0	1	0	1.0	1	1.0	0
Sep 16-30	3	--	--	1	4.0	1.0	1	0	0	1	0	0
Oct 01-15	1	0	0	2	0	0	0	--	--	0	--	--

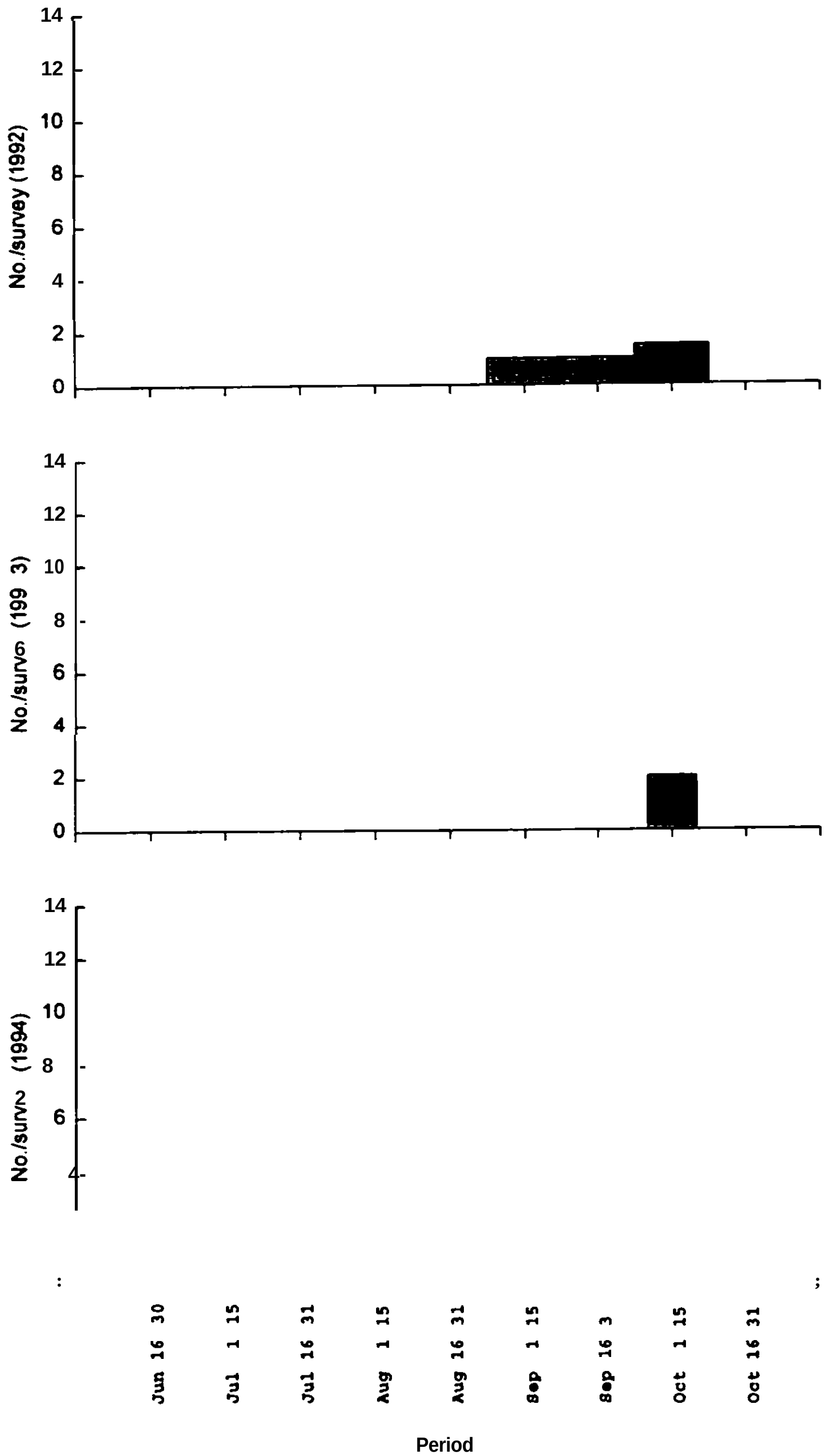


Figure 21. Numbers per survey for bull trout greater than 20 cm observed in Clear Branch (Reach 1) below Clear Branch Dam by period and year.

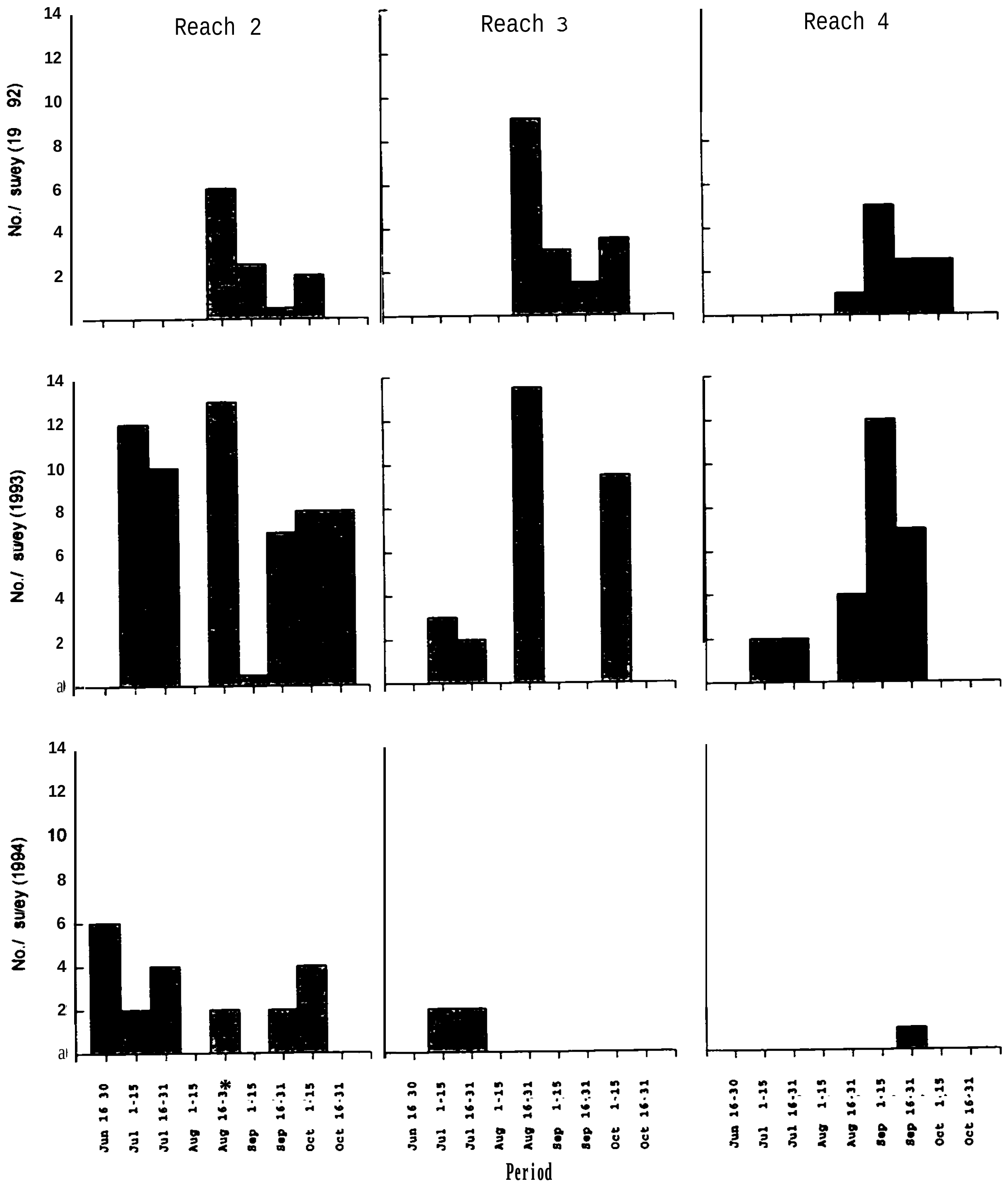


Figure 22. Numbers per survey for bull trout greater than 20 cm observed in Clear Branch (Reaches 2-4) above Clear Branch Dam. by period and year.

Table 14 Date of capture, fork length (cm), and weight (kg) for bull trout sampled at the Powerdale Dam trap, 1992-94.

Date	Fork length (cm)	Weight (kg)
05/08/92	--	--
05/10/92	--	--
05/19/92	51.5	--
05/26/92	56.0	--
05/26/92	45.2	--
06/06/92	55.5	--
05/17/93	55.5	--
06/01/93	48.0[a]	--
05/13/94	55.5	2.5
05/22/94	43.5	1.0
05/23/94	53.0[a]	1.6
06/02/94	37.5	0.8
06/13/94	37.0	0.6
06/14/94	24.3	--
06/24/94	33.5	0.5
06/26/94	41.C	0.8
06/30/94	41.6	0.5
07/20/94	37.5	0.5
07/25/94	35.5	0.5

[a] Fish was recaptured after being released upstream from the trap on 06/01/93.

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.

Origin, run year	March 01-15	March 16-31	April 01-15	April 16-30	May 01-15	May 16-31	June 01-15	June 16-30	July 01-15	July 16-31	August 01-15	August 16-31	September 01-15	September 16-30	October 01-15	October 16-31	November 01-15	November 16-30	December 01-15	December 16-31	Jan-May	Total
Wild,																						
1992-93	0	1	12	6	I	21	31	68	49	48	37	18	17	55	25	24	38	1?	2	1	4	476
1993-94	0	1	10	5	8	21	13	21	25	26	13	10	8	5	11	8	1	1	10	0	30	227
1994-95[a]	0	0	3	4	9	7	22	25	32	33	11	1	4	8	2	7	5	0	0	0	..	173
Subbasin hatchery,																						
1992-93	0	8	40	A?	131	191	136	279	253	220	136	28	26	55	24	10	15	4	1	4	19	1,670
1993-94	0	1	13	38	83	120	75	156	194	169	112	34	24	8	17	10	0	1	11	1	23	1,090
1994-95[a]	0	4	14	80	128	171	281	308	329	169	24	10	13	17	18	1?	13	4	0	0	..	1,599
Stray hatchery																						
1992-93	0	0	0	0	2	3	0	2	6	4	3	0	4	16	0	4	5	0	0	0	7	56
1993-94	0	0	0	1	0	0	2	2	7	0	1	3	0	0	1	0	0	0	1	0	1	19
1994-95[a]	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	..	4
Unknown,																						
1992-93	1	2	1	0	1	0	1	1	2	2	1	1	0	1	2	0	2	0	0	1	0	19
1993-94	0	0	0	0	1	0	0	3	5	0	4	2	0	1	0	0	0	0	0	1	3	20
1994-95[a]	0	1	0	4	2	4	5	7	11	7	1	0	11	0	0	1	1	0	0	0	..	55

[a] Preliminary estimates. Summaries are complete through 31 January 1995.

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.

Origin, run year	Mar-Dec	January 01-15	January 16-31	February 01-15	February 16-29	March 01-15	March 16-31	April 01-15	April 16-30	May 01-15	May 16-31	Total
Wild,												
1992-93	472	0	1	0	0	1	1	0	0	1	0	476
1993-94	197	16	2	0	1	2	1	2	6	0	0	227
1994-95[a]	173	0	0	--	--	--	--	--	--	--	--	173
Subbasin hatchery,												
1992-93	1,651	0	3	3	0	0	3	11	4	1	0	1,670
1993-94	1,067	4	2	3	0	1	2	7	7	0	0	1,090
1994-95[a]	1,595	0	4	--	--	--	--	--	--	--	--	1,599
Stray hatchery,												
1992-93	49	0	1	1	0	1	1	3	0	0	0	56
1993-94	16	0	0	3	0	0	0	1	0	0	0	19
1994-95[a]	3	0	1	--	--	--	--	--	--	--	--	4
Unknown,												
1992-93	19	0	0	0	0	0	0	0	0	0	0	19
1993-94	17	1	0	3	0	0	0	0	2	0	0	20
1994-95[a]	55	0	0	--	--	--	--	--	--	--	--	55

[a] Preliminary estimates. Summaries are complete through 31 January 1995.

Table 17. 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, 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,														
1992-93	483	..	5	0		25	305	47	0	6	77	0	1	17
1993.94	237	..	1	2		11	105	49	3	5	44	8	0	9
Subbasin hatchery,														
1992-93	1,682	48	1,477	143	1	..	—	..	..		..		..	13
1993-94	1,100	36	818	236	3	.			.	.	..		.	7
Stray hatchery,														
1992-93	56	4	43	8	..	—	..	1	..	..	..	--	.	..
1993-94	19	1	14	4		..	.	0	.	..	--		.	--

Table 18. Adult summer steelhead escapements to the Power-dale Dam trap by origin. brood year. and ocean age category. (Percent return is in parentheses. Estimates are based on returns in the 1992-93 through 1993-94 run years.)

Origin, brood year[a]	Smolts	Ocean age				Repeat spawners
		1 salt	2 salt	3 salt	4 salt	
Wild,						
1966	--	--	1	0	0	3
1987	--	0	77	55	3	16
1988	--	6	343	44	0	6
1989	--	33	113	2	--	1
1990	--	11	1	--	--	0
Subbasin hatchery,						
1987	79.867	--	--	--	1 (0.001)	--
1988	89.026	--	--	143 (0.16)	3 (0.003)	13 (0.02)
1989	81.795	--	1.477 (1.81)	236 (0.29)	--	6 (0.01)
1990	77.132	48 (0.06)	818 (1.06)	--	--	1 (0.002)
1991	99.973	35 (0.04)	--	--	--	--

[a] Based on estimates of age structure for adult summer steelnead sampled at Powerdale Dam trap. the 1989 wild and 1990 hatchery broods represent the first brood years for which complete estimates of escapement can be made Estimates of escapement for prior brood years do not include adult returns from all possible age categories. Complete brood year specific estimates of escapement for the 1989 wild and 1993 hatchery broods will be available upon completion of the 1995-96 run year.

Table 19. Age composition (percent) of adult summer steelhead 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/ocean aae 1/1	1/2	1/3	114	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/2	Repeat spawners
Wild.														
1992-93	476	..	1.0	0	..	5.3	63.0	9.7	0	1.3	16.0	0	0.2	3.6
1993-94	221	..	0.5	0.9	..	4.5	44.3	20.8	1.4	2.3	18.6	3.2	0	3.6
Subbasin hatchery.														
1992.93	1.669	2.8	87.8	8.5	0.06	--	..	--	..	--	..		.	0.8
1993-94	1,067	3.3	74.3	21.5	0.3	..	..	..	..					0.7
Stray hatchery.														
1992-93	56	7.1	76.8	14.3	..	..	..	1.8	..	..	..	..	..	..
1993-94	19	5.3	73.7	21.1	..	..	..	0	..	..	..	..	..	

Table 20. Mean fork length (cm) of adult summer steelhead with spawning checks in the 1993-94 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	1/2s.3	1/2s.4	2/1s.3	2/2s.3	2/2s.4	2/3s.4	3/2s.3	3/3s.4	2/2s.3s.4
Wild,										
Female,										
N	--	1	--	--	1	1	1	--	1	1
Mean	--	63.0	--	--	78.5	79.0	79.5	--	83.5	85.0
STD	--	--	-	-	-	--	--	--	--	--
Range	--	63.0	--		78.5	79.0	79.5	--	83.5	85.0
Male,										
N	--	--	--	1	--		--	1	--	--
Mean		--	--	67.5			--	66.0		
STD		--	--	--	--	--	--	--	--	--
Range	--	--	--	67.5	--	--	--	66.0	--	--
Total,										
N	--	1	--	1	1	1	1	1	1	1
Mean	--	63.0	--	67.5	78.5	79.0	79.5	66.0	83.5	85.0
STD	--	--	--	--	--	--	--	--	--	--
Range		63.0	--	67.5	78.5	79.0	79.5	66.0	83.5	85.0
Subbasin hatchery,										
Female,										
N	--	2	1	--	--	--	--	--	--	--
Mean	-	73.75	76.0	--	--	--	--	--	--	--
STD	--	1.06	--	--	--	--	--	--	--	--
Range	--	73.0-74.5	76.0	--	--		--	--	--	--
Male,										
N	1	1	1	--	--	--	--	--	--	--
Mean	77.5	75.0	74.0	--	--	--	--	--	--	--
STD	--	--	--	--	--	--	--	--	--	--
Range	77.5	75.0	74.0	--	--	--	--	--	--	--
Total,										
N	1	3	2	--	--	--	-	--	--	--
Mean	77.5	74.17	75.00	--	--	--	--	--	--	--
STD	--	1.04	1.41	--	--	--	--	--	--	--
Range	77.5	73.0-75.0	74.0-76.0	--	--	--	--	--	--	-

Table 21. Mean fork length (cm) of adult summer steelhead without spawning checks in the 1993-94 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/ocean age											Sample[a] mean
	1/1	112	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	
Wild,												
Female,												
N	· ·		1		3	74	22	3	?	30	2	148
Mean	·		89.5		55.00	68.23	77.77	70.03	55.50	65.42	77.25	69.62
STD	· ·				2.00	4.39	3.37	6.17	3.54	5.16	6.01	7.04
Range	· ·		89.5	-	53.0-57.0	58.0-76.0	72.0-85.5	72.0-84.0	53.0-58.0	51.5-75.0	73.0-81.5	51.5-89.5
Male,												
N		1	1		7	24	24	-	3	11	5	79
Mean	· ·	70 0	86.5		55 50	68 94	R3.00	. ·	51.33	67.86	79.10	72.10
STD	--	--	--		8.4%	/.06	3.93	..	4.54	3.46	2.25	10.83
Range	·	70.0	86.5		40.5-64.0	54.0-83.0	73.0-93.5	..	48.0-56.5	62.0-76.0	77.5-83.0	40.5-93.5
Total.												
N	· ·	1	2		10	98	46	3	5	41	7	227
Mean		70.0	88.00		55.35	68.40	80.50	78.83	53.00	66.07	70.57	70.48
STD	·	--	2.12		6.94	5.14	4.49	6.17	4.32	4.85	3.19	8.61
Range	·	70.0	86.5-89.5		40 5-64.0	54.0-83.0	72.0-93.5	72.0-84.0	48.0-58.0	51.5-76.0	73.0-83.0	40.5-93.5
Subbasin hatchery,												
Female.												
N	21	599	98	3	--		--	·	--	--	--	740
Mean	52.98	66.80	77.13	70.67		--	--			--	--	G7.94
STD	2.62	3.85	3.97	2.75		-		--	--	--		5.85
Range	48.0-57.0	52.0-85.5	68.5-86.0	75.5-80.5				--	--	--		48.0-86.0
Male,												
N	14	194	131			--		--	·	--		350
Mean	54.11	68.86	81.60			--		--	·	--	--	73.27
STD	1.97	5.10	4.34	--		-		--	--	--		8.63
Range	50.0-57.0	53.0-78.5	67.5-90.5	--	--			--	--	--		50.0-90.5
Total.												
N	35	793	229	3			--					1,090
Mean	53.43	67.31	79.68	70.67			--	·	--	--		69.65
STD	2.42	4.28	4.73	2.75				--	--	--		7.30
Range	48.0-57.0	52.0-85.5	67.5-90.5	75.5-80.5	--		--	--	--	--		48.0-90.5

[a] Mean estimate Includes steelhead with spawning checks and steelhead in which the origin, but not the age of the fish could be determined from scale analysis.

Table 22. 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).]

Origin, 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,												
1986	--			.	--	--	64 (1)	--	..	.	--	
1987	..	--	--	--	--	68 (76)	--	.	82 (46)	79 (7)	--	79 (3)
1988	..		54 (6)		70 (300)	66 (41)	--	..	80 (46)	--	--	--
1989		57 (25)	53 (5)	69 (5)	68 (98)		..	88 (2)	--	.		
1990	..	55 (10)	..	70 (1)	--	--	--	--	--	..	--	..
Subbasin hatchery,												
1987			--	.	--	..	--	.	--	..	90 (1)	--
1988	--		--	--	--	--	--	78 (142)	--	--	79 (3)	--
1989	--	--	--	68 (1,466)	--	--	--	80 (229)	--	--	--	--
1990	55 (47)	--	.	67 (793)	--	--	--	--	..	..	.	--
1991	53 (35)	--	--	--	--	--	--	--	--	--		

Table 23. 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, run year	Freshwater/ocean aae												Repeat
	1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/2	spawner
Wild,													
1992-93		60 (5)	--	--	72 (25)	79 (300)	28 (46)	--	83 (6)	80 (76)		100 (1)	69 (16)
1993-94	..	0 (1)	50 (2)	--	30 (10)	76 (98)	48 (46)	100 (3)	40 (5)	73 (41)	29 (7)	--	75 (8)
Subbasin hatchery,													
1992-93	47 (47)	73 (1,466)	34 (142)	0 (1)	--	..	--	..	..	..	.	.	77 (13)
1993-94	60 (35)	76 (793)	43 (229)	100 (3)	--	..	..	..			.		50 (6)

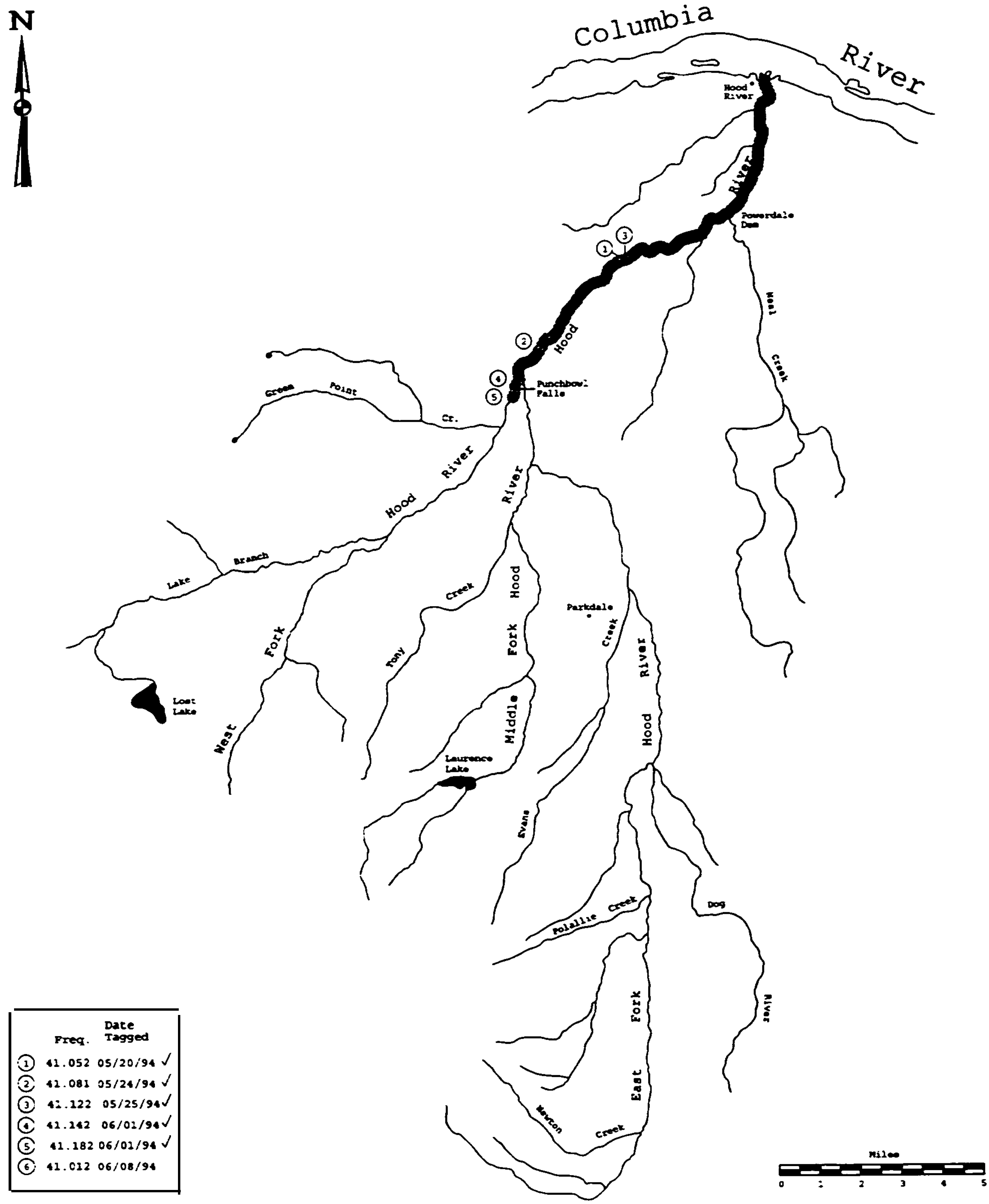


Figure 23. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 05/20-06/09/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

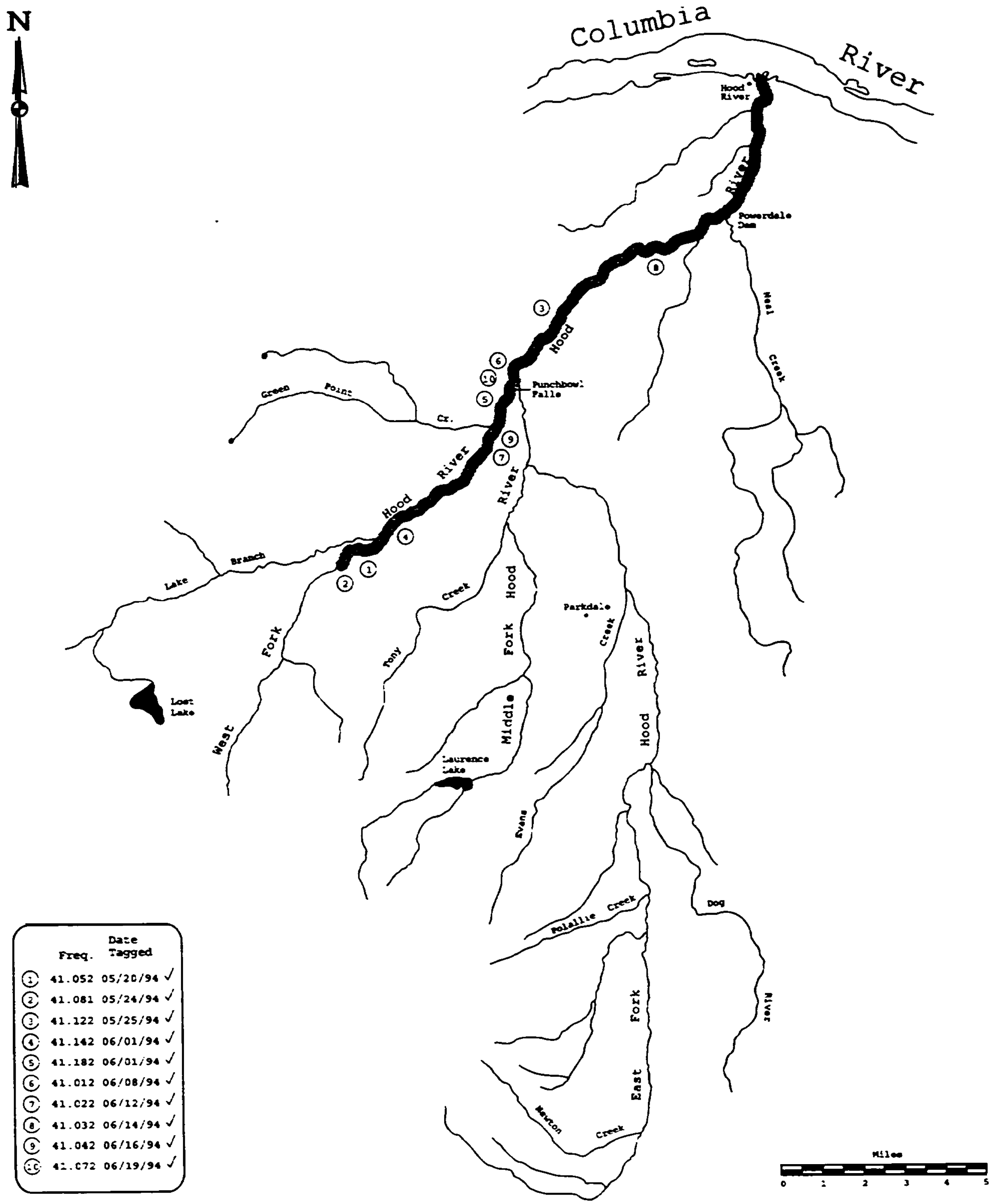


Figure 24. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 06/10-24/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

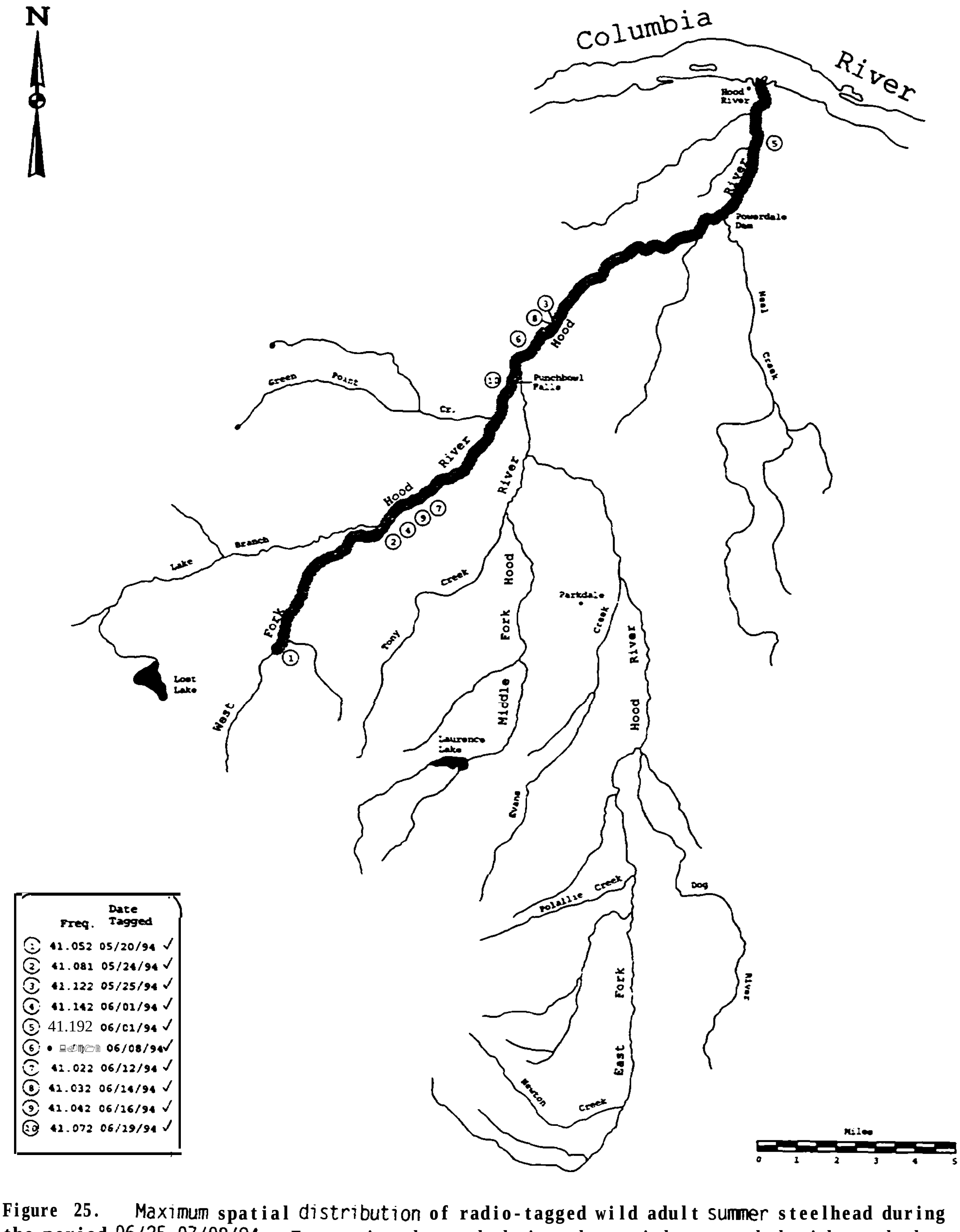


Figure 25. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 06/25-07/08/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

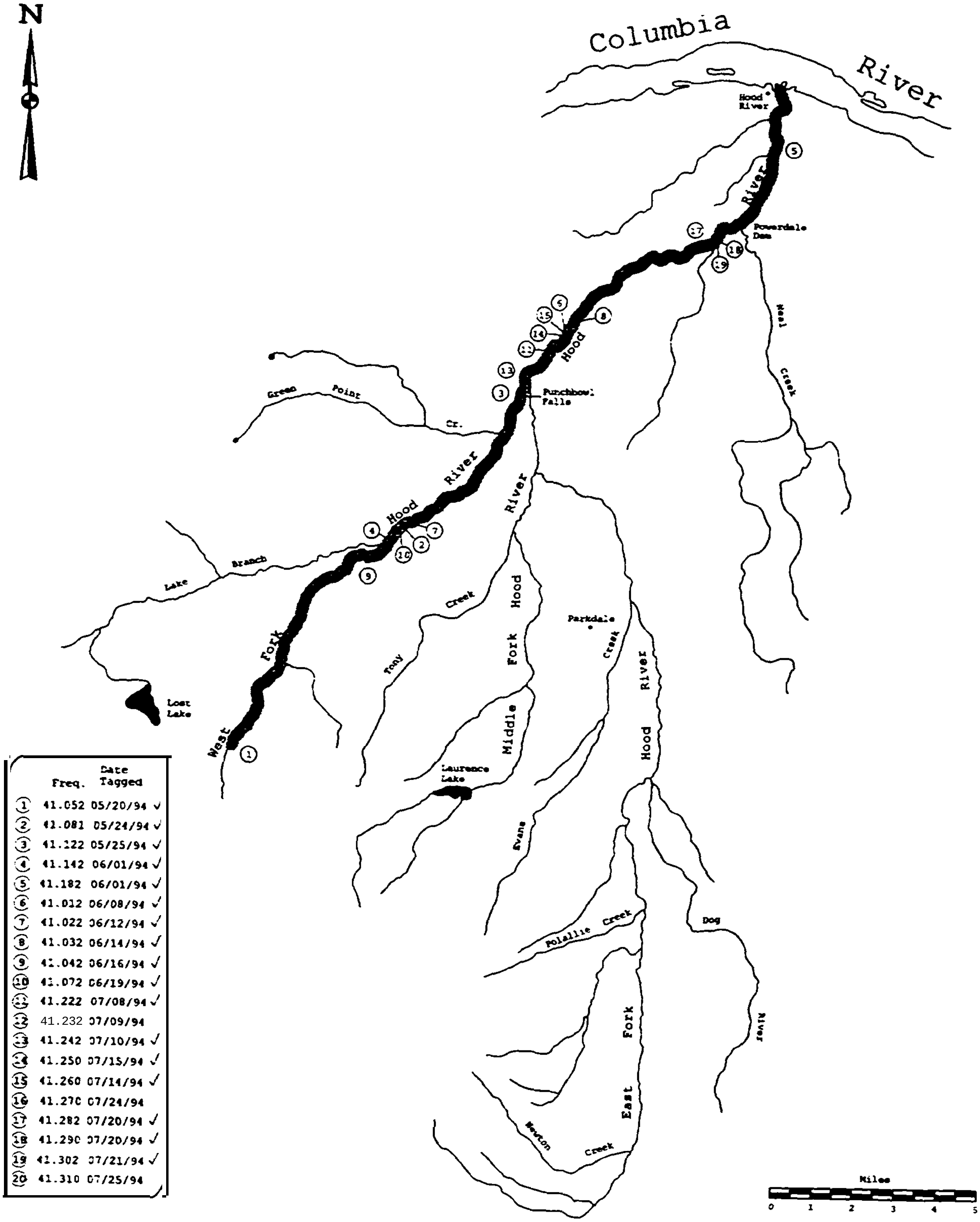


Figure 26. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 07/09-26/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

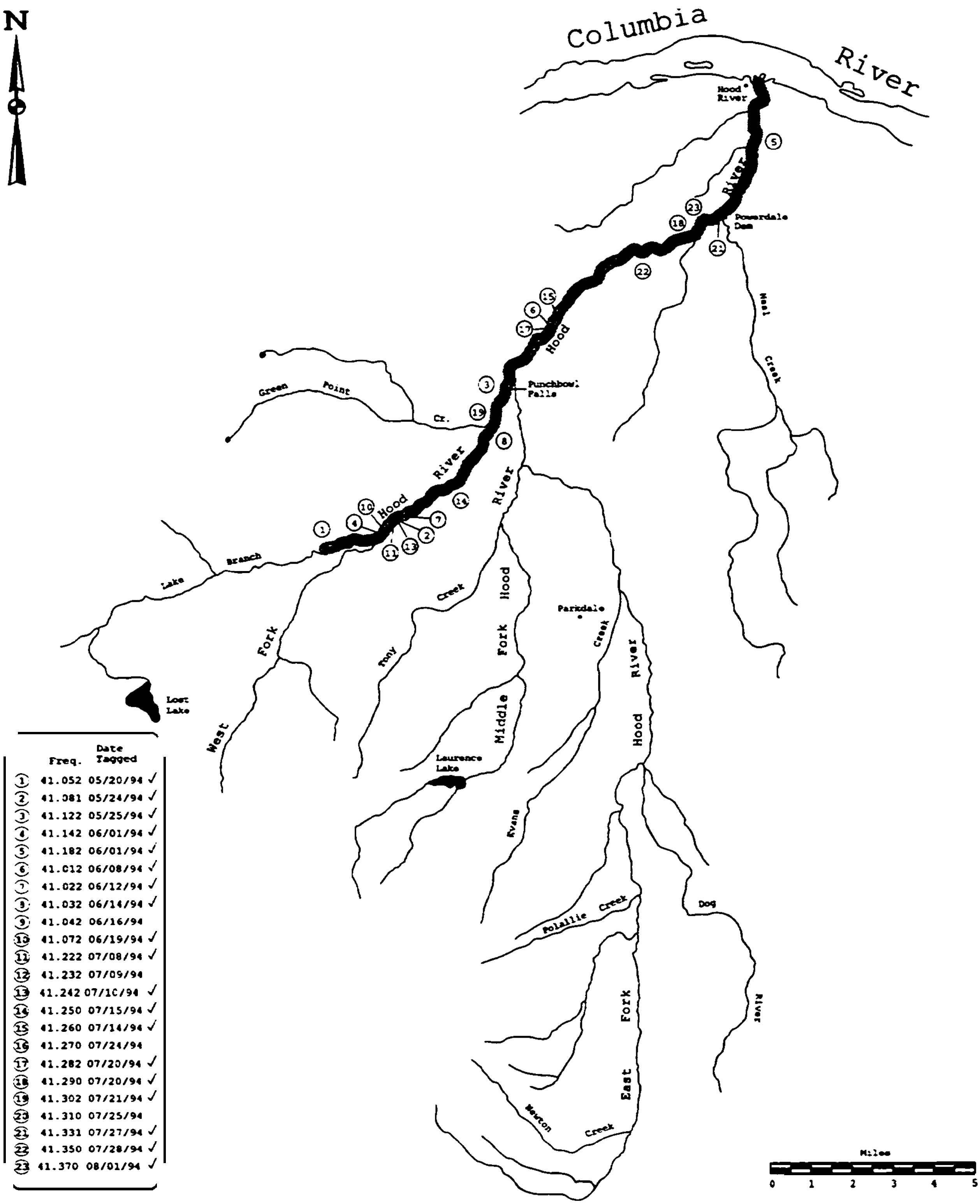


Figure 27. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 07/27-08/15/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

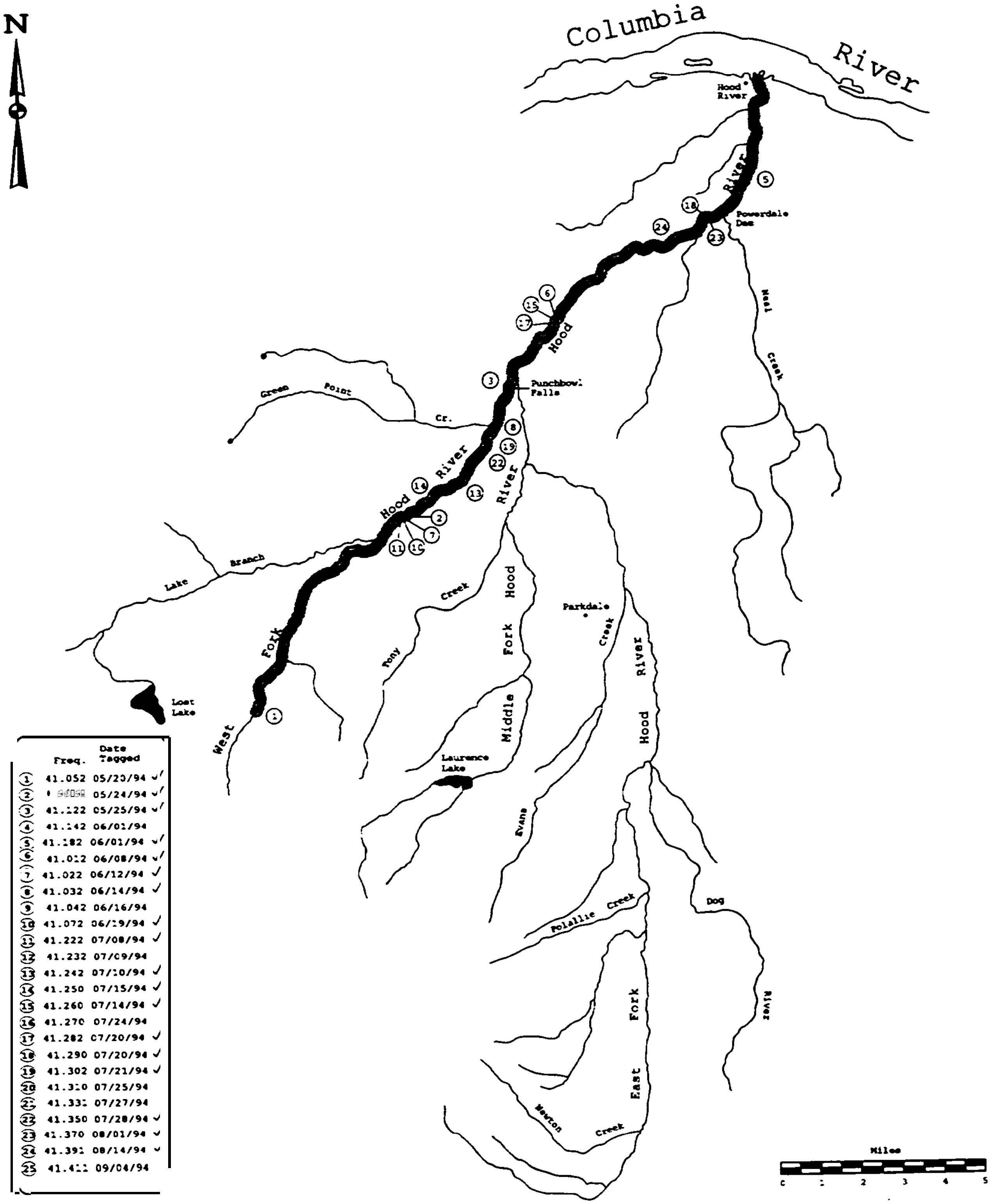


Figure 28. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 08/16-09/06/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

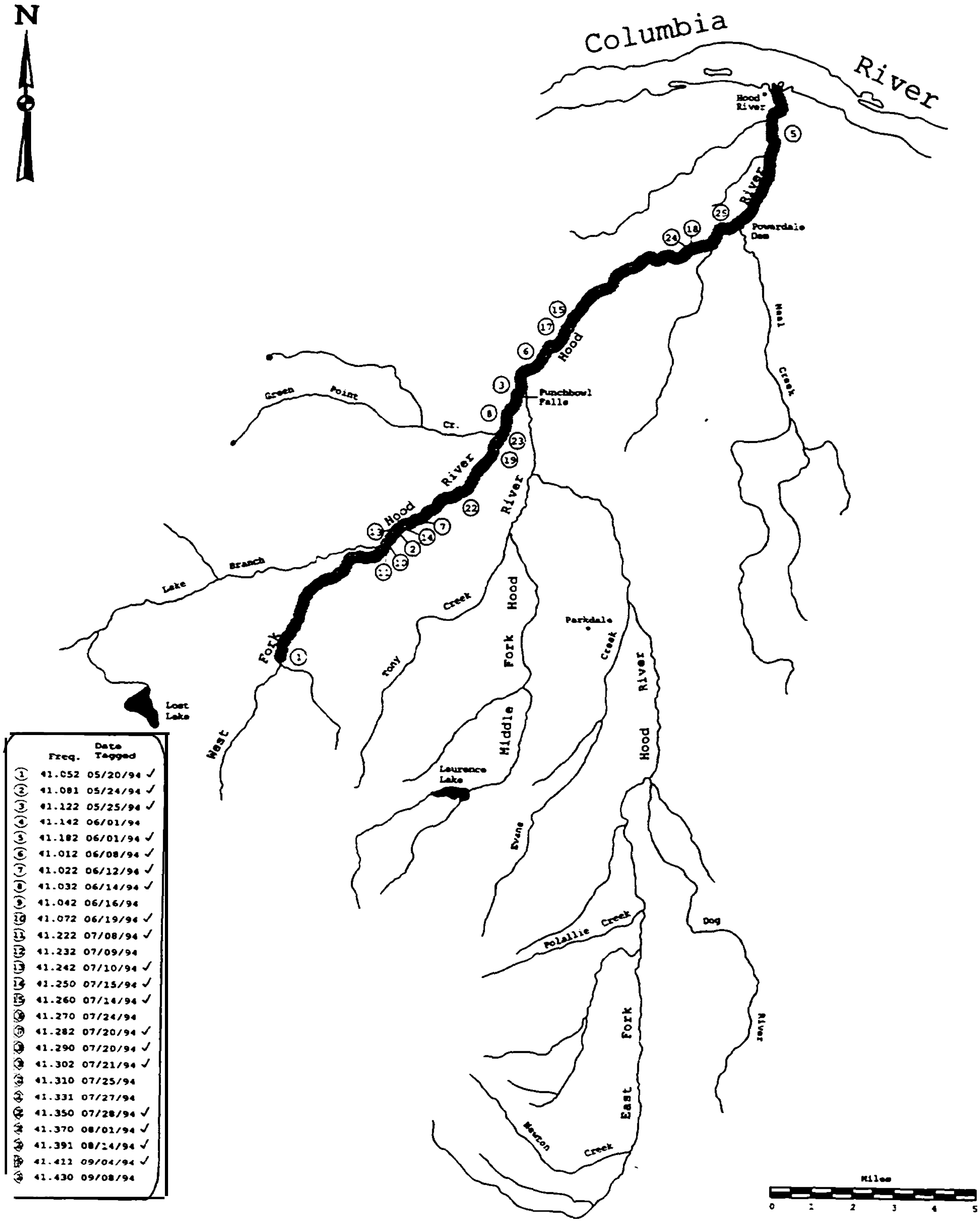


Figure 29. Maxinum spatial distribution of radio-tagged wild adult summer steelhead during the period 09/07-21/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

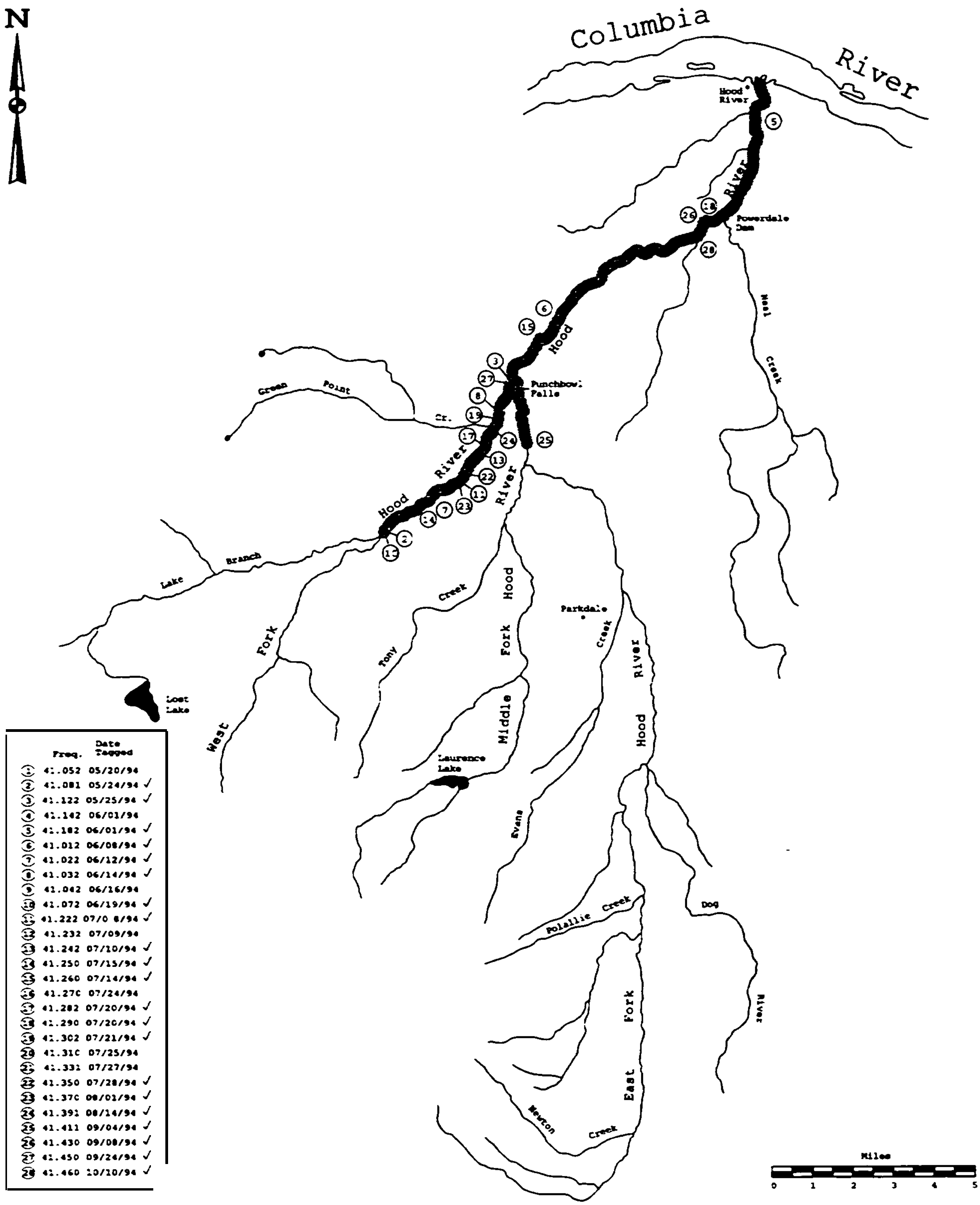
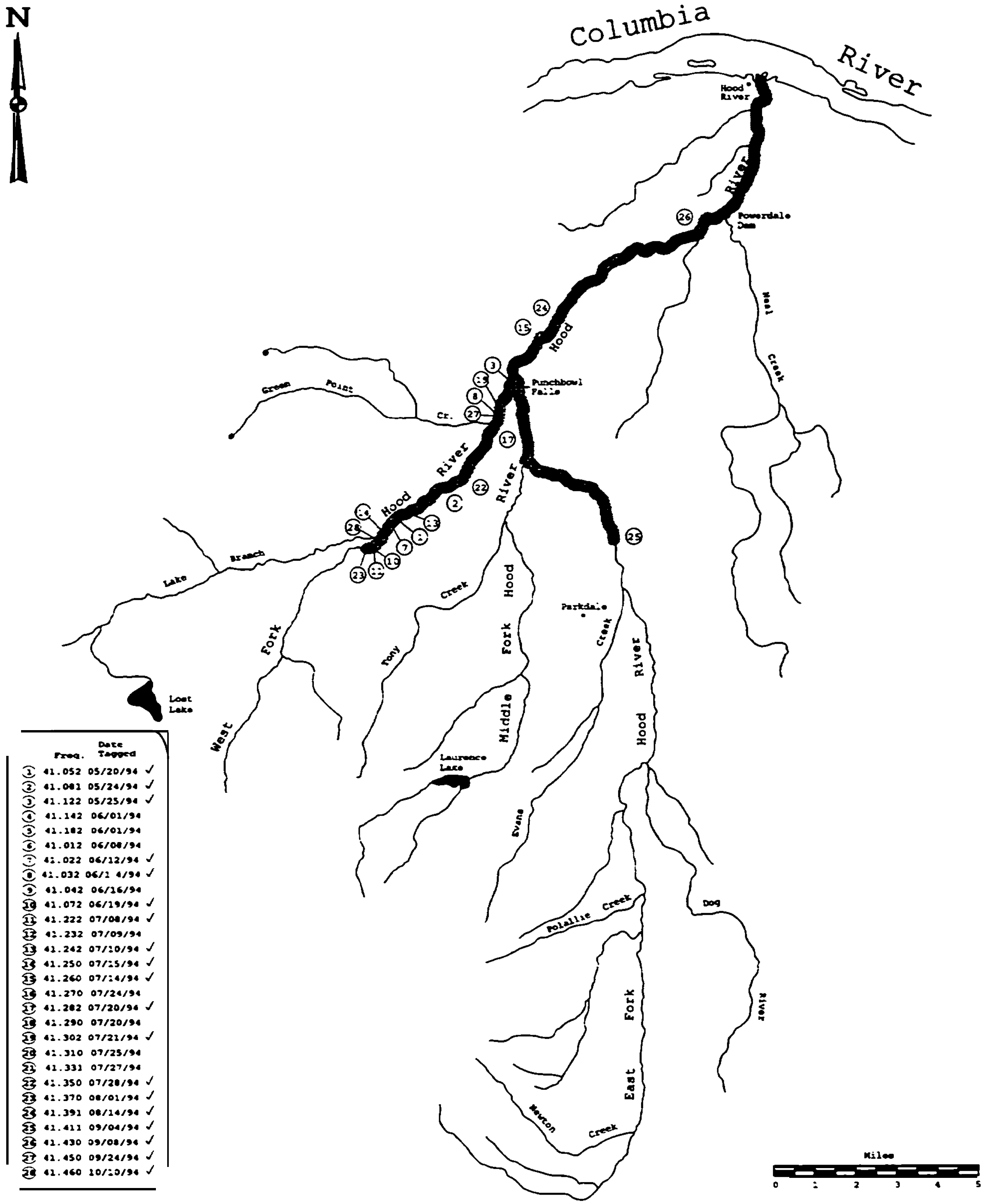


Figure 30. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 09i22-10/Q/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.



	Freq.	Date Tagged	
1	41.052	05/20/94	✓
2	41.081	05/24/94	✓
3	41.122	05/25/94	✓
4	41.142	06/01/94	
5	41.182	06/01/94	
6	41.012	06/08/94	
7	41.022	06/12/94	✓
8	41.032	06/14/94	✓
9	41.042	06/16/94	
10	41.072	06/19/94	✓
11	41.222	07/08/94	✓
12	41.232	07/09/94	
13	41.242	07/10/94	✓
14	41.250	07/15/94	✓
15	41.260	07/14/94	✓
16	41.270	07/24/94	
17	41.282	07/20/94	✓
18	41.290	07/20/94	
19	41.302	07/21/94	✓
20	41.310	07/25/94	
21	41.331	07/27/94	
22	41.350	07/28/94	✓
23	41.370	08/01/94	✓
24	41.391	08/14/94	✓
25	41.411	09/04/94	✓
26	41.430	09/08/94	✓
27	41.450	09/24/94	✓
28	41.460	10/10/94	✓

Figure 31. **Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 10/13-11/07/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.**

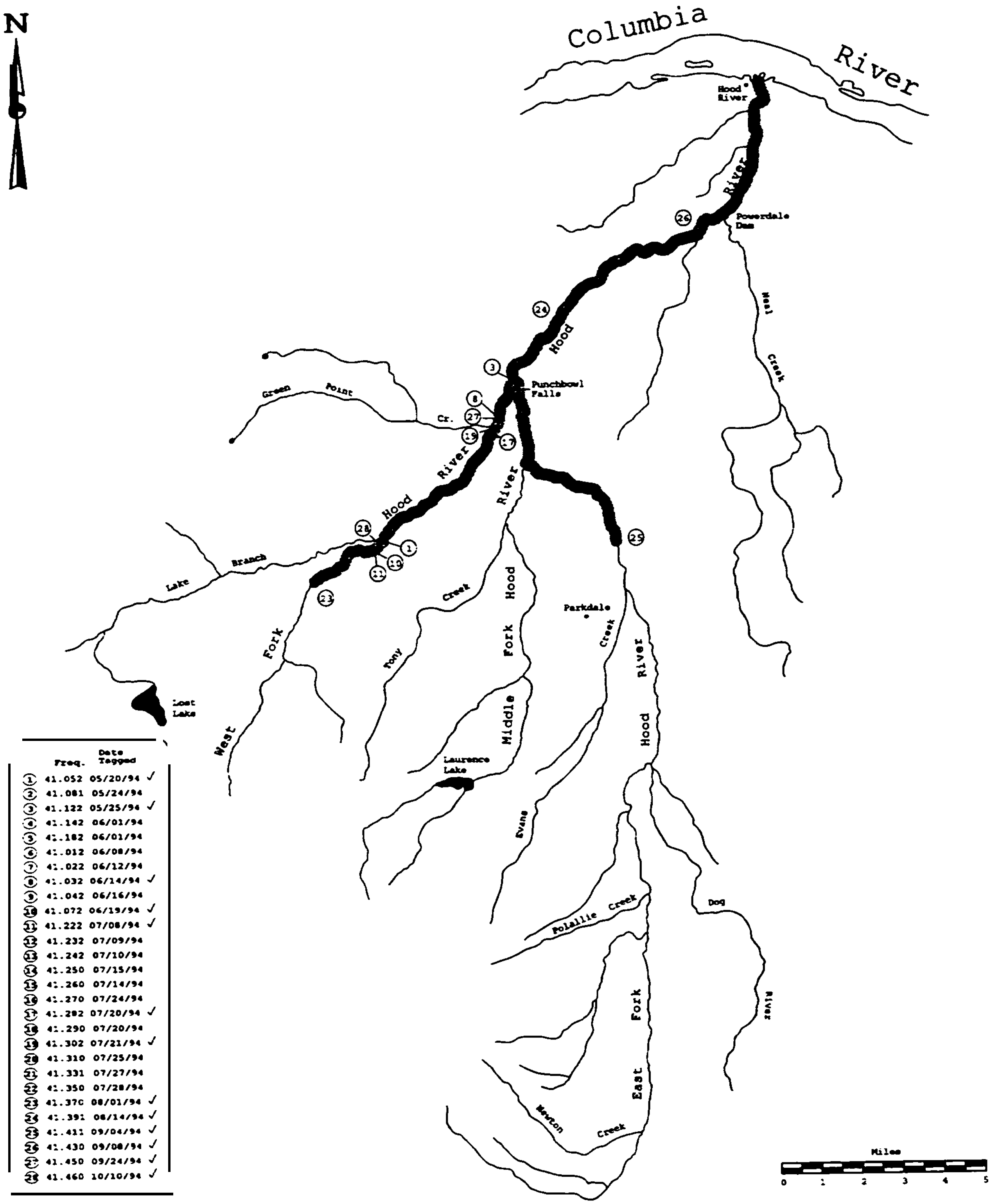


Figure 32. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 11/08-12/31/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

Table 24. Bimonthly counts of upstream migrant adult winter steelhead at Powerdale Dam by origin and run year.

Origin, run year	December 01-15	December 16-31	January 01-15	January 16-31	February 01-15	February 16-29	March 01-15	March 16-31	April 01-15	April 16-30	May 01-15	May 16-31	June 01-15	June 16-30	Total
Wild,															
1991-92	0	0	0	24	28	32	75	98	153	149	88	29	2	0	678
1992-93	0	4	0	2	3	0	28	61	99	78	86	30	3	2	396
1993-94	0	0	4	7	0	6	23	25	77	127	76	21	11	0	377
Subbasin hatchery,															
1991-92	0	5	15	114	59	49	33	5	2	2	0	0	0	0	284
1992-93	2	15	0	34	48	0	42	32	18	13	3	0	0	0	207
1993-94	0	0	29	32	8	37	33	5	3	2	0	0	0	0	149
Stray hatchery,															
1991-92	0	0	0	3	5	1	6	6	7	3	1	1	0	0	33
1992-93	0	1	0	4	3	0	3	9	7	1	1	0	0	0	29
1993-94	0	0	2	1	0	0	2	3	11	7	0	0	0	0	26
Unknown,															
1991-92	0	0	0	1	1	0	2	3	3	7	3	1	0	0	21
1992-93	1	1	0	1	1	0	2	4	3	2	2	0	0	0	17
1993-94	0	0	1	1	0	0	4	8	5	5	3	2	0	0	29

Table 25. 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 aoe												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.														
1991-92	593	-	3	4	__	9	421	75	0	1	111	17	1	51
1992-93	407	--	2	6	__	35	173	121	1	1	20	16	0	32
1993-94	400	__	2	6	__	9	272	78	0	1	16	4	0	12
Subbasin hatchery.														
Big Creek.														
1991-92	289	..	269	7	--	..	6	1	--	--	--	--	--	6
1992-93	205	.	64	133	--	..	0	0	--	--	--	--	--	8
1993-94	140	--	..	64	--	__	72	0	--	--	--	--	--	4
Mixed.[a]														
1992-93	7	7	--	__	--	--	--	--	--	--	--	--	--	
1993-94	14	__	14	--	--	--	--	--	--	--	--	--		--
Hood River.[b]														
1993-94	0	0	--		--	--	--	--		--	-	--	--	--
Stray hatchery.														
Unknown.														
1991-92	34	0	19	14	0	--	0	--	--	--	--	--	--	1
1992-93	30	0	18	9	0	--	0	--	__	__	__	--	--	3
1993-94	27	1	0	23	1	__	1	__	--	__	__	__	__	1

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

[b] The 1993-94 run year is the first run year in which the native 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 trapping facility.

Table 26. Adult winter steelhead escapements to the Powerdale Dam trap by origin. stock, brood year. and ocean age category. (Percent return is in parentheses. Estimates are based on returns in the 1991-92 through 1993-94 run years.)

Origin. stock. brood year[a]	Smolts	Ocean age: 1 salt	2 salt	3 salt	4 salt	Repeat spawners
Wild.						
Hood River,						
1985	--		--	--	--	2
1986	--		1	17	0	18
1987	--		111	91	1	39
1988	--	1	441	129	0	23
1989	--	10	192	84	0	12
1990	--	36	274	6	--	1
1991	--	9	2	--	--	--
Subbasin hatchery,						
Big Creek.						
1987	28,000		--	1 (0.004)	--	2 (0.009)
1988	4,890	--	6 (0.12)	7 (0.14)	--	4 (0.07)
1989	36,038		269 (0.75)	133 (0.37)	--	9 (0.02)
1990	20.434		136 (0.67)	64 (0.31)	--	3 (0.01)
Mixed.[b]						
1991	4.595	7 (0.15)	14 (0.30)	--	--	--
Hood River.						
1992	48.985	0	--	--		

[a] Based on estimates of age structure for adult winter steelhead sampled at Powerdale Dam trap, the 1989 wild and 1990 hatchery broods represent the first brood years for which complete estimates of escapement can be made. Estimates of escapement for prior brood years do not include adult returns from all possible age categories. Complete brood year specific estimates of escapement for the 1989 wild and 1990 hatchery broods will be available upon completion of the 1994-95 run year.

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

Table 27. Age composition (percent) of adult winter steelhead sampled at the Powerdale Dam trap by origin. stock. 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 1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/2	Repeat spawners
Wild.														
Hood River.														
1991-92	662	--	0.5	0.6	--	1.4	60.7	10.7	0	0.2	16.0	2.4	0.2	7.4
1992-93	393	--	0.5	1.5	--	8.7	42.3	29.8	0.3	0.3	4.8	3.8	0	7.9
1993-94	370	--	0.5	1.6	--	2.2	67.8	19.5	0	0.3	4.1	1.1	0	3.0
Subbasin hatchery.														
Big Creek.														
1991-92	245		93.1	2.4	--	--	2.0	0.4	--	--	--	--	--	2.0
1992-93	185	--	31.4	64.9	--	--	0	0	--	--	--	--	--	3.8
1993-94	129	--	--	45.7	--	--	51.2	0	--	--	--	--	--	3.1
Mixed.[a]														
1992-93	6	100	--				--	--	--					
1993-94	13	--	100	--	--	--	--	--	--	--		--	--	--
Stray hatchery.														
Unknown.														
1991-92	32	0	56.2	40.6	0	--	0	--		--	--	--	--	3.1
1992-93	29	0	58.6	31.0	0	--	0	--	--	--	--	--	--	10.3
1993-94	24	4.2	0	83.3	4 2	--	4.2	--	--	--	--	--	--	4.2

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

Table 28 Mean fork length (cm) of adult winter steelhead with spawning checks in the 1993-94 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	2/1s.2	2/2s.3	2/3s.4	2/2s.3s.4
Wild,						
Female,						
N			1	7	2	1
Mean			63.5	70.14	74.25	67.5
STD			--	6.54	2.47	
Range			63.5	63.0-83.5	72.5-76.0	67.5
Male,						
N						
Mean			--			
STD						
Range						
Total,						
N			1	7	2	1
Mean			63.5	70.14	74.25	67.5
STD			--	6.54	2.47	--
Range		--	63.5	63.0-83.5	72.5-76.0	67.5
Subbasin hatchery,						
Female,						
N	1	1		--	--	--
Mean	70.0	81.0	--	--	--	--
STD		--	--	--	--	--
Range	70.0	81.0	--	--	--	--
Male,						
N	2	--	--	--	--	--
Mean	69.00	--	--	--	--	--
STD	1.41	--	--	--	--	--
Range	68.0-70.0	--	--	--	--	--
Total,						
N	3	1	--	--	--	
Mean	69.33	81.0	--	--	--	--
STD	1.15	--		--	--	--
Range	68.0-70.0	81.0	--	--	--	--

Table 29. Mean fork length (cm) of adult winter steelhead without spawning checks in the 1993-94 run year by origin. sex. and age category. Fish were sampled at the Powerdale Dam trap.

Origin. sample pop statistic	Freshwater/ocean age								Sample[a] mean
	1/2	1/3	2'1	2/2	2/3	3/1	3/2	3/3	
Wild.									
Female.									
N		4	1	174	48	--	9	3	254
Mean	--	77.00	50 5	67.12	75.51	--	66.78	79.33	69.01
STD	--	5.85	--	3.88	4.67	--	4.07	4.19	5.63
Range	--	71.5-83.0	50.5	57.0-76.5	64.0-87.0	--	62.0-74.0	74.5-82.0	50.5-87.0
Male.									
N	2	2	7	77	24	1	6	1	123
Mean	58 00	86.75	50.29	69.21	80.29	47.0	62.17	74.5	70.08
STD	3.54	0.35	3.13	5.04	5.13	--	3.67	--	9.05
Range	55.5-60.5	86.5-87.0	44.5-54.0	61.0-83.5	69.5-91.0	47.0	56.5-66.0	74.5	44.5-91.0
Total.									
N	2	6	8	251	72	1	15	4	377
Mean	58.00	80.25	50.31	67.76	77.10	47.0	64.93	78.12	69.36
STD	3.54	6.77	2.90	4.37	5.30	--	4.44	4.19	6.94
Range	55.5-60.5	71 5-87.0	44.5-54.0	57.0-83.5	64.0-91.0	47.0	56.5-74.0	74.5-82.0	44.5-91.0
Subbasin hatchery.[b]									
Female.									
N	4	39	--	26	--	--	--	--	74
Mean	65.38	75.51	--	63.42	--	--	--	--	70.49
STD	10.05	3 61	--	2 86	--	--	--	--	7.05
Range	52.0-74.5	68.0-85.0		[illegible]3.5-68.5	--	--	--	--	52.0-85.0
Male.									
N	9	20	--	40	--	--	--	--	75
Mean	67 11	79.18	--	65.22	--	--	--	--	69.95
STD	7.80	4.68	--	3.35	--	--	--	--	7.77
Range	56.5-81.5	69.5-88.0	--	57.5-71.5			--	--	56.5-88.0
Total.									
N	13	59	--	66	--	--	--	--	149
Mean	66.58	76.75	--	64.52	--	--	--	--	70.22
STD	8.16	4.33	--	3.27	--	--	--	--	7.40
Range	52.0-81.5	68.0-88.0	--	57.5-71.5	--	--	--	--	52.0-88.0

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

[b] Age 1/2 winter steelhead are returns from the 1991 brood release. These fish are progeny of wild x Big Creek stock hatchery crosses.

Table 30. 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).]

Origin. stock. brood year	Freshwater/ocean age 111	2/1	3/1	1/2	2/2	3/2	4/2	113	2/3	3/3	1/4	2/4
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)	--	—
1989	—	49 (9)	55 (1)	62 (3)	66 (167)	65 (15)	--	77 (6)	77 (72)	—	—	--
1990	—	52 (34)	47 (1)	59 (2)	68 (251)	--	—	80 (6)		..		..
1991	—	50 (8)		58 (2)	—	—	..		..	..	—	—
Subbasin Hatchery.												
Big Creek.												
1987	—	..	..	..	..	..	..	..	76 (1)	..	..	..
1988	..	—	..	..	73 (5)	--	—	75 (6)	--	..	..	..
1989		..	..	64 (228)	..	—	..	77 (120)	--	..	..	..
1990	..	..	—	62 (58)	65 (66)	--	..	77 (59)	--	..		..
Mixed.[a]												
1991	57 (6)	--	—	67 (13)				..	..			

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

Table 31 Mean weight (kg) of adult winter steelhead without spawning checks in the 1993-94 run year by origin. sex. and age category. Fish were sampled at the Powerdale Dam trap.

Origin. sample pop.. statistic	Freshwater/ocean age 1/2	1/3	2/1	2/2	2/3	3/1	3/2	3/3	Sample[a] mean
Wild.									
Female.									
N		3	1	150	29		9	2	206
Mean		5.00	1.4	3.25	4.61		3.07	4.50	3.47
STD		1.32	--	0.59	0.96		0.52	1.27	0.87
Range		3.5-6.0	1 4	1.8-5.0	3.1-6.7	--	2.6-4.2	3.6-5.4	1.4-6.7
Male.									
N	1	1	7	65	11	1	4		93
Mean	2.4	6.8	1.31	3.39	5.28	1.1	2.22		3.45
STD		--	0.18	0.78	1.22	--	0.57		1.30
Range	.4	6.8	1.0-1.6	2.0-6.1	3.3-8.0	1.1	1.7-3.0	--	1.0-8.0
Total.									
N	1	4	8	215	40	1	13	2	301
Mean	.4	5.45	1.32	3.29	4.79	1.1	2.81	4.50	3.46
STD	--	1.41	0.17	0.66	1.06	--	0.65	1.27	1.02
Range	2.4	3.5-6.8	1.0-1.6	1.8-6.1	3.1-8.0	1.1	1.7-4.2	3.6-5.4	1.0-8.0
Subbasin hatchery.[b]									
Female.									
N	1		--	--			--		1
Mean	1.1		--	--			--		1.1
STD				--			--		
Range	1.1		--	--			--		1.1
Male.									
N	2	1	--	--			--	--	3
Mean	3.25	3.9	--	--			--		3.47
STD	1.34	--	--	--		--	--	--	1.02
Range	2.3-4.2	3.9	--				--	--	2.3-4.2
Total.									
N	3	1	--	--		--	--		4
Mean	2.53	3.9	--	--	--	--	--		2.88
STD	1.56	--	--	--	--	--	--		1.45
Range	1.1-4.2	3.9	--	--		--	--		1.1-4.2

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

[b] Age 11'2 winter steelhead are returns from the 1991 brood release. These fish are progeny of wild x Big Creek stock hatchery crosses.

Table 32. Adult winter steelhead sex ratios as a percentage of females by origin. run year. and age category. Fish were sampled at the Powerdale Dam trap. (Sample size is in parentheses.)

Origin. stock. run year	Freshwater/ocean age											Repeat spawners
	1/1	1/2	1/3	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/2	
Wild.												
Hood River												
1991-92	--	67 (3)	75 (4)	0 (9)	58 (402)	63 (71)	--	0 (1)	64 (106)	88 (16)	100 (1)	64 (47)
1992-93	--	50 (2)	67 (6)	26 (34)	63 (167)	72 (117)	0 (1)	100 (1)	42 (19)	60 (15)	--	87 (31)
1993-94	--	0 (2)	67 (6)	12 (8)	69 (251)	67 (72)	--	0 (1)	60 (15)	75 (4)	--	100 (11)
Subbasin hatchery												
Big Creek.												
1991-92	--	36 (228)	100 (6)	--	60 (5)	100 (1)	--	--	--	--	--	80 (5)
1992-93	--	21 (58)	74 (120)	--	--	--	--	--	--	--	--	71 (7)
1993-94	--	--	66 (59)	--	39 (66)	--	--	--	--	--	--	50 (4)
Mixed.[a]												
1992-93	67 (6)	--		--	--	--	--	--	--	--	--	--
1993-94	--	31 (13)	-			--	--	--	--	--	--	--

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

Table 33. Mean, fecundity of wild adult winter steelhead by ocean age. Fish were sampled at the Powerdale Dam trap.

Ocean age, run year	Mean fork length (cm)	Fecundity N	Mean	Range	95% C.I.
2 Salt.					
1991-92	62.7	11	2.940	1.933 - 4.950	± 624
1992-93	56.4[a]	3	3.620	3.036 - 4.117	± 317
1993-94	58.C	13	3.330	2.025 - 6.480	± 519
3 Salt.					
1991-92	74.8	5	3.032	2.502 - 4.080	± 572
1992-93	78.8	8	4.266	2.916 - 6.398	± 1.341
1993-94	76.6	7	4.500	2.493 - 5.400	± 880

[a] Fork length was not recorded for one fish.

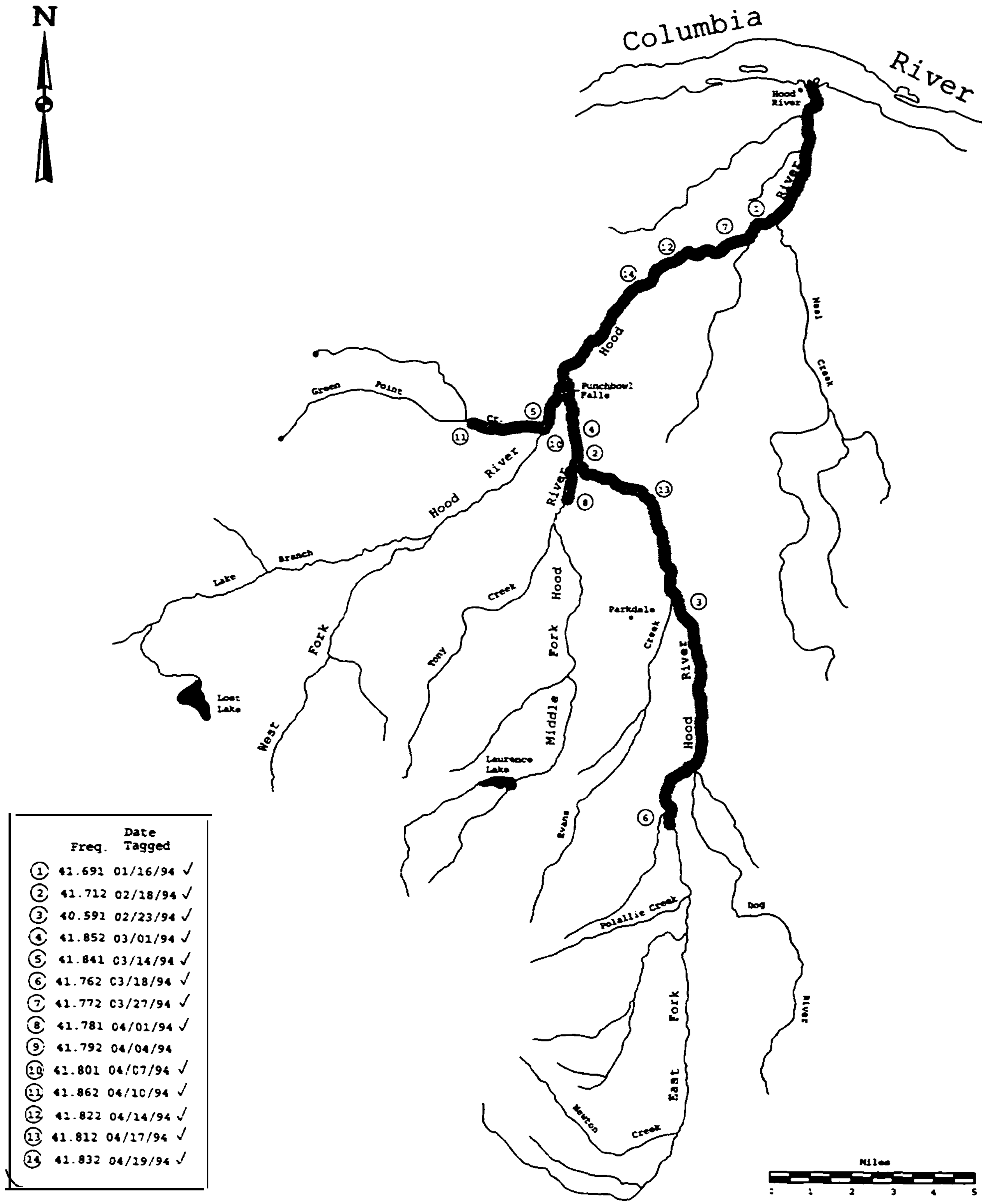


Figure 33. Maximum spatial distribution of radio-tagged wild adult winter steelhead during the period 01/16-04/21/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged winter steelhead are from the 1993-94 run year.

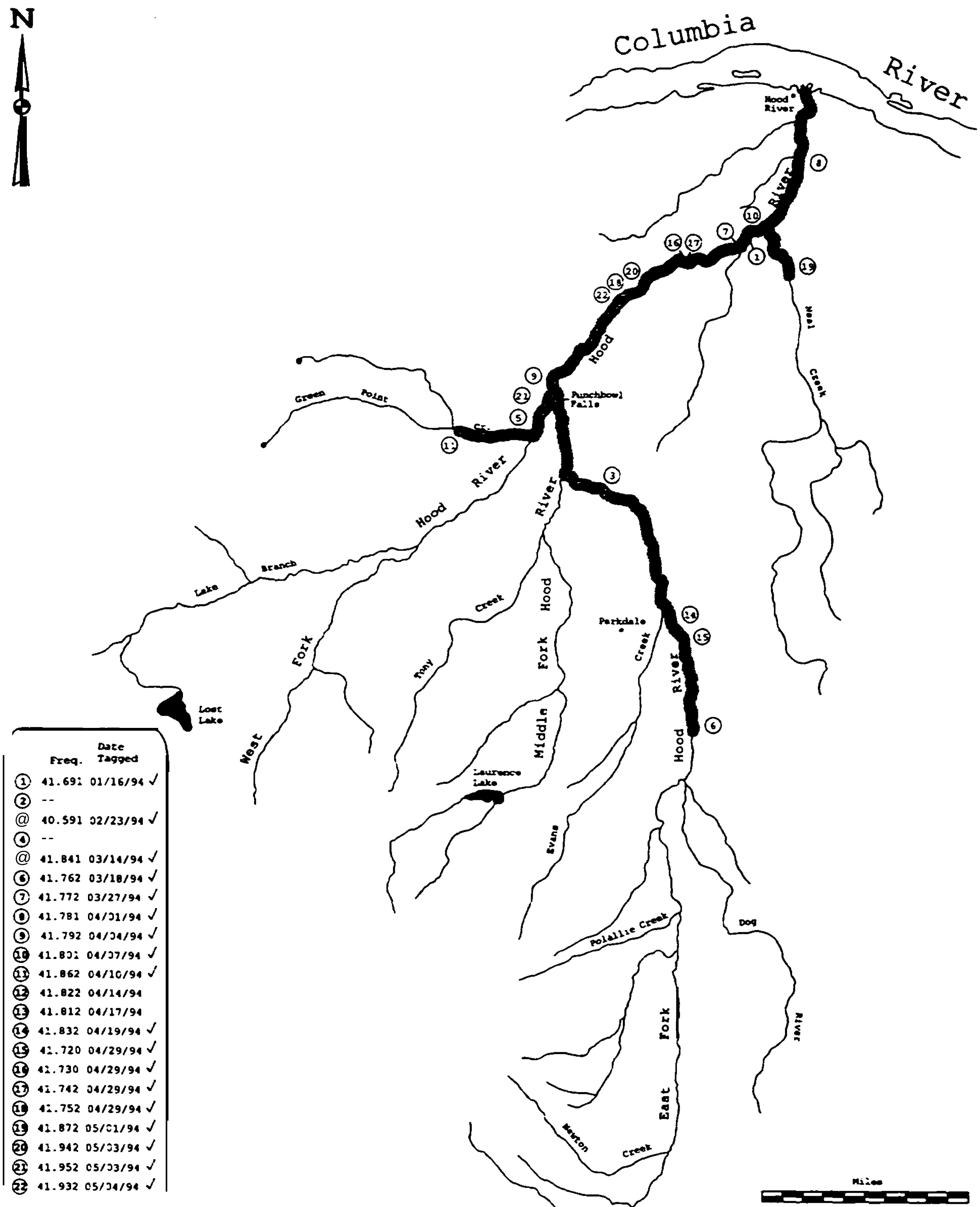


Figure 34. Maximum spatial distribution of radio-tagged wild adult winter steelhead during the period 04/22-05/06/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged winter steelhead are from the 1993-94 run year.

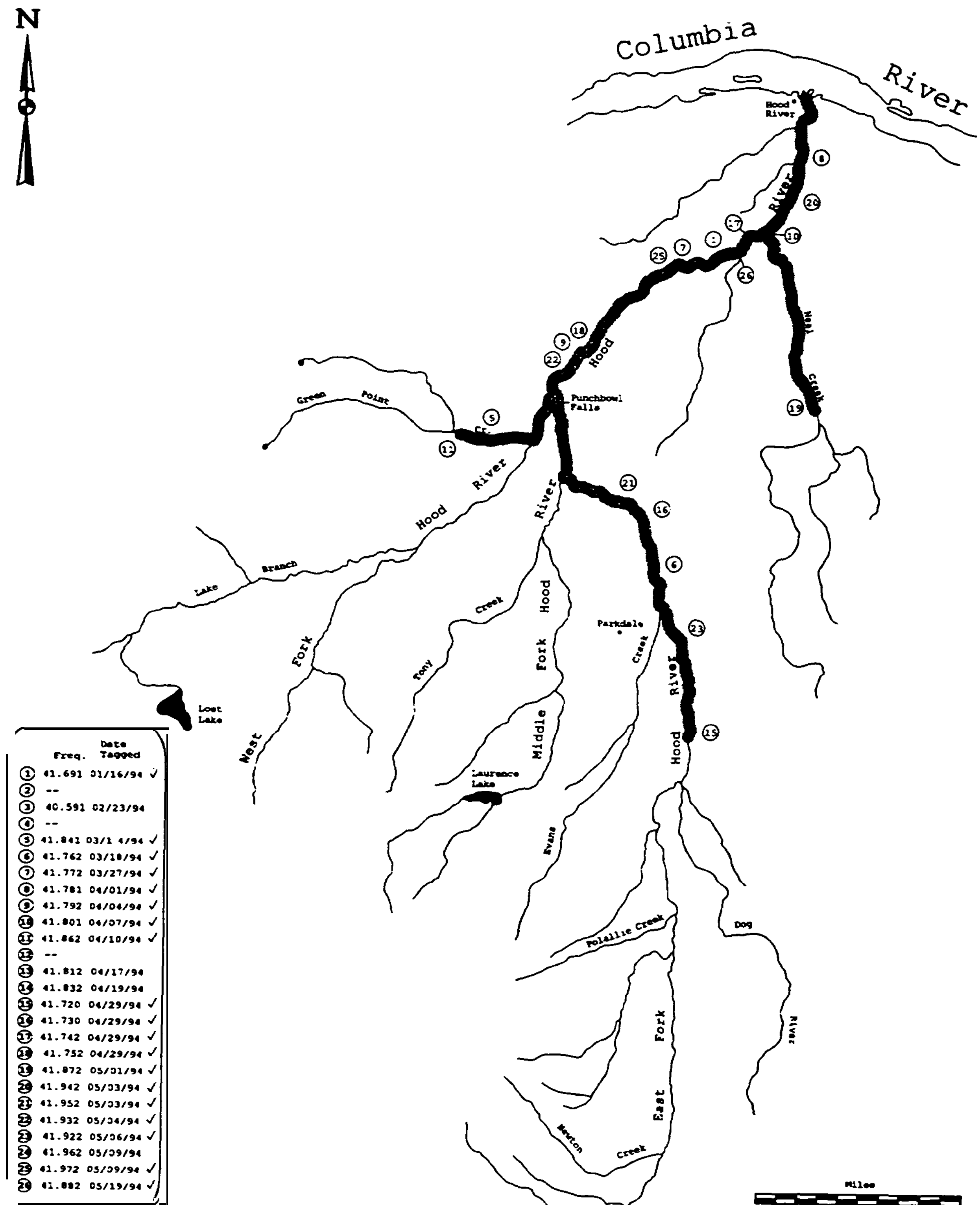


Figure 35. Maximum spatial distribution of radio-tagged wild adult winter steelhead during the period 05/07-20/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged winter steelhead are from the 1993-94 run year.

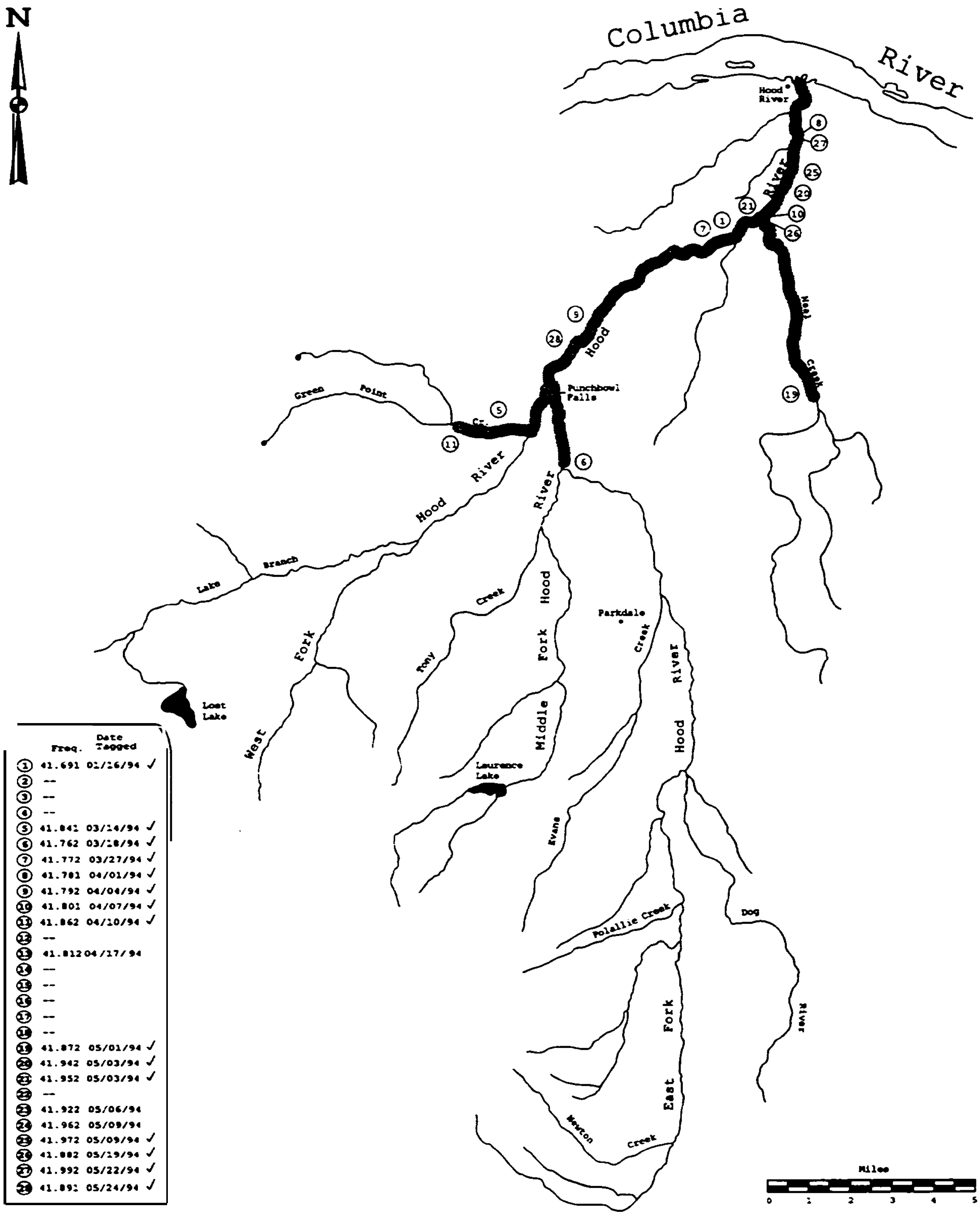


Figure 36. Maximum spatial distribution of radio-tagged wild adult winter steelhead during the period 05/21-06/09/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged winter steelhead are from the 1993-94 run year.

Table 34. Bimonthly counts of upstream migrant jack and adult spring chinook salmon at Powerdale Dam, by run year

Origin, run year	April 01-15	April 16-30	May 01-15	May 16-31	June 01-15	June 16-30	July 01-15	July 16-31	August 01-15	August 16-31	September 01-15	September 16-30	October 01-15	October 16-31	Total
Natural,															
1992	0	0	1	8	5	11	4	4	0	0	0	1	0	0	34
1993	0	0	1	4	3	9	6	8	2	6	2	0	0	0	41
1994	0	0	1	5	0	1	3	8	1	2	0	12	0	0	33
Subbasin hatchery,															
1992	0	9	77	145	75	63	15	4	4	1	2	2	1	0	398
1993	0	1	25	206	89	51	51	17	5	9	5	0	0	0	459
1994	0	6	34	166	28	7	4	17	1	0	1	1	0	0	765
Stray hatchery,															
1992	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
1993	0	0	0	0	1	0	1	0	0	0	0	0	0	0	2
1994	0	0	0	0	0	0	1	6	1	2	0	0	0	0	10
Unknown,															
1992	0	3	5	8	3	0	0	0	1	0	0	0	0	0	20
1993	0	0	0	4	0	0	2	2	0	0	0	0	0	0	8
1994	0	0	0	0	0	1	0	0	0	0	0	1	0	0	2

Table 35. Jack and adult spring chinook salmon escapements to the Powerdale Dam trap by origin, run year, and age category. Fish of unknown origin were allocated to origin categories based on scale analysis and the ratio of fish of known origin (*see* **METHODS**).

Origin, stock, run year	Total escapement	Freshwater.total age								
		1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6
Natural,										
Hood River,										
1992	36	0	1	22	1	0	--	9	3	0
1993	44	0	1	16	11	1	--	6	9	0
1994	34	1	2	15	5	0	..	5	5	1
Subbasin hatchery,										
Carson,										
1992	416	--	--	--	--	--	3	395	18	..
1993	461	--	--			--	15	214	232	--
1994	261	--	--	--	--	--	--	245	16	--
Deschutes,										
1993	3		--	..	..	3	.		--	--
1994	5	..	--	--	--	--	5	--	--	--
Stray hatchery,										
Unknown,										
1992	1	.	--	1	--	0	--	--	.	--
1993	2	--	--	2	--	0	--	--	--	--
1994	10	--	--	0	--	10	--	--	--	--

Table 36. Coded-wire tag recoveries from stray mini-jack spring chinook salmon sampled at the Powerdale Dam trap. 1994.

Brood year	Tag code	Hatchery	Release site	Number recovered
1532	07-03-18	Youngs Bay Net Pens	Youngs River & Bay	1
1992	63-53-06	Klickitat	Klickitat	1
1592	63-53-07	Klickitat	Klickitat	1
1992	63-53-08	Klickitat	Klickitat	2
1992	63-54-31	Klickitat	Klickitat	2

Table 37. Jack and adult spring chinook salmon escapements to the Powerdale Dan 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 me 1992-94 run years.)

Origin. stock. brood year[a]	Smolt production	Total age				
		Age 2	Age 3	Age 4	Age 5	Age 6
Natural.						
Hood River.						
1986	--			--	--	0
1987	--			--	4	0
1988	--	--	--	31	20	1
1985	--	--	1	22	10	--
1990	--	0	1	20	--	--
1991	--	1	2	--	--	--
1992	--	1	--	--	--	--
Subbasin hatchery.						
Carson.						
1987	134.047	--	--	--	18 (0.01)	--
1988	197.988	--	--	395 (0.20)	232 (0.12)	--
1989	125.432	--	3 (.002)	214 (0.17)	16 (0.01)	--
1990	163.295	--	15 (.009)	245 (0.15)	--	--
Deschutes.						
1991	75.205	--	3 (.004)	5 (.007)	--	--
1992[b]	0	--	--	--	--	--

[a] Based on estimates of age structure for jack and adult spring chinook salmon sampled at Powerdale Dam trap. the 1990 brood represents the first brood year for which complete estimates of escapement can be made 'or naturally produced fish. Estimates of escapement for prior brood years do not include adult returns fran all possible age categories. Complete brood year specific estimates of escapement for naturally produced fish from tne 1990 brood will be available upon completion of the 19% run year. Complete brood year specific estimates of escapement are avaiiable for the 1989 brood Carson stock.

[b] Ho fish were released fran the 1992 brood.

Table 38. Age composition (percent) of jack and adult spr ng 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 ounding error)

Or gin, stock, run year	N	Freshwater.total age 1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	1.2
Natural:										
1992	34	0	2.9	61.8	2.9	0	--	23.5	8.8	0
1993	41	0	2.4	36.6	24.4	2.4		14.6	19.5	0
1994	33	3.0	6.1	42.4	15.2	0	--	15.2	15.2	3.0
Subbasin hatchery										
Carson,										
1992	390	--	--	--	--	0	0.8	94.9	4.4	--
1993	451	--	--		-	--	3.3	46.3	50.3	--
1994	258	--	--	--	--	--	--	93.8	6.2	--
Deschutes										
1993	3			--	--	100	--	--	--	--
1994	5				-	--	00	--	--	-
Stray hatchery										
Unknown										
1992	1			100	--	--	-	--	--	
1993	2			100	--	--	-	--	--	
1994	10			0	--	00		--	--	

Table 39. Mean fork length (cm) of Jack and adult spring chinook salmon in the 1992 run year by origin. sex. and age category. Fish were sampled at the Powerdale Dam trap.

Origin. sample pop.. statistic	Freshwater total age						Sample[a] mean
	1.3	1.4	1.5	2.3	2.4	2.5	
Natural.							
Female.							
N	--	14	1	--	2	2	19
Mean	--	80.04	85.0	--	69.75	85.25	79.82
STD	--	7.19	--	--	8.13	10.96	8.03
Range	--	62.0-91.0	86.0	--	64.0-75.5	77.5-93.0	62.0-93.0
Male.							
N	1	7	--	--	6	1	15
Mean	71.0	84.14	--	--	73.17	84.0	78.87
STD	--	5.65	--	--	9.31		8.88
Range	71.0	79.0-95.0	--	--	57.5-82.0	84.0	57.5-95.0
Total.							
N	1	21	1	--	8	3	34
Mean	71.0	81.40	86.0	--	72.31	84.83	79.40
STD	--	5.87	--	--	8.59	7.78	8.29
Range	71.0	62.0-95.0	86.0	--	57.5-82.0	77.5-93.0	57.5-95.0
Subbasin hatchery.							
Jacks.							
N	--	--	--	3			3
Mean	--	--	--	55.57			55.67
STD	--	--	--	5.35			5.35
Range	--	--	--	51.0-61.5	--	--	51.0-61.5
Female.							
N	--	--	--	--	275	12	288
Mean	--	--	--	--	73.31	84.83	73.76
STD	--	--	--	--	4.03	7.70	4.85
Range	--	--	--	--	53.5-93.0	72.0-99.0	53.5-99.0
Male.							
N	--	--	--	--	95	5	100
Mean	--	--	--	--	75.48	98.40	76.62
STD	--	--	--	--	6.17	5.77	7.92
Range	--	--	--	--	56.0-90.0	91.0-105.0	56.0-105.0
Total.							
N	--	--	--	3	370	17	398
Mean	--	--	--	55.67	73.87	88.82	74.32
STD	--	--	--	5.35	4.76	9.47	6.13
Range	--	--	--	51.0-61.5	53.5-93.0	72.0-105.0	51.0-105.0

[a] Mean estimates include jack and adult spring chinook salmon in which the origin. but not the age of the fish could be determined fran the scale sample.

Table 40. Mean fork length (cm) of jack and adult spring chinook salmon in the 1993 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater.total age							Sample[a] mean
	1.3	1.4	1.5	2.2	2.3	2.4	2.5	
Natural.								
Jacks.								
N	--			1	--	--	--	1
Mean	--			66.5	--	--	--	66.5
STD	--			--	--	--	--	--
Range	--			65.5	--	--	--	66.5
Female.								
N	--	11	8			4	4	27
Mean	--	80.27	83.94			84.88	88.00	84.96
STD	--	9.86	5.55	--	--	5.14	3.89	8.30
Range	--	64.0-98.0	80.0-96.0	--	--	78.0-89.5	83.5-93.0	64.0-98.0
Male.								
N	1	4	2			2	4	13
Mean	78.5	87.50	53.00			91.00	88.88	80.62
STD	--	6.94	11.31	--	--	2.12	2.36	6.13
Range	76.5	80.0-95.0	85.0-101.0	--	--	89.5-92.5	85.5-91.0	78.5-101.0
Total.								
N	1	15	13	1	--	6	8	41
Mean	78.5	82.20	90.55	66.5	--	86.92	88.44	85.67
STD	--	9.52	6.34	--	--	5.17	3.02	8.27
Range	76.5	64.0-96.0	80.0-101.0	66.5	--	78.0-92.5	83.5-93.0	64.0-101.0
Subbasin hatchery.[b]								
Jacks.								
N	--	--	--	3	15	--	--	18
Mean	--	--	--	30.33	52.27	--	--	48.62
STD	--	--	--	2.57	5.66	--	--	9.90
Range	--	--	--	27.5-32.5	44.5-60.0	--	--	27.5-60.0
Female.								
N	--	--	--		--	149	139	289
Mean	--	--	--		--	82.24	86.22	84.17
STD	--	--	--		--	6.05	4.46	5.69
Range	--	--	--			66.5-95.5	69.0-95.0	66.5-95.5
Male.								
N	--	--	--			60	88	148
Mean	--	--	--			85.87	92.74	89.95
STD	--	--	--	--		6.35	4.96	6.50
Range	--	--	--	--	--	72.5-98.0	78.5-108.0	72.5-108.0
Total.								
N	--	--	--	3	15	209	227	459
Mean	--	--	--	3c.33	52.27	83.28	88.74	84.63
STD	--	--	--	2.57	5.66	6.34	5.64	9.90
Range	--	--	--	27.5-32.5	44.5-60.0	66.5-98.0	69.0-108.0	27.5-108.0

a Mean estimates include jack and adult spring chinook salmon in which the origin, but not the age of the fish could be determined from the scale sample.

b Age 2.2 spring chinook salmon are returns from the 1991 brood release of Deschutes stock spring chinook salmon. Other age categories are returns from Carson stock releases of spring chinook salmon.

Table 41. Mean fork length (cm) of jack and adult spring chinook salmon in the 1994 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	1.2	1.3	1.4	1.5	2.3	2.4	2.5	2.6	Sample[a] mean
	Freshwater total age								
Natural,									
Jacks,									
N	1				--	--	--	--	1
Mean	30.0				--	--	--	--	30.0
STD	--				--	--	--	--	--
Range	30.0			--	--	--	--	--	30.0
Females,									
N	--		5	3	--	3	2	1	14
Mean	--		77.00	92.83	--	73.67	69.25	92.5	79.68
STD	--		5.24	7.08	--	0.29	3.18	--	9.87
Range	--		73.0-86.0	88.5-101.0	--	73.5-74.0	67.0-71.5	92.5	67.0-101.0
Males,									
N	--	2	9	2	--	2	3	--	18
Mean	--	62.00	76.61	100.50	--	70.25	85.17	--	78.36
STD	--	1.41	10.74	4.95	--	3.18	9.07	--	13.21
Range	--	61.0-63.0	61.0-94.0	97.0-104.0	--	68.0-72.5	78.5-96.5	--	61.0-104.0
Total,									
N	1	2	14	5	--	5	5	1	33
Mean	30.0	62.00	76.75	95.90	--	72.30	78.80	92.5	77.45
STD	--	1.41	8.92	6.99	--	2.46	11.28	--	14.33
Range	30.0	61.0-63.0	61.0-94.0	88.5-104.0	--	68.0-74.0	67.0-96.5	92.5	30.0-104.0
Subbasin hatchery,[b]									
Jacks,									
N	--			--	5	--	--	--	5
Mean	--				52.40	--	--	--	52.4
STD	--			--	2.95	--	--	--	2.95
Range	--			--	49.5-56.0	--	--	--	49.5-56.0
Females									
N	--		--	--	--	156	10	--	167
Mean	--				--	74.65	80.35	--	74.99
STD	--			--	--	3.73	9.05	--	4.39
Range	--			--	--	61.5-87.0	69.5-96.5	--	61.5-96.5
Males,									
N	--		--	--	--	86	6	--	93
Mean	--				--	76.45	85.42	--	76.98
STD	--	--		--	--	4.74	12.18	--	5.83
Range	--			--	--	55.0-89.5	74.5-104.0	--	55.0-104.0
Total,									
N	--			--	5	242	16	--	265
Mean	--				52.40	75.29	82.25	--	75.26
STD	--			--	2.95	4.20	10.25	--	5.92
Range	--			--	49.5-56.0	55.0-89.5	69.5-104.0	--	49.5-104.0

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

[b] Age 2.3 spring chinook salmon are returns from the 1991 brood release of Deschutes stock spring chinook salmon. Other age categories are returns from Carson stock releases of spring chinook salmon

Table 42. Mean fork length (cm) of jack and adult spring chinook salmon by origin, brood year, and age category. (Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables.)

Origin, stock, brood year	Freshwater.total age 1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	7.6
Natural,									
Hood River,									
1987	--	--	--	86 (1)	--	--	--	85 (3)	--
1988	..	--	81 (21)	91 (10)	--	--	72 (8)	88 (8)	97 (1)
1989	--	71 (1)	82 (15)	96 (5)		--	87 (6)	79 (5)	..
1990	--	78 (1)	77 (14)	--	.	.	72 (5)		
1991	--	62 (2)	--	--	66 (1)	--	--	.	--
1992	30 (1)		..	--	..	--	--	..	--
Subbasin hatchery,									
Carson,									
1987	--	--	--	--	--	.	..	89 (17)	--
1988	--	--	--	--	..	--	74 (370)	89 (227)	--
1989	.		--	--	--	56 (3)	83 (209)	82 (16)	--
1990	--	--	.	..	..	52 (15)	75 (242)	--	--
Deschutes,									
1991	--	--	--	--	30 (3)	52 (5)	--	--	--

Table 43. Mean weights (kg) of jack and adult spring chinook salmon in the 1994 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	2.3	2.4	2.5	2.6	Sample mean[a]
Natural.									
Jacks.									
N	1	--	--	--	--	--	--	--	1
Mean	0.3	--	--	--	--	--	--	--	0.3
STD	--	--	--	--	--	--	--	--	--
Range	0 3	--	--	--	--	--	--	--	0.3
Females.									
N	--	--	4	3	--	3	2	1	13
Mean	--	--	4.90	9.67	--	5.17	4.30	9.5	6.32
STD	--	--	0.64	2.31	--	0.12	0.71	--	2.52
Range	--	--	4 0-5 5	8.0-12.3	--	5.1-5.3	3.8-4.8	9.5	3.8-12.3
Males.									
N	--	2	9	2	--	2	3	--	18
Mean	--	2.90	5.69	10.75	--	4.50	7.43	--	6.10
STD	--	0.28	2.20	134	--	0.99	1 93	--	2.71
Range	--	2 7-3 1	2.9-9.0	9.8-11.7	--	3.8-5.2	5.9-9.6	--	2.7-11.7
Total.									
N	1	2	13	5	--	5	5	1	32
Mean	0.3	2.90	5.45	10.10	--	4.90	6.18	9.5	6.01
STD	--	0.28	1.66	1.86	--	0.62	2.22	--	2.75
Range	0 3	2.7-3.1	2 9-9.0	8.0-12.3	--	3.8-5.3	3.8-9.6	9.5	0.3-12.3
Subbasin hatchery.[b]									
Jacks.									
N	--	--	--	--	5	--	--	--	5
Mean	--	--	--	--	1.64	--	--	--	1.64
STD	--	--	--	--	0.21	--	--	--	0.21
Range	--	--	--	--	1 3-1 8	--	--	--	1.3-1.8
Females									
N	--	--	--	--	--	151	10	--	162
Mean	--	--	--	--	--	5.19	6.18	--	5.25
STD	--	--	--	--	--	0.78	2.21	--	0.94
Range	--	--	--	--	--	2.8-8.0	3.9-10.8	--	2.8-10.8
Males.									
N	--	--	--	--	--	84	6	--	91
Mean	--	--	--	--	--	5.40	7.67	--	5.53
STD	--	--	--			0.97	3.18	--	1.35
Range	--	--	--	--	--	2 1-7.9	5.1-13.0	--	2.1-13.0
Total.									
N	--	--	--	--	5	235	16	--	258
Mean	--	--	--	--	1.64	5.27	6 74	--	5.28
STD	--	--	--	--	0 21	0.86	2.62	--	1.21
Range	--	--	--	--	1 3-1 8	2 1-8.0	3.9-13.0	--	1.3-13.0

a Mean estimates include jack and adult spring chinook salmon in which the origin. but not the age of the fish could be determined from the scale sample.

b Age 2.3 spring chinook salmon are returns from the 1991 brood release of Deschutes stock spring chinook salmon. Other age categories are returns from Carson stock releases of spring chinook salmon

Table 44. Jack and adult spring chinook salmon sex ratios as a percentage of females by origin, run year, and age category. Fish were sampled at the Powerdale Dam trap. (Sample size is in parentheses.)

Origin, stock, run 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,									
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)
Subbasin hatchery,									
Carson,									
1992	--	--	--	--	--	0 (3)	74 (370)	71 (17)	--
1993	--	..	--	--	--	0 (15)	71 (209)	61 (227)	--
1994	..	--	--	--	--	--	64 (242)	62 (16)	--
Deschutes,									
1993	--	--	.	--	0 (3)	--	--	.	..
1994	--	--	--			0 (5)	--	--	--

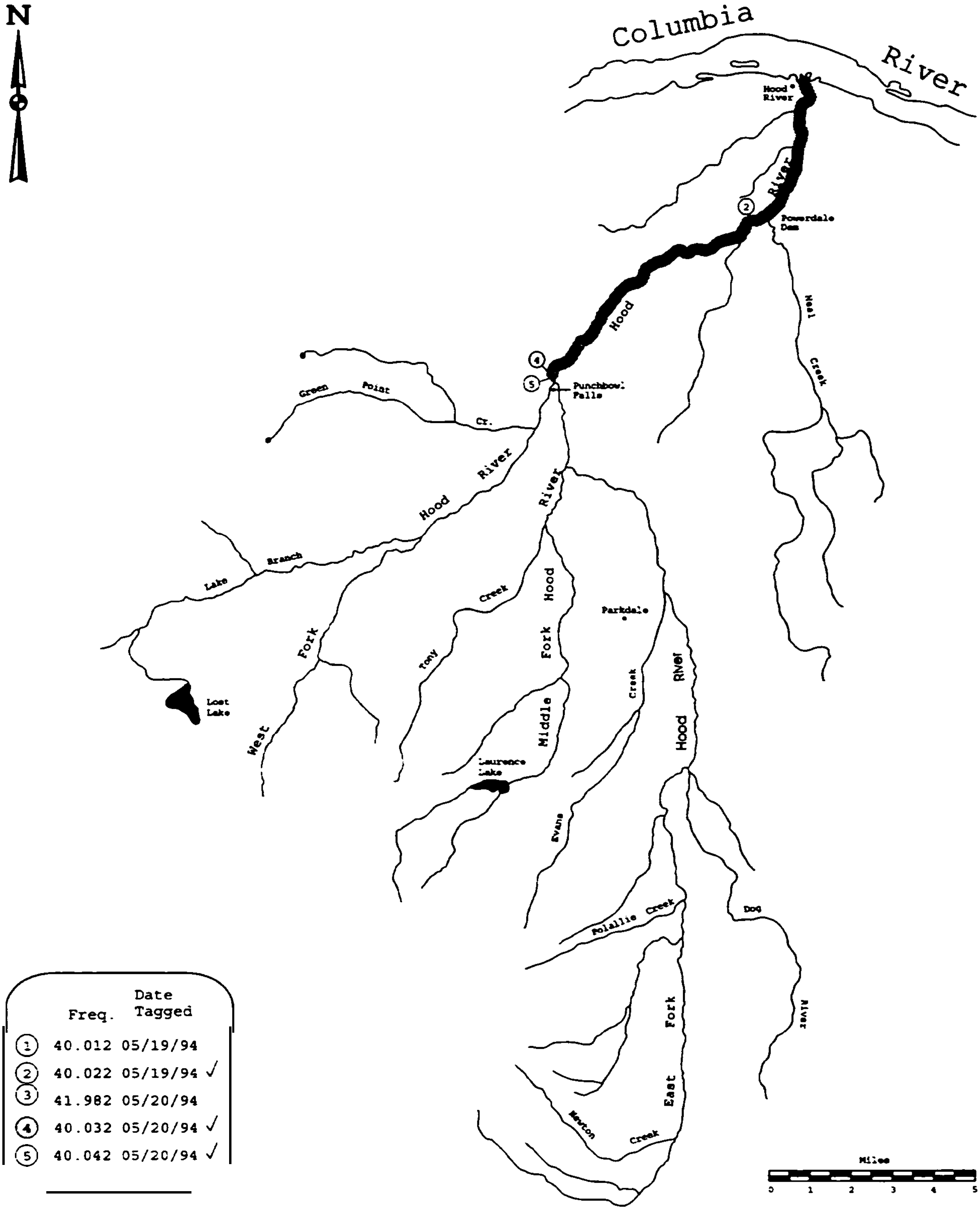


Figure 37. Maximum spatial distribution of radio-tagged unmarked adult spring chinook salmon during the period 05/19-21/94. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced salmon.

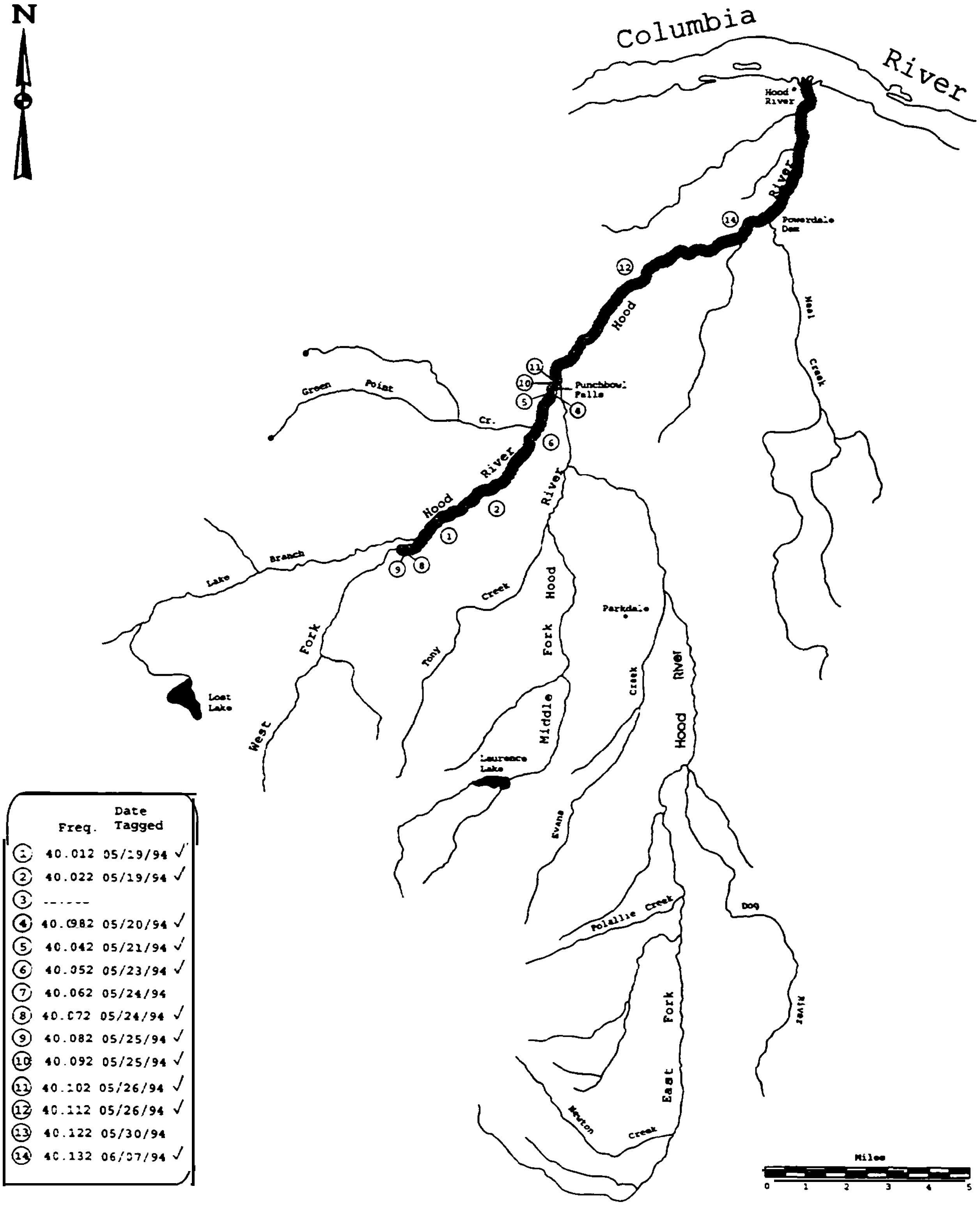


Figure 38. Maximum spatial distribution of radio-tagged unmarked adult spring chinook salmon during the period 05/22-06/09/94. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced salmon.

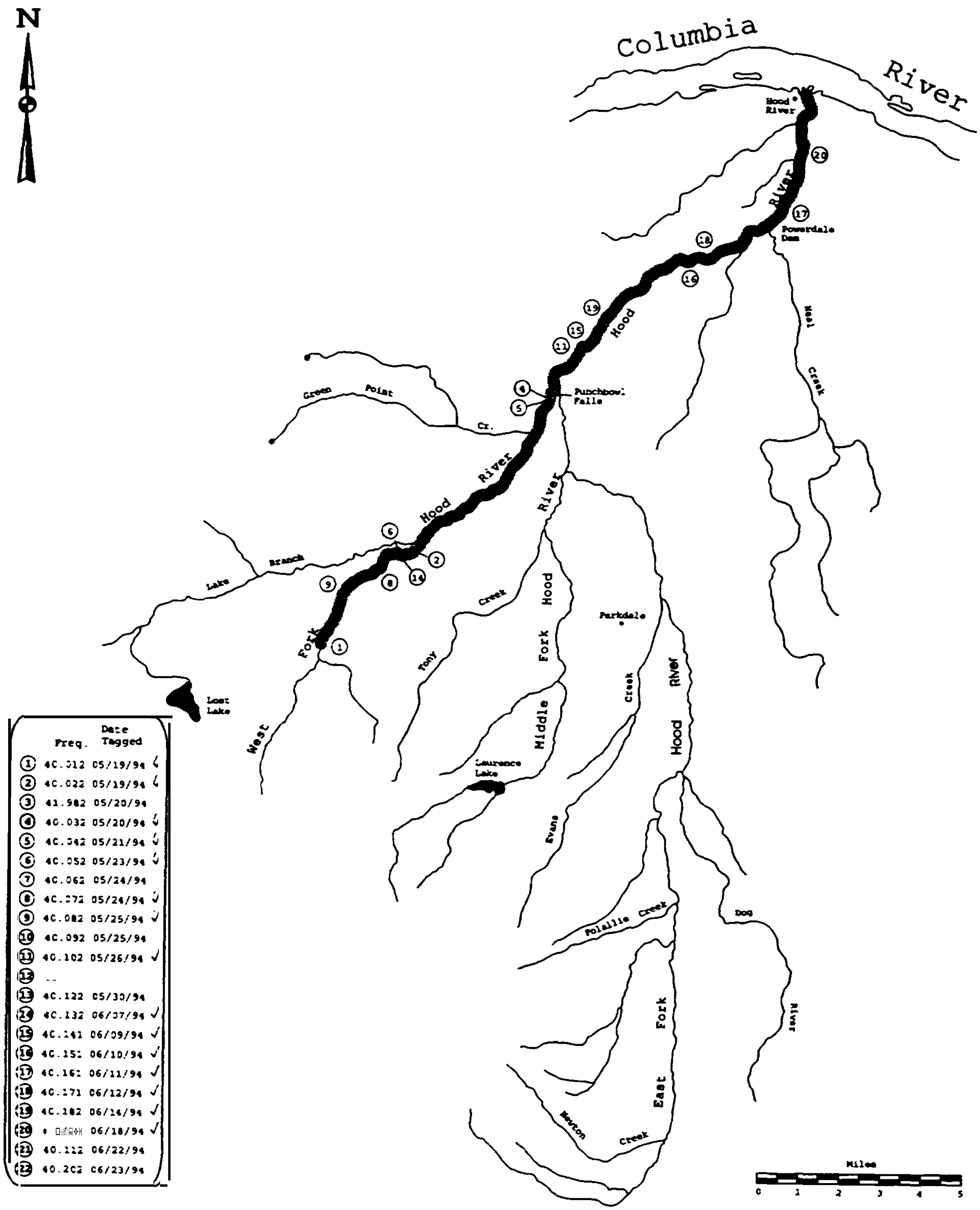


Figure 39. Maximum spatial distribution of radio-tagged unmarked adult spring chinook salmon during the period 06/10-24/94. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced salmon.

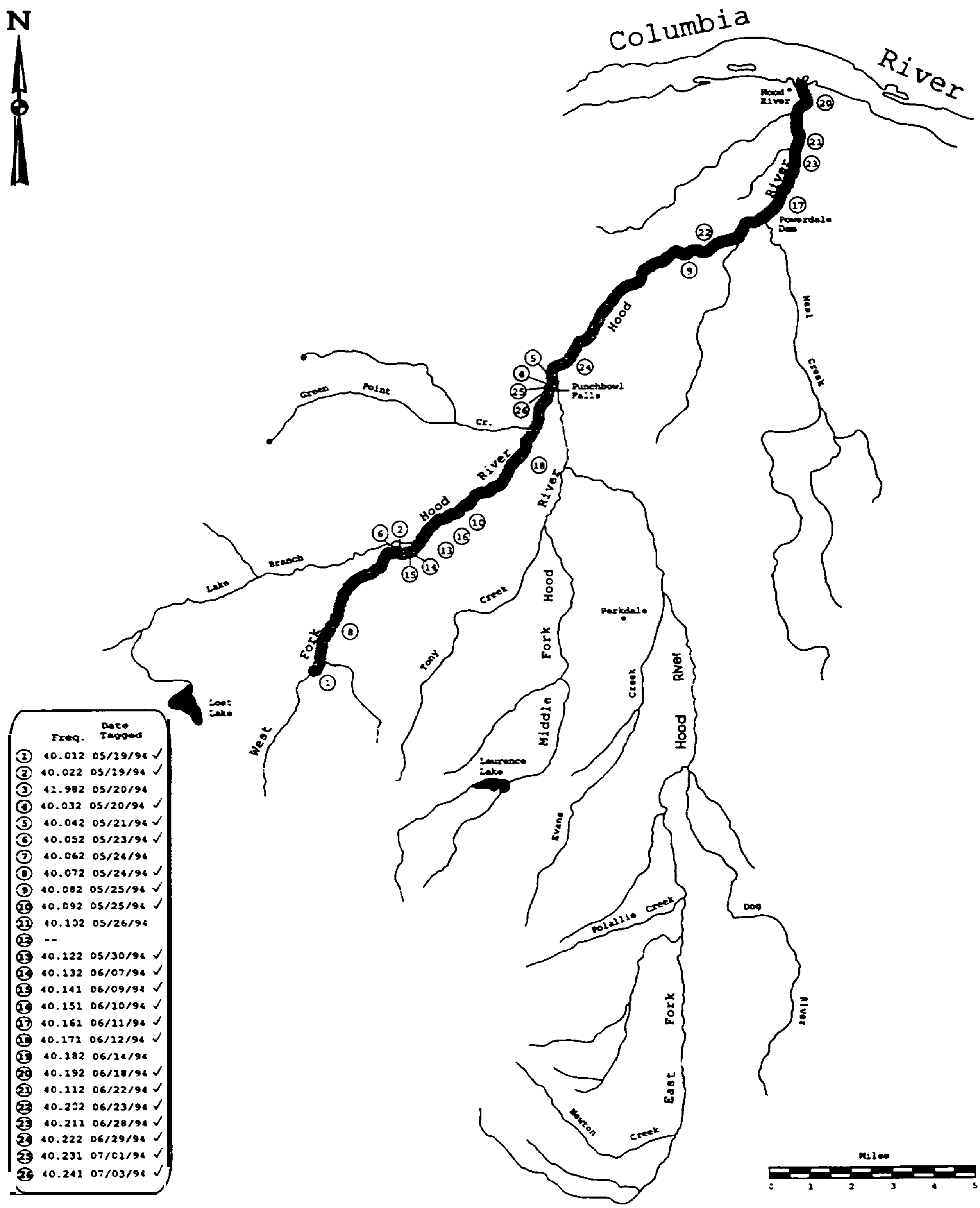


Figure 40. Maximum spatial distribution of radio-tagged unmarked adult spring chinook salmon during the period 06/25-07/08/94. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced salmon.

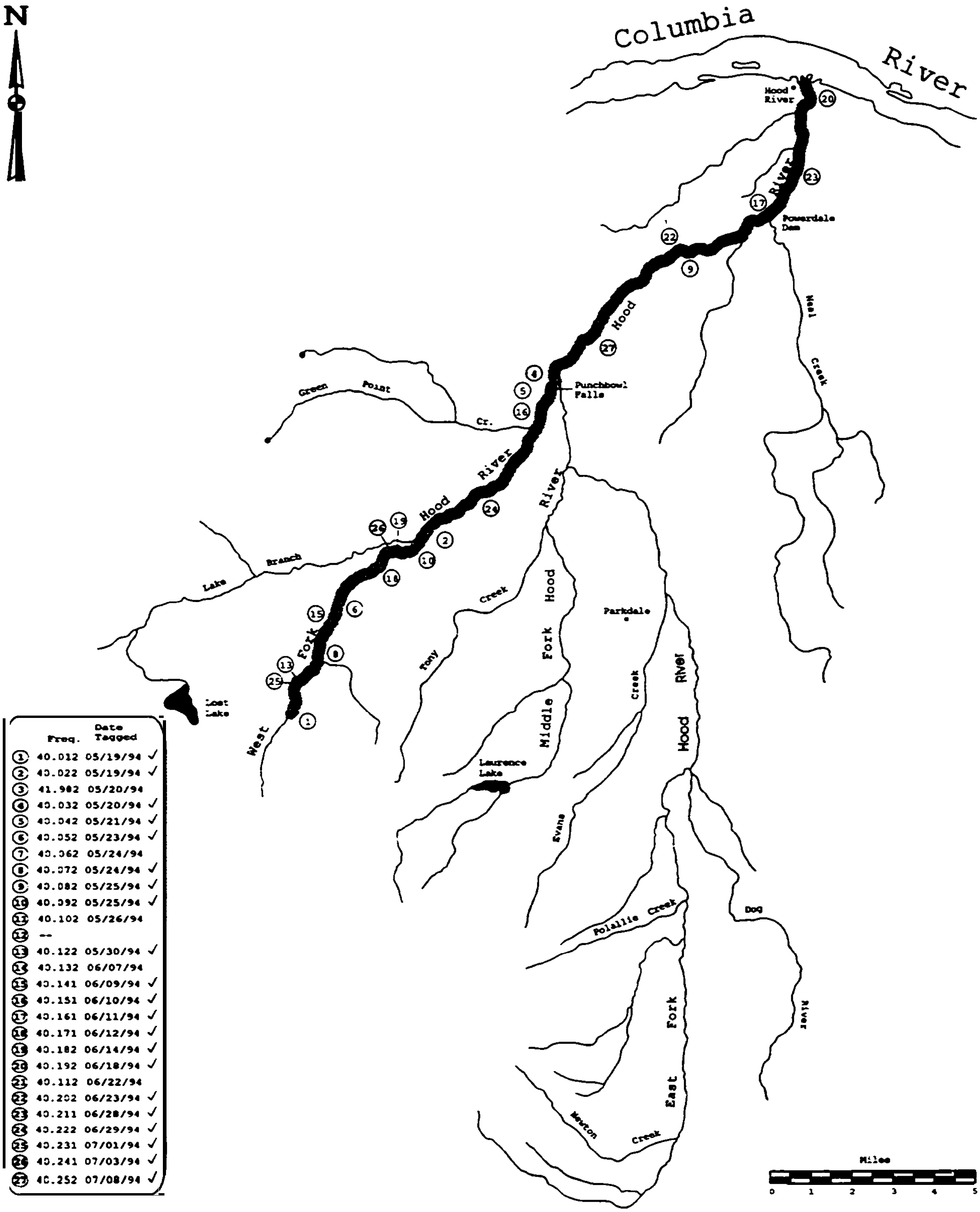


Figure 41. Maximum spatial distribution of radio-tagged unmarked adult spring chinook salmon during the period 07/09-08/15/94. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced salmon.

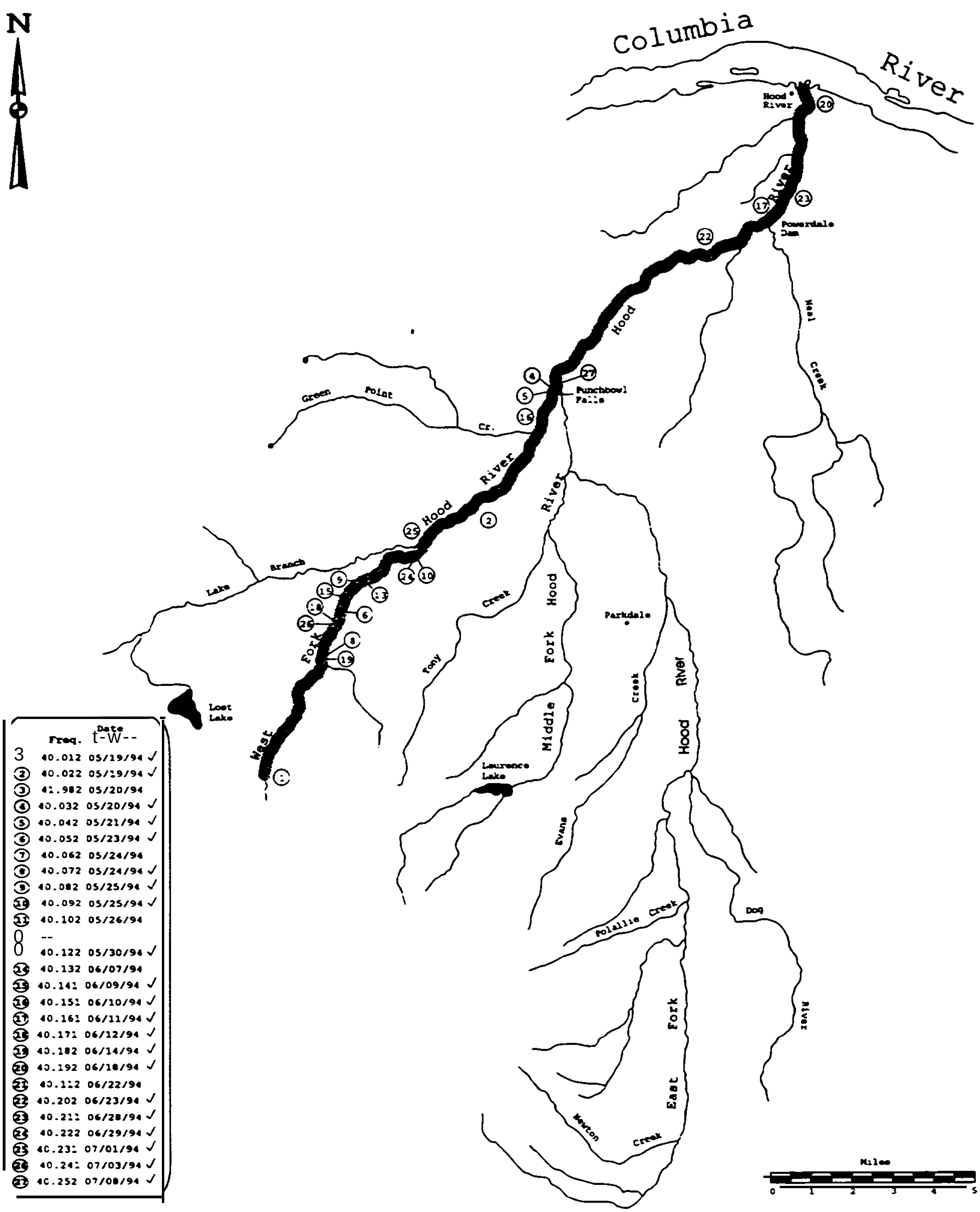


Figure 42. Maximum spatial distribution of radio-tagged unmarked adult spring chinook salmon during the period 08/16-09/06/94. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced salmon.

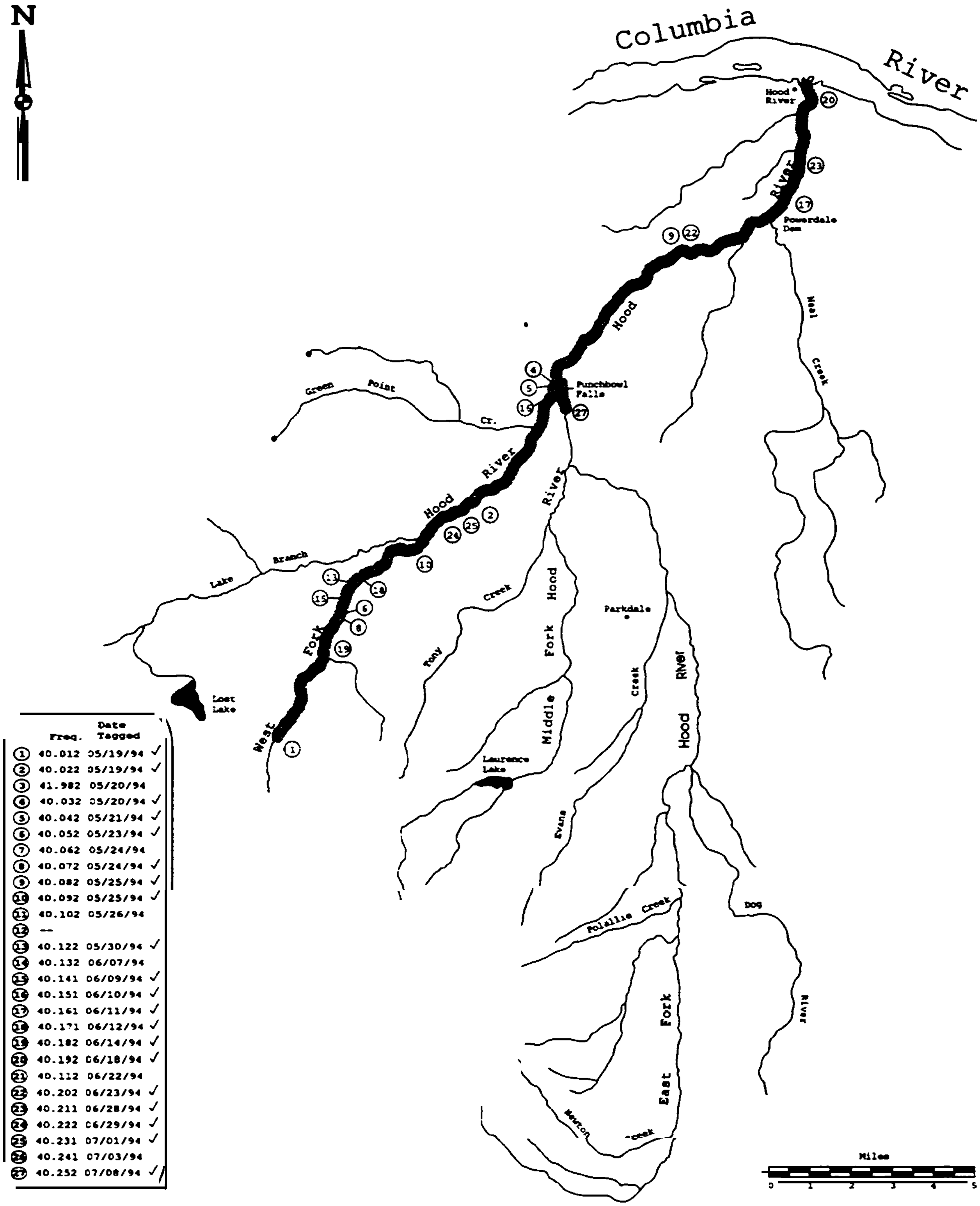


Figure 43. Maximum spatial distribution of radio-tagged unmarked adult spring chinook salmon during the period 09/07-21/94. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced salmon.

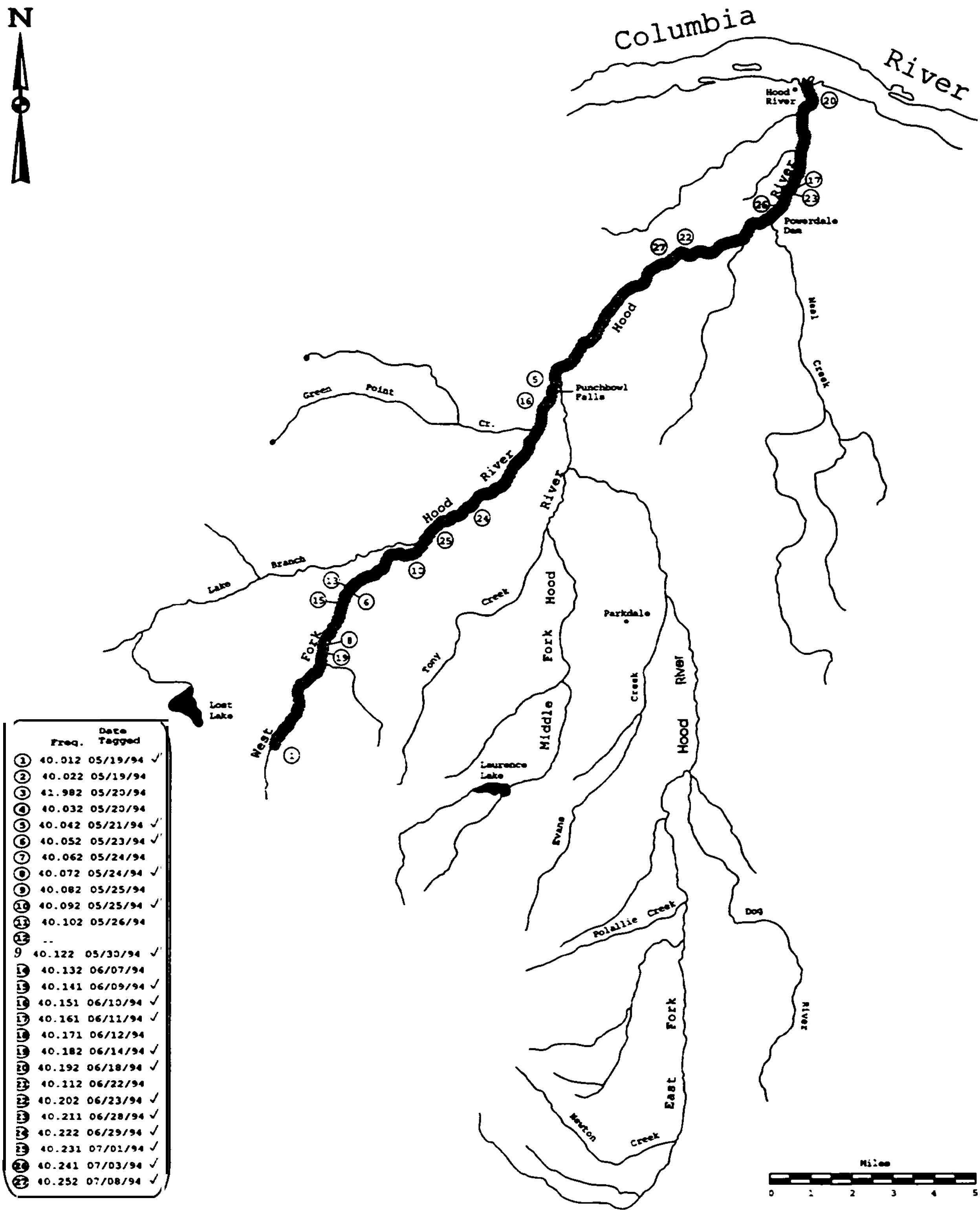


Figure 44. Maximum spatial distribution of radio-tagged unmarked adult spring chinook salmon during the period 09/22-10/12/94. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced salmon.

Table 45. Bimonthly counts of upstream migrant Jack and adult coho salmon at the Powerdale Dam trap by origin and run year.

Origin, run year	August 01-15	August 16-31	September 01-15	September 16-30	October 01-15	October 15-31	November 01-15	November 16-30	December 01-15	December 16-30	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
Stray hatchery.											
1992	0	1	6	37	12	12	11	0	0	0	79
1993	0	0	0	3	9	10	0	3	2	0	27
1994[a]	0	0	3	15	11	23	0	0	0	0	52
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

[a] Trap was inoperable from 10/27-11/07/94 because of damage caused by a major flood event in the Hood River subbasin.

Table 46. 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	Freshwater.total age 2.3
Natural.			
1992	22	--	22
1993	0	--	0
1994	1	--	1
Stray hatchery.			
1992	81	13	68
1993	32	0	32
1994	55	3	52

Table 47 Age composition (percent) of jack and adult coho salmon sampled at the Powerdale Dan trap by origin and run year.

Origin. run year	N	Freshwater.total age 2.2	Freshwater.total age 2.3
Natural.			
1992	22	--	100
1993	0	--	--
1994	1	--	100
Stray hatchery.			
1992	79	15.5	83.5
1993	26	0	100
1994	52	5.8	94.2

Table 46. Mean fork length (cm) of Jack and adult coho salmon in the 1994 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,			
Female,			
N	--	--	--
Mean	--	--	--
STD	--	--	--
Range	--	--	--
Male,			
N	--	1	1
Mean	--	56.0	56.0
STD	--	--	--
Range	--	56.0	56.0
Total,			
N	--	1	1
Mean	--	56.0	56.0
STD	--	--	--
Range	--	55.0	56.0
Stray hatchery			
Jacks,			
N	3	--	3
Mean	39.17	--	39.17
STD	4.19	--	4.19
Range	36.5-44.0	--	36.5-44.0
Female,			
N	--	21	21
Mean	--	67.60	67.60
STD	--	5.53	5.53
Range	--	56.0-78.0	56.0-78.0
Male,			
N	--	28	28
Mean	--	70.82	70.82
STD	--	6.05	6.05
Range	--	60.0-81.5	60.0-81.5
Total,			
N	3	49	52
Mean	39.17	69.44	67.69
STD	4.19	5.99	9.23
Range	36.5-44.0	56.0-81.5	36.5-81.5

Table 49. Mean fork length (cm) of Jack and adult coho salmon by origin. brood gear. 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).]

Origin. brood year	Freshwater total age 2.2	2.3
Natural.		
1989	--	58 (22)
1990	--	—
1991	--	56 (1)
1992	--	--
Stray hatchery.		
1989	--	58 (66)
1990	38 (13)	65 (27)
1991	--	69 (49)
1592	39 (3)	--

Table 50. Mean weight (gm) cf Jack and adult coho salmon in the 1994 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.			
Female.			
N			
Mean		--	
STD		--	--
Range	--	--	--
Hale.			
N		1	1
Mean		1.8	1.8
STD	--	--	
Range	--	1.8	1.8
Total.			
N		1	1
Mean		1.8	1.8
STD	--	--	
Range		1.8	1.8
Stray hatchery.			
Jacks.			
N	3		3
Mean	0.73		0.73
STD	0.32	--	0.32
Range	0.5-1.1		0.5-1.1
Female.			
N		21	21
Mean		3.60	3.60
STD	--	0.84	0.84
Range		1.9-5.2	1.9-5.2
Male.			
N		28	28
Mean	--	3.77	3.77
STD		0.95	0.95
Range		2.1-5.5	2.1-5.5
Total.			
N	3	49	52
Mean	0.73	3.70	3.52
STD	3.32	0.90	1.12
Range	0.5-1.1	1.9-5.5	0.5-5.5

Table 51. Jack and adult coho salmon sex ratios as a percentage cf 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	Freshwater total age 2.3
Natural.		
1992	--	64 (22)
1993	--	--
19%	--	C (1)
Stray haicnery.		
1942	62 (13)[a]	36 (56)
1993	--	18 (28)
19%	33 (3)[b]	43 (49)

a fight jacks were classified as females based on visual observation

b One jack was classified as a female based on visual observation.

Table 52. Hatchery juvenile summer steelhead 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
1487	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	Rest 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	15.504	West Fork Hood River
1486	AD	--	04/06-12/89	5.5	32.853	West Fork Hood River
1989	AD	--	04/04/90	5.3	4,876	Hood River
1585	AD		04/11/90	6.5	10.660	Hood River
1985	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	All	--	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
1590	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
199C	AD		04/23/91	5.6	6,776	West Fork Hood River
199C	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	5.958	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
1492	AD		05/04/93	6.3	17,555	West Fork Hood River
1452	AD		05/05/93	6.5	15.403	Rest Fork Hood River

Table 52. Continued

Broodstock, hatchery, brood year	Fin clip[b] or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released	Release location
1993	AD	--	03/29-31/94	4.6	71,760	West Fork Hood River
1993	AD	--	03/29/94	4.0	5,880	West Fork Hood River
1993	AD	--	03/30-31/94	5.2	12,402	West Fork Hood River

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

[b] Ac = Adipose.

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

Table 53. Hatchery Juvenile winter steelhead 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
1984	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	26.000	MFk 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						
1951	Ad	--	03/31/92	4.5	4.595	East Fork Hood River
Hood River,						
Oak Springs						
1992	Ad-LP	--	04/06/93	5.e	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	07-05-36	--	04/12-13/94	4.5	6.863	East Fork Hood River
1493	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	07-05-38	--	04/12/94	5.4	6.445	East Fork Hood River
1993	07-05-39	--	04/12/94	5.4	6.531	East Fork Hood River
1993	Ad-LP	--	06/28/94	5.8	2.155	East Fork Hood River

a Estimates of production releases prior to the 1987 brood are in Olsen et al (1992).
b Ad = Adipose; LP = Left Pectoral; LM = Left Maxillary.
c The 1991 brood are progeny of wild x Big Creek stock hatchery crosses.

Table 54. Hatchery Juvenile spring chinook salmon releases in the Hood River subbasin by brood year[a].

Life history stage. broodstock. hatchery. brood year	Fin clip or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released	Release location
Fingerling.						
Carson.						
Irrigon.						
1985	No mark	--	05/18/86	23.0	92.580	West Fork Hood River
Smolt.						
Carson.						
Bonneville.						
1986	No mark	--	03/14/88	5.4	11.724	West Fork Hood River
1986	No mark	--	03/14/88	5.7	30.895	West Fork Hood River
1986	No mark	--	03/14/88	10.1	11.544	West Fork Hood River
1586	ho mark	--	03/14/88	10.2	12.288	West Fork Hood River
1486	No mark	--	03/14/88	10.5	4.988	West Fork Hood River
1586	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
1586	07-42-57	--	03/14/88	11.2	34.548	West Fork Hood River
1566	07-42-57	--	03/14/88	11.4	14.443	West Fork Hood River
1986	07-42-57	--	03/14/88	11.6	5.685	West Fork Hood River
1987	Co 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
1537	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	07-42-58	--	03/09/89	11.1	28.521	West Fork Hood River
1988	07-52-23	--	03/13/90	5.4	23.970	West Fork Hood River
1588	No mark	--	03/12-13/90	5.5	42.565	West Fork Hood River
1988	No mark	--	03/13/90	10.0	20.759	West Fork Hood River
1588	07-52-23	--	03/13/90	10.0	10.550	West Fork Hood River
1988	No mark	--	03/12/90	10.1	11.209	West Fork Hood River
1968	No mark	--	03/12/90	10.2	13.973	West Fork Hood River
1988	07-52-23	--	03/14/90	10.2	10.761	West Fork Hood River
1588	No mark	--	03/12-13/90	10.3	30.483	West Fork Hood River
1588	07-52-23	--	03/14/90	10.4	14.144	West Fork Rood River
1988	No mark	--	03/12/90	10.5	7.770	West Fork Hood River
1988	No mark	--	03/12/90	10.8	11.664	West Fork Hood River
1989	07-55-30	--	03/25/91	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	li.2	42.419	West Fork Hood River
1990	No mark	--	04/02/92	9.7	41.547	West Fork Hood River
1990	No mark	--	04/02/92	5.9	62.954	West Fork Hood River
1990	07-56-59	--	04/02/92	10.2	58.694	West Fork Hood River

Table 54. Continued

Life history stage. broodstock. hatchery. brood year	Fin clip or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released	Release location
Smolt. (cont.)						
Deschutes.						
Bonneville.						
1991	07-33-35	--	04/01/93	11.2	11.760	West Fork Hood River
1991	07-33-35	--	04/01/53	11.3	34.685	West Fork Hood River
Round Butte.						
1991	07-50-22 R2	--	04/08-09/93	6.7	28.760	West Fork Hood River

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

Table 55. 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. 1994.

Race	Hatchery production release	Estimated smolts[a] to mouth	95% C.I.	Percent of production release
Summer steelhead	90.042	38.262	26.322 - 50.202	42.52
Winter steelhead	38.334	12.201	5.826 - 18.577	32.1%

[a] Hatchery smolts appear to exhibit a high degree of stress associated with trapping and handling (see HATCHERY PRODUCTION. Post-Release Survival). The methodology used to estimate numbers of hatchery summer and winter steelhead smolts will result in inflated estimates as the mortality rate increases for marked juveniles released above the trap.

Table 56. Estimates of mean fork length (mm). weight (gm). and condition factor (CF) for 1993 brood hood River stock hatchery winter steeihead smolts released into the Hood River subbasin fran Cak Springs Hatchery. Estimates are for small mediun. and large size groups which were ponded separately at the hatchery.

Statistic. size group	N	Mean	Range	95% C.I
Fork length (mm).				
hall	130	183.8	115 - 234	± 4.2
Medium	132	193.1	82 - 283	± 3.9
Large	185	200.2	144 - 246	± 2.9
Weight (gms).				
Small	129	69.5	16.0 - 145.5	± 4.8
Medium	152	87.2	6.1 - 236.4	± 4.6
La-ge	185	91.1	33.1 - 168.5	± 3.8
CF [a]				
Small	129	1.06	0.88 - 1.22	± 0.005
Medium	192	1.15	0.97 - 1.35	± 0.005
Large	165	1.10	0.93 - 1.31	± 0.005

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

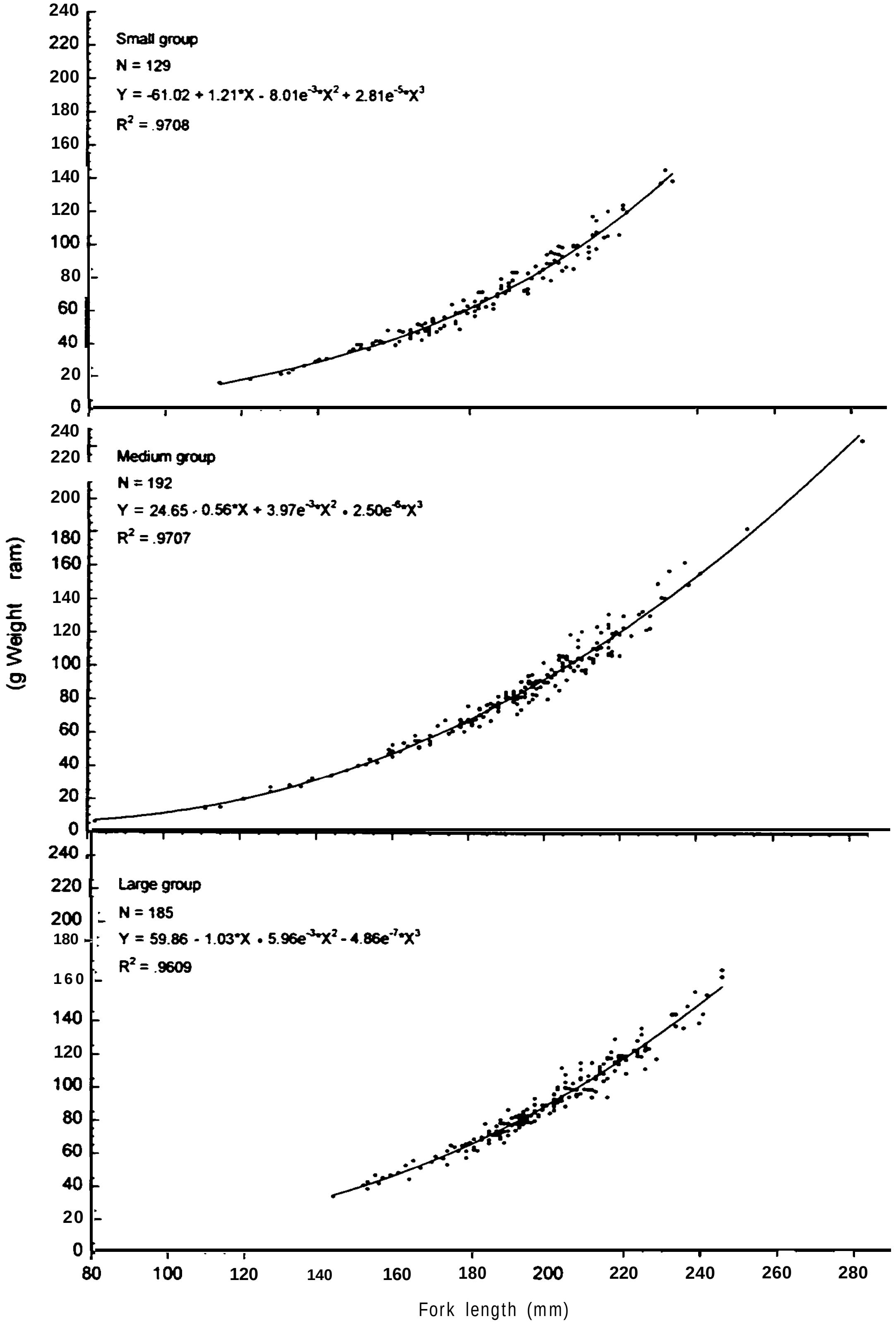


Figure 45. Length x weight regression of small, medium. and large size groups of Hood River stock hatchery winter steelhead released into the Hood River subbasin from Oak Springs Hatchery. 1994.

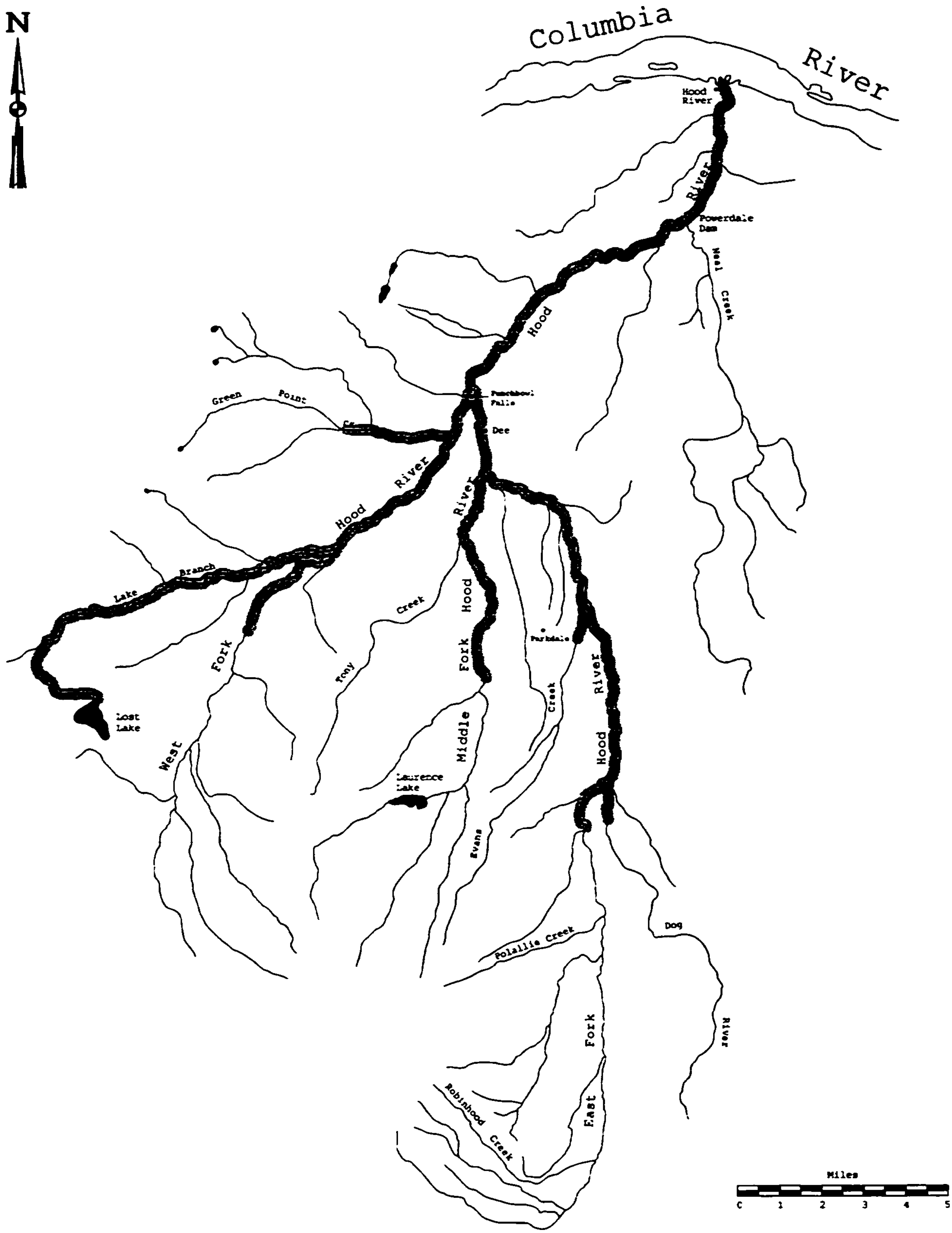


Figure 46. Location of habitat surveys conducted in the Hood River subbasin. 1994.

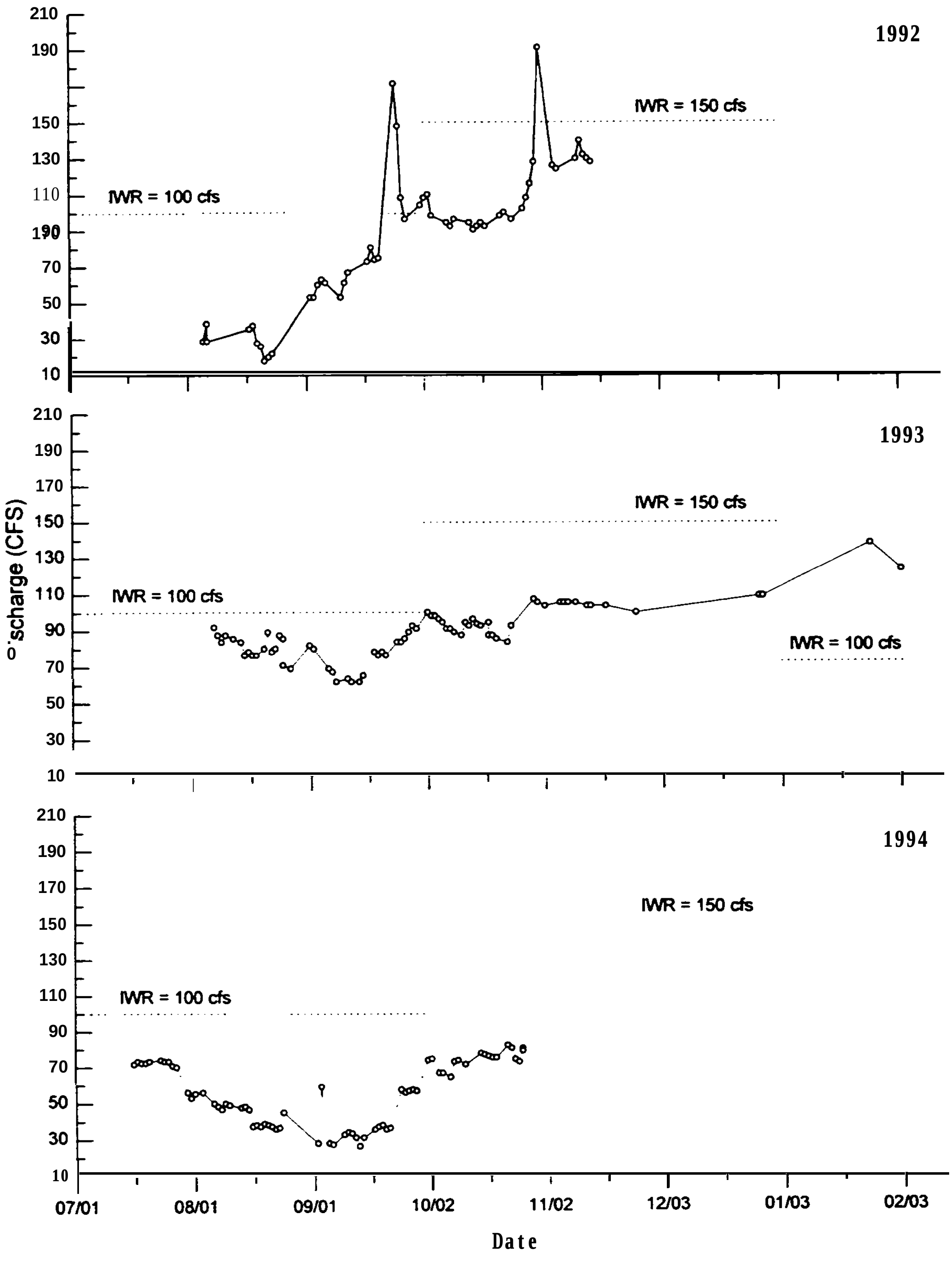


Figure 47. Streamflows in the East Fork Hood River at the measuring site for the instream water right (IWR). 1992-94.

Table 58. Whole juvenile fish collected in the Hood River subbasin for genetic inventory and analysis. 1994

Collection site	Date sampled	River mile	Species	Number	Township and quarter section
Oak Sprirlgs Hatcnery	03/29	--	Hood River Stock Steelheaa	50	
Oak Springs Hatcnery	03/29	--	Foster/Skamania Stock Steelhead	50	--
mainstem Hood River	06/10	4.5	Rainbow-Steelhead	18	R10E/T2N SECT 12
mainstem Hood River	05/26	4.5	Rainbow-Steelnead	20	R10E/T2N SECT 12
West Fork Hood River	05/26	4.5	Rainbow-Steelhead	9	R9E/T1N SECT 22
West Fork Hood River	06/10	4.5	Rainbow-Steelhead	12	R9E/T1N SECT 22
East Fork Hood River	06/10	1.0	Rainbow-Steelhead	3	R10E/T1N SECT 18
Rimrock Creek	07/28	c.25	Cutthroat	25	R10E/T1S SECT 9
Robinhood Creek	08/09	0.5	Rainbow-Cutthroat	23	R10E/T2S SECT 32
Dog River	07/28	C.25	Rainbow-Cutthroat	64	R10E/T1S SECT 20
Bear Creek	07/20	C.5	Cutthroat	a	R9E/T1S SECT 11
Tony Creek	07/20	C.5	Rainbow-Cutthroat	45	R9E/T1N SECT 25
ilk Creek	07/20	C.25	Rainbow	b	R8E/T1S SECT 26
McGee Creek	07/20	C.25	Rainbow	25	R8E/T1S SECT 25
Greenpoint Creek	08/09	10	Rainbow	35	R9E/T1N SECT 11

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

ACKNOWLEDGEMENTS

We sincerely appreciate the many persons who helped complete this report. Special thanks to Jim Newton and Steve Pribyl of the ODFW. mid-Columbia fisheries district. for both the construction and operation of the Powerdale Dam trap and for supervision of field personnel. We thank them for their insight and guidance throughout the study. We also thank trap operators Jim Burgett and Brian Arrington for working many long hours in keeping the Powerdale Dam trap operational. We gratefully appreciate the contributions of scale readers Lisa Borgerson and Ken Kenaston. We would also like to thank Pacific Power and Light for allowing us to operate an adult trapping facility at Powerdale Dam and Steve Pribyl. Patty O'Toole. Mick Jennings. Mike Lambert, and Mark Chilcote 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.

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APPENDIX A

Summary Counts and Statistics for Three Pass Removal Estimates on Rainbow-Steelhead and Cutthroat Trout

Appendix Table A-1. Three pass removal estimates of population numbers for two size categories of rainbow-steelhead sampled in selected reaches of stream located in the Hood River subbasin. Included are numbers of fish sampled in each pass.

Location, sampling area	Sampling date	River mile	Reach length (m)	Rainbow-steelhead less than 85 mm fork length					Rainbow-steelhead greater than or equal to 85 mm fork length					Total	
				Pass 1	Pass 2	Pass 3	N	90% C.I.[a]	Pass 1	Pass 2	Pass 3	N	90% C.I.[a]	N[b]	90% C.I.[a]
Mainstem,															
Neal Creek	09/26/94	1.5	60.0	7	0	0	7.0	c	23	1	0	24.0	c	31.0	c
Neal Creek	08/25/94	5.0	60.0	72	11	4	87.6	± 1.8	33	3	0	36.0	c	123.5	± 1.5
Lenz Creek	09/02/94	0.5	60.0	0	0	0	0		1	0	0	1.0	c	1.0	c
West Fork,															
Greenpoint Cr	09/06/94	1.0	66.0	95	45	36	221.8	±36.7	117	41	16	182.8	± 8.7	391.5	±24.4
Lake Branch	09/22/94	0.2	63.0	187	77	35	324.2	±16.9	67	30	11	116.5	± 9.6	440.7	119.4
Lake Branch	09/21/94	4.0	65.0	5	4	5	17.9[d]	--	52	18	5	77.6	± 4.4	95.5	± 8.3
Lake Branch	08/30/94	7.0	60.0	10	3	0	13.1	c	9	6	0	15.7	c	78.6	c
Red Hill Cr	09/14/94	1.0	60.0	2	2	2	6.8[d]	--	13	2	0	15.0	c	21.8	c
McGee Creek	08/18/94	0.5	69.0	19	6	0	25.2	c	29	9	1	39.6	c	64.8	± 2.1
Elk Creek	08/19/94	0.5	65.6	15	3	0	18.1	c	12	4	4	23.4	c	39.6	c
Middle Fork,															
MFk Hood	09/20/94	4.5	60.0	15	5	4	26.8	c	10	2	1	13.3	c	39.4	c
Tony Creek	09/27/94	1.0	60.0	6	0	0	6.0	c	13	6	0	19.4	c	25.2	c
East Fork,															
EFk Hood	09/08/94	0.5	60.0	48	12	3	64.0	± 2.4	53	14	3	71.1	± 2.5	135.1	± 3.5
EFk Hood	09/12/94	5.5	60.0	60	18	4	83.8	± 3.3	14	4	1	19.4	c	103.2	± 3.7
EFk Hood	09/13/94	20.2	60.0	0	0	0	0	--	1	0	0	1.0	c	1.0	c

a The standard error formula in Zippin (1958) was used to estimate confidence intervals. This formula is satisfactory for estimating the 95% confidence interval for populations greater than 200 fish. For populations ranging from 50-200 fish, "in which the assumptions are assumed to hold reasonably well, the above method provides approximately 90 percent confidence limits rather than 95 percent limits" (Zippin 1958).

b Total population size was estimated based on the total catch for each pass. As a result, the estimate of total population size may not equal the sum of the estimated population sizes in each size category.

c Estimated population size too small to accurately estimate confidence limits (Zippin 1958).

d Population estimates for the lower size category were determined by subtracting the estimate for the larger size category from the total estimate.

Appendix Table A-2. Three pass removal estimates of population numbers for two size categories of cutthroat trout sampled in selected reaches of stream located in the Hood River subbasin. Included are nunbers of fish sampled in each pass.

Location, sampling area	Sampling date	River mile	Reach length (m)	Cutthroat trout less than 85 mm fork length					Cutthroat trout greater than or equal to 85 mm fork length					Total	
				Pass 1	Pass 2	Pass 3	N	90% C.I.[a]	Pass 1	Pass 2	Pass 3	N	90% C.I.[a]	N[b]	90% C.I.[a]
Mainstem,															
Neal Creek	08/25/94	5.0	60.0	0	0	0	0	..	1	0	0	1.0	c	1.0	c
Middle Fork,															
Tony Creek	09/27/94	1.0	60.0	11	4	1	16.6	c	13	6	5	30.3	c	45.0	c
Bear Creek	08/26/94	0.6	60.0			..	21.2[d]	--	..	..	..	86.4[d]	..	107.6	± 4.2
East Fork,															
EFk Hood	09/08/94	0.5	60.0	3	3	0	6.5	c	1	0	0	1.0	c	7.4	c
EFk Hood	09/13/94	20.2	60.0	0	0	0	0	_	2	0	0	2.0	c	2.0	c
Dog River	08/29/94	0.7	61.0	..	..	..	20.4[d]	..	.	..	_	30.5[d]	..	50.9	± 6.6
Tilly Jane Cr	09/27/94	0.1	60.0	4	3	1	9.6	c	22	4	2	28.4	c	37.1	c
Robinhood Cr	09/13/94	1.0	60.0	16	7	4	30.5	c	37	4	5	46.9	c	76.1	± 5.0

[a] The standard error formula in Zippin (1958) was used to estimate confidence intervals. This formula is satisfactory for estimating the 95% confidence interval for populations greater than 200 fish. For populations ranging from 50-200 fish, "in which the assumptions are assumed to hold reasonably well, the above method provides approximately 90 per cent confidence limits rather than 95 percent limits" (Zippin 1958).

[b] Total population size was estimated based on the total catch for each pass. As a result, the estimate of total population size may not equal the sum of the estimated population sizes in each size category.

[c] The standard error formula in Zippin (1958) was used to estimate confidence intervals. This formula is satisfactory for estimating the 95% confidence interval for populations greater than 200 fish. For populations ranging from 50-200 fish, "in which the assumptions are assumed to hold reasonably well, the above method provides approximately 90 percent confidence limits rather than 95 percent limits" (Zippin 1958).

[d] Population estimates in each size category were determined by multiplying the estimated total population by the ratio of each size category in the random length sample. There were 15 and 12 cutthroat trout less than 85 mm fork length in Bear Creek and Dog River, respectively, and 61 and 18 cutthroat trout greater than or equal to 85 mm fork length in Bear Creek and Dog River, respectively.

APPENDIX B

Summary of injuries observed on Summer and winter steelhead and spring chinook salmon

Appendix Tabie B-1. Numbers[a] of summer and winter steelhead and sprirg chinook salmon with predator scars. net ma-ks. hook scars. and scrapes. by run year. (Percentage of total estimate is in parentheses.)

Species. run year	N	Predator scars	Net marks	Hook scars	Scrapes
Summer steelhead.					
1993-94	1.356	576(42)	206(15)	44(3)	383(28)
1994-95[b]	1.858	804(43)	198(11)	66(4)	210(11)
winter steelhead.					
1992-93	649	345(53)	43(7)	12(2)	62(10)
1993-94	581	223(38)	23(4)	21(4)	62(11)
1994-95	183	72(39)	6(3)	8(4)	27(15)
Spring chinook.					
1993	510	152(30)	14(3)	5(1)	158(31)
1994	310	88(28)	13(4)	10(3)	54(17)

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

[b] Pre imanary estimates. Summaries are fcr summer steelhead sampled through 25 April 1995