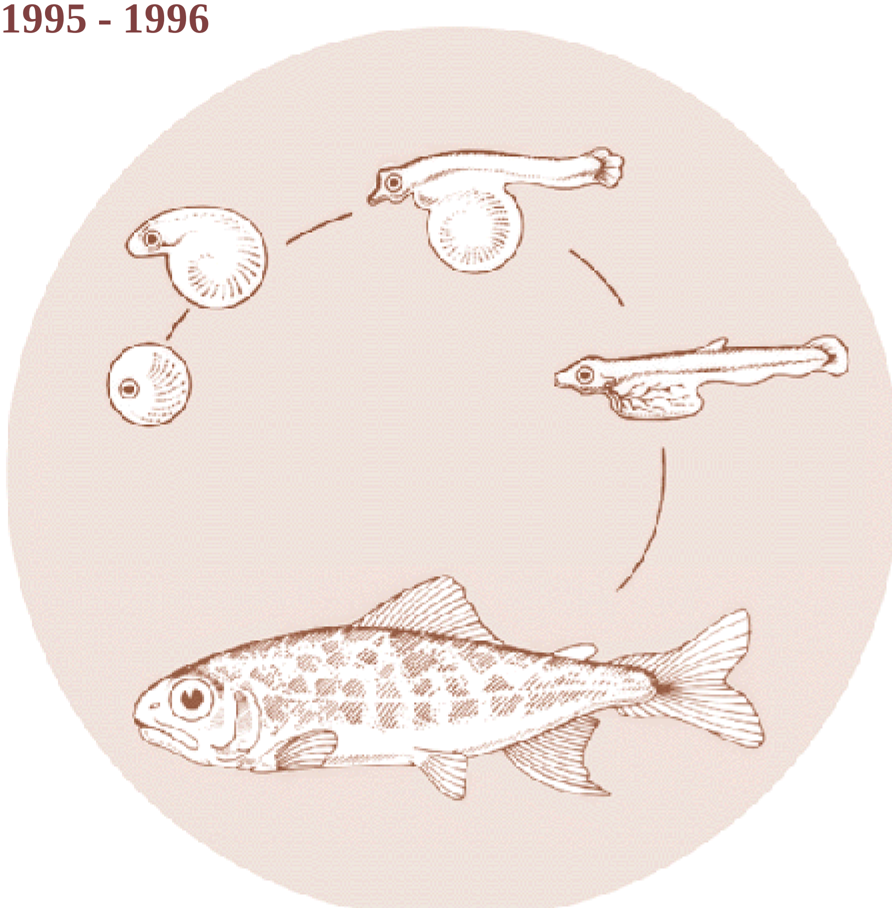
Hood River and Pelton Ladder Evaluation Studies

Annual Report
1995 - 1996



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HOOD RIVER PELTON LADDER STUDIES

Annual Report 1995

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September 1996

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REPORT A

HOOD RIVER AND PELTON LADDER EVALUATION STUDIES

ANNUAL PROGRESS REPORT
1995

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INTRODUCTION

In 1992, the Northwest Power Planning Council approved the Hood River and Pelton ladder master plans (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) 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 Production Program (HRPP). The HRPP will be phased in over several years and will be jointly implemented by the Oregon Department of Fish and Wildlife (ODFW) and the Confederated Tribes of the Warm Springs (CTWS) Reservation.

In December 1991, a monitoring and evaluation (M&E) program was implemented in the Hood River subbasin to collect life history and production information on stocks of anadromous salmonids returning to the Hood River subbasin. Data collected from the M&E program will provide the baseline information needed to (1) evaluate various management options for implementing the HRPP and (2) determine any post-project impacts the HRPP has on indigenous populations of resident fish. Information will also be used in the preparation of an environmental impact statement (EIS). The EIS will be completed by mid- 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 includes work that falls under a "categorical exclusion" from NEPA. and Phase II includes work requiring an EIS prior to implementation. The categorical exclusion defines 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 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) increase production of wild summer and winter steelhead (*Oncorhynchus mykiss*) and (2) 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 95 was 1 October 1994 through 30 September 1995. Work implemented during FY 95 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 95. 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. 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.

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 West (RM 4.0), Middle (RM 1.0), 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 the West, Middle, and East fork migrant traps fished to a maximum depth of 0.8 meters. The migrant traps fished approximately 8%. 9%. 14%. and 16% of the stream channels width in the mainstem. West Fork (WFk), East Fork (EFk), and Middle Fork

(MFk), 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. Counts of downstream migrant rainbow-steelhead (rb-st) were made for two size categories; they included fish greater than or equal to 150 mm fork length and fish less than 150 mm fork length. Counts of downstream migrant juvenile wild chinook and coho salmon were made for three size categories: they included fish less than 50 mm fork length, fish 50-69 mm fork length, and fish greater than 69 mm fork length. A random sample of fish were measured to the nearest millimeter fork length and weighed to the nearest 0.1 gram. Data was recorded on a computerized data entry form and keypunched into a computer database.

Downstream migrant salmonids were sampled at the mainstem migrant trap to monitor temporal distribution of migration from the Hood River subbasin. Estimates of migration timing were based on biweekly counts at the 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 downstream migrant steelhead smolts. To estimate migration timing for steelhead smolts. it was also necessary to define a cutoff date in which the majority of smolts should have migrated past the trapping 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 abundance of wild, natural, and hatchery produced anadromous salmonid smolts that migrated from the Hood River subbasin. Estimates of smolt production for wild and naturally produced salmonids were limited to the upper size category because outmigrant smolts are believed to predominately be the larger size fish. A pooled Petersen estimate with Chapman's modification (Ricker 1975) was used to estimate numbers of downstream migrants, by species and size category, as follows:

$$\hat{N} \quad \frac{(M\ 1)\,(C\ 1)}{(R\ 1)}$$

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 migrants captured at the rotary-screw trap, and
R = number of marked migrants recaptured at the rotary-screw trap.

Approximate 95% confidence intervals (C.I.) were calculated as follows (Seber 1973; Ott 1977):

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

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

where

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

Downstream migrants were marked with a panjet. The panjet was used to shoot a narrow high speed stream of colored dye at selected fins. This process permanently marked the fin with a unique color code by infusing a small amount of the colored dye below the epidermal layer. The dye color and marked fin combination was changed every two weeks to uniquely mark fish at defined time intervals throughout the sampling period. Unique dye color and marked fin combinations were also assigned to each trap so that the origin of recaptures at the mainstem migrant trap could be determined.

Population estimates were made in selected reaches of stream located throughout the Hood River subbasin (Figure 3) to estimate rearing abundance of anadromous and resident salmonids. Streams were selected based on 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 effectively 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 millimeter mesh seines to prevent both immigration and emigration of fish.

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

$$\hat{N} \quad \frac{6X^2 \quad 3XY \quad Y^2 \quad Y(Y^2 \quad 6XY \quad 3X^2)^{.5}}{18(X \quad Y)}, \text{ and}$$

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

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.

A two pass removal method was used to estimate population numbers in several sampling reaches (see APPENDIX A). The population estimate and probability of capture for the two pass removal method (Zippin 1958) were estimated as follows:

$$\hat{N} \quad \frac{y_1^{2}}{y_1 \quad y_2}, \quad and$$

$$\hat{p} \quad \frac{y_1 \quad y_2}{y_1}$$

where

$\hat{N}$ = population size,

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

y_1 = pass 1, and

y_2 = pass 2.

The 95% confidence limits (Zippin 1958) for both the two and three pass removal methods were estimated as follows:

$$SE(\hat{N}) \quad \sqrt{\frac{\hat{N}(\hat{N} \quad T)\,T}{T^2 \quad \hat{N}(\hat{N} \quad T)\,\frac{(k\hat{p})^2}{1 \quad \hat{p}}}}, \quad and$$

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

where

T = total catch and

k = number of trappings.

Fish were collected using one to four 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 (i.e., less than 85 mm fork length and greater than and equal to 85 mm fork length) and counts were made for each size group. The 85 mm fork length break point was designed to correspond with the estimated upper size distribution of age-0 steelhead and 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 was measured to the nearest 0.1 gram. Data was recorded on a computer form and keypunched into a computer database.

Volume and surface area was estimated for each stream reach sampled for abundance and biomass. Estimates were derived by dividing the planar area of the stream reach by 11 equidistant parallel 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. With the exception of five stream reaches sampled in 1994, five depth measurements (i.e.. d_1, d_2, . . d_5) were taken along each transect at intervals of 1, 3. 5. 7. and 9 tenths of the width (w) of the transect line. In 1994, four depth measurements (i.e.. d_1, d_2, d_4) were taken along each transect at intervals of 1. 3. 5, and 7 eights of the width of the transect line in Neal (RM 5), McGee, Elk, and Bear creeks and in Dog River.

The 11 equidistant parallel transects of common height (h) formed 10 trapezoids and, depending on the number of depth measurements taken (i.e., four or five). either fifty or sixty hexahedrons. The area of each trapezoid was estimated using the formula: $\frac{1}{2}*(h)*(y_n+y_{(n+1)})$. The volume of each hexahedron was estimated using the formula:

$$\text{Volume} = \tfrac{1}{3} * L * (G_1 + G_2 + (G_1*G_2)^{.5}), \text{ and}$$

$$G_n \text{ (Area)} = \tfrac{1}{2} * w * (d_n + d_{n+1})$$

where

L = length of the hexahedron,
G_1 = area of the plane formed by the face of the upriver side of the hexahedron,
G_2 = area of the plane formed by the face of the downriver side of the hexahedron,
w = width of the hexahedron. and
d_n = depth measurement at interval n along the transect line.

Surface area for the entire sampling reach was estimated as the sum of the surface areas for the 10 trapezoids. Volume for the entire sampling reach was estimated as the sum of the volumes for each hexahedron.

Adult Trapping

An upstream migrant adult fish trap (Powerdale Dam trap) was installed at Powerdale Dam in December 1991. Powerdale Dam, which is owned and operated by PacifiCorp, is located at RM 4.5 in the mainstem Hood River (Figure 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 was observed that spring chinook salmon would avoid swimming through the submerged fyke and would often try to jump over it. There was no delay in migration timing. or other abnormal fish behavior, observed with the new design.

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

Spring and fall races of chinook salmon were distinguished based on run timing, external coloration, and general appearance. Summer and winter races of steelhead were distinguished based on fin 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 and coho 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 for wild winter steelhead from adults used as hatchery broodstock. Females used for hatchery broodstock were air spawned and the number of eggs per female was estimated with a volumetric displacement technique. Estimates were not adjusted to account for potential egg retention. 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 analyzed 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 hatchery winter steelhead were classified as Hood River subbasin hatchery fish based on fin mark and age. Hatchery winter steelhead from the 1989 brood were the first fin-marked fish released into the Hood River subbasin. 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, all hatchery winter steelhead released in the Hood River subbasin are fin-marked prior to release and, with the exception of the 1993 and 1994 brood releases, 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 of fish would include marked wild and natural strays and Hood River subbasin wild fish with deformed fins or whose fins were removed by sport fishers. Fin removal, 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. Summer 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 and fall chinook salmon were classified as natural or hatchery fish based on fin mark and scale analysis. Unmarked spring and fall 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 releases. 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). Hatchery spring chinook salmon that had a fin mark combination other than a single adipose mark were classified as a stray hatchery fish. All unmarked and marked fall chinook salmon, classified as hatchery fish from scale analysis, were assumed to be 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. To estimate escapements, fall chinook salmon with regenerated scales, or from which no scale samples were taken, were assumed to occur as natural and stray hatchery fish in the same proportions as those in the sample population.

Coho salmon (*Oncorhynchus 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.

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 of this report.

Rainbow-steelhead were recovered at all sampling sites with the exception of those located in Lenz. Bear, Tilly Jane. Robinhood. and Rogers creeks and the EFk Hood River (RM 20.2; Table 1). Cutthroat trout was the dominant salmonid species in Bear, Tilly Jane, and Robinhood creeks. Tony and Tilly Jane creeks were the most productive streams sampled based on total biomass (i.e., grams/m^3) of wild rb-st and cutthroat trout (Table 1). Greenpoint Creek was the most productive rb-st stream sampled in the subbasin with an estimate of biomass (i.e.. grams/m') 6% 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 8,075 rb-st greater than or equal to 150 mm passed the migrant trap from 30 March through 31 July 1995 (Table 2). Estimates of the number of downstream migrant rb-st do not include 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 (60.9%).

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-STEELHEAO, 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 smolt life history pattern. Numbers of steelhead migrating as freshwater age-l, age-2. and age-3 smolts was determined 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 in the corresponding age category. Downstream migrants greater than 165 mm fork length were assumed to be predominately steelhead smolts based on three primary assumptions: (1) that most freshwater age-3 migrants are steelhead smolts; (2) that physiological changes associated with the smolting process are, in part, initiated by size: and (3) that the size range of freshwater age-3 migrant rb-st in the sample population is an indicator of the size range of downstream migrant steelhead smolts.

Data, collected at the mainstem migrant trap in 1994, was used as the basis for developing the 165 mm fork length as the size break for classifying a downstream migrant rb-st as a steelhead smolt. The smallest freshwater age-3 rb-st sampled in 1994 was 168 mm fork length (Olsen et al. 1995). The size break was based on data collected in 1994, rather than for data collected in 1995. because it represents a more conservative approach for estimating the potential size range of downstream migrant smolts. The size range of age-3 rb-st sampled in 1995 included several juveniles smaller than 165 mm fork length. Data collected from adult scale analysis, however, indicates that a small percentage of steelhead migrate as freshwater age-4 smolts (Table 3). Using 165 mm fork length as the size break for downstream migrant rb-st smolts provides a basis for adjusting the freshwater age-3 category to account for downstream migrant rb-st that will remain in freshwater for an additional year prior to migration as smolts.

An estimated 6,313 steelhead smolts (Table 4) migrated past the juvenile migrant trap from 30 March through 31 July based on the above criteria. The age structure of downstream migrant steelhead smolts was estimated as 18%. 64%. and 18% freshwater age-l, age-2. and age-3. respectively (Table 4). The ratio of freshwater age categories was markedly higher for freshwater age-l 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 underlying cause might be for the large difference between the two estimates for the freshwater age-l category. Differences may be attributed to a combination of (1) the criteria used to estimate freshwater age-l steelhead smolts. (2) brood strength, or (3) a significantly lower smolt-to-adult survival rate for freshwater age-l smolts than for older age smolts.

Size and Weight

Estimates of mean fork length and condition factor are summarized for resident rb-st in Table 5. Estimates, by age category, of mean fork length, weight, and condition factor are summarized for downstream migrant rb-st in Table 6. Length x weight regressions for resident rb-st are presented in Figures 4-8 and for downstream migrant rb-st in Figure 9. A length frequency histogram for downstream migrant rb-st is summarized by age category in Figure 10.

Mean fork length of freshwater age-1, age-2, and age-3 downstream migrant rb-st was less than the mean fork length of yearling hatchery summer and winter steelhead smolts sampled at the mainstem migrant trap (see HATCHERY PRODUCTION, Size and Weight). Mean condition factor of downstream migrant rb-st was less than Hood River stock hatchery winter steelhead sampled at Oak Springs Hatchery, prior to release, but similar to the mean condition factor of summer and winter steelhead smolts sampled at the mainstem migrant trap (see HATCHERY PRODUCTION, Size and Weight).

Smolt Migration Timing

Peak steelhead smolt migration was estimated to occur from May to mid-June (Figure 11). Freshwater age-3 rb-st appeared to migrate earlier than the other age categories (Figure 11). Freshwater age-l and age-2 rb-st migrated throughout the entire sampling period.

CUTTHROAT TROUT

Natural Production

Cutthroat trout were recovered in eight of a total 22 reaches of stream sampled in the subbasin in 1995 (see Appendix Table C-3). No rainbow-steelhead were found in three of the eight reaches of stream. Robinhood and Bear creeks were the most productive cutthroat trout streams sampled, based on total biomass (i.e.. both grams/m^2 and grams/m^3; Table 7). Robinhood Creek was the most productive cutthroat trout stream sampled in the subbasin with an estimate of biomass (i.e., grams/m^2) 16% higher than the next highest estimate.

Sixteen downstream migrant cutthroat trout were captured in the mainstem migrant trap and no adult cutthroat trout were captured in the Powerdale Dam trap in 1995 (unpublished data on 3/18/95 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 and condition factor are summarized for resident cutthroat trout in Table 8. Length x weight regressions for resident cutthroat trout are presented in Figures 12 and 13.

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 9 and 10). The median migration date occurred during 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 10).

Escapement and Survival

Estimates of summer steelhead escapements to the Powerdale Dam trap ranged from 211-483 wild, 1,100-1,682 subbasin hatchery, and 5-56 stray hatchery fish for the 1992-93 through 1994-95 run years (Table 11). The percentage of summer steelhead with predator scars ranged from 42-43% (Appendix Table E-1). The percentage of summer steelhead with net marks and hook scars ranged from 11-15% and from 3-4%, respectively (Appendix Table E-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 12). Data indicates that the post-release survival rate back to the Powerdale Dam trap is probably averaging somewhere around 2% and, when adjusted for 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 Deschutes River were adjusted to account for mortality. and further potential for straying, between the mouth of the Hood and Deschutes river subbasins. Post-release survival back to the Deschutes River subbasin is subject to losses associated with (1) mainstem Columbia River fisheries located between the mouth of the Hood and Deschutes rivers, (2) the negotiation of one additional mainstem Columbia River dam (i.e., The Dalles Dam), and (3) increased potential for straying.

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 2-salt adults (Table 13). Virtually all subbasin hatchery smolts migrate in the year of release (i.e.. freshwater age-l) and return mainly as 2-salt adults (Table 13). Only one adult subbasin hatchery summer steelhead has been sampled to date with a scale pattern indicating the juvenile remained in freshwater for an additional year prior to migration as a smolt. An estimated 3.6-6.9% of the wild adults and 0.6-0.8% of the subbasin hatchery adults returned as repeat spawners (Table 13). All repeat spawners sampled from the 1994-95 run year had only a single spawner check (Table 14).

Mean fork length of wild summer steelhead without a spawning check ranged from 51-57 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 15 and 16). Mean fork length of subbasin hatchery summer steelhead without a spawning check ranged from 53-55 cm for l-salt adults, 67-75 cm for 2-salt adults. 78-80 cm for 3-salt adults, and 79-90 cm for 4-salt adults (Table 16).

Mean weight of wild summer steelhead without a spawning check was 1.6 kg for 1 salt adults and ranged from 3.4-3.6 kg for 2-salt adults and from 5.2-5.3 kg for 3-salt adults (Table 17). Mean weight of subbasin hatchery summer steelhead without a spawning check was 1.6 kg for 1 salt adults: ranged from 3.4-4.1 kg for 2-salt adults: and was 5.1 kg for 3-salt adults (Table 17).

Sex ratios varied among age categories and run year for both wild and subbasin hatchery summer steelhead (Table 18). In general, 2-salt adults returned predominately as females and 3-salt adults predominately as males (Table 18).

Spatial Distribution

Twenty-eight unmarked summer steelhead, randomly selected from throughout the 1994-95 run year, were tagged with radio transmitters. Five tagged summer steelhead remained in the mainstem Hood River throughout the sampling period (Figures 14-28). A total of 19 summer steelhead moved into the West Fork (WFk) Hood River, one into the lower East Fork (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 18-28). All radio-tagged summer steelhead were classified as wild based on scale analysis.

Nineteen unmarked and five marked summer steelhead, randomly selected from throughout the 1995-96 run year, were tagged with radio transmitters. All unmarked summer steelhead were classified as wild based on scale analysis. All marked summer steelhead were classified as subbasin hatchery summer steelhead based on scale analysis and fin mark. Seven tagged summer steelhead remained in the mainstem Hood River throughout the sampling period (Figures 29-35). A total of 14 summer steelhead moved into the WFk Hood River and three into the EFk Hood River. Two summer steelhead. detected in the WFk Hood River, moved into Lake Branch during October and November. One was later detected back in the WFk Hood River near the mouth of Lake Branch (Figures 33-35). One summer steelhead. detected in the WFk Hood River, moved into Greenpoint Creek in December (Figure 35).

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 19). The median migration date occurred in April and early May for wild winter steelhead and from early February to early March for subbasin hatchery winter steelhead. Migration to the Powerdale Dam trap was completed. in the second calendar year. by early to late June for the wild run and by late April to late May for the subbasin hatchery run (Table 191. In all four 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 of 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 randomly collect hatchery broodstock from throughout the entire run of wild and Hood River stock hatchery adults entering the Powerdale Dam trap. Hatchery broodstock for the Hood River Production Program will be collected in accordance with guidelines established in the Oregon Department of Fish and Wildlife's Wild Fish Policy. Progeny of these brood releases should have a run timing more similar to the native run. The 1995-96 run year will be the first run year in which the entire subbasin hatchery component of the run will be progeny of Hood River stock wild adult winter steelhead (*see* HATCHERY PRODUCTION, Production Releases).

Escapement and Survival

Estimates of winter steelhead escapements to the Powerdale Dam trap ranged from 204-693 wild, 10-289 Big Creek stock hatchery, 7-14 mixed-stock hatchery, 0-90 Hood River stock hatchery, and 5-34 stray hatchery fish for the 1991-92 through 1994-95 run years (Table 20). The percentage of winter steelhead with predator scars ranged from 37-53% (Appendix Table E-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 E-1).

Preliminary estimates of post-release survival from smolt-to-adult return to the Powerdale Dam trap indicate that survival may have been fairly low for the Big Creek stock of hatchery winter steelhead (i.e., around 1.5%: Table 21) 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 to release in the subbasin. Acclimation sites were identified in the fall of 1995 and developed in early 1996. Acclimation facilities will be operationall in the spring of 1996 to acclimate juvenile hatchery winter steelhead from the 1995 brood,. prior to release in the Hood River subbasin.

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 and released at the mouth of the Hood River. This program was established to prevent non-indigenous stocks from spawning above Powerdale Dam, in accordance with guidelines established in the ODFW's Wild Fish Policy. Releasing hatchery adults at the mouth of the Hood River has an additional benefit created by recycling returning hatchery adult winter steelhead through the sport fishery located below Powerdale Dam. Stray and Big Creek stock hatchery fish are identified based on fin marks.

Limited numbers of Hood River stock hatchery winter steelhead were passed above Powerdale Dam from the 1994-95 run year. These are the first returns of Hood River stock hatchery winter steelhead that were passed above Powerdale Dam since the current hatchery program was implemented in the winter of 1991. The HRPP will begin passing adult Hood River stock hatchery winter steelhead above Powerdale Dam, on a defined schedule, beginning with the 1995-96 run year (memo dated 1/12/96 from Jim Newton, Mid-Columbia District. Oregon Department of Fish and Wildlife, The Dalles. Oregon). The number that are passed above Powerdale Dam will be regulated in accordance with guidelines established in the Wild Fish Policy for a Type 1 hatchery program.

Age Composition, Size, and Sex Ratio

Most wild winter steelhead migrate as freshwater age-2 and age-3 smolts and return mainly as 2- and 3-salt adults (Table 22). Subbasin hatchery winter steelhead migrate as freshwater age-l and age-2 (i.e., residualize) smolts and return mostly as 2- and 3-salt adults (Table 22). Repeat spawners comprised 3-8.5% of the wild winter steelhead run (Table 22) and 2-3.8% (i.e., 1991-92 and 1992-93 run years) of the subbasin hatchery winter steelhead run sampled at the Powerdale Dam trap. Only one repeat spawner in the 1994-95 run year had more than one spawning check (Table 23).

Mean fork length of wild adult winter steelhead without a spawning check ranged from 58-76 cm for 2-salt adults and 76-80 cm for 3-salt adults (Tables 24 and 25). Mean fork length for subbasin hatchery adult winter steelhead without a spawning check ranged from 48-57 cm for l-salt adults, 62-73 cm for 2-salt adults, and 72-77 cm for 3-salt adults (Table 25).

Mean weight of wild adult winter steelhead without a spawning check ranged from 2.4-4.6 kg for 2-salt adults and 4.5-5.4 kg for 3-salt adults (Tables 26 and 27). Mean weight of subbasin hatchery adult winter steelhead without a spawning check ranged from 2.5-3.0 kg for 2-salt adults and 3.8-4.6 kg for 3-salt adults (Table 27).

Although sex ratio as a percentage of females varied markedly among age classes, wild adult winter steelhead returned mostly as females (Table 28). Subbasin hatchery adult winter steelhead mainly returned as males in age category 1/2 and as females in age category 1/3 (Table 28). Both wild and subbasin hatchery repeat spawners returned mainly as females.

Estimates of fecundity for wild winter steelhead ranged from 1,737 to 6.480 eggs per female for 2-salt adults, 2,493 to 6,398 eggs per female for 3-salt adults, and 3.240-4.632 eggs per female for 4-salt adults (Table 29).

Spatial Distribution

Fourteen unmarked winter steelhead, randomly selected from throughout the 1994-95 run year, were tagged with radio transmitters. Five tagged winter steelhead remained in the mainstem Hood River throughout the sampling period and one tagged adult was never found (Figures 36-39). Five tagged adult winter steelhead were found in the major forks: one in the EFk Hood River, three in the WFk Hood River (two below RM 0.3), and one in the lower Middle Fork (MFk) Hood River. Three adult winter steelhead were also found in Neal Creek. All radio-tagged winter steelhead were classified as wild based on scale analysis.

JACK AND ADULT SPRING CHINOOK SALMON

Migration Timing

Natural jack and adult spring chinook salmon begin entering the Powerdale Dam trap early in May and subbasin hatchery jack and adult spring chinook salmon begin entering the trap late in April (Table 30). Median date of migration occurred between the last two weeks of June and the last two weeks of July for the natural run, and between the last two weeks of May and first two weeks of June for the subbasin hatchery run. Both natural and subbasin hatchery components of the run were completed by late September to early October (Table 30).

Escapement and Survival

Estimates of escapement to the Powerdale Dam trap ranged from 21-44 natural, 36-461 Carson stock hatchery, 3-27 Deschutes stock hatchery, and l-10 stray hatchery spring chinook salmon for the 1992-95 run years (Table 31). The percentage of spring chinook salmon with predator scars ranged from 16-30% (Appendix Table E-l). The percentage of spring chinook salmon with either a net mark or hook scar ranged from 3-4% and from 0-3%, respectively (Appendix Table E-l).

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 (Table 32).

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 32). 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. 19891. 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, and potential for further straying, between the mouth of the Hood and Deschutes river subbasins. Post-release survival back to the Deschutes River subbasin is subject to any losses associated with (1) mainstem Columbia River fisheries located between the mouth of the Hood and Deschutes rivers, (2) the negotiation of one additional mainstem Columbia River dam (i.e., The Dalles Dam). and (3) increased potential for straying.

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 to four weeks prior to release in the subbasin. Acclimation sites were identified in the fall of 1995 and developed in early 1996. Acclimation facilities will be operational in the spring of 1996 to acclimate juvenile hatchery spring chinook salmon from the 1994 brood, prior to release in the Hood River subbasin.

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 33). The subyearling smolt life history pattern appears to be unique to the natural Hood River run, which was developed from Carson stock hatchery production releases in the Hood River subbasin (see Olsen et al. 1994 and Olsen et al. 1995). What mechanism might cause naturally produced spring chinook salmon to migrate as subyearling smolts in the Hood River subbasin. and how progeny of Deschutes stock hatchery spring chinook salmon will ultimately adapt to the Hood River subbasin. is unknown.

Mean fork length of natural adult spring chinook salmon that migrated as yearling smolts ranged from 72-87 cm for age-4 adults and 79-95 cm for age-5 adults (Tables 34 and 35). Mean fork length for subbasin hatchery produced spring chinook salmon ranged from 52-56 cm for age-3 jacks, 74-83 cm for age-4 adults, and 82-92 cm for age-5 adults (Table 35).

Mean weight of natural adult spring chinook salmon that migrated as yearling smolts ranged from 4.6-4.9 kg for age-4 adults and from 6.2-9.3 kg for age-5 adults (Table 36 and 37). Mean weight for subbasin hatchery spring chinook salmon was 1.6 kg for age-3 jacks and ranged from 4.9-5.3 kg for age-4 adults and from 6.7-8.5 kg for age-5 adults (Table 37).

Sex ratio as a percentage of females varied widely for age-4 and age-5 adult spring chinook salmon (Table 38). Age-4 and older natural and hatchery adults returned mostly as females (Table 38).

Spatial Distribution

Ten unmarked and 6 marked adult spring chinook salmon, randomly selected from throughout the 1995 run year, were tagged with radio transmitters. A combination of fin mark and scale analysis identified five tagged spring chinook salmon as naturally produced adults and 11 as subbasin hatchery produced adults. Three radio-tagged spring chinook salmon remained in the mainstem Hood River throughout the sampling period (Figures 40-44). A total of 13 adult spring chinook salmon moved into the WFk Hood River: one never moved above Punchbowl Falls and 8 never moved above RM 0.5 (Figures 40-44). Four of the five natural spring chinook salmon moved into the WFk Hood River: three were located between RM 6 and RM 11. above Lake Branch, and one remained below RM 0.5. One natural spring chinook remained in the area of Powerdale Dam throughout the sampling period.

JACK AND ADULT FALL CHINOOK SALMON

Migration Timing

Natural jack and adult fall chinook salmon begin entering the Powerdale Dam trap from late July to early August and stray hatchery jack and adult fall chinook salmon begin entering the trap in early to late September (Table 39). Median date of migration occurred between the last two weeks of July and the last two weeks of September for the natural run, and between the first two weeks of September and the last two weeks of September for the stray hatchery run. Both natural and stray hatchery components of the run were completed by late October (Table 39).

Escapement

Estimates of escapement to the Powerdale Dam trap ranged from 6-32 natural and 4-7 stray hatchery fall chinook salmon for the 1992-95 run years (Table 40).

Age Composition, Size, and Sex Ratio

Scale analysis indicates that naturally produced fall chinook salmon primarily migrate as sub-yearling smolts and return as four and five year old adults (Table 41). Mean fork length of natural fall chinook salmon. that migrated as sub-yearling smolts. ranged from 79-89 cm for age-4 adults and 89-96 cm for age-5 adults (Tables 42-46). Mean weight of natural fall chinook salmon that migrated as sub-yearling smolts ranged from 7.0-8.9 kg for age-4 adults and from 9.1-9.5 kg for age-5 adults (Tables 47-49).

Sex ratio as a percentage of females varied widely for age-4 and age-5 adult fall chinook salmon (Table 50). Age-4 and older natural adults returned mostly as females (Table 50).

JACK AND ADULT COHO SALMON

Migration Timing

Natural coho salmon begin entering the Powerdale Dam trap as early as the first two weeks of September (Table 51). The median date of migration for natural coho salmon occurred around late September to early November (Table 51). The natural run was completed by late October to early November. The early entry time of natural coho salmon suggests returns may be progeny of hatchery strays (see Olsen et al. 1995). No information is available to test this hypothesis because of the lack of any information on the temporal distribution of migration for the original wild run of coho salmon in the Hood River subbasin.

Escapement

For the 1992-95 run years, estimates of coho salmon escapement ranged from 0-23 natural and from 33-80 stray hatchery fish (Table 52).

Age composition, Size, and Sex Ratio

All natural coho salmon escaping to the Powerdale dam trap were adults (Table 53). Mean fork length ranged from 56-65 mm for natural adult coho salmon and from 38-40 cm and from 58-69 mm for jack and adult stray hatchery coho salmon, respectively (Tables 54 and 55).

Mean weight ranged from 1.8-3.3 kg for natural adult coho salmon and from 0.7-0.8 kg and from 3.5-3.7 kg for jack and adult stray hatchery coho salmon, respectively (Tables 56 and 57). Sex ratio of freshwater/ocean age 2.3 adults, as a percentage of females, was 64% and 50% for natural adult coho salmon in the 1992 and 1995 run years, respectively (Table 58).

Spatial Distribution

Five unmarked coho salmon selected from the 1995 run year were tagged with radio transmitters. Scale analysis identified two of the tagged coho salmon as naturally produced adults and three as stray hatchery adults. One tagged coho salmon remained in the mainstem Hood River throughout the sampling period, one was detected only once in the mainstem Columbia River, and one was never detected (Figures 45-47). Two radio-tagged coho salmon moved into the MFK Hood River in November (Figure 46). One of these coho salmon was later detected in the EFk Hood River in December (Figure 47). One of the natural coho salmon was detected in the MFk Hood River in November.

HATCHERY PRODUCTION

Broodstock Collection

The current hatchery production program in the Hood River subbasin was implemented beginning in 1990. Hook and line was used to capture hatchery broodstock in the first year of the program. Broodstock was collected from both wild and Big Creek stock components of the run. Beginning with the 1991-92 run year, all hatchery broodstock has been collected from the wild run escaping to the Powerdale Dam trap. Numbers of adult winter steelhead collected for hatchery broodstock ranged from 4-54 adults (Table 59). The hatchery winter steelhead program is presently designed to collect approximately 35-40 adults (15-25 females) for hatchery broodstock. Fifty-four adults were collected from the 1994-95 run year to compensate for a low fertilization rate (see Olsen et al. 1995). For the 1991-95 broods, egg take ranged from 4,595-48,985 and egg to smolt survival ranged from 38.8-96.5% (Table 59).

A continuing decline in the wild run of winter steelhead (*see* ADULT WINTER STEELHEAD. Escapement and Survival) makes it difficult to justify the continued collection of hatchery broodstock entirely from the wild run. For this reason. beginning with the 1995-96 run year, the HRPP will randomly collect a maximum of 50% of the hatchery broodstock from throughout the entire subbasin hatchery component of the run. It is believed that the modified hatchery program will have a minimal genetic impact on the hatchery program primarily because subbasin hatchery adults in the 1995-96 run year should all be the progeny of wild x wild crosses of Hood River stock adults (memo dated 1/12/96 from Jim Newton, Mid-Columbia District, Oregon

Department of Fish and Wildlife, The Dalles, Oregon). The subbasin hatchery run should also be comprised of all but two of the freshwater/ocean age categories observed in previous runs of subbasin hatchery produced adults. Inclusion of most freshwater/ocean age life history patterns should help to minimize the potential genetic risks associated with collecting hatchery broodstock from a population comprised of a limited number of life history patterns. The 1995-96 run of Hood River stock hatchery winter steelhead should be comprised of freshwater/ocean age 1/1, 1/2, and 1/3 adults. The hatchery winter steelhead program has not been implemented long enough to have freshwater/ocean age 2/2 and 2/3 subbasin adults returning in the 1995-96 run year, but these two age categories typically comprise only a small percentage of the hatchery run (see ADULT WINTER STEELHEAD, Age Composition, Size, and Sex Ratio).

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 to 48,985 winter steelhead for the 1987-94 broods (Tables 60 and 61). There were 76,330 summer and 42.860 winter steelhead from the 1994 brood released into the Hood River subbasin in 1995. 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 and 1993 broods (Table 62). No spring chinook salmon smolts were released into the Hood River subbasin from the 1992 brood (see Olsen et al. 1995). There were 170.004 spring chinook salmon, from the 1993 brood. released into the Hood River subbasin in 1995.

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 steelhead. 30,000 Hood River stock winter steelhead. and 125.000 Deschutes stock spring chinook salmon smolts. Target production goals for summer and Hood River stock winter steelhead have been exceeded. Target production goals for spring chinook salmon have been achieved or exceeded with the exception of the 1991 and 1992 broods (see Olsen et al. 1995).

Juvenile hatchery summer and winter steelhead are reared at Oak Springs hatchery. All juvenile hatchery spring chinook salmon production, beginning with the 1993 brood, have been reared at Round Butte Hatchery. Juvenile hatchery spring chinook salmon from the 1994 brood are the first to be finish reared in the newly completed pelton ladder facility. Juvenile hatchery spring chinook salmon were transferred from Round Butte Hatchery to pelton ladder on 27 and 28 September 1995.

The winter steelhead and spring chinook salmon components of the Hood River Production

Program are being implemented at a reduced level based on the approach outlined in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs (Undated). How the Hood River Production Program has evolved into the present day program is described in Olsen et al. (1994) and Olsen et al. (1995).

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 47,281 summer and 16,344 winter steelhead smolts passed the mainstem migrant trap during the sampling period (Table 63). Estimates represent 62% and 38% of the total hatchery summer and winter steelhead production releases, respectively.

During the 1995 sampling season, heavy algae load and high stream high flows at the mainstem migrant trap significantly reduced overall trapping efficiency. In addition, an analysis of unique mark groups indicated that the recapture rate on mark groups of hatchery summer and winter steelhead were consistently lower than for corresponding mark groups of wild rb-st. A similar, although less pronounced, situation occurred for the combined mark groups released in 1994 (Appendix Table B-11. The markedly lower recapture rate for marked hatchery juveniles in both the'1994 and 1995 sampling seasons is believed to be caused by a combination of 1) a significantly higher rate of handling mortality on hatchery fish and 2) altered migratory behavior caused by handling stress. This assumption is based on the fact that visual observation of downstream migrant steelhead sampled at the mainstem migrant trap showed juvenile hatchery fish to be in much poorer condition than downstream migrant wild rb-st. This problem was particularly evident with the hatchery summer steelhead production releases. Downstream migrant hatchery summer steelhead generally exhibited considerable descaling and many were observed with deformed opercles. The deformed opercle was unique to the hatchery summer steelhead production release. The generally poor quality of hatchery production, as well as the stress associated with the hauling of hatchery fish for off station release into the Hood River subbasin. is believed to have put juvenile hatchery fish at or near their level of tolerance for stress. The additional stress of trapping and handling at the migrant traps is believed to have increased 1) the potential handling mortality and 2) the possibility of modifying migration behavior.

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

The extent to which estimates of downstream migrant hatchery summer and winter steelhead may be biased by poor trapping efficiency during the 1995 sampling season, and the use of the wild rb-st mark:recapture ratio in estimating population numbers, cannot be accurately assessed. Assuming that estimates made in 1995 are not significantly biased then the data indicates that the percentage of the hatchery summer and winter steelhead production groups, which migrate past the mainstem migrant trap (i.e., out of the subbasin), may be highly variable; ranging from a low of 32% for hatchery winter steelhead and a high of 62% for hatchery summer steelhead (Table 63).

The consistently lower estimate for the percentage of the hatchery winter steelhead production group to migrate past the mainstem migrant trap is believed to be the result of a higher rate of residualization. Hatchery winter steelhead are not graded prior to release, as are the hatchery summer steelhead, and it is believed that the smaller juveniles do not migrate as smolts. This assumption is corroborated by comparing the range of fork lengths observed in samples of hatchery winter steelhead collected at Oak Springs Hatchery and at the mainstem migrant trap. A random sample of juvenile hatchery winter steelhead collected from the ponds at Oak Springs Hatchery, prior to release in the Hood River subbasin. ranged from 116-247 mm fork length (Table 64). The smallest hatchery winter steelhead caught at the mainstem migrant trap was 152 mm fork length (Table 65).

Size variability in the production release may also determine what percentage of the production group residualizes. Mean fork length of both medium- and large-sized groups of hatchery winter steelhead, sampled at Oak Springs Hatchery from the 1993 brood. were higher than estimates for the 1994 brood, but samples were considerably more variable in size for the 1993 brood. Juvenile winter steelhead from the 1993 brood ranged from 82-283 mm fork length (Table 64). A greater percentage of the 1993 brood release was also less than 150 mm fork length. An estimated 3.7% and 2.7% of the juvenile hatchery winter steelhead sampled at Oak Springs Hatchery from the 1993 and 1994 broods, respectively, were less than 150 mm fork length. The lower size variability in the 1994 hatchery winter steelhead brood release may in part account for the higher estimate of out-migrants from the hatchery winter steelhead production release in 1995.

Size and Weight

Mean length, weight, and condition factor were estimated for two size groups of Hood River stock hatchery winter steelhead reared at Oak Springs Hatchery (OSH). Hatchery winter steelhead production at OSH was graded into the two size groups prior to tagging in late October. The two groups were classified as medium- and large-sized fish. The two groups were classified as medium- and large-sized fish because the two size groups were comparable to the medium- and large-sized groups sampled from the 1993 brood. No juvenile hatchery winter steelhead from the 1994 brood were grouped into a size category comparable to the small-sized group sampled from the 1993 brood. Juveniles in this small-sized group were all progeny of the last hatchery production spawning on 9 June 1993 (Olsen et al. 1995). Juveniles from the last hatchery production spawning in 1993 were markedly smaller than juveniles in the rest of the hatchery production group so they were held separately in a small circular tank and categorized as the small-sized group. No similar situation occurred with the 1994 brood. The two size groups from the 1994 brood will be classified as medium- and large-sized groups throughout the rest of this report.

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

Mean fork length was 186 mm and 197 mm for medium- and large-sized groups, respectively (Table 64). Estimates of mean fork length for the two size categories sampled from the 1994 brood were less than estimates for the corresponding size categories sampled from the 1993 brood, but juveniles from the 1994 brood were more uniformly sized. As with the 1993 brood, the high degree of variation in size, both within and among groups, is in part an artifact of the time of spawning. Broodstock is collected from throughout the run and juveniles from later spawned fish have a progressively shorter period of growth prior to release. The fact that mean fork length was even closely similar between the two size groups is primarily due to adjustments made in feeding schedules. The medium-sized group was placed on an increased feeding schedule to get them to size.

Mean weight was 73 gm and 86 gm for medium- and large-sized groups, respectively (Table 64). Mean condition factor was 1.1 for both size groups (Table 64). Estimates of mean condition factor for 1994 brood hatchery winter steelhead sampled at OSH prior to release were consistently higher than for downstream migrant wild rainbow-steelhead sampled at the mainstem migrant trap in 1995 (see JUVENILE RAINBOW-STEELHEAD, Size and Weight). Estimates of mean condition factor for freshwater age-0 through age-3 migrant wild rainbow-steelhead ranged from 0.93 to 1.05 (Table 6). The estimate of mean condition factor for hatchery winter steelhead sampled at the mainstem migrant trap was 0.97 (Table 65). This estimate falls within the range observed for downstream migrant wild rainbow-steelhead. Length x weight regressions for each size group of hatchery winter steelhead are presented in Figure 48.

SUMMARY

This report summarizes the life history and production data collected in the Hood River subbasin through FY 95. Included is a summary of jack and adult life history data collected at the Powerdale Dam trap on four complete run years of winter steelhead, spring and fall chinook salmon, and coho salmon and on three complete run years of summer steelhead. Also included are summaries of 1) the spatial distribution of radio-tagged adult summer and winter steelhead, spring chinook salmon. and coho salmon: 2) life history and production data on rearing populations of resident and anadromous salmonids; 3) the hatchery winter steelhead broodstock collection program and hatchery production releases in the Hood River subbasin; and 4) the number of outmigrant wild rainbow-steelhead and hatchery summer and winter steelhead smolts. Data will be used as baseline information for (1) evaluating the HRPP. (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.

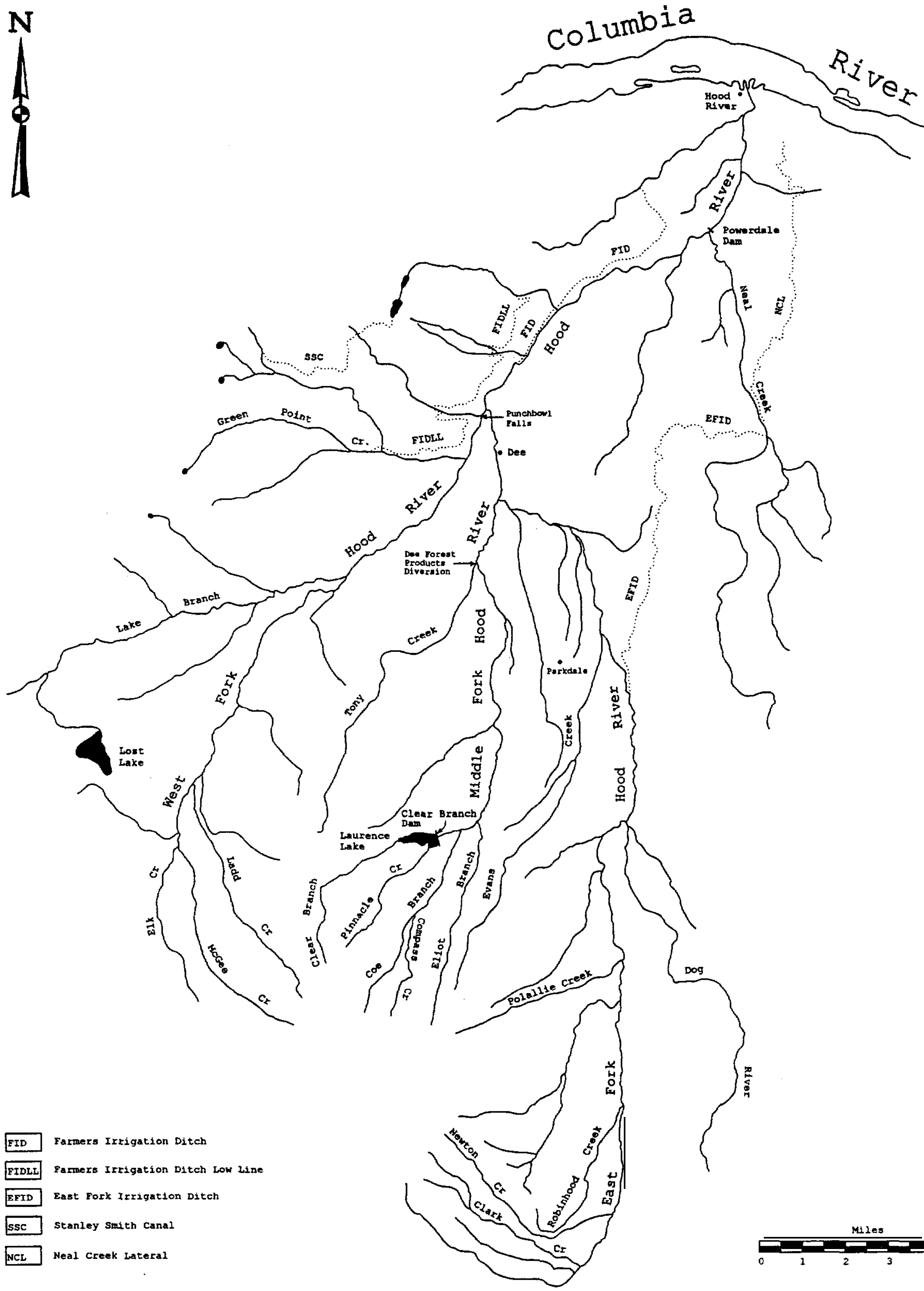


Figure 1. Map of the Hood River subbasin.

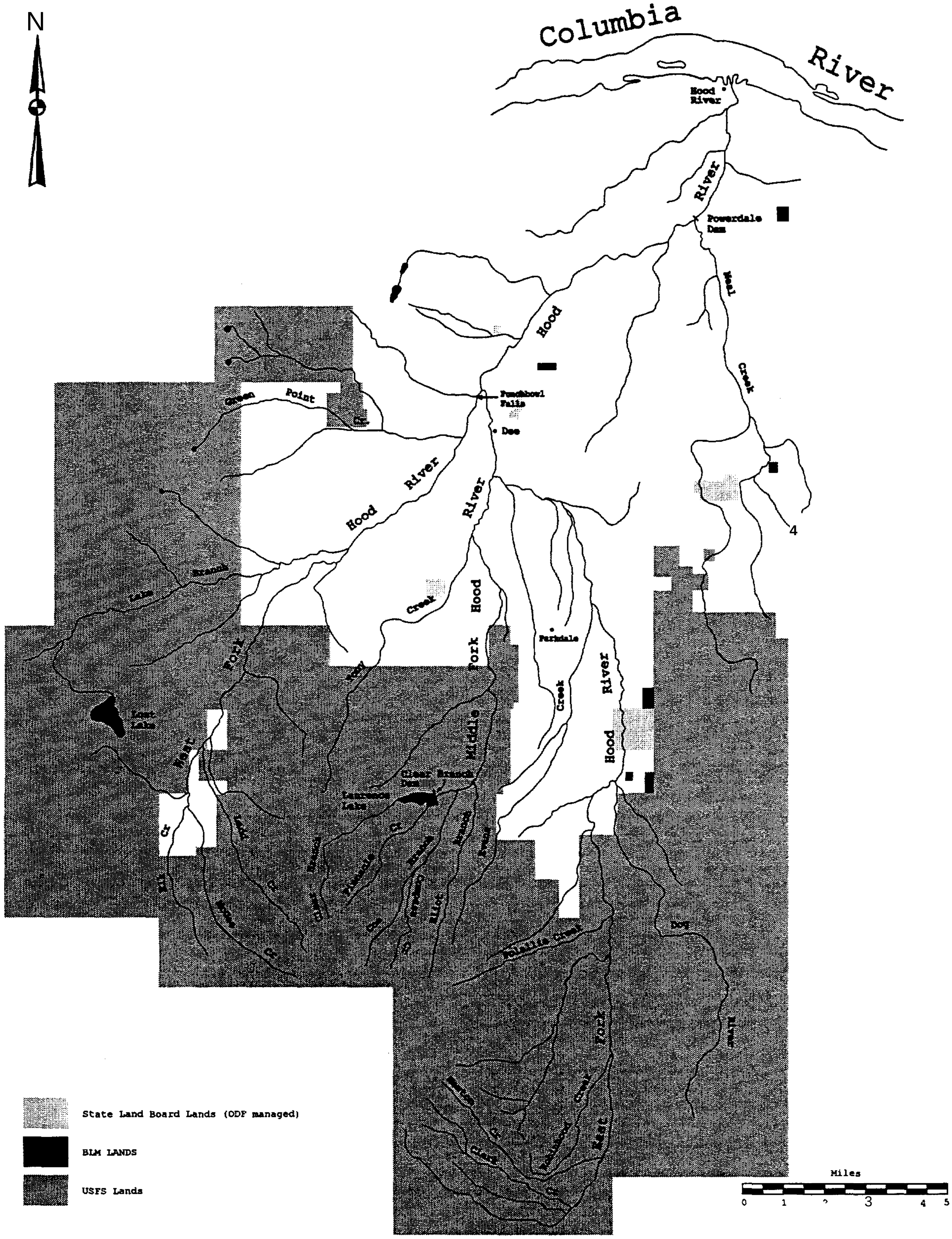


Figure 2. Location of public lands in the Hood River subbasin.

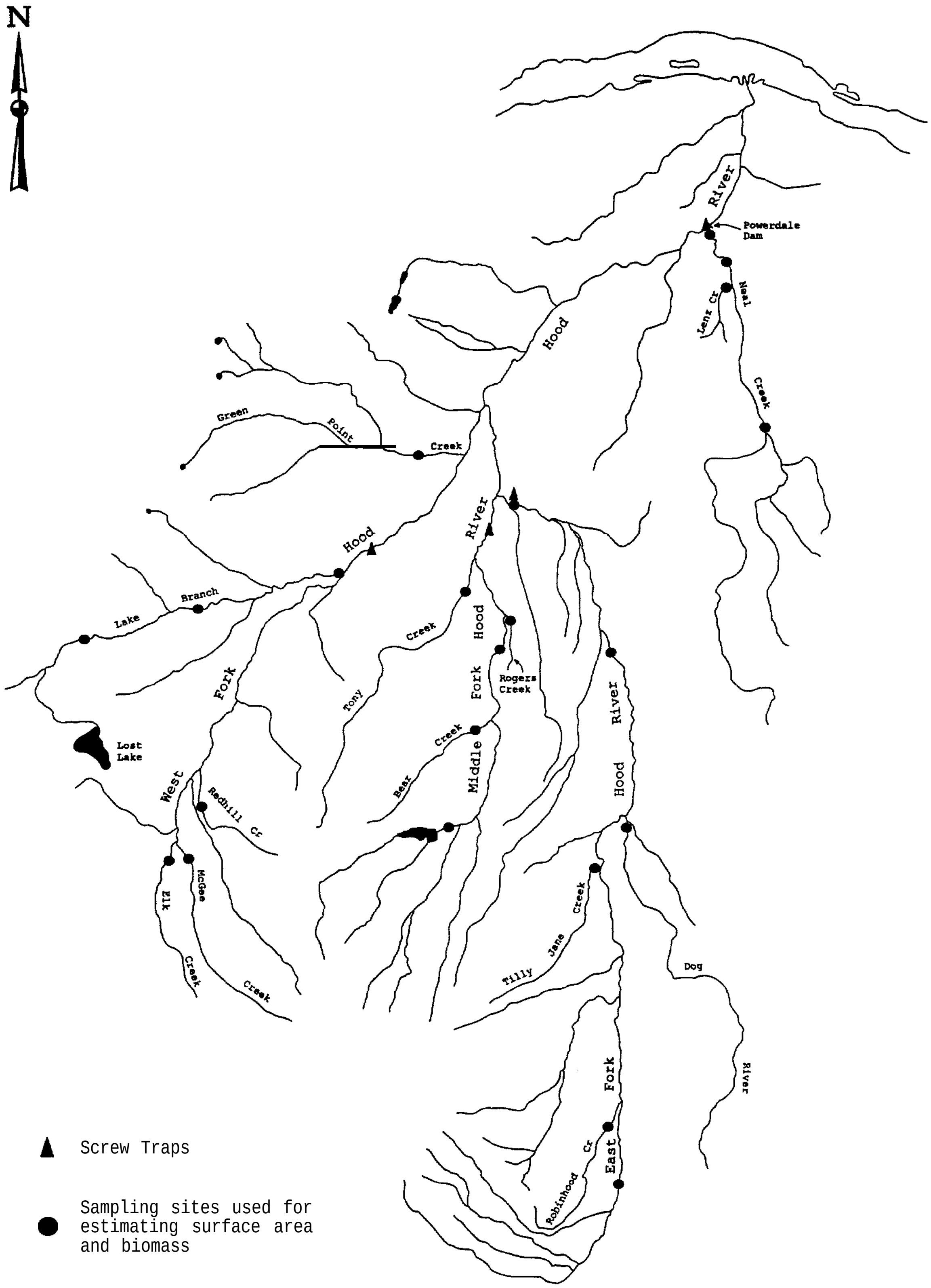


Figure 3. Location of sampling sites in the Hood River subbasin.

Table 1. Estimates of density (numbers) and biomass (gms) in relation to surface area (m^2) and volume (m^3) for rb-st sampled at selected sites in the Hood River subbasin by location. area. and year. (Estimates for hatchery produced steelhead are in parentheses. Sampling dates. reach lengths, and removal numbers for each pass are presented in Appendix A. Also included in Appendix A are the qualifiers associated with each population estimate.)

Location. area. year	RM	Fish/1000m² <85mm	Fish/1000m² ≥85mm	Grams/100m²	Fish/1000m³ <85mm	Fish/1000m³ ≥85mm	Grams/100m³
Mainstem.							
Neal Cr.							
1995	0.0	38	10	40	173	45	182
1994	1.5	20	68(9)	246(117)	71	245(31)	888(421)
1995	1.5	32	46	182	128	184	730
1994	5.0	296	122(7)	282(--)	1.968	809(45)	1.869(--)
1995	5.0	354	37	197	2.352	245	1.306
Lenz Cr.							
1994	0.5	0	7	23	0	37	121
1995	0.5	0	0	0	0	0	0
West Fork,							
Greenpoint Cr.							
1994	1.0	346	285	744	2.913	2,401	6.271
1995	1.0	172	134	424	1.305	1.014	3.208
Lake Branch.							
1994	0.2	397	143(1)	431(17)	1.915	688(6)	2.076(80)
1995	0.2	471	56(3)	258(29)	1.980	233(11)	1.079(120)
1994	4.0	23	99	418	137	592	2.498
1995	4.0	34	86	177	170	438	a97
1994	7.0	31	37	84	343	411	938
1995	7.0	62	125	345	404	al3	2,246
Red Hill Cr.							
1994	1.0	33	73	261	466	1.027	3,676
1995	1.0	10	90	221	137	1.229	3.016
McGee Cr.							
1994	0.5	50	79	155	428	673	1.320
1995	0.5	17	46	171	107	300	1.115
Elk Cr.							
1994	0.5	46	59	207	508	657	2.302
1995	0.5	134	a3	202	1.160	720	1.752
Middle Fork.							
MFk HDR.							
1994	4.5	45	22	79	322	160	574
Tony Cr.							
1994	1.0	17	54	115	163	528	1.123
1995	1.0	90	12	51	783	108	454
Bear Cr.							
1994	0.6	0	0	0	0	0	0
1995	0.6	0	0	0	0	0	0

Table 1. Continued.

Location, area, year	RM	Fish/1000m² <85mm	Fish/1000m² ≥85mm	Grams/100m²	Fish/1000m³ <85mm	Fish/1000m³ ≥85mm	Grams/100m³
East Fork.							
1994	0.5	80	89(4)	338(43)	407	453(19)	1.720(221)
1995	0.5	44	45(1)	109(15)	124	128(3)	311(44)
1994	5.5	198	46(12)	167(47)	1.623	376(97)	1,365(388)
1995	5.5	100	21(10)	82(55)	381	81(39)	314(211)
1994	20.2	0	2	11	0	10	53
1995	20.2	0	0	0	0	0	0
Dog River.							
1994	0.7	0	0	0	0	0	0
1995	0.7	28	9	31	353	110	376
Tilly Jane Cr.							
1994	0.1	0	0	0	0	0	0
1995	0.1	0	0	0	0	0	0
Robinhood Cr.							
1994	1.0	0	0	0	0	0	0
1995	1.0	0	0	0	0	0	0

Table 2. Estimated number of wild downstream migrant rainbow-steelhead to a migrant trap located at RM 4.5 in the mainstem Hood River by age category. (Percent of total migrants is in parentheses. Population estimators and sampling period are in Appendix B.)

Year	Estimated number[a] of migrants	95% C.I.	Estimated number by age category: Age 0	Age 1	Age 2	Age 3
1994	9.916	4.473 - 15.359	250 (2.5)	2.333 (23.5)	6,375 (64.3)	958 (9.7)
1995[b]	8,075	641 - 15.508	_	1.799 (22.3)	4.918 (60.9)	1.358 (16.8)

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

[b] Estimates are for migrants $ 150 mm fork length. There were no age 0 juveniles in this size category.

Table 3. Freshwater age structure (percent) of wild adult summer and winter steelhead sampled at the Powerdale Dam 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
Summer,					
1992-93	466	1.1	80.9	17.8	0.2
1993-94	228	1.3	73.7	25.0	0
1994-95	197	0	60.4	39.6	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	388	2.1	92.5	5.4	0
1994-95	187	1.1	90.4	8.6	0

Table 4. Estimated number of wild steelhead smolts migrating from the Hood River subbasin. by age category. (Percent of total migrants is in parentheses.)

Year	Estimated number of smolts	Freshwater age		
		Age 1	Age 2	Age 3
1994	7.335	1.166 (15.9)	5.208 (71.0)	961 (13.1)
1995	6.313	1.138 (18.0)	4.037 (64.0)	1.138 (18.0)

Table 5. Estimates of mean fork length (mm) and condition factor for wild rainbow-steelhead sampled at selected sites in the Hood River subbasin. by location and area. (Sampling dates are in Appendix A.)

Location, area	River mile	Year	Fork length (mm)				Condition factor[a]			
			N	Mean	Range	95% C.I.	N	Mean	Range	95% C.I.
Mainstem.										
Lenz Cr	0.5	1994	1	144	144	--	1	1.10	1.10	--
Neal Cr	0.0	1995	21	78	46-148	±14.6	21	1.20	1.06-1.43	± 0.05
Neal Cr	1.5	1994	27	127	67-203	±16.0	27	1.09	0.96-1.24	± 0.03
Neal Cr	1.5	1995	23	107	54-182	±16.9	23	1.35	1.04-1.88	± 0.08
Neal Cr	5.0	1994	105	74	42-165	± 6.0	104	1.14	0.83-2.32	± 0.04
Neal Cr	5.0	1995	121	64	38-160	± 4.8	121	1.11	0.72-1.48	± 0.02
West Fork.										
Greenpoint Cr	1.0	1994	212	98	44-215	± 4.4	212	1.09	0.70-1.92	± 0.01
Greenpoint Cr	1.0	1995	207	96	40-192	± 4.8	203	1.13	0.90-1.88	± 0.02
Lake Branch	0.2	1994	254	80	46-242	± 3.4	253	1.05	0.61-1.69	± 0.01
Lake Branch	0.2	1995	389	69	39-197	± 2.0	220	1.19	0.78-1.84	± 0.02
Lake Branch	4.0	1994	57	140	70-285	±10.6	56	1.06	0.74-1.57	± 0.03
Lake Branch	4.0	1995	a2	100	59-192	± 6.5	81	1.16	0.92-1.43	± 0.03
Lake Branch	7.0	1994	18	89	38-209	±22.5	18	1.01	0.77-1.25	± 0.06
Lake Branch	7.0	1995	69	101	30-236	±11.5	69	1.08	0.63-1.85	± 0.04
Red Hill Cr	1.0	1994	15	124	81-205	81.3	15	1.14	0.98-1.27	± 0.05
Red Hill Cr	1.0	1995	20	118	35-188	±15.3	20	1.13	0.97-1.40	± 0.05
McGee Cr	0.5	1994	48	91	51-197	± a.9	48	1.14	0.97-1.42	± 0.03
McGee Cr	0.5	1995	31	120	31-206	±16.4	31	1.15	0.97-1.49	± 0.04
Elk Cr	0.5	1994	27	a5	35-228	60.5	27	1.06	0.51-2.08	± 0.10
Elk Cr	0.5	1995	86	74	30-174	± 9.6	62	1.05	0.67-1.34	± 0.04
Middle Fork.										
MFk HDR	4.5	1994	25	92	58-176	±15.5	25	1.19	0.96-1.59	± 0.06
Tony Cr	1.0	1994	19	99	41-148	±19.0	19	1.06	0.83-1.45	± 0.07
Tony Cr	1.0	1995	33	60	36-182	±10.1	33	1.23	0.88-2.79	± 0.11
East Fork.										
EFk HDR	0.5	1994	97	103	45-200	± 8.6	97	1.16	0.75-1.65	± 0.02
EFk HDR	0.5	1995	66	94	54-186	± 6.5	66	1.19	0.77-1.52	± 0.03
EFk HDR	5.5	1994	72	78	52-162	± 6.7	71	1.04	0.48-1.45	± 0.04
EFk HDR	5.5	1995	79	68	30-161	± 6.2	79	1.16	0.37-1.42	± 0.03
EFk HDR	20.2	1994	1	167	167	—	1	1.14	1.14	—
Dog River	0.7	1995	11	69	35-143	69.6	11	1.06	0.86-1.32	± 0.07

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

Table 6. Estimates of mean fork length (FL: mm), weight (gm), and condition factor (CF) for wild downstream migrant rainbow-steelhead sampled at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River, by age category and for the sample mean. (Sampling periods are in Appendix B.)

Statistic, age, year	N	Mean	Range	95% C.I
FL (mm),				
Age 0,				
1994	6	78.3	67 - 107	± 15.6
1995	1	74	74	± --
Age 1,				
1994	56	165.4	120 - 200	± 4.3
1995	56	171.2	77 - 216	± 6.2
Age 2,				
1994	153	180.3	129 - 221	± 2.4
1995	135	180.3	144 - 218	± 2.7
Age 3,				
1994	23	196.0	168 - 214	± 5.1
1995	37	181.1	153 - 202	± 4.4
Total[a],				
1994	420	176.3	67 - 221	± 2.0
1995	268	163.6	27 - 218	± 5.5
Weight (gms),				
Age 0,				
1994	6	6.0	3.2 - 13.1	± 3.8
1995	1	4.0	4.0	± --
Age 1,				
1994	44	43.8	21.1 - 69.8	± 3.3
1995	54	55.4	4.6 - 96.9	± 5.1
Age 2,				
1994	114	60.4	26.1 - 91.8	± 2.6
1995	133	58.2	27.3 - 117.6	± 2.8
Age 3,				
1994	17	76.9	46.7 - 100.9	± 7.9
1995	35	56.7	29.6 - 82.7	± 5.0
Total[a],				
1994	283	56.3	3.2 - 100.9	± 2.1
1995	251	52.2	0.1 - 117.6	± 2.8
CF,[b]				
Age 0,				
1994	6	1.17	1.06 - 1.42	± 0.14
1995	1	0.99	0.99	± --
Age 1,				
1994	44	0.96	0.75 - 1.22	± 0.03
1995	54	1.05	0.83 - 1.30	± 0.03
Age 2,				
1994	114	1.02	0.83 - 1.46	± 0.02
1995	133	0.97	0.78 - 1.24	± 0.01
Age 3,				
1994	17	1.00	0.82 - 1.27	± 0.06
1995	35	0.93	0.81 - 1.17	± 0.03
Total[a],				
1994	283	1.01	0.75 - 1.46	± 0.01
1995	251	0.98	0.34 - 1.65	± 0.02

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

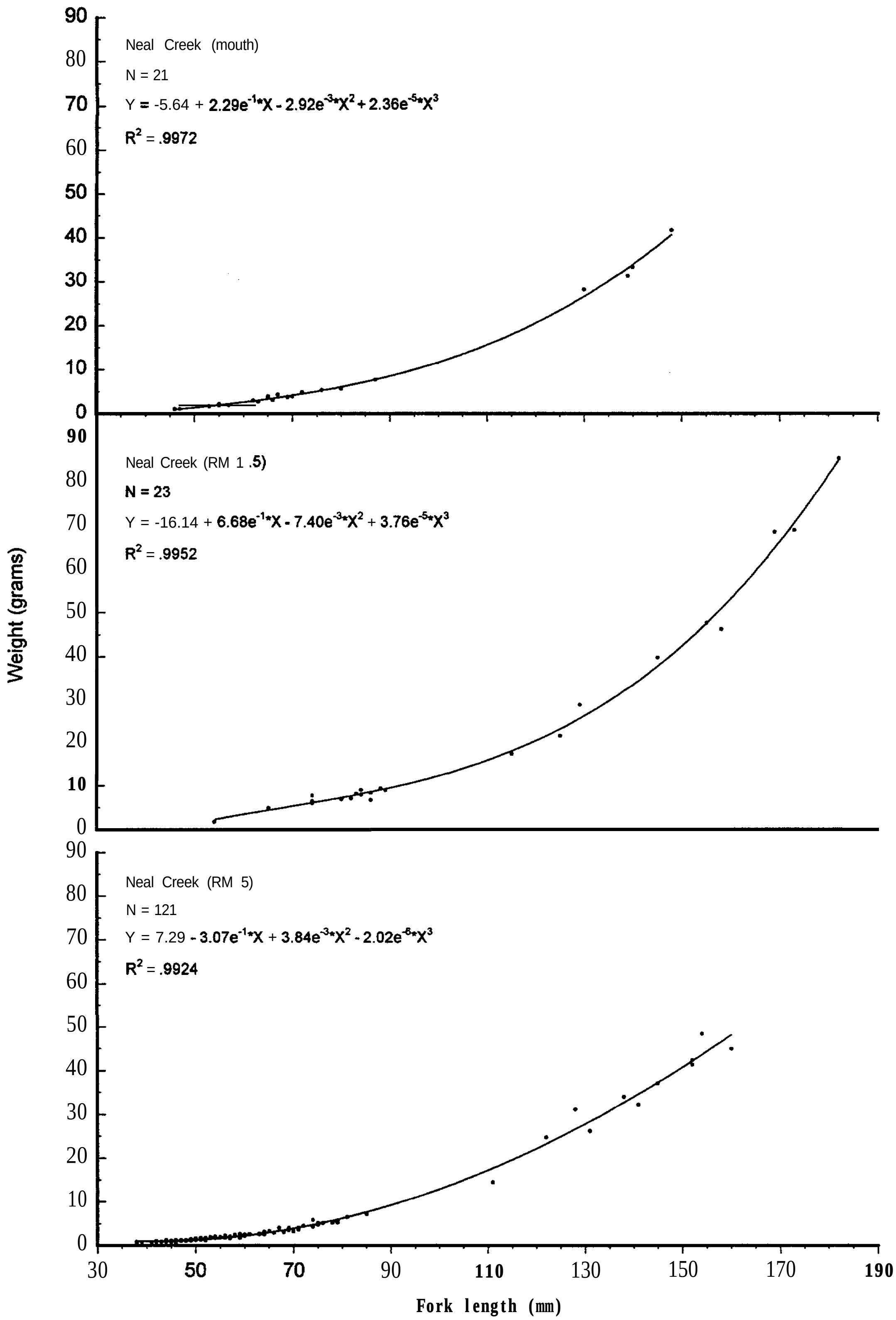


Figure 4. Length x weight regression of wild rainbow-steelhead sampled at selected sites in Neal Creek, 1995.

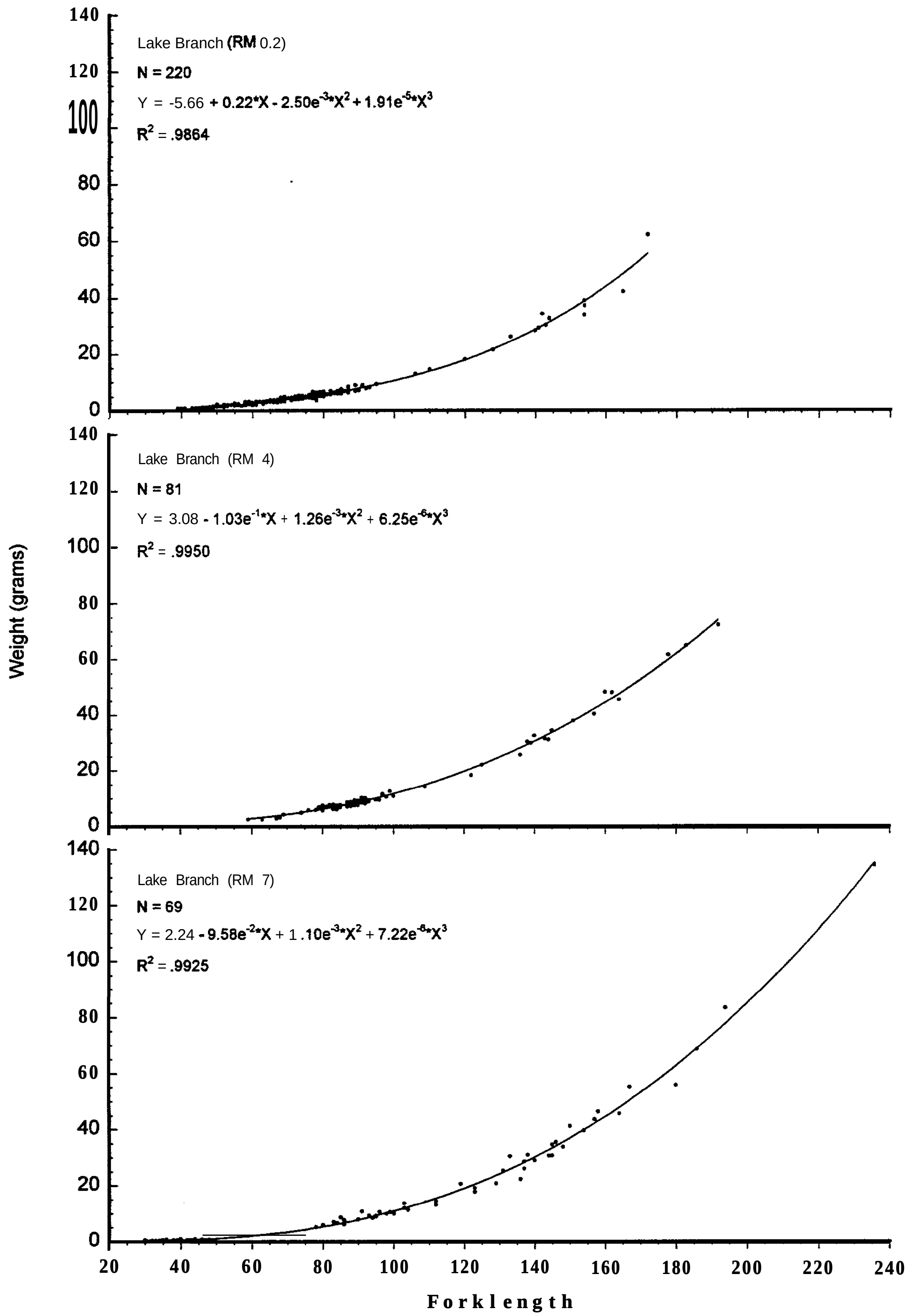


Figure 5. Length x weight regression of wild rainbow-steelhead sampled at selected sites in Lake Branch, 1995.

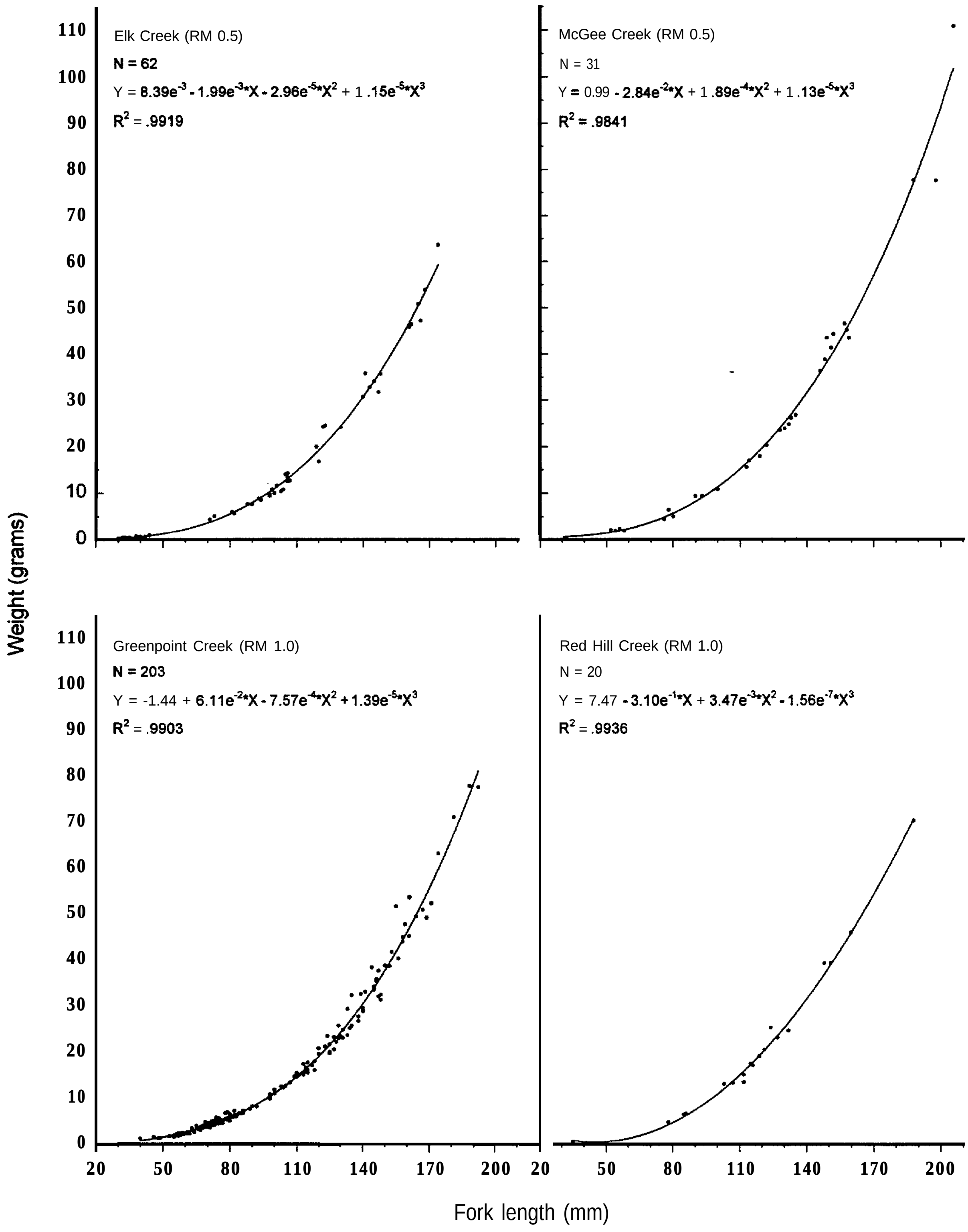


Figure 6. Length x weight regression of wild rainbow-steelhead sampled at selected sites in Elk, McGee, Greenpoint. and Red Hill creeks, 1995.

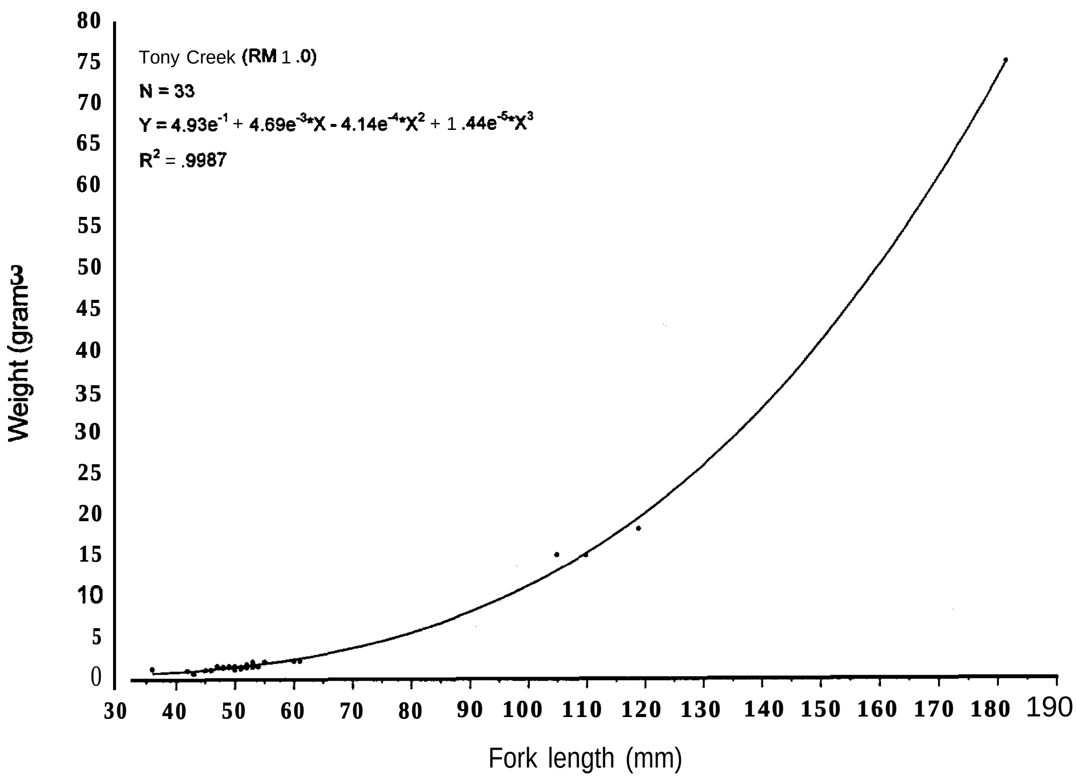


Figure 7. Length x weight regression of wild rainbow-steelhead sampled in Tony Creek, 1995.

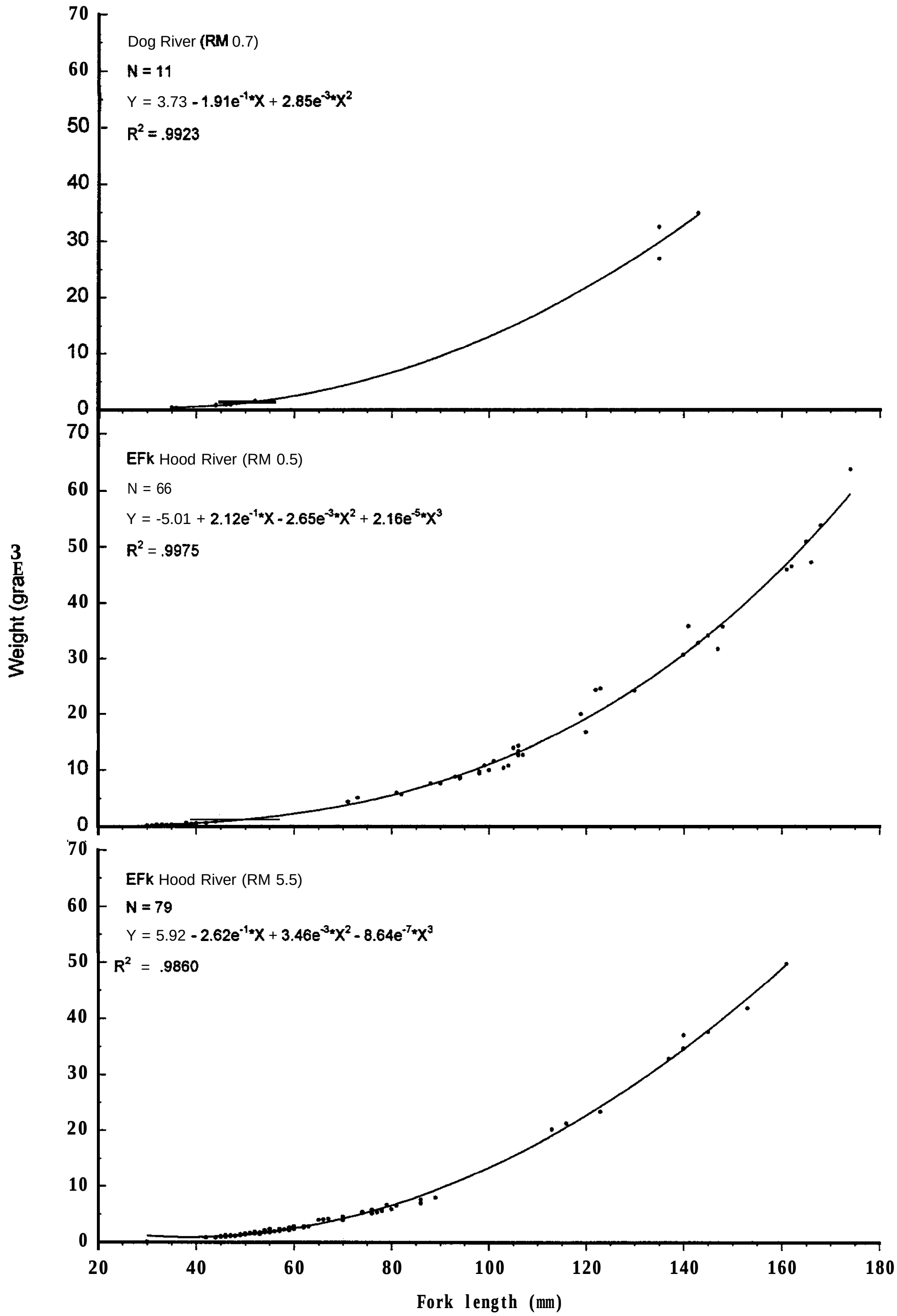


Figure 8. Length x weight regression of wild rainbow-steelhead sampled at selected sites in Dog Creek and the East Fork of the Hood River, 1995.

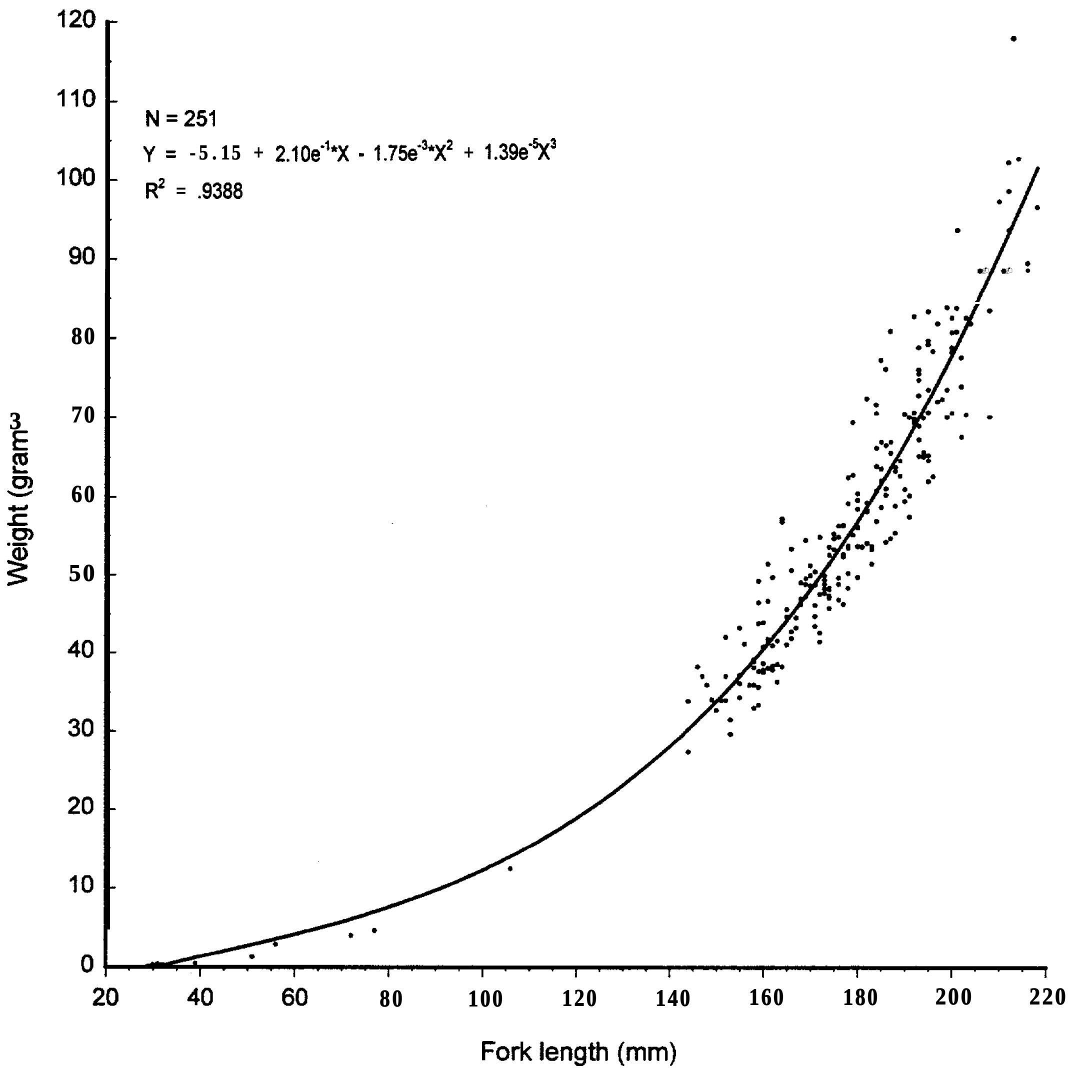


Figure 9. Length x weight regression of downstream migrant wild rainbow-steelhead sampled from 14 April through 28 July 1995 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River.

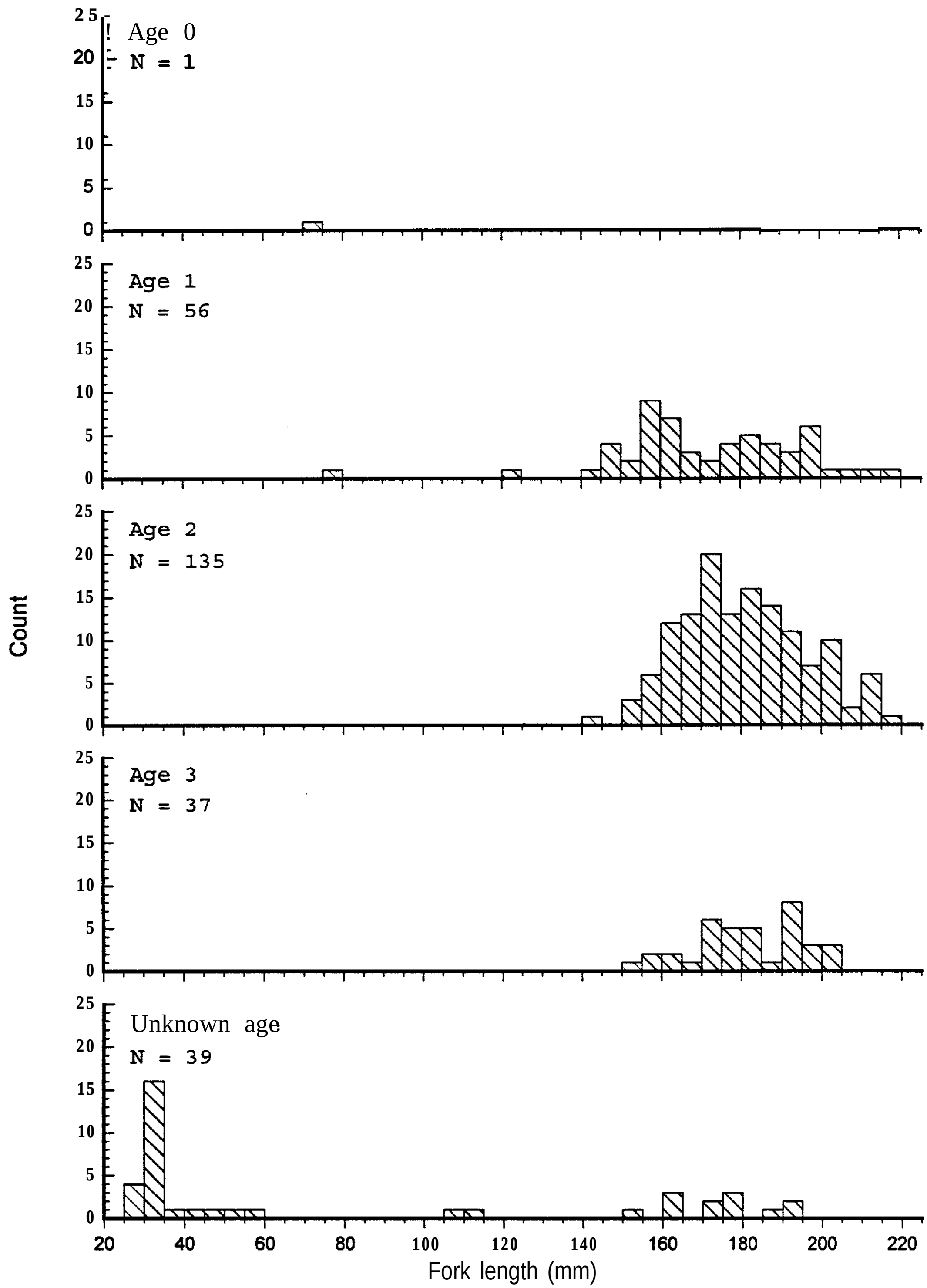


Figure 10. Length frequency histogram of downstream migrant wild rainbow-steelhead sampled from 14 April through 28 July 1995 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River, by age category.

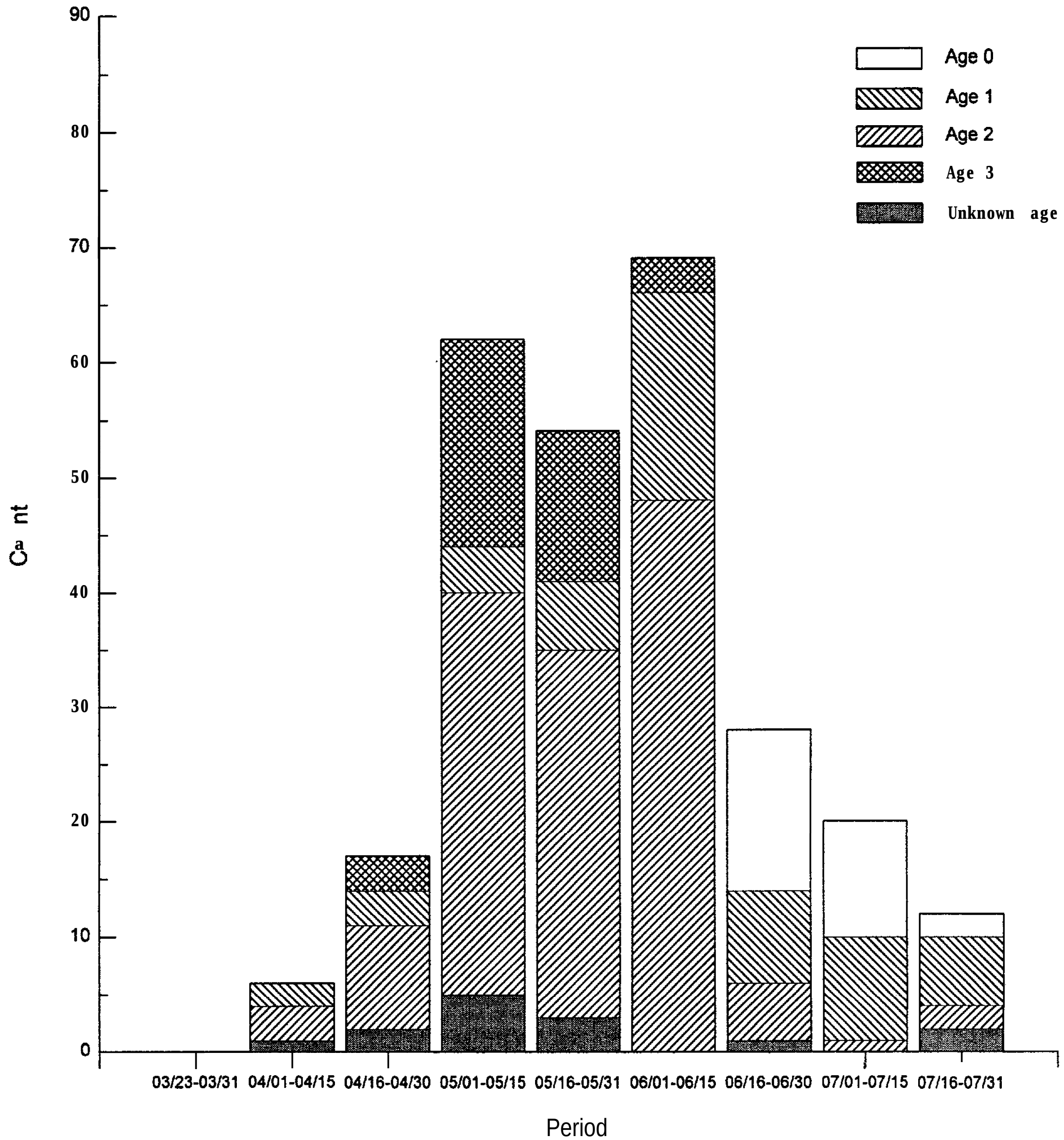


Figure 11. Temporal distribution of downstream migrant wild rainbow-steelhead sampled from 14 April through 28 July 1995 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River. Juveniles less than 70 mm fork length, for which age was unknown, were assumed to be age 0 rb-st. Estimates are not adjusted for trap efficiency.

Table 7. Estimates of density (numbers) and biomass (gms) in relation to surface area (m^2) and volume (m^3) for wild cutthroat trout sampled at selected sites in the Hood River subbasin by location, area. and year. (Sampling dates, reach lengths. and removal numbers for each pass are presented in Appendix A. Also included in Appendix A are the qualifiers associated with each estimate.)

Location. area, year	RM	Fish/1000m^2		Grams/100m^2	Fish/1000m^3		Grams/100m^3
		<85mm	≥85mm		<85mm	≥85mm	
Mainstem.							
Neal Cr.							
1995	1.5	0	3	8	0	13	33
1994	5.0	0	3	14	0	22	104
1995	5.0	40	18	60	263	117	390
Middle Fork.							
Tony Cr.							
1994	1.0	46	85	163	452	825	1.581
1995	1.0	50	134	400	432	1.169	3.485
Bear Cr							
1994	0.6	55	223	377	483	1.966	3.321
1995	0.6	122	237	501	1.038	2.014	4.261
East Fork,							
EFk HDR.							
1994	0.5	8	1	5	41	6	28
1995	0.5	10	1	11	30	3	32
1994	20.2	0	4	14	0	20	72
Dog River,							
1994	0.7	30	45	119	615	922	2.442
1995	0.7	6	55	185	73	702	2.354
Tilly Jane Cr.							
1994	0.1	38	113	172	376	1.113	1.695
1995	0.1	211	105	272	2,774	1.380	3.572
Robinhood Cr.							
1994	1.0	155	238	637	866	1.331	3.564
1995	1.0	283	206	582	1.468	1.070	3.023

Table 8. Estimates of mean fork length (mm) and condition factor for wild cutthroat trout sampled at selected sites in the Hood River subbasin. by location and area. (Sampling dates are in Appendix A.)

Location. area	River mile	Year	Fork length (mm)				Condition factor[a]			
			N	Mean	Range	95% C.I.	N	Mean	Range	95% C.I.
Mainstem.										
Neal Cr	1.5	1995	1	133	133-133	_	1	1.08	1.08-1.08	--
Neal Cr	5.0	1994	1	165	165	_	1	1.05	1.05	--
Neal Cr	5.0	1995	13	85	53-159	±18.5	13	1.18	1.05-1.40	± 0.07
Middle Fork,										
Tony Cr	1.0	1994	24	88	48-178	±15.3	24	1.08	0.87-1.28	± 0.05
Tony Cr	1.0	1995	56	110	51-205	±11.2	56	1.13	0.75-1.51	± 0.04
Bear Cr	0.6	1994	76	104	58-190	± 6.1	74	1.00	0.55-1.42	± 0.03
Bear Cr	0.6	1995	112	104	34-170	± 5.6	112	1.06	0.77-1.87	± 0.03
East Fork,										
EFk HDR	0.5	1994	4	84	68-114	_	4	1.09	1.03-1.18	± 0.10
EFk HDR	0.5	1995	9	84	62-191	±31.3	9	1.09	0.96-1.22	± 0.07
EFk HDR	20.2	1994	2	152	m-171	--	2	1.01	0.90-1.11	--
Dog River	0.7	1994	30	102	42-203	±12.9	30	1.15	0.92-2.19	± 0.08
Dog River	0.7	1995	21	129	69-238	±18.9	21	1.12	0.97-1.50	± 0.06
Tilly Jane Cr	0.1	1994	26	101	44-165	±10.7	25	1.01	0.70-1.29	± 0.05
Tilly Jane Cr	0.1	1995	115	75	30-183	± 7.3	114	1.18	0.10-4.03	± 0.07
Robinhood Cr	1.0	1994	54	104	39-200	±12.2	54	1.02	0.62-1.22	± 0.04
Robinhood Cr	1.0	1995	93	80	22-210	± 9.9	90	1.01	0.14-1.35	± 0.04

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

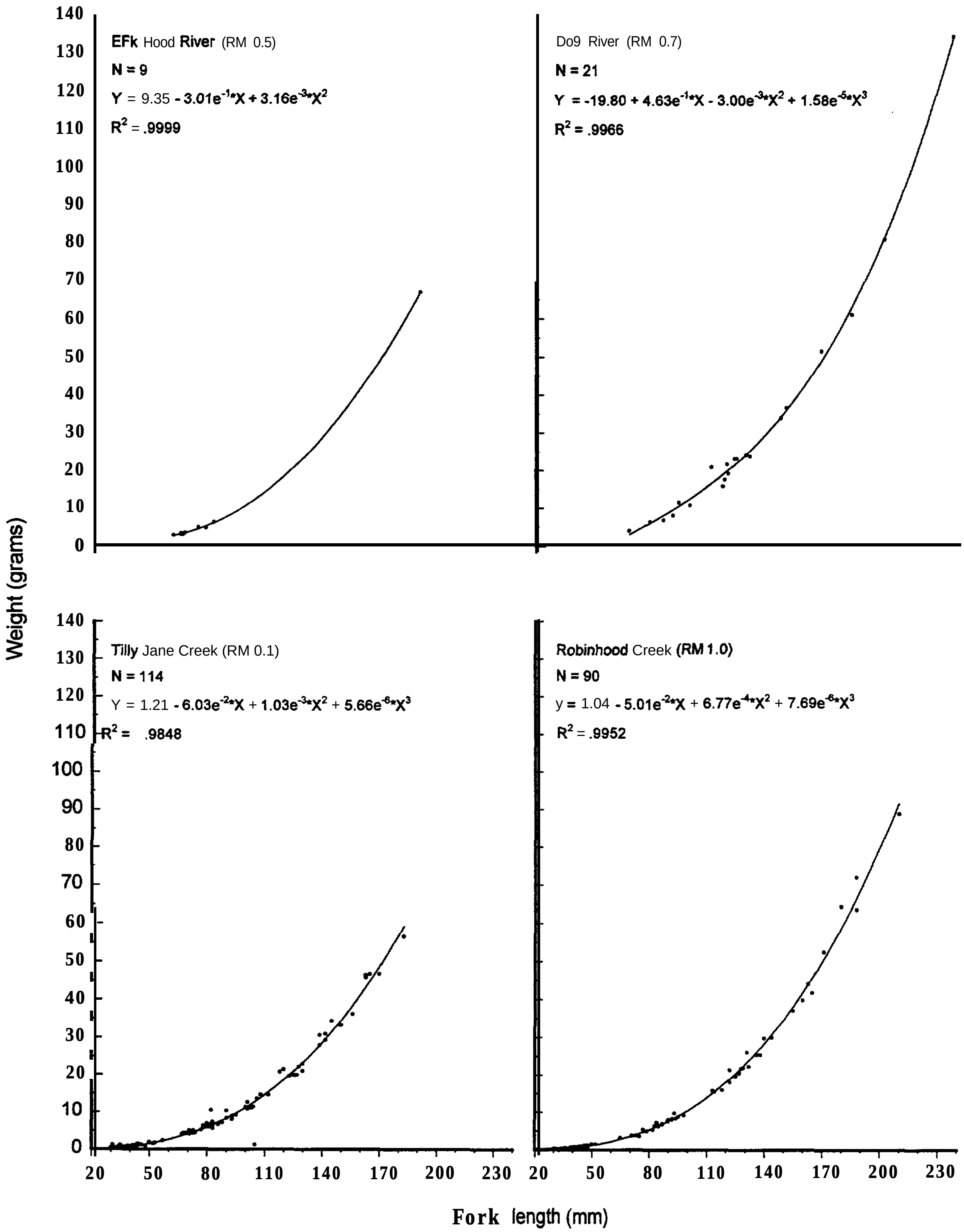


Figure 12. Length x weight regression of wild cutthroat trout sampled at selected sites in the East Fork Hood River, Dog River, and in Tilly Jane and Robinhood creeks, 1995.

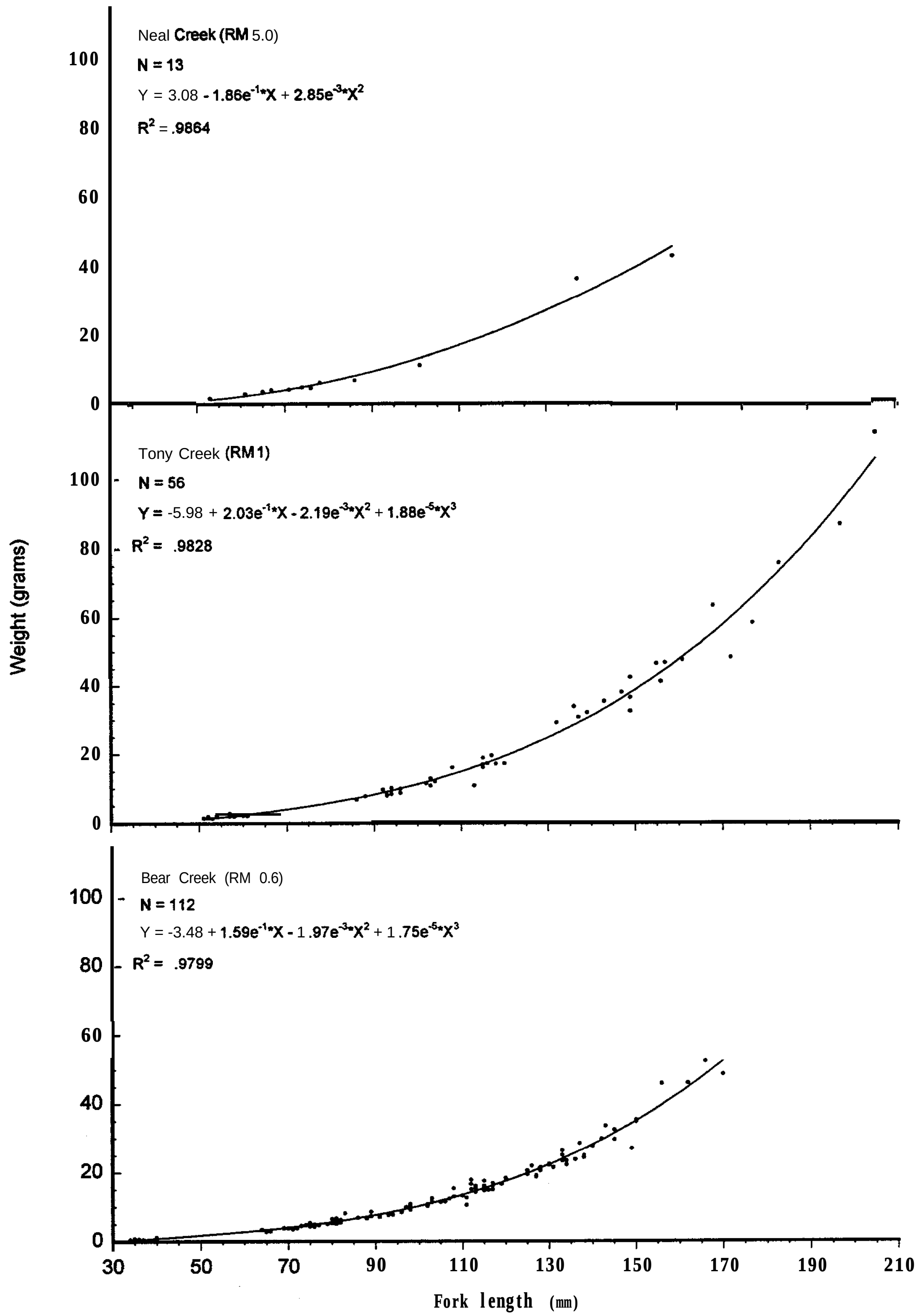


Figure 13. Length x weight regression of wild cutthroat trout sampled at selected sites in Neal, Tony, and Bear creeks, 1995.

Table 9. 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. Counts are boldfaced for the bimonthly period in which the median date of migration occurred in each origin category and for canplete run years (i.e.. 1992-93 through 1994-95 run years).

Origin,	March		April		Mav		June		July		August		September		October		November		December			
run year	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	Jan-May	Total
Wild,																						
1992-93	0	1	12	6	7	21	31	68	49	48	37	18	17	55	25	24	38	12	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	0	0	3	4	9	7	22	25	32	33	11	1	4	8	2	7	5	0	0	0	9	182
1995-96[a,b]	0	0	0	0	2	1	4	6	37	19	16	2	5	5	0	0	0	0	0	0	--	97
Subbasin hatchery.																						
1992-93	0	8	48	82	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	0	4	14	80	128	171	281	308	329	169	24	10	13	17	18	12	13	4	0	0	20	1.615
1995-96[a,b]	0	0	4	0	5	12	30	33	220	104	58	13	15	6	5	0	0	0	0	0	--	505
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	0	0	0	0	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	5
1995-96[a,b]	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	--	1
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	0	1	0	4	2	4	4	7	11	7	1	0	11	0	0	1	1	0	0	0	1	55
1995-96[a,b]	0	0	0	0	0	0	1	2	6	5	7	0	0	0	0	13	2	24	0	2	--	68

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

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

Table 10. 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-Dee	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	173	0	0	5	1	1	1	1	0	0	0	182
Subbasin hatchery,												
1992-93	1.651	0	0	0	0	0	3	11	4	1	0	1.670
1993-94	1,067	4	2	0	0	1	2	7	7	0	0	1,090
1994-95	1.595	0	4	2	3	6	2	0	3	0	0	1.615
Stray hatchery,												
1992-93	49	0	1	1	0	1	1	3	0	0	0	56
1993-94	18	0	0	0	0	0	0	1	0	0	0	19
1994-95	4	0	0	0	0	0	0	1	0	0	0	5
Unknown.												
1992-93	19	0	0	0	0	0	0	0	0	0	0	19
1993-94	17	1	0	0	0	0	0	0	2	0	0	20
1994-95	54	0	0	0	0	0	0	1	0	0	0	55

Table 11. 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 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,														
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
1994-95	211	--	0	0	—	5	86	28	0	1	66	11	0	14
Subbasin hatchery.														
1992-93	1.682	48	1.477	143	1	—	0	—	--	--	--	—	—	13
1993-94	1.100	36	818	236	3	—	0	—	—	--	--	—	--	7
1994-95	1,641	12	1.367	251	0	--	1	--	--	—	--	--	—	10
Stray hatchery.														
1992-93	56	4	43	8	--	—	—	1	--	--	--	--	—	--
1993-94	19	1	14	4	—	—	--	0	—	—	--	--	--	—
1994-95	5	0	2	3	—	—	--	0	--	—	—	--	—	--

Table 12. Adult summer steelhead escapements to the Powerdale 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 1994-95 run years.)

Origin, brood year[a]	Smolts	Ocean age 1 salt	Ocean age 2 salt	Ocean age 3 salt	Ocean age 4 salt	Repeat spawners
Wild.						
1986	--	--	1	0	0	3
1987	--	0	77	55	3	18
1988	--	6	349	60	0	11
1989	--	30	176	30	--	7
1990	--	12	87	--	--	1
1991	--	5	--	--	--	--
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)	0 (0.0)	7 (0.01)
1990	77.132	48 (0.06)	819 (1.06)	251 (0.33)	--	8 (0.01)
1991	99,973	36 (0.04)	1.368 (1.37)	--	--	2 (0.002)
1992	70.928	12 (0.02)	--	--	--	--

[a] Based on estimates of age structure for adult summer steelhead sampled at the 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 1995-96 run year.

Table 13. Age composition (percent) of adult summer steelhead sampled at the Powerdale Dam trap by origin, run year, and age category. (Estimates in a given run year may not add to 100% due to rounding error.)

Origin, 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,														
1992-93	476	--	1.1	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
1994-95	175	--	0	0	--	2.3	40.6	13.1	0	0.6	31.4	5.1	0	6.9
Subbasin hatchery,														
1992-93	1.669	2.8	87.8	8.5	0.06	--	0	--	--	--	--	--	--	0.8
1993-94	1.067	3.3	74.3	21.5	0.3	--	0	--	--	--	--	--	--	0.7
1994-95	1.563	0.7	83.3	15.3	0	--	0.06	--	--	--	--	--	--	0.6
Stray hatchery.														--
1993-94	19	5.3	73.7	21.1	--	--	--	1.0	--	--	--	--	--	--
1994-95	5	0	40.0	60.0	--	--	--	0	--	--	--	--	--	--

Table 14. Mean fork length (cm) of adult summer steelhead with spawning checks in the 1994-95 run year by origin. sex. and age category. Fish were sampled at the Powerdale Dam trap.

Origin. sample pop., statistic	Freshwater/ocean age							
	1/1s.2	1/1s.3	1/2s.3	1/2s.4	2/1s.2	2/2s.3	2/3s.5	3/2s.3
Wild,								
Female,								
N	--	--	--	--	--	4	1	3
Mean	--	--	--	--	--	77.88	84.5	69.50
STD	--	--	--	--	--	2.66	--	3.91
Range	--	--	--	—	—	75.0-81.0	84.5	67.0-74.0
Male.								
N	--	--	--	--	1	--	--	1
Mean	--	--	--	--	44.0	--	--	74.0
STD	--	--	--	—	--	--	--	--
Range	—	--	--	--	44.0	--	--	74.0
Total.								
N	--	--	--	--	1	4	1	4
Mean	--	--	--	--	44.0	77.88	84.5	70.62
STD	—	--	--	--	--	2.66	--	3.90
Range	--	--	--	--	44.0	75.0-81.0	84.5	67.0-74.0
Subbasin hatchery								
Female.								
N	1	1	3	1	--	--	--	--
Mean	63.0	68.0	72.33	77.0	--	--	--	—
STD	--	—	3.82	--	--	—	--	—
Range	63.0	68.0	69.0-76.5	77.0	--	--	--	--
Male.								
N	1	--	3	—	--	--	—	--
Mean	57.0	--	78.83	--	--	—	—	—
STD	--	--	3.33	--	--	--	—	--
Range	57.0	--	76.0-82.5	--	--	--	—	—
Total,								
N	2	1	6	1	—	--	--	—
Mean	60.00	68.0	75.58	77.0	—	—	—	—
STD	4.24	--	4.79	--	--	--	—	—
Range	57.0-63.0	68.0	69.0-82.5	77.0	--	--	--	—

Table 15. Mean fork length (cm) of adult summer steelhead without spawning checks In the 1994-95 run year by origin, sex. and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/ocean ase									Sample[a]
	1/1	112	1/3	2/1	2/2	2/3	3/1	3/2	3/3	mean
Wild,										
Female,										
N	--			3	56	11	1	36	4	122
Mean	--			53.17	68.36	75.68	54.5	69.68	76.38	69.66
STD	—			7.18	5.13	4.34	--	3.87	4.33	6.18
Range	--		--	45.0-58.5	54.0-77.5	68.0-82.5	54.5	63.0-78.5	72.5-82.0	45.0-84.5
Male,										
N	--		--	1	15	12	--	19	5	59
Mean	--			43.0	70.03	83.50	--	71.50	81.70	73.74
STD	--			--	5.49	4.84	--	5.61	9.24	9.53
Range	--			43.0	60.0-81.0	74.0-91.0	--	58.0-80.0	68.0-91.0	43.0-91.0
Total,										
N	--			4	71	23	1	55	9	181
Mean	--		--	50.62	68.71	79.76	54.5	70.31	79.33	70.99
STD	--		--	7.76	5.21	6.02	--	4.58	7.59	7.66
Range	--		--	43.0-58.5	54.0-81.0	68.0-91.0	54.5	58.0-80.0	68.0-91.0	43.0-91.0
Subbasin hatchery,										
Female,										
N	4	810	99	--	--	--	--	--	--	940
Mean	53.12	68.01	77.18	--	--	--	--	--	--	68.94
STD	7.36	3.62	4.16	--	--	--	--			4.80
Range	44.5-62.5	54.0-80.0	69.5-87.5	--	--	--	--	--	--	44.5-87.5
Male,										
N	7	492	140	--	1	—	—	--	--	669
Mean	52.43	70.25	80.88	—	75.0	--	--	--	--	72.43
STD	3.38	4.13	4.98	--	--	—	--	--	--	6.61
Range	48.0-58.5	53.5-86.5	69.5-93.0	--	75.0	--	--	--	--	48.0-93.0
Total,										
N	11	1,302	239	--	1	--	--			1.610
Mean	52.68	68.86	79.34	--	75.0	—	--	--	--	70.40
STD	4.82	3.97	4.99	--	--	--	--	--	--	5.88
Range	44.5-62.5	53.5-86.5	69.5-93.0	—	75.0	—	—	--	--	44.5-93.0

[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 16. 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. Olsen et al. (1994). and Olsen et al. (1995).]

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)	79 (9)	--	--
1989	--	57 (25)	53 (5)	69 (5)	68 (98)	70 (55)	--	88 (2)	80 (23)	--	--	--
1990	--	55 (10)	54 (1)	70 (1)	69 (71)	--	--	—	--	--	--	--
1991	--	51 (4)	--	--	--	--	--	--	--	--	--	--
Subbasin hatchery+												
1987	--	--	--	--	--	--	--	--	--	--	90 (1)	--
1988	--	--	--	--	--	--	--	78 (142)	--	—	79 (3)	--
1989	--	--	—	68 (1,466)	--	--	—	80 (229)	--	--	--	--
1990	55 (47)	--	--	67 (793)	75 (1)	--	--	79 (239)	--	--	--	--
1991	53 (35)	--	--	69 (1,302)	--	--	--	--	--	--	--	--
1992	53 (11)	--	--	--	--	--	--	--	--	--	--	--

Table 17. Mean weight (kg) of adult summer steelhead without spawning checks in the 1994-95 run year by origin. sex. and age category. Fish were sampled at the Powerdale Dam trap.

Origin. sample pop.. statistic	Freshwater/ocean aoe 1/1	1/2	1/3	2/1	2/2	2/3	3/2	3/3	Sample[a] mean
Wild.									
Female.									
N	--	—	--	2	55	11	36	4	117
Mean	--	—	--	2.05	3.34	4.40	3.54	4.58	3.56
STD	--	--	--	1.06	0.71	0.82	0.60	0.76	0.82
Range	--	--	--	1.3-2.8	1.5-4.9	3.3-5.9	2.5-5.5	3.9-5.6	1.3-5.9
Male,									
N	--	—	--	1	15	12	18	5	58
Mean	--	—	--	0.8	3.46	5.97	3.57	5.96	4.21
STD	--	--	--	--	0.83	0.98	0.92	1.92	1.57
Range	--	—	--	0.8	1.9-5.3	4.2-7.5	1.0-4.6	3.4-8.0	0.8-8.0
Total.									
N	--	—	--	3	70	23	54	9	175
Mean	--	--	--	1.63	3.37	5.22	3.55	5.34	3.78
STD	--	—	--	1.04	a.73	1.20	0.71	1.61	1.16
Range	--	--	--	0.8-2.8	1.5-5.3	3.3-7.5	1.0-5.5	3.4-8.0	0.8-8.0
Subbasin hatchery									
Female.									
N	4	654	68	--	—	--	—	—	746
Mean	1.88	3.29	4.76	—	--	--	—	--	3.43
STD	0.76	0.55	0.79	—	—	--	—	—	0.73
Range	1.0-2.8	1.4-5.2	3.5-6.5	--	—	--	--	--	1.0-6.5
Male.									
N	6	409	115	—	1	--	--	--	555
Mean	1.48	3.60	5.35	--	4.1	--	—	—	3.96
STD	0.30	0.65	1.07	--	--	--	--	--	1.09
Range	1.1-1.9	1.6-5.9	3.4-8.3	—	4.1	--	--	—	1.1-8.3
Total.									
N	10	1.063	183	—	1	--	—	—	1.302
Mean	1.64	3.41	5.13	—	4.1	--	--	--	3.65
STD	0.53	0.61	1.01	--	—	—	—	--	0.94
Range	1.0-2.8	1.4-5.9	3.4-8.3	--	4.1	--	--	—	1.0-8.3

[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 18. 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 spawners
	1/1	1/2	113	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/2	
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)
1994-95	--	--	_	--	75 (4)	79 (71)	48 (23)	--	100 (1)	65 (55)	44 (9)	--	82 (11)
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)
1994-95	36 (11)	62 (1.302)	41 (239)	--	--	0 (1)	--	_	--	_	--	--	60 (10)

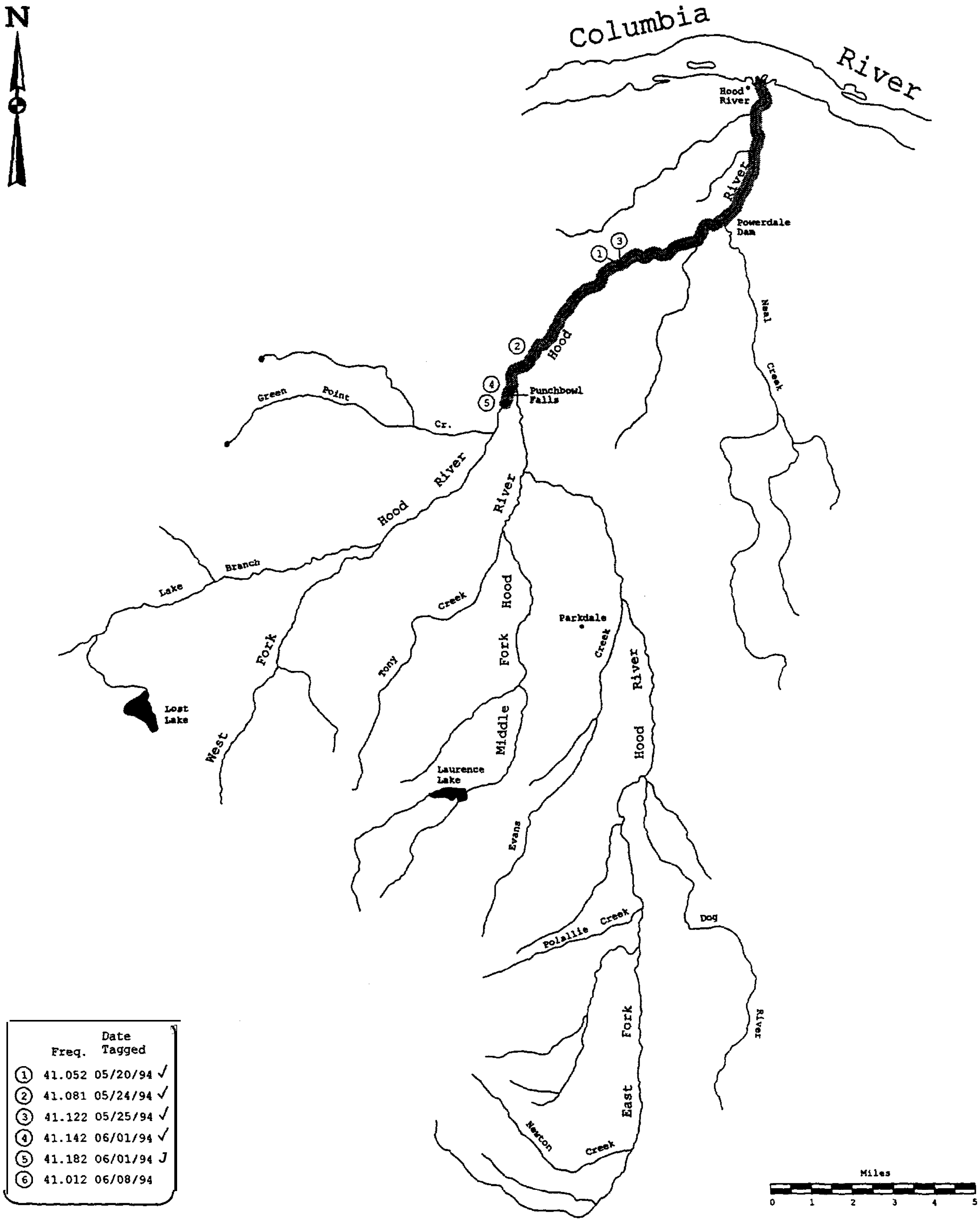


Figure 14. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 05/20-06/09/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

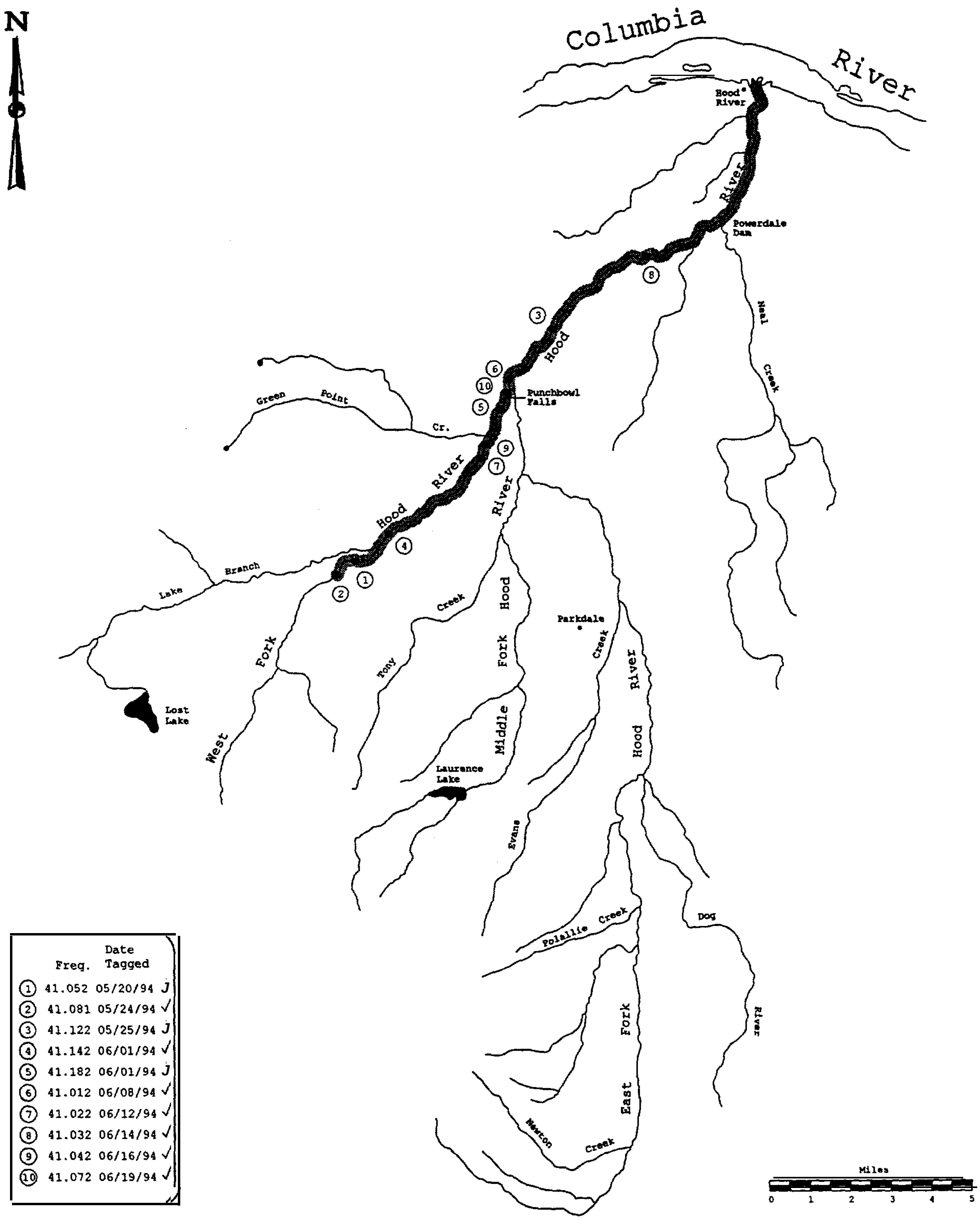


Figure 15. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 06/10-24/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

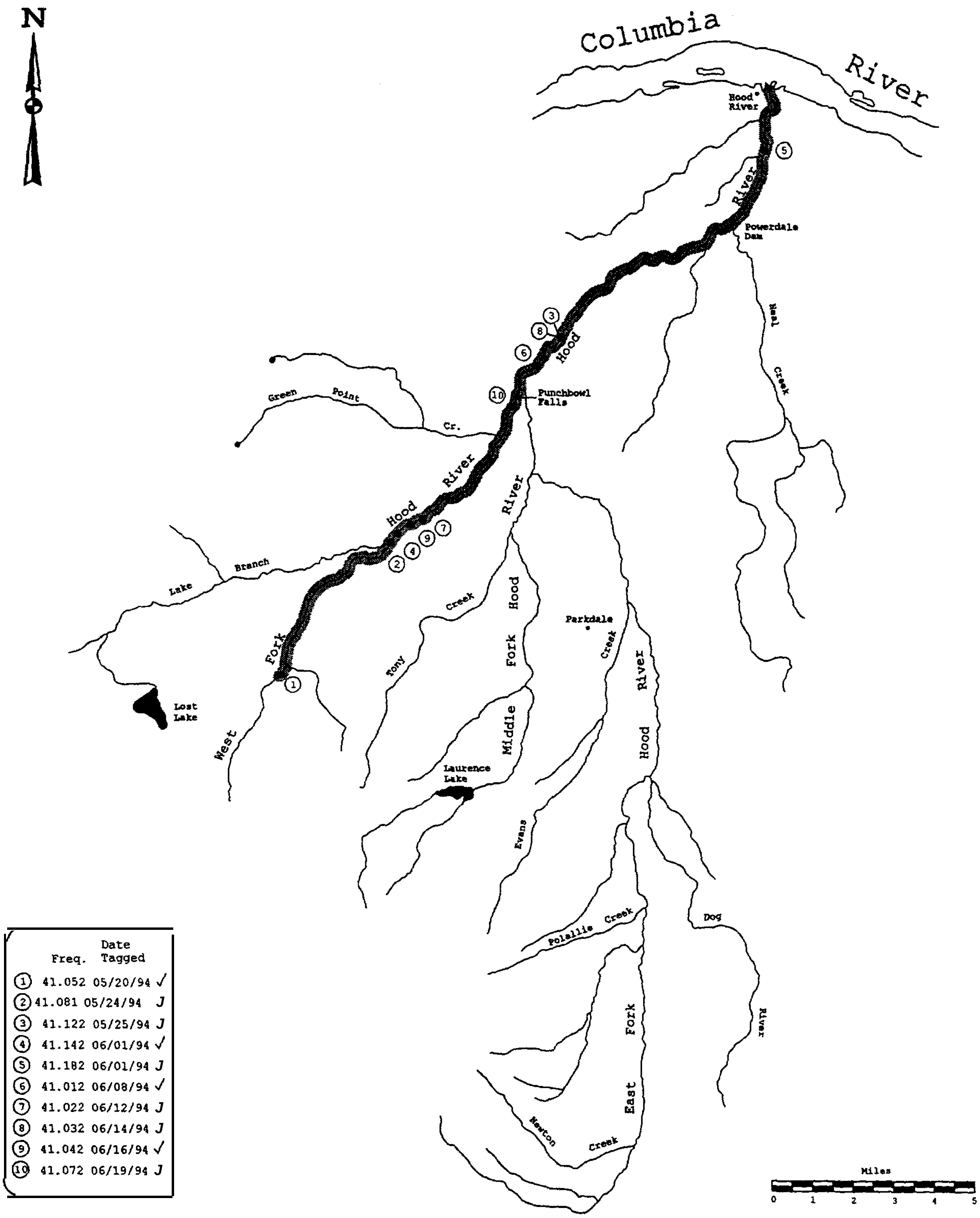


Figure 16. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 06/25-07/08/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

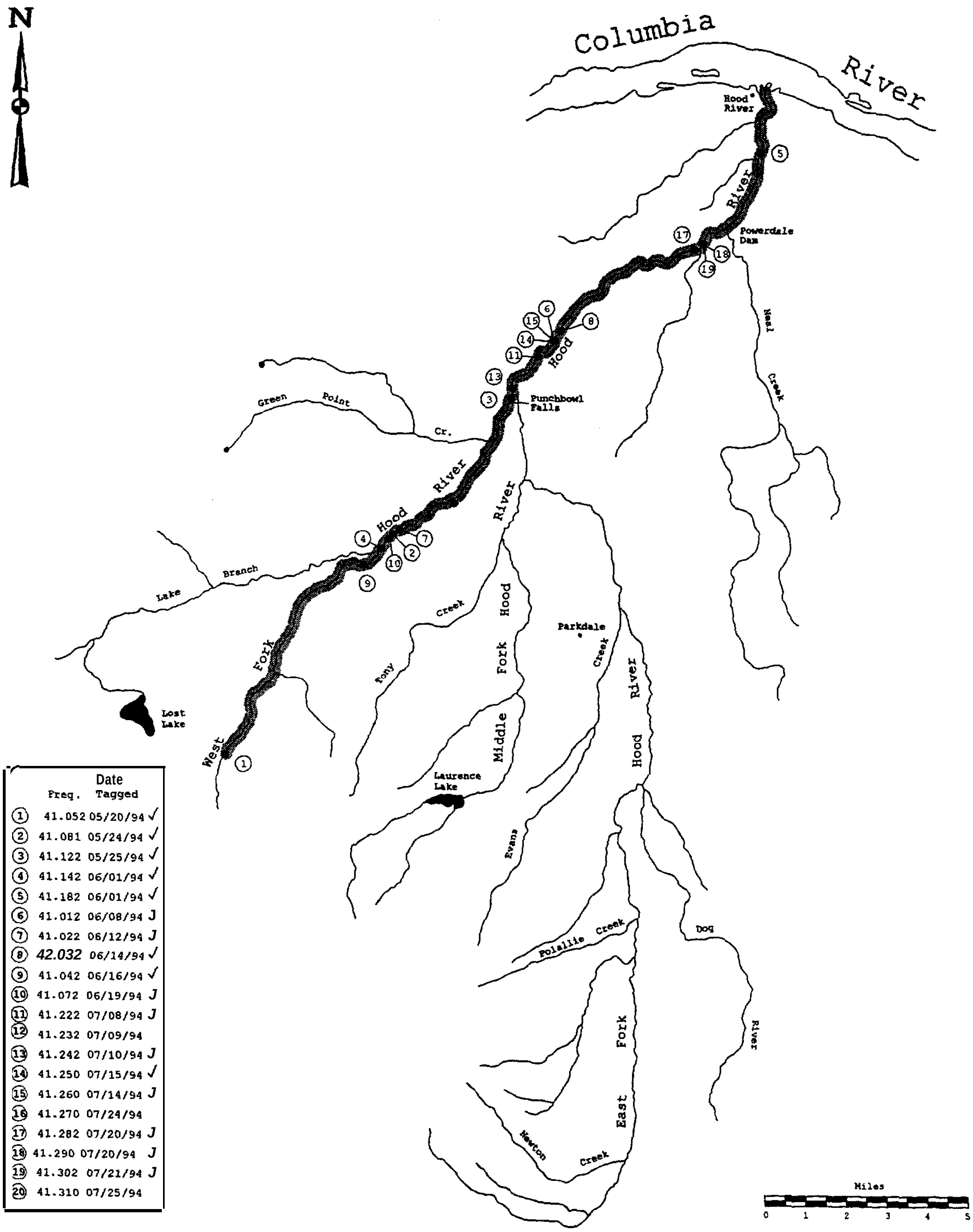


Figure 17. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 07/09-26/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

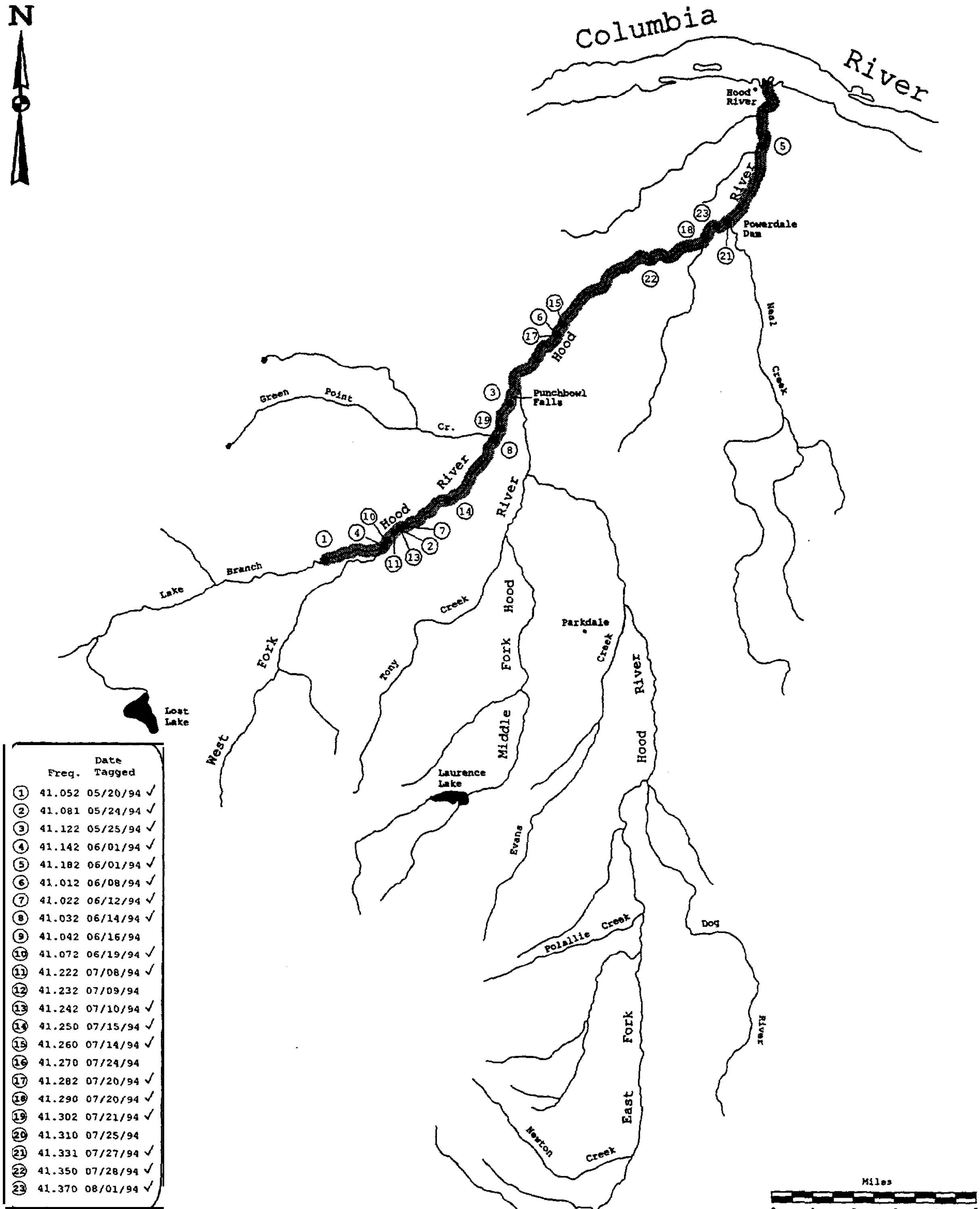
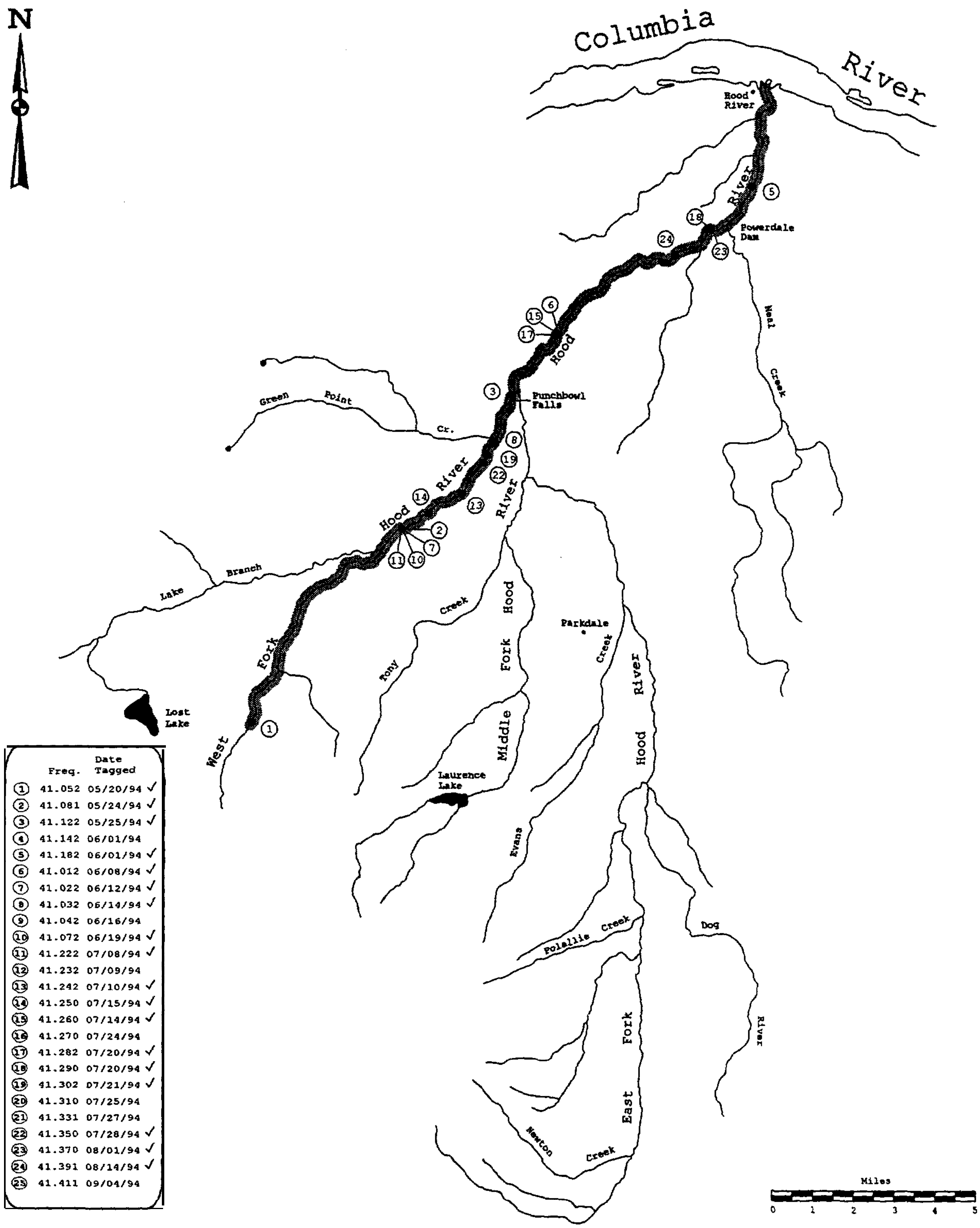


Figure 18. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 07/27-08/15/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.



	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	

Figure 19. **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.**

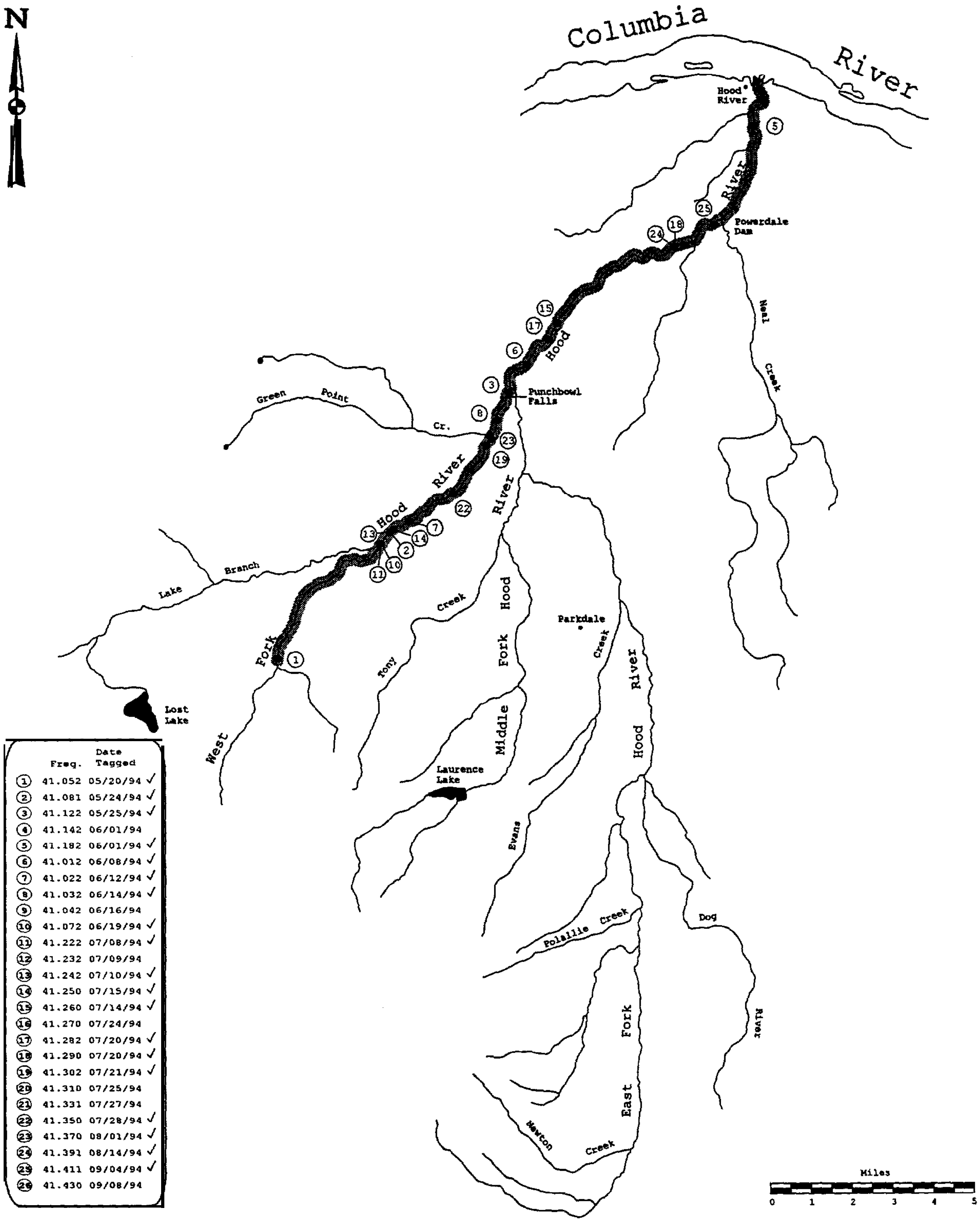


Figure 20. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 09/07-21/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

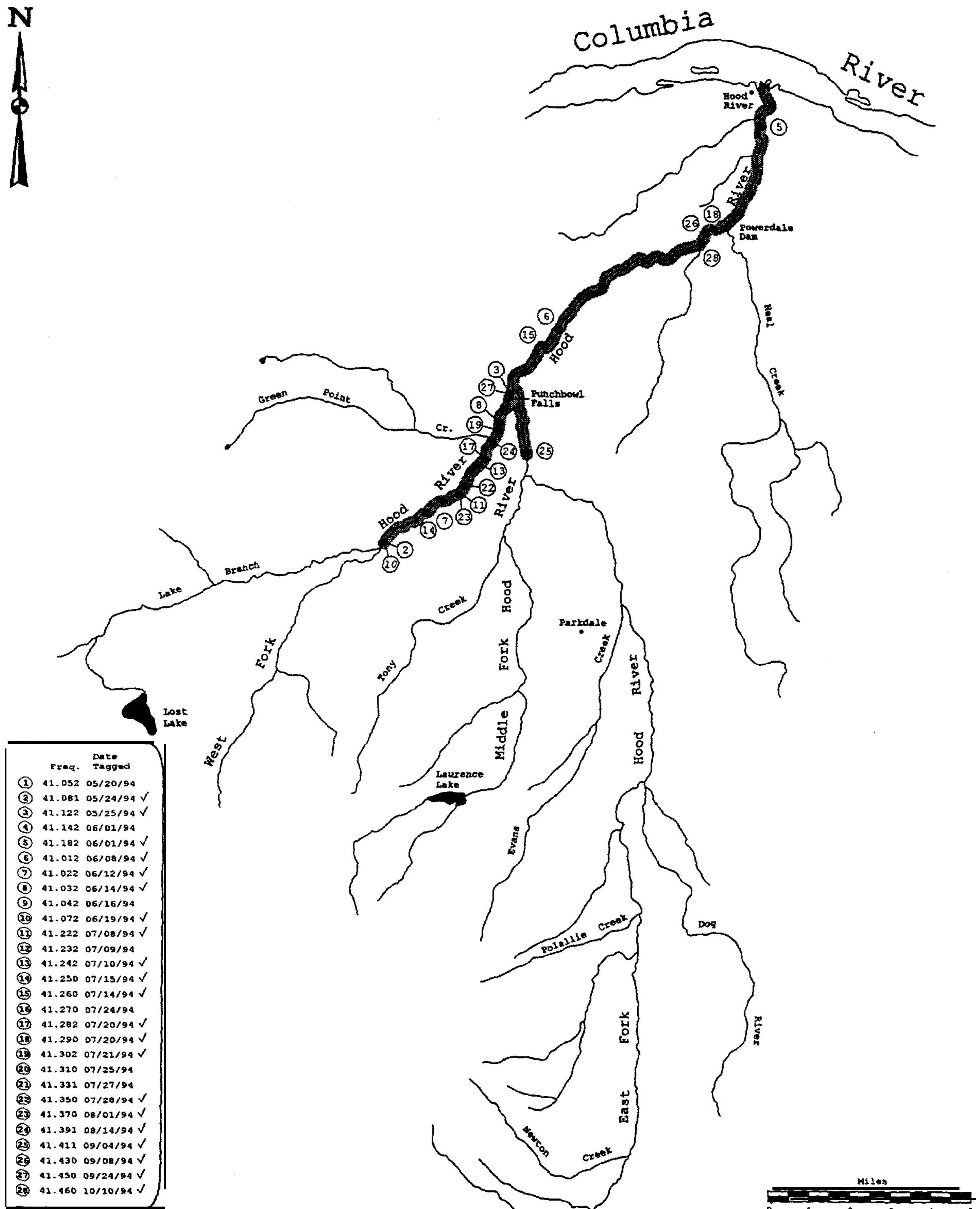


Figure 21. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 09/22-10/12/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

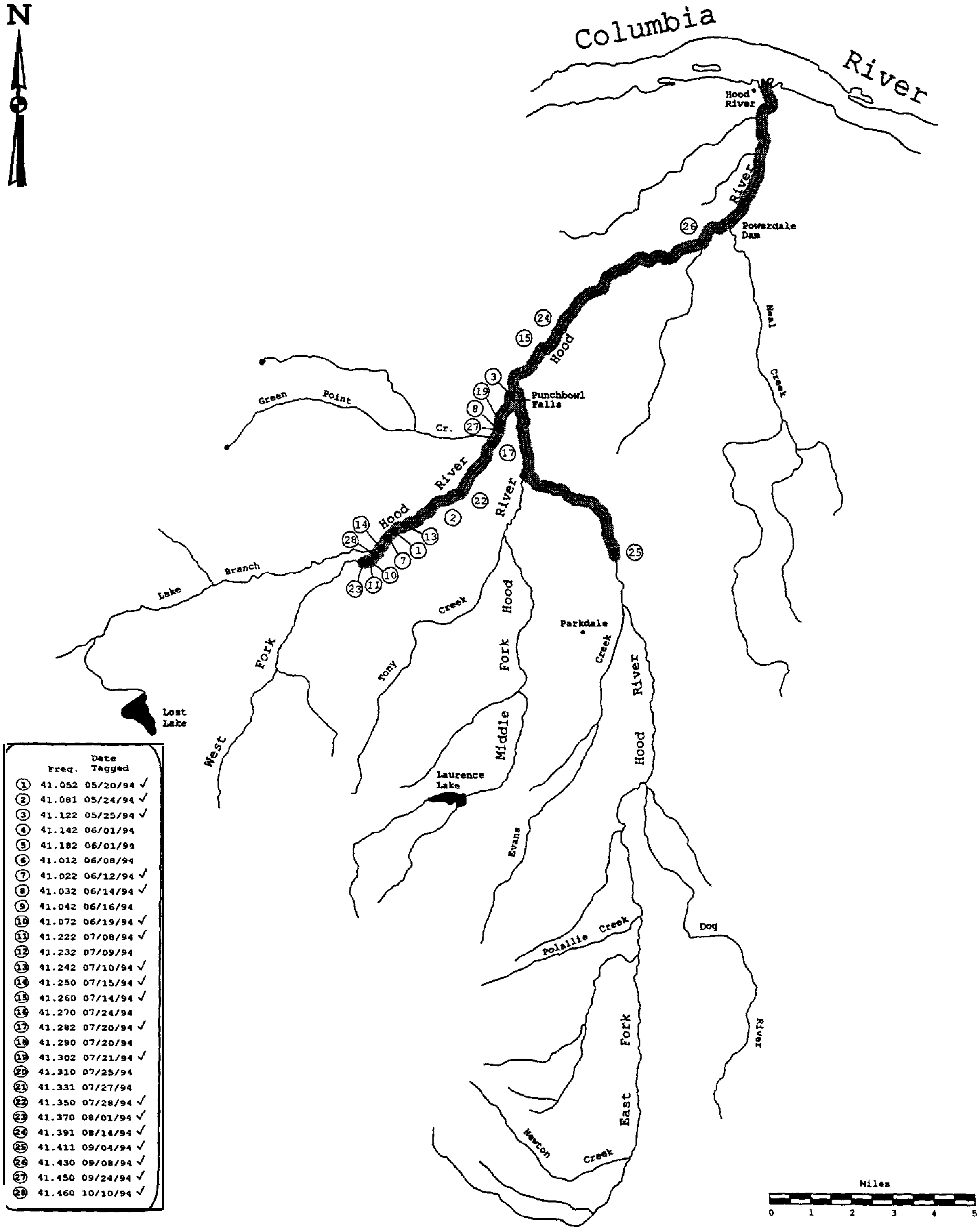


figure 22. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 10/13-11/07/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

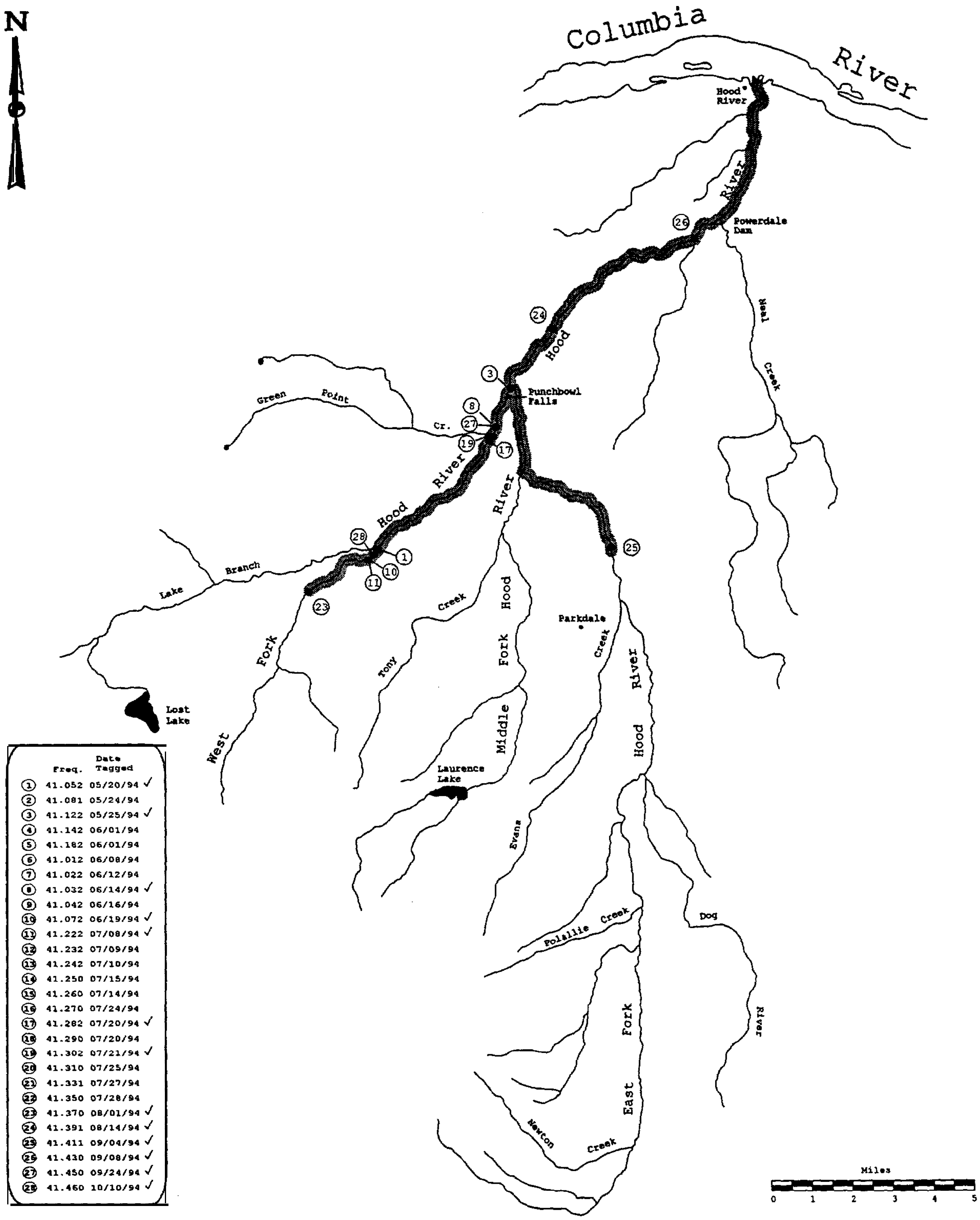


Figure 23. Maximum spatial distribution of radio-tagged wild adult summer steelhead during the period 11/08-12/31/94. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

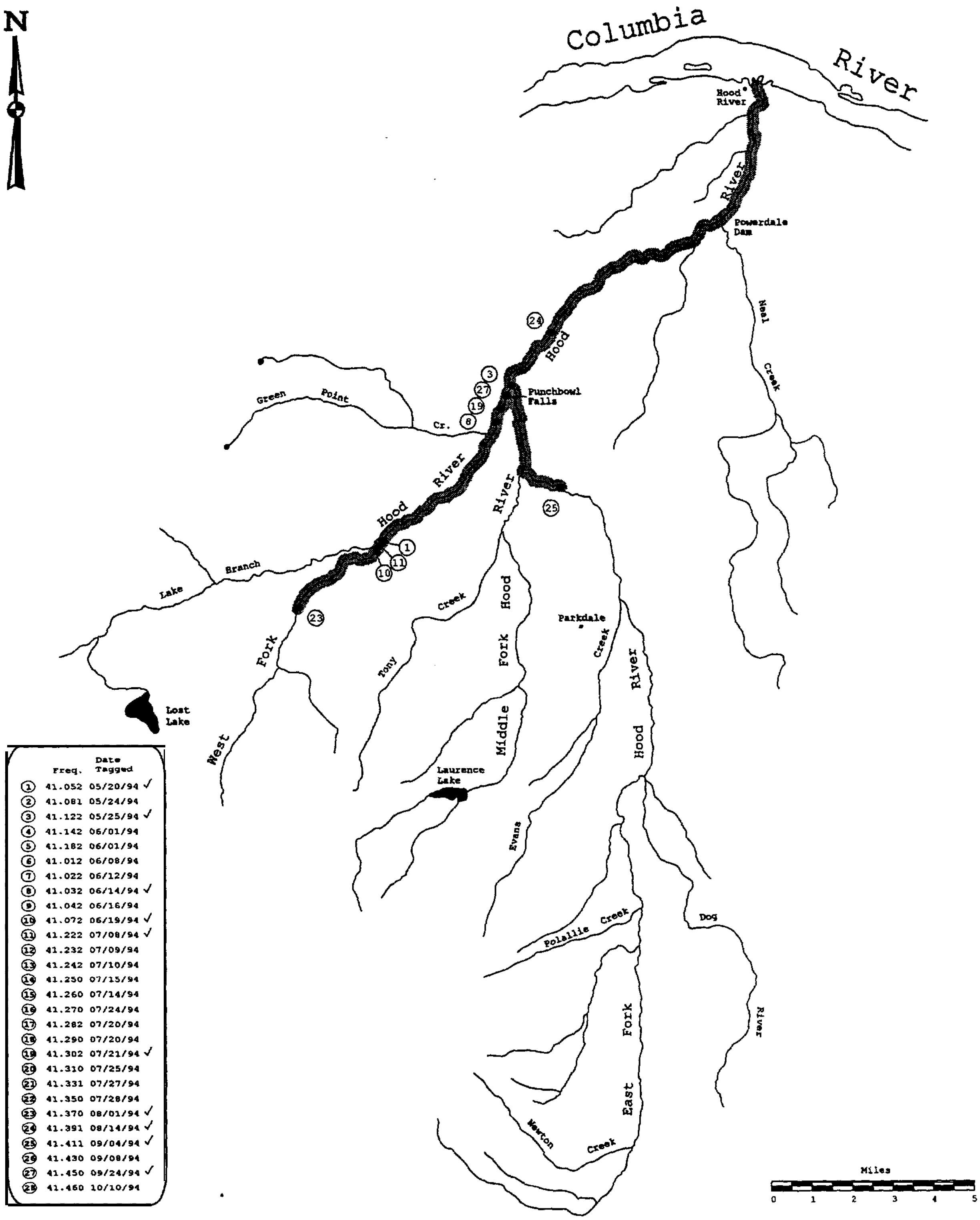


Figure 24. Maximum spatial distribution of radio-tagged wild adult summer steelhead during January 1995. **Frequencies detected during the period are marked with a check** ("✓"). **Radio-tagged summer steelhead are from the 1994-95 run year.**

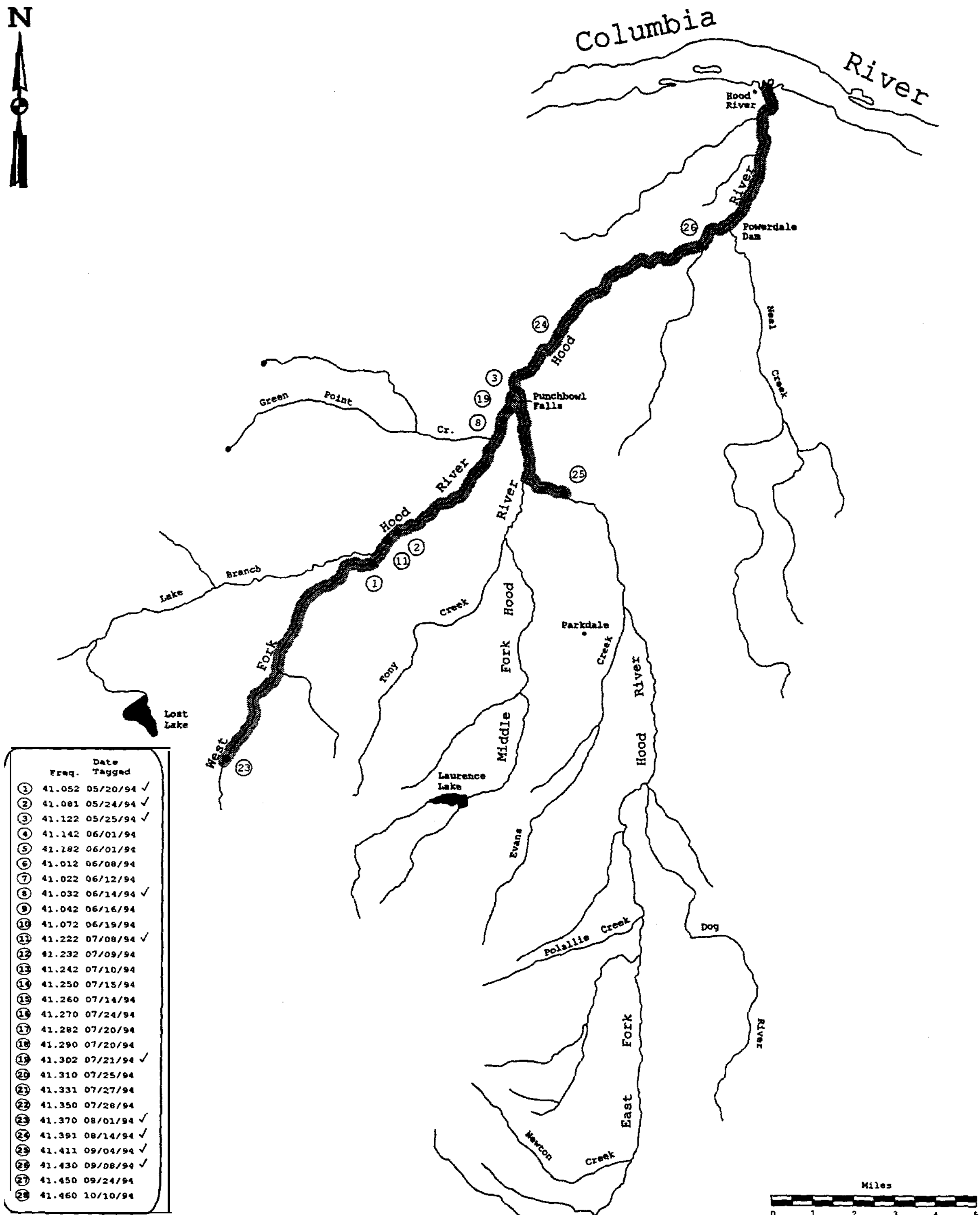
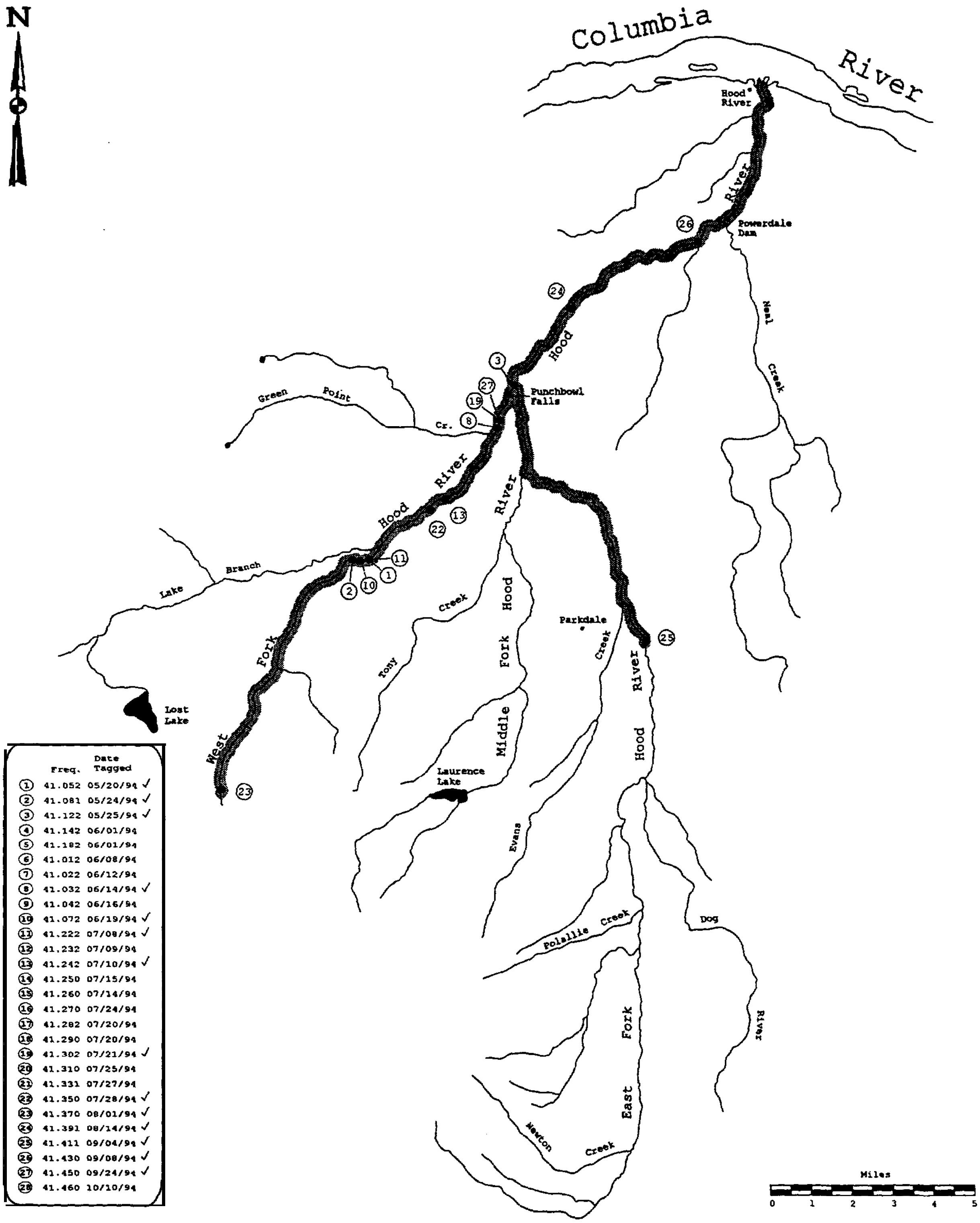


Figure 25. Maximum spatial distribution of radio-tagged wild adult summer steelhead during February 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.



	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 26. Maximum spatial distribution of radio-tagged wild adult summer steelhead during March 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

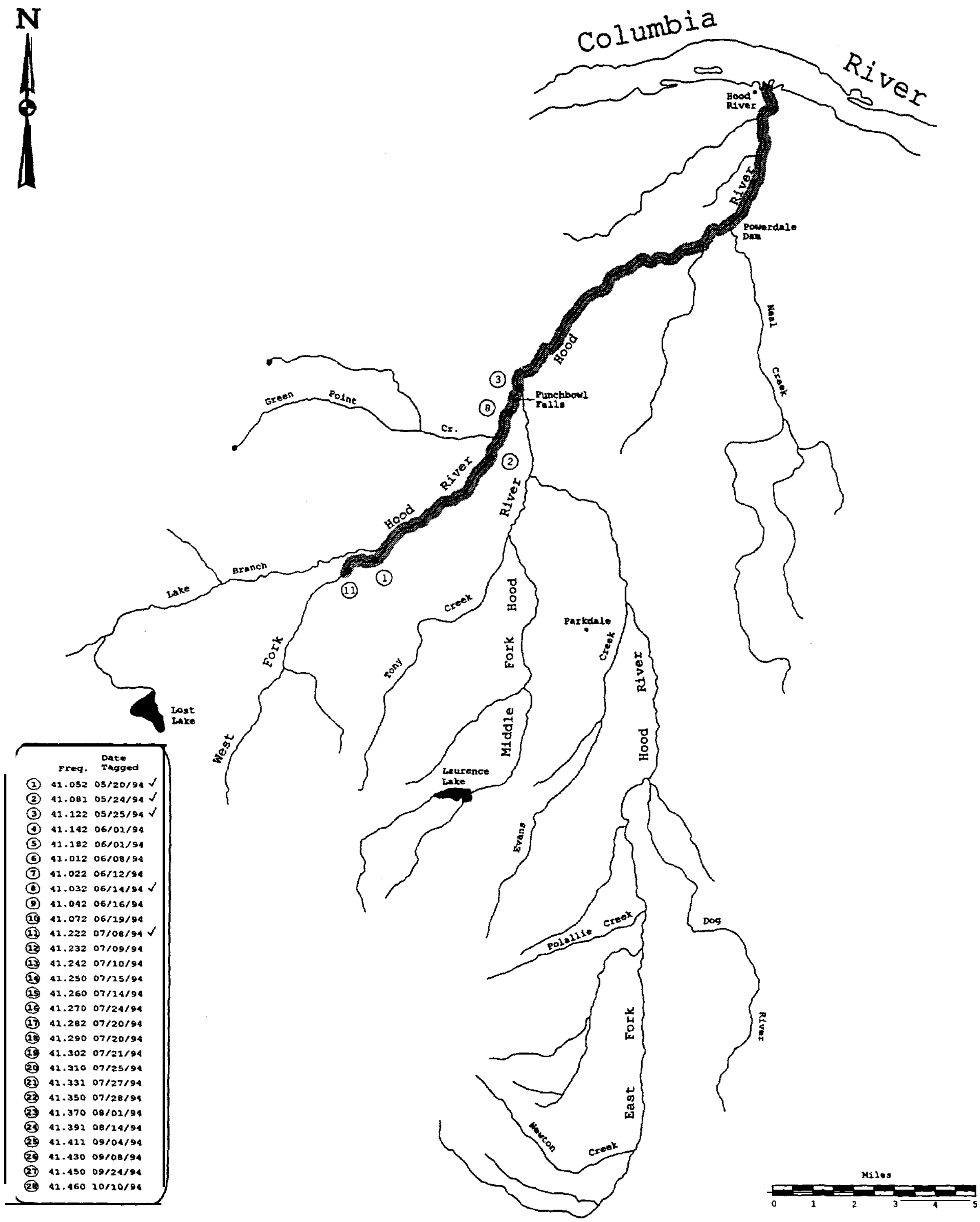


Figure 27. Maximum spatial distribution of radio-tagged wild adult summer steelhead during April 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

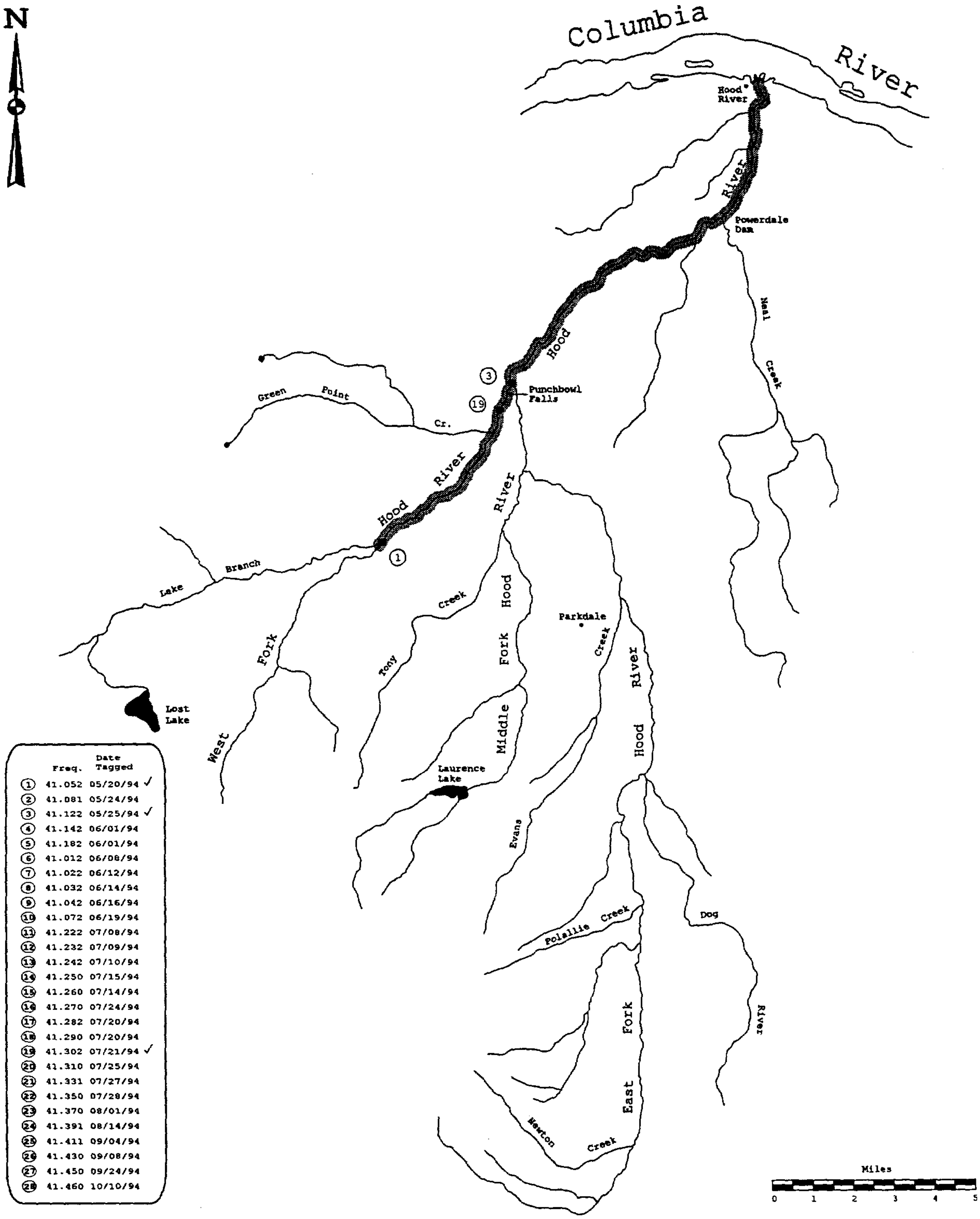


Figure 28. Maximum spatial distribution of radio-tagged wild adult summer steelhead during May 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1994-95 run year.

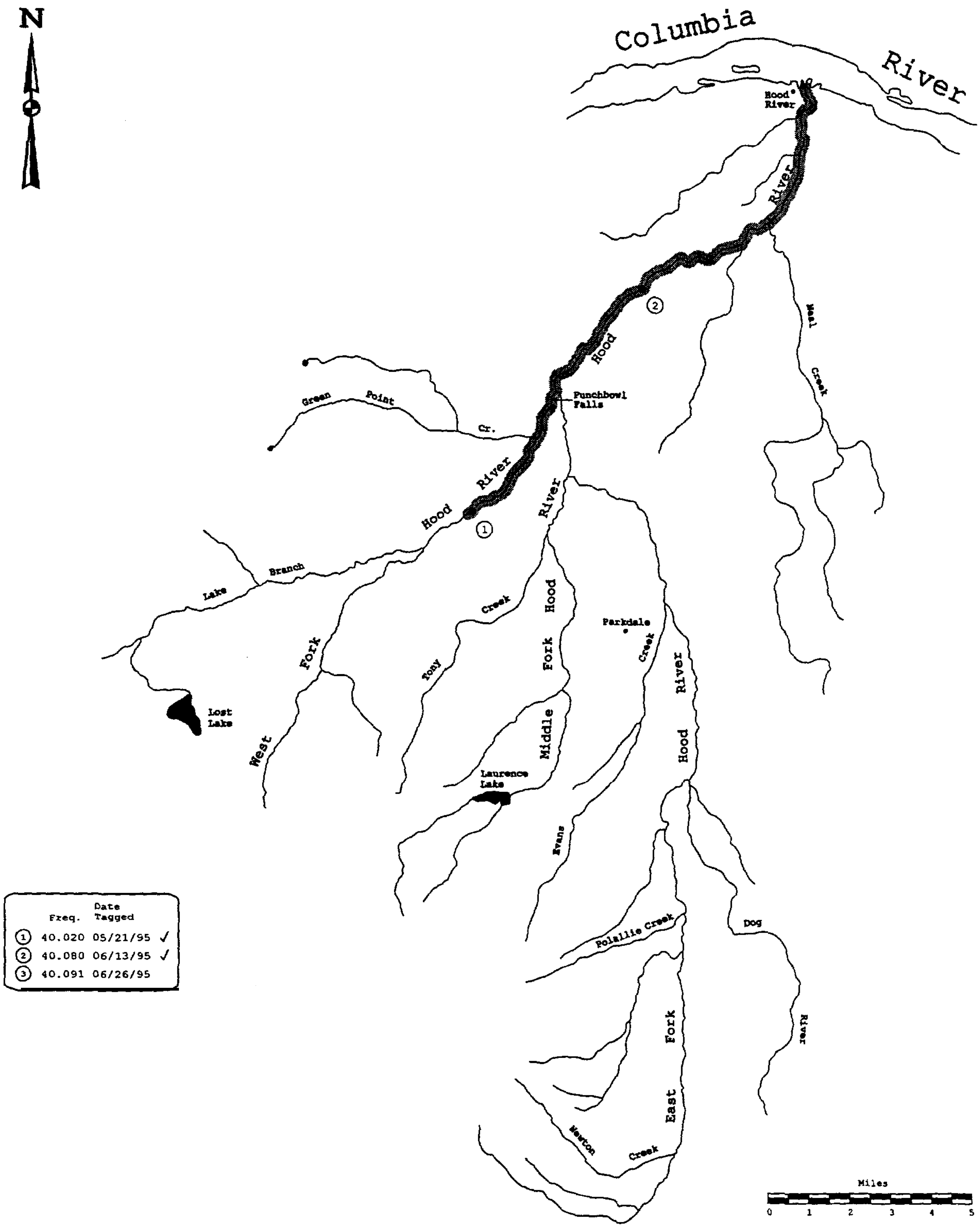


Figure 29. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during June 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

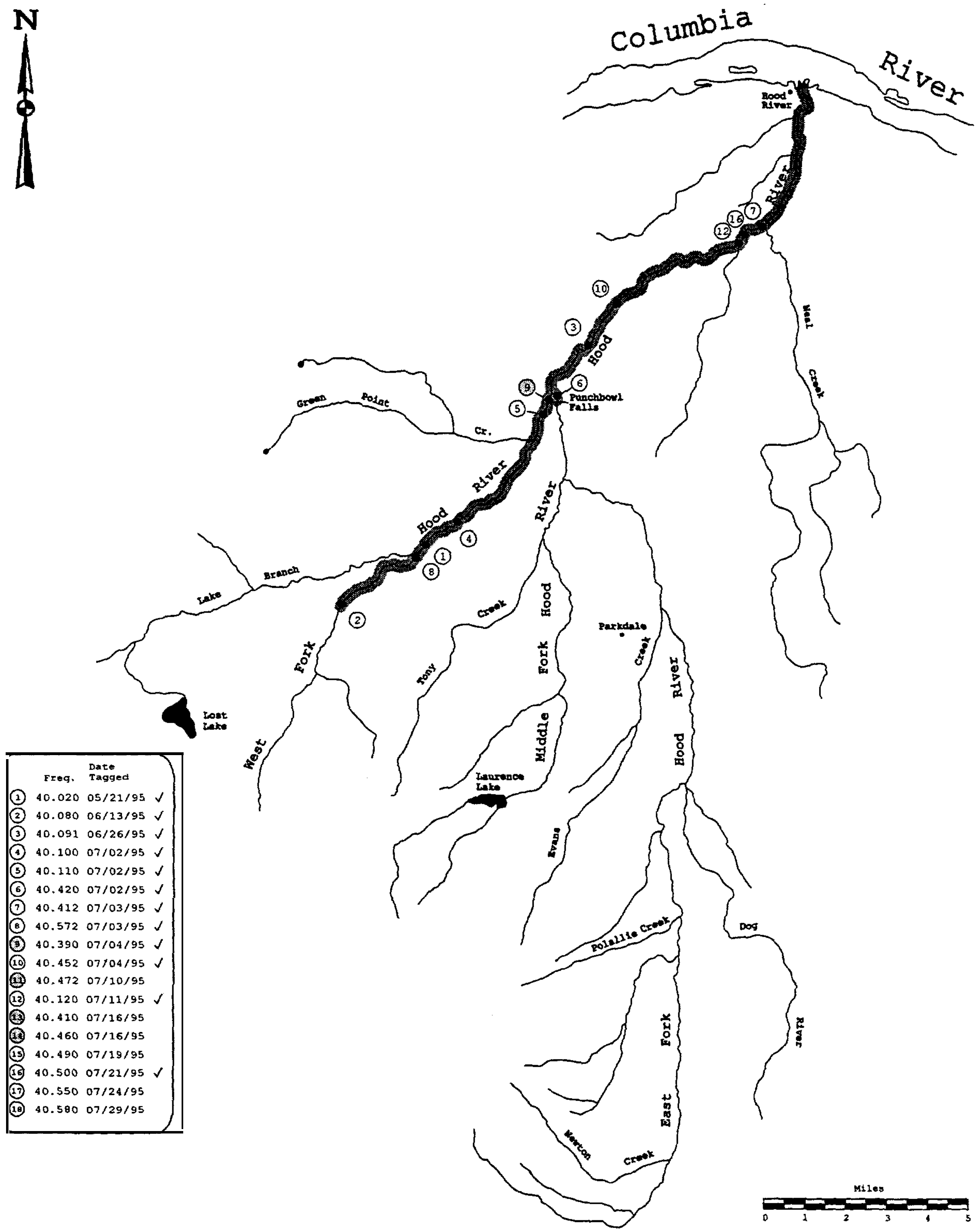


Figure 30. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during July 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

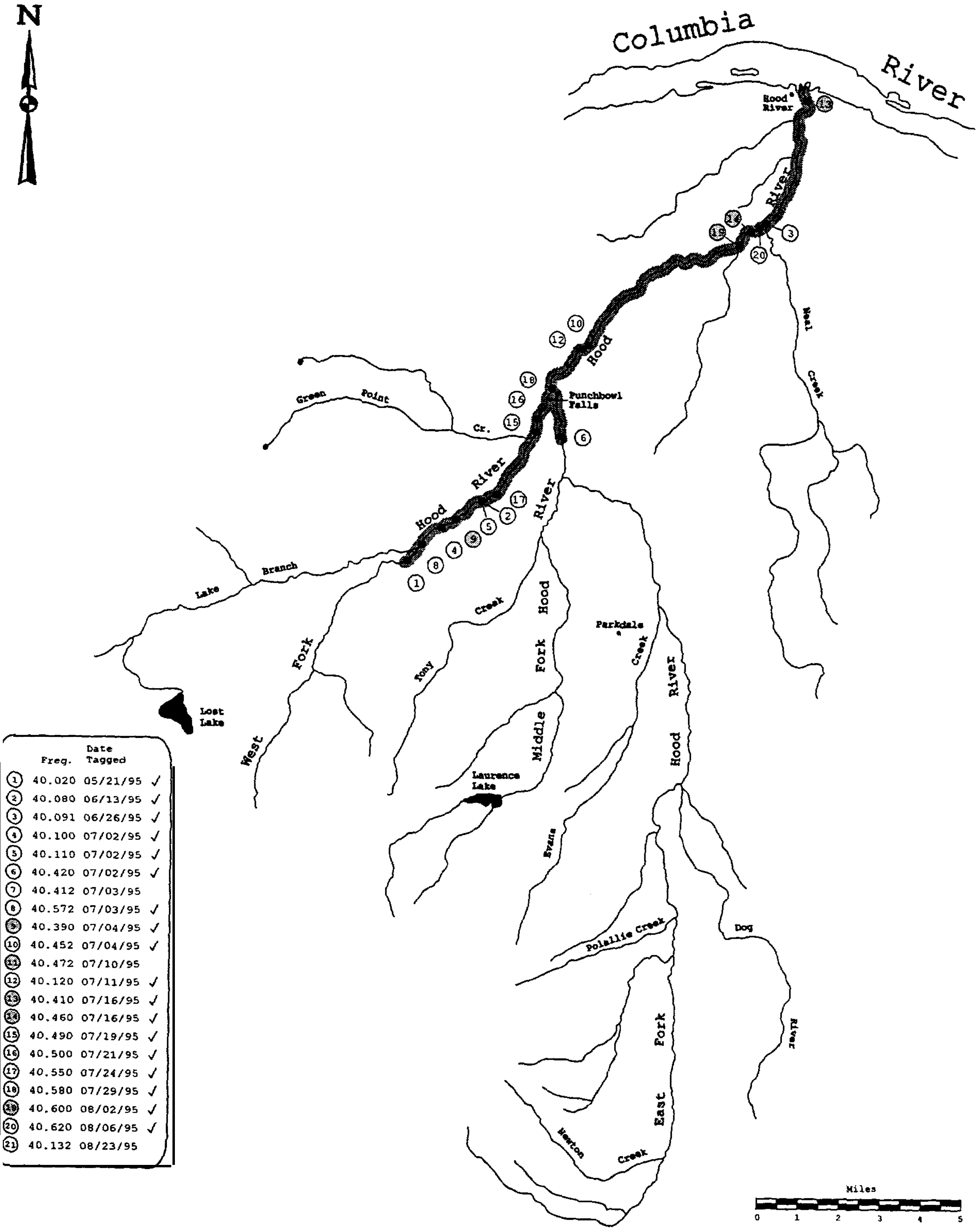


Figure 31. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during August 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

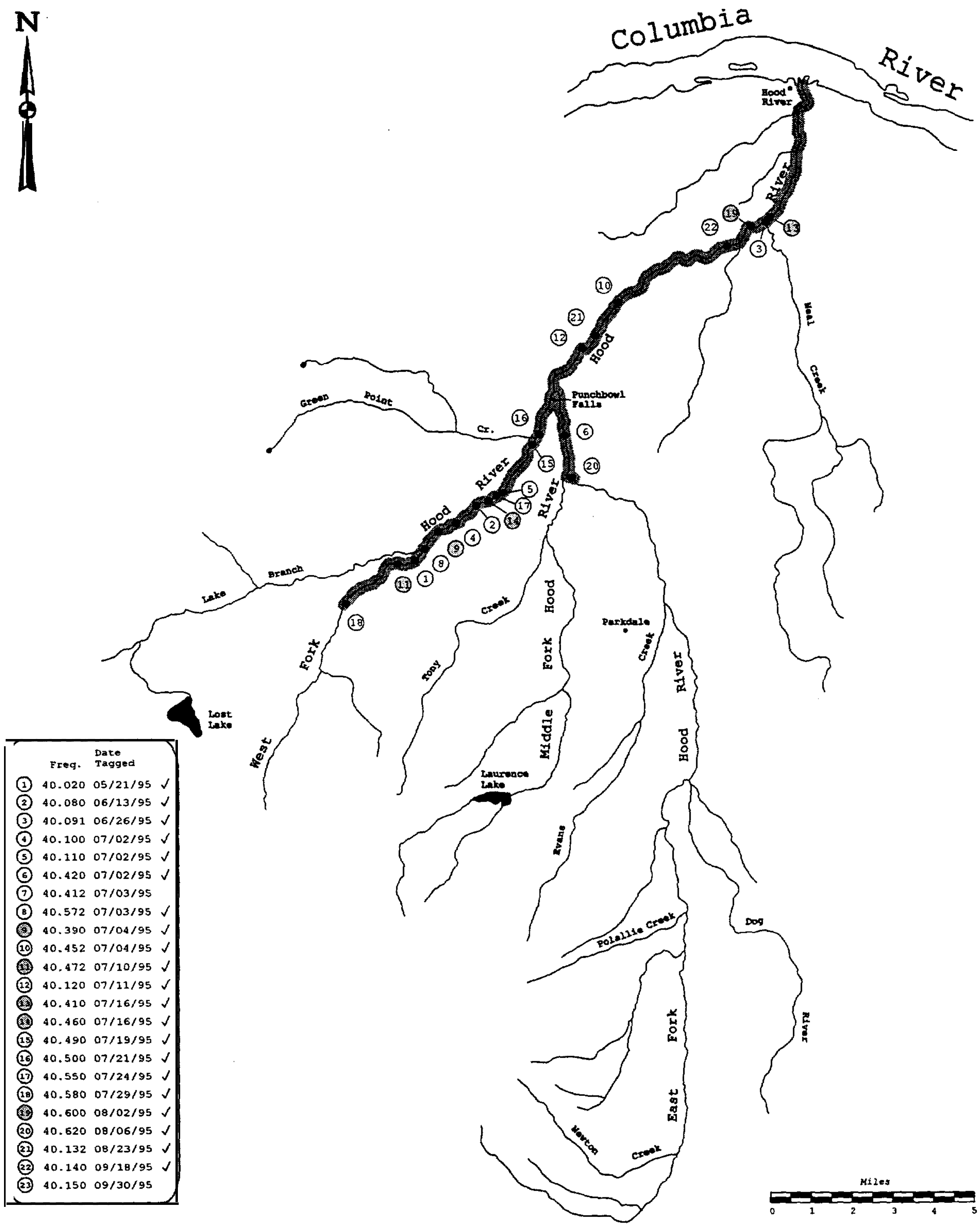


Figure 32. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during September 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

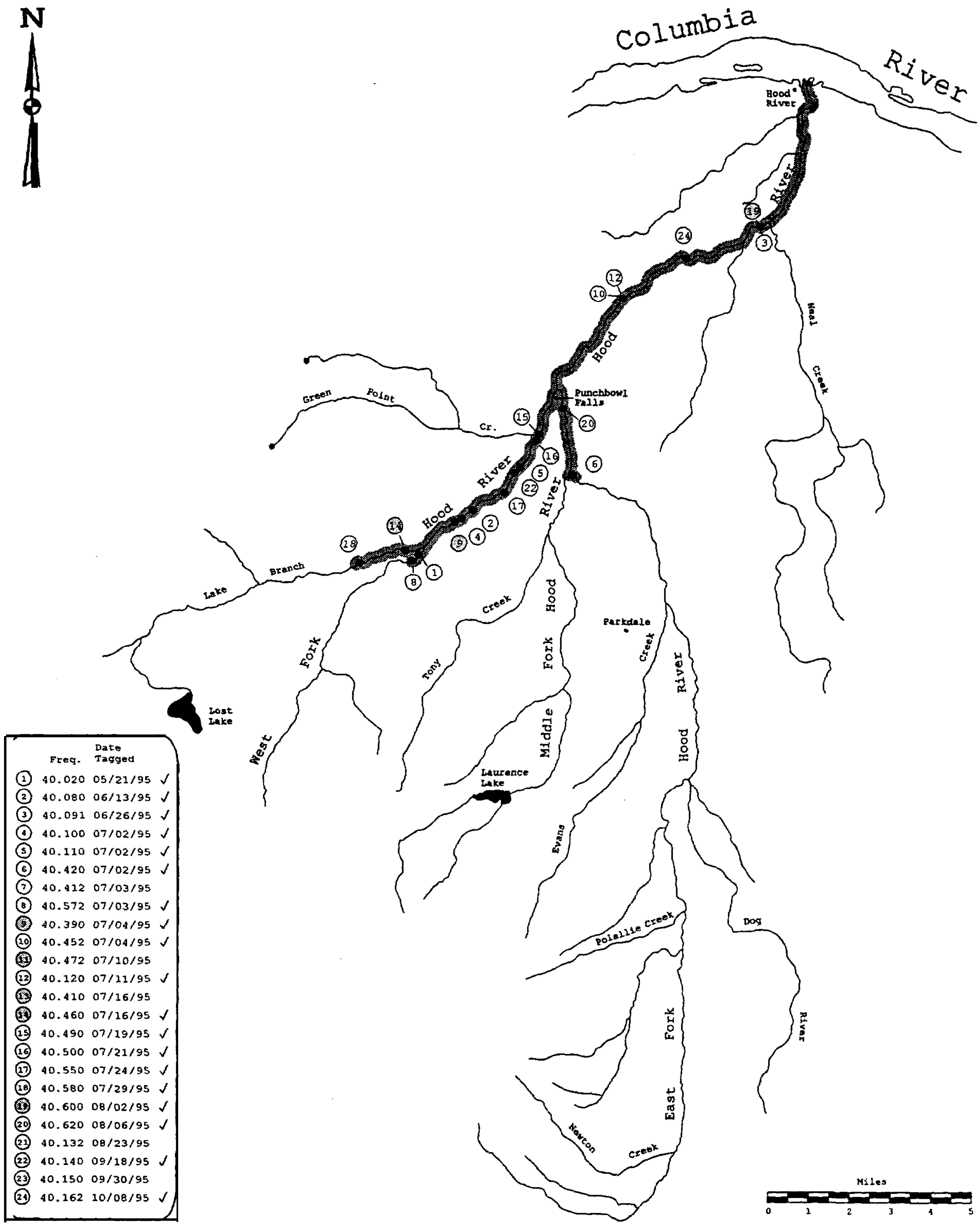


Figure 33. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during October 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

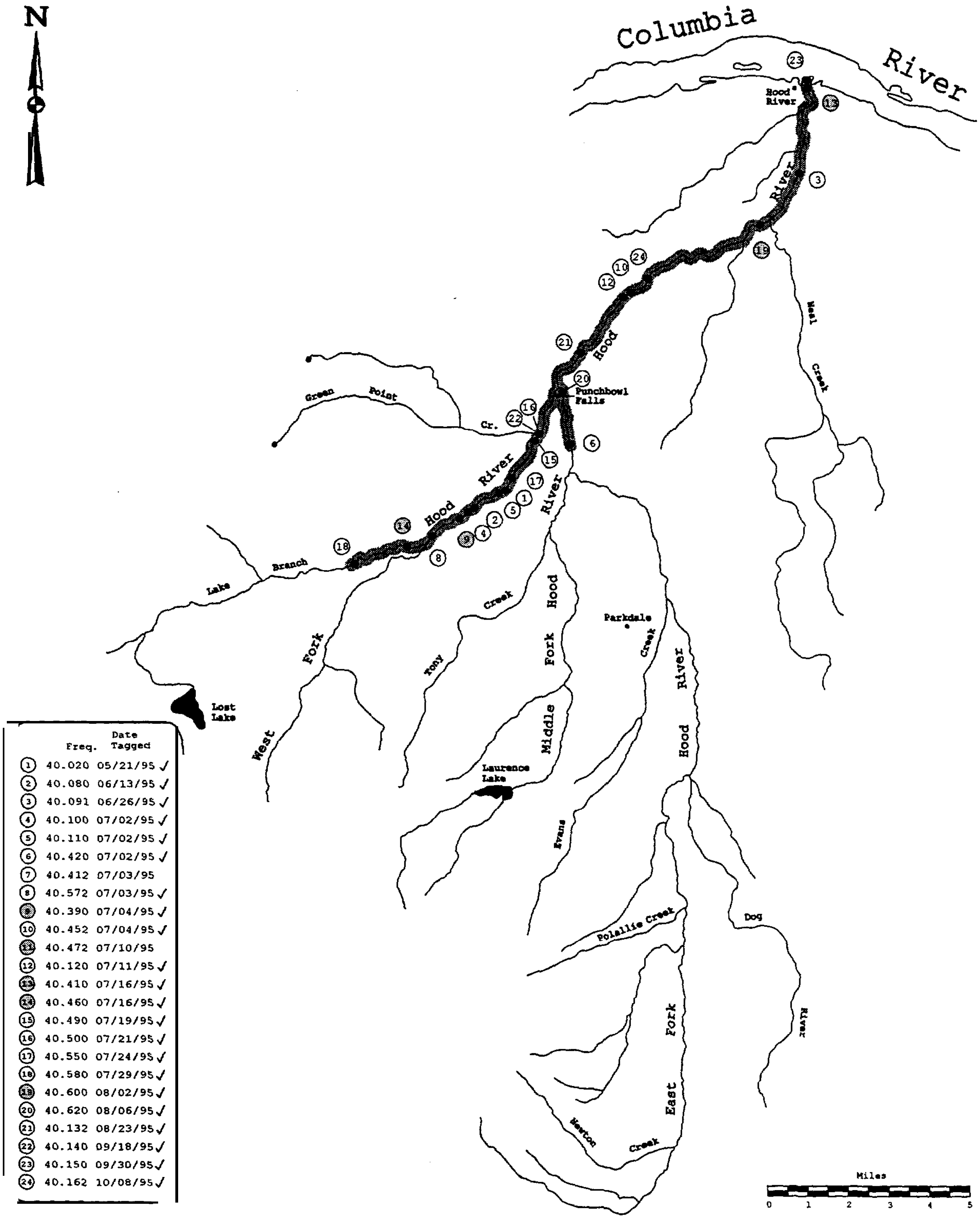


Figure 34. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during November 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

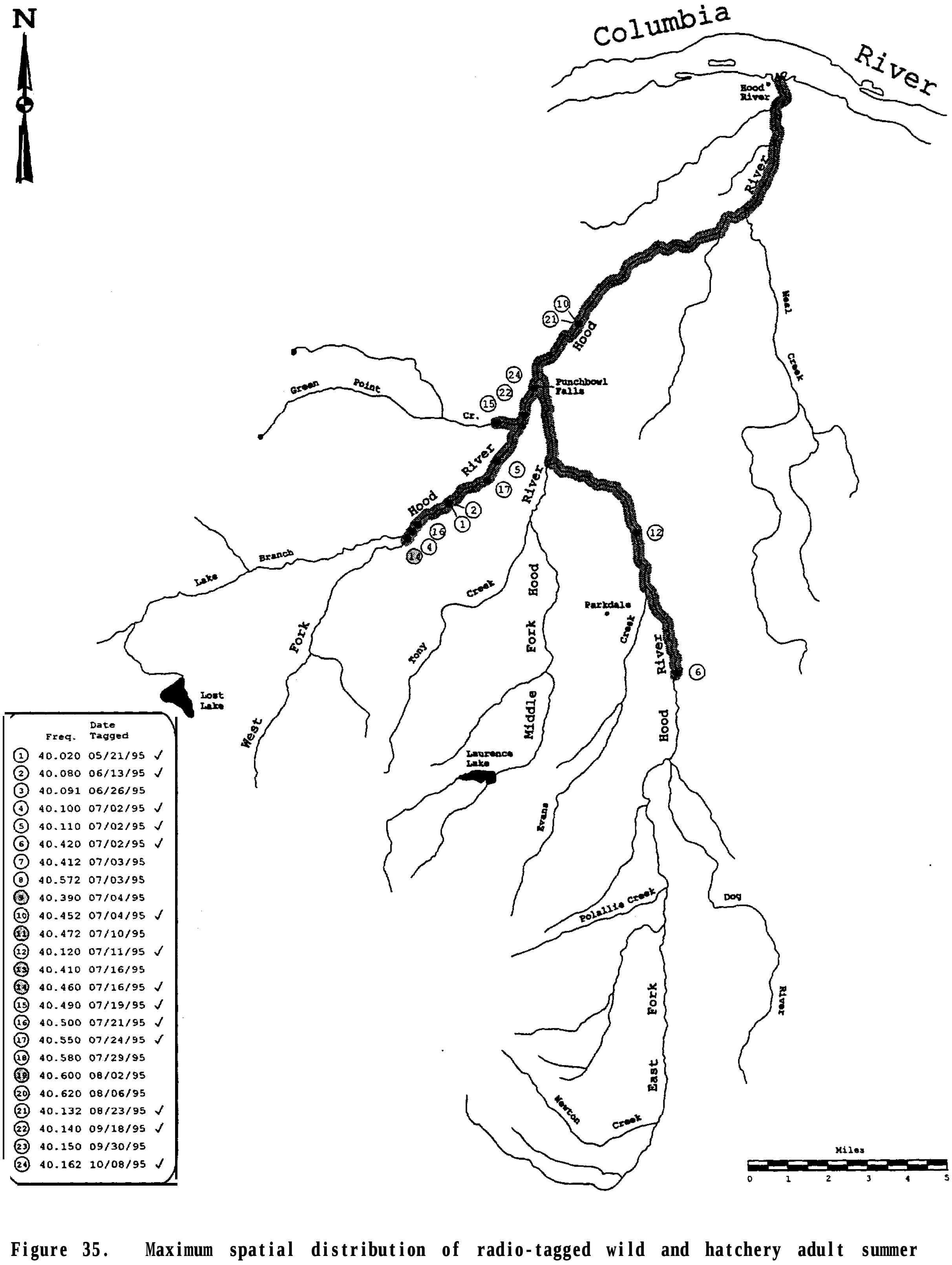


Figure 35. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during December 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

Table 19. Bimonthly counts of upstream migrant adult winter steelhead captured at the Powerdale Dam trap, by origin and run year. Counts are boldfaced for the bimonthly period in which the median date of migration occurred in each origin category.

Origin,	December		January		February		March		April		May		June		
run year	01-15	16-31	01-15	16-31	01-15	16-29	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-30	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
1994-95	0	0	0	0	9	0	6	2	55	14	52	44	10	1	193
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	46	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
1994-95	0	0	0	6	31	19	11	4	24	3	6	1	0	0	105
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	8	0	0	0	0	27
1994-95	0	1	0	0	0	1	1	1	0	0	1	0	0	0	5
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	4	3	2	0	0	28
1994-95	0	0	0	0	2	2	1	0	2	2	2	2	2	0	15

Table 20. Adult winter steelhead escapements to the Powerdale Dam trap by origin, stock. run year. and age category. Fish of unknown origin were allocated to origin categories based on scale analysis and the ratio of fish of known origin (see METHODS).

Origin, stock. run year	Total escapement	Freshwater/ocean age													Repeat spawners
		1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	3/4	4/2	
Wild,															
Hood River,															
1991-92	693	--	3	4	--	9	421	75	0	I	111	17	0		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
1994-95	204	—	1	1	_	28	105	35	1	3	9	3	1		17
Subbasin hatchery.															
Big Creek,															
1991-92	289	--	269	7	--	--	6	1	--	--	--	--	--		6
1992-93	205	--	64	133	--	--	0	0	--	--			--		8
1993-94	139	—	--	64	--	—	71	0	--	--	--	--	--		4
1994-95	10	--		—	—	—	—	7	--	--	--	--	--		3
Mixed.[a]															
1992-93	7	7		--	--	--	—		--	--			--		
1993-94	14	--	14	--	--	—	—	--	--	--	--	--	--		
1994-95	9	--		2	—	--	7		--	--	--	--	--		
Hood River,															
1993-94[b]	0	0		--	--	--	--		--	--					--
1994-95	90	11	78	--	--	--	--	--	--	--	--	--	--		1
Stray hatchery															
Unknown.															
1991-92	34	0	19	14	0	--	0	--	--	__	--	--	--	__	1
1992-93	30	0	18	9	0	—	0		—	--	--	--	--	--	3
1993-94	28	1	1	23	1	--	1		__	--	--	--	--	__	1
1994-95	5	1	2	2	0	--	0		__	--	--	--	--	--	0

[a] Returns from the 1991 brood are progeny of wild x Rig 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 21. Adult winter steelhead escapements to the Powerdale Dam trap by origin, stock, brood year. and ocean age category. (Percent return is in parentheses. Brood years are bold faced for those years in which brood year specific estimates of escapement are complete. Estimates are based on returns in the 1991-92 through 1994-95 run years.)

Origin. stock. brood year[a]	Smolts	Ocean age 1 salt	Ocean age 2 salt	Ocean age 3 salt	Ocean age 4 salt	Repeat spawners
Wild,						
Hood River,						
1985				--	--	2
1986			1	17	0	18
1987	--	--	111	91	1	39
1988	--	1	441	129	1	23
1989	--	10	192	87	1	14
1990		36	283	41	--	14
1991		12	107	1	--	2
1992		28		--	--	--
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		135 (0.66)	71 (0.35)	--	6 (0.03)
Mixed,[b]						
1991	4,595	7 (0.15)	21 (0.46)	2 (0.04)	--	--
Hood River,						
1992	48,985	0 (0)	78 (0.16)	--	--	1 (0.002)
1993	38.034	11 (0.03)		--	--	--

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

Origin, stock, run year	N	Freshwater/ocean age													Repeat spawners
		1/1	1/2	1/3	114	2/1	2/2	2/3	2/4	3/1	3/2	3/3	3/4	4/2	
Wild,															
Hood River,															
1991-92	662	--	0.5	0.6	--	1.4	60.7	10.7	0	0.2	16.0	2.4	0	0.2	7.4
1992-93	393	--	0.5	1.5	--	8.7	42.5	29.8	0.3	0.3	4.8	3.8	0	0	7.9
1993-94	370	--	0.5	1.6	--	2.2	67.8	19.5	0	0.3	4.1	1.1	0	0	3.0
1994-95	189	--	0.5	0.5	--	13.8	51.3	16.9	0.5	1.6	4.2	1.6	0.5	0	8.5
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
1994-95	9	--	--	--	--	--	--	66.7	--	--	--	--	--	--	33.3
Mixed,[a]															
1992-93	6	100	--	--	—	--	--	--	—	--	--	--	--	--	--
1993-94	13	--	100	--	—	--	--	--	--	--	--	--	--	--	--
1994-95	8	--	--	25.0	--	--	75.0	--	--	--	--	--	--	--	—
Hood River,															
1994-95	82	12.2	86.6	--	—	--	--	--	--	--	--	--	--	--	1.2
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	25	4.0	4.0	80.0	4.0	--	4.0	--	--	--	--	--	--	--	4.0
1994-95	5	20.0	40.0	40.0	0	—	0	—	--	—	--	—	--	--	0

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

Table 23. Mean fork length (cm) of adult winter steelhead with spawning checks in the 1994-95 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	2/1s.2	2/2s.3	2/3s.4	2/2s.3s.4
Wild.					
Female.					
N	--	1	8	1	1
Mean		66.5	72.69	76.5	70.5
STD			2.91		
Range		66.5	68.5-77.5	76.5	70.5
Male.					
N		1	4		
Mean	--	79.5	76.88	--	--
STD	--	--	4.07	--	
Range		79.5	71.0-82.0		
Total.					
N		2	12	1	1
Mean		73.00	74.08	76.5	70.5
STD		9.19	4.02	--	--
Range		66.5-79.5	68.5-82.0	76.5	70.5
Subbasin hatchery,					
Female.					
N	1	--	3	--	--
Mean	64.0	--	68.00	--	--
STD	--	--	0.50	--	--
Range	64.0	--	67.5-68.5	--	--
Male.					
N					
Mean					
STD					
Range	--	--	--	--	--
Total.					
N	1	--	3	--	--
Mean	64.0	--	68.00	--	--
STD	--	--	0.50	--	--
Range	64.0	--	67.5-68.5	--	--

Table 24. Mean fork length (cm) of adult winter steelhead without spawning checks in the 1994-95 run year by origin. sex. and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/ocean aoe											Sample[a] mean
	1/1	1/2	1/3	2/1	2/2	2/3	2/4	3/1	3/2	3/3	3/4	
Wild,												
Female,												
N	--	--	1	5	56	17	1		2	3	1	99
Mean	--	--	78.0	55.30	66.21	76.59	84.5	--	68.75	76.83	71.5	68.92
STD	—	--	--	5.75	4.24	4.56	--	-	2.47	4.80	--	6.86
Range	--	--	78.0	48.0-62.5	55.0-74.5	69.5-85.5	84.5	--	67.0-70.5	72.5-82.0	71.5	48.0-85.5
Male,												
N	—	1	--	21	41	15	--	3	6	--	--	94
Mean	--	75.5	--	53.71	68.57	79.57	--	53.67	63.67	--	--	66.84
STD	--	--	--	4.50	4.47	6.35	-	6.79	6.47	--	--	10.15
Range	—	75.5	--	46.5-63.5	59.5-83.0	71.0-94.0	--	46.5-60.0	54.5-74.0	--	--	46.5-94.0
Total,												
N	--	1	1	26	97	32	1	3	8	3	1	193
Mean	--	75.5	78.0	54.02	67.21	77.98	84.5	53.67	64.94	76.83	71.5	67.91
STD	--	--		4.68	4.47	5.59	--	6.79	6.03	4.80	--	8.66
Range	--	75.5	78.0	46.5-63.5	55.0-83.0	69.5-94.0	84.5	46.5-60.0	54.5-74.0	72.5-82.0	71.5	46.5-94.0
Subbasin hatchery,[b]												
Female.												
N	1	37	2	--	2	6	--	--	--	--	--	56
Mean	55.0	64.15	72.00	--	67.00	75.58	--	--	--	--	--	65.75
STD	--	2.37	0.71	--	5.66	1.36	--	--	--	--	--	4.64
Range	55.0	60.0-69.5	71.5-72.5	--	63.0-71.0	73.0-76.5	--	--	--	--	--	55.0-76.5
Male.												
N	9	34	--	--	4	--	--	--	--	--	--	49
Mean	46.89	65.32		--	64.62	--	--	--	--	--	--	61.53
STD	3.05	2.88	--	--	5.07	--	--	--	--	--	--	8.03
Range	44.0-52.5	59.5-72.0	--	-	57.5-69.5	--	--	--	--	--	--	44.0-72.0
Total.												
N	10	71	2	--	6	6	--	--	--	--	--	105
Mean	47.70	64.71	72.00	--	65.42	75.58	--	--	--	--	--	63.78
STD	3.85	2.67	0.71	--	4.83	1.36	--	--	--	--	--	6.76
Range	44.0-55.0	59.5-72.0	71.5-72.5	--	57.5-71.0	73.0-76.5	--	--	--	--	--	44.0-76.5

[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 1/3 and 2/2 hatchery winter steelhead are returns from the 1991 brood release of wild x Dig Creek stock hatchery crosses, Age 2/3 hatchery winter steelhead are progeny of Big Creek stock hatchery releases. Other age classes are returns from hatchery brood releases of the Hood River stock.

Table 25. 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, Olsen et al. (1994). and Olsen et al. (1995).]

Origin. stock. brood year	Freshwater/ocean age 1/1	2/1	3/1	112	2/2	3/2	4/2	1/3	2/3	3/3	2/4	3/4
Wild.												
Hood River,												
1986	--	--	--	--		--	60 (1)	--	--	78 (16)	--	
1987	--	--	--		--	65 (106)	-_	—	76 (71)	80 (15)	95 (1)	
1988	--	—	52 (1)	--	66 (402)	65 (19)	--	77 (4)	77 (117)	78 (4)	--	
1989	--	**49** (9)	55 (1)	62 (3)	66 (167)	65 (15)	--	77 (6)	77 (72)	77 (3)	84 (1)	
1990	--	52 (34)	47 (1)	59 (2)	68 (251)	65 (8)	--	80 (6)	78 (32)	--	--	
1991	--	50 (8)	54 (3)	58 (2)	67 (97)		--	78 (1)	--	--	--	
1992	--	54 (26)	—	76 (1)			--	—	—	--	--	
Subbasin hatchery												
Big Creek,												
1987	--	--	—	--	--	--	--	--	76 (1)	--	--	
1988	--	—	--	--	73 (5)	--	--	75 (6)	—	—	--	
1989	--	—	--	64 (228)		--	--	77 (120)	--	—	—	
1990	--	—	--	62 (58)	65 (66)		--	77 (59)	76 (6)	--	--	
Mixed.[a]												
1991	57 (6)	—	--	67 (13)	65 (6)	--	--	72 (2)	--	--	--	
Hood River,												
1992	—	—	--	65 (71)	--				--	--	--	
1993	48 (10)	--	--	—		--	--	--	--	—	—	

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

Table 26. Mean weight (kg) of adult winter steelhead without spawning checks in the 1994-95 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	1/2	1/3	2/1	2/2	2/3	2/4	3/1	3/2	3/3	3/4	
Wild.												
Female,												
N	--	--	1	5	55	17	1	--	2	3	1	97
Mean	--	--	4.7	1.84	3.08	4.55	6.9	--	3.50	4.63	3.2	3.48
STD	--	--	--	0.54	0.62	0.84	--	--	0.57	0.92	--	1.05
Range	--	--	4.7	1.3-2.6	1.3-4.2	3.3-6.2	6.9	--	3.1-3.9	4.1-5.7	3.2	1.3-6.9
Male.												
N	--	1	--	21	40	15	--	2	6	--	--	92
Mean	--	4.6	--	1.57	3.19	4.99	--	1.35	2.42	--	--	3.13
STD	--	--	--	0.43	0.65	1.46	--	0.35	0.83	--	--	1.43
Range	--	4.6	--	1.0-2.8	2.2-4.9	3.5-8.4	--	1.1-1.6	1.6-3.9	--	--	1.0-8.4
Total.												
N	--	1	1	26	95	32	1	2	8	3	1	189
Mean	--	4.6	4.7	1.62	3.12	4.76	6.9	1.35	2.69	4.63	3.2	3.31
STD	--	--	--	0.45	0.63	1.17	--	0.35	0.89	0.92	--	1.26
Range	--	4.6	4.7	1.0-2.8	1.3-4.9	3.3-8.4	6.9	1.1-1.6	1.6-3.9	4.1-5.7	3.2	1.0-8.4
Subbasin hatchery.[b]												
Female.												
N	1	31	2	--	2	6	--	--	--	--	--	50
Mean	1.4	2.90	3.75	--	3.20	4.55	--	--	--	--	--	3.15
STD		0.43	0.35	--	0.99	0.42	--	--	--	--	--	0.74
Range	1.4	2.1-3.8	3.5-4.0	--	2.5-3.9	3.8-4.9	--	--	--	--	--	1.4-4.9
Male.												
N	9	30	--	--	4	--	--	--	--	--	--	45
Mean	1.12	2.73	--	--	2.98	--	--	--	--	--	--	2.39
STD	0.18	0.48	--	--	0.28	--	--	--	--	--	--	0.80
Range	0.8-1.4	2.1-3.9	--	--	2.7-3.3	--	--	--	--	--	--	0.8-3.9
Total.												
N	10	61	2	--	6	6	--	--	--	--	--	95
Mean	1.15	2.82	3.75	--	3.05	4.55	--	--	--	--	--	2.79
STD	0.19	0.46	0.35	--	0.50	0.42	--	--	--	--	--	0.85
Range	0.8-1.4	2.1-3.9	3.5-4.0	--	2.5-3.9	3.8-4.9	--	--	--	--	--	0.8-4.9

[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 1/3 and 2/2 hatchery winter steelhead are returns from the 1991 brood release of wild x Big Creek stock hatchery crosses. Age 2/3 hatchery winter steelhead are progeny of Big Creek stock hatchery releases. Other age classes are returns from hatchery brood releases of the Hood River stock.

Table 27. Mean weight (kg) of adult winter steelhead without spawning checks by origin. stock. brood year. and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1995).]

Origin, stock, brood year	Freshwater/ocean age										
	1/1	2/1	3/1	1/2	2/2	3/2	1/3	2/3	3/3	2/4	3/4
Wild,											
Hood River,											
1988	--	--	--	--	--	--	--	--	4.5 (2)	--	3.2 (1)
1989	--	--	--	--	--	2.8 (13)	--	4.8 (40)	4.6 (3)	6.9 (1)	--
1990	--	--	1.1 (1)	--	3.3 (215)	2.7 (8)	5.4 (4)	4.8 (32)	--	--	--
1991	--	1.3 (8)	1.4 (2)	2.4 (1)	3.1 (95)	--	4.7 (1)	--	--	--	--
1992	--	1.6 (26)	--	4.6 (1)	--	--	--	--	--	--	--
Subbasin hatchery,											
Big Creek.											
1990	--	--	--	--	--	--	3.9 (1)	4.6 (6)	--	--	--
Mixed,[a]											
1991	--	--	--	2.5 (3)	3.0 (6)	--	3.8 (2)	--	--	--	--
Hood River,											
1992	--	--	--	2.8 (61)	--	--	--	--	--	--	--
1993	1.2 (10)	--	--	--	--	--	--	--	--	--	--

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

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

Origin, stock, run year	Freshwater/ocean age												Repeat spawners
	1/1	1/2	1/3	2/1	2/2	2/3	2/4	3/1	3/2	3/3	3/4	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)	—	--	a7 (31)
1993-94	--	0 (2)	67 (6)	12 (8)	69 (251)	67 (72)	--	0 (1)	60 (15)	75 (4)	—	—	100 (11)
1994-95	--	0 (1)	100 (1)	19 (26)	58 (97)	53 (32)	100 (1)	0 (3)	25 (8)	100 (3)	100 (1)	--	69 (16)
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)
1994-95	—	—	--	--	--	100 (6)	--	--	--	--	—	--	100 (3)
Mixed,[a]													
1992-93	67 (6)	--	—								--	--	--
1993-94	--	31 (13)	--		--	--	--				--	--	--
1994-95	—	—	100 (2)		33 (6)	--	--				--	--	--
Hood River,													
1994-95	10 (10)	52 (71)	--						--		--	--	100 (1)

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

Table 29. Mean fecundity of wild adult winter steelhead by ocean age and run year. Fish were sampled at the Powerdale Dam trap.

Ocean age, run year	N	Mean fork length (cm)	Fecundity (eggs/female) Mean	Range	95% C.I.
2 Salt,					
1991-92	11	62.7	2,940	1.930 - 4.950	± 624
1992-93	8	66.7	3,620	3.036 - 4.117	± 317
1993-94	18	68.0	3,330	2.025 - 6.480	± 519
1994-95	12	66.2	3.150	1.737 - 5.016	± 611
3 Salt,					
1991-92	6	74.8	3,032	2,502 - 4,080	± 572
1992-93	7	77.2	4,080	2.856 - 6.398	± 1.189
1993-94	7	76.6	4.500	2,493 - 5.400	± 880
1994-95	6	74.8	4,331	3,375 - 5.472	± 840
4 Salt.					
1991-92	1	78.0	3.240	3.240	--
1992-93	1	85.0	4,632	4,632	_

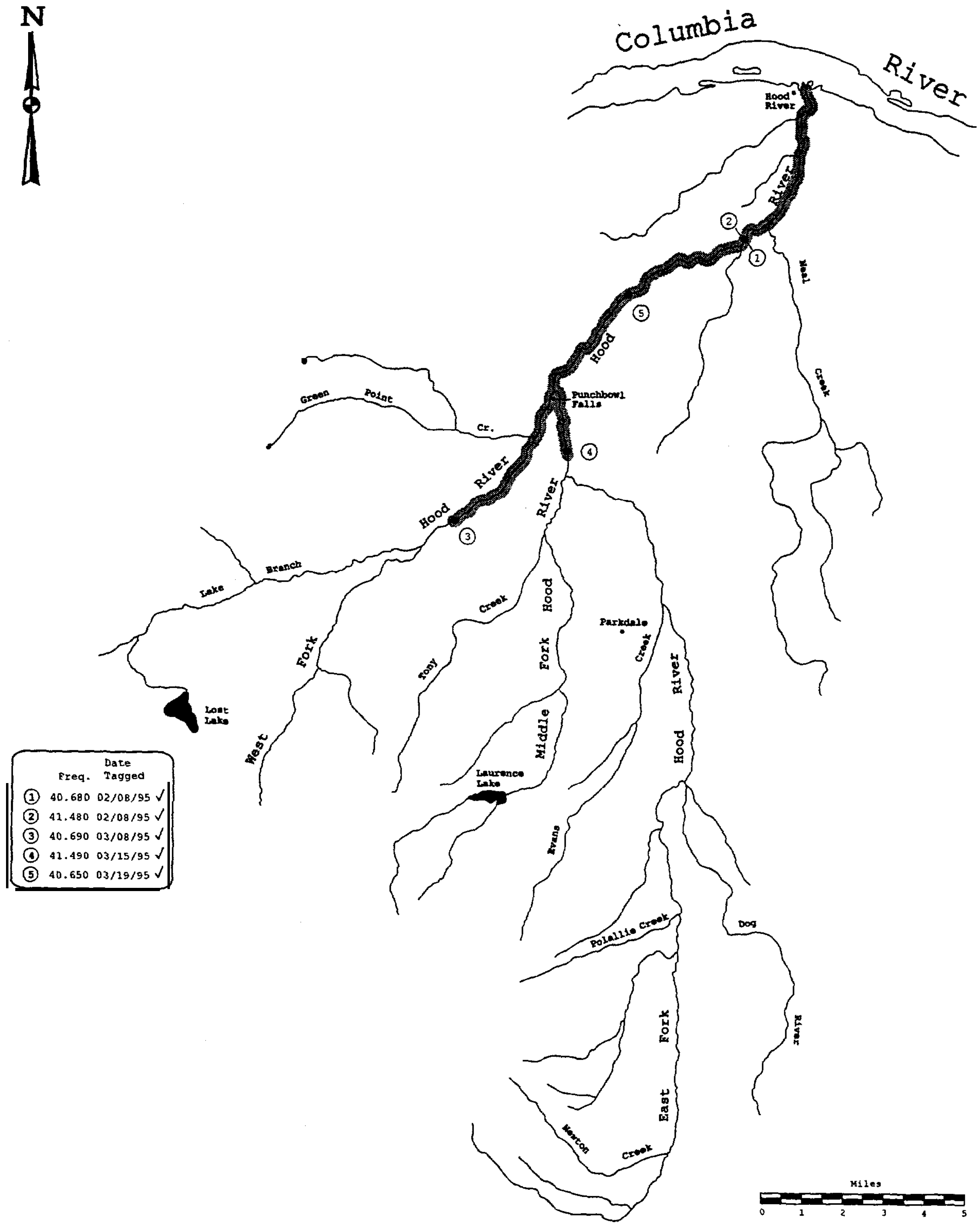


Figure 36. Maximum spatial distribution of radio-tagged wild adult winter steelhead during March 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged winter steelhead are from the 1994-95 run year.

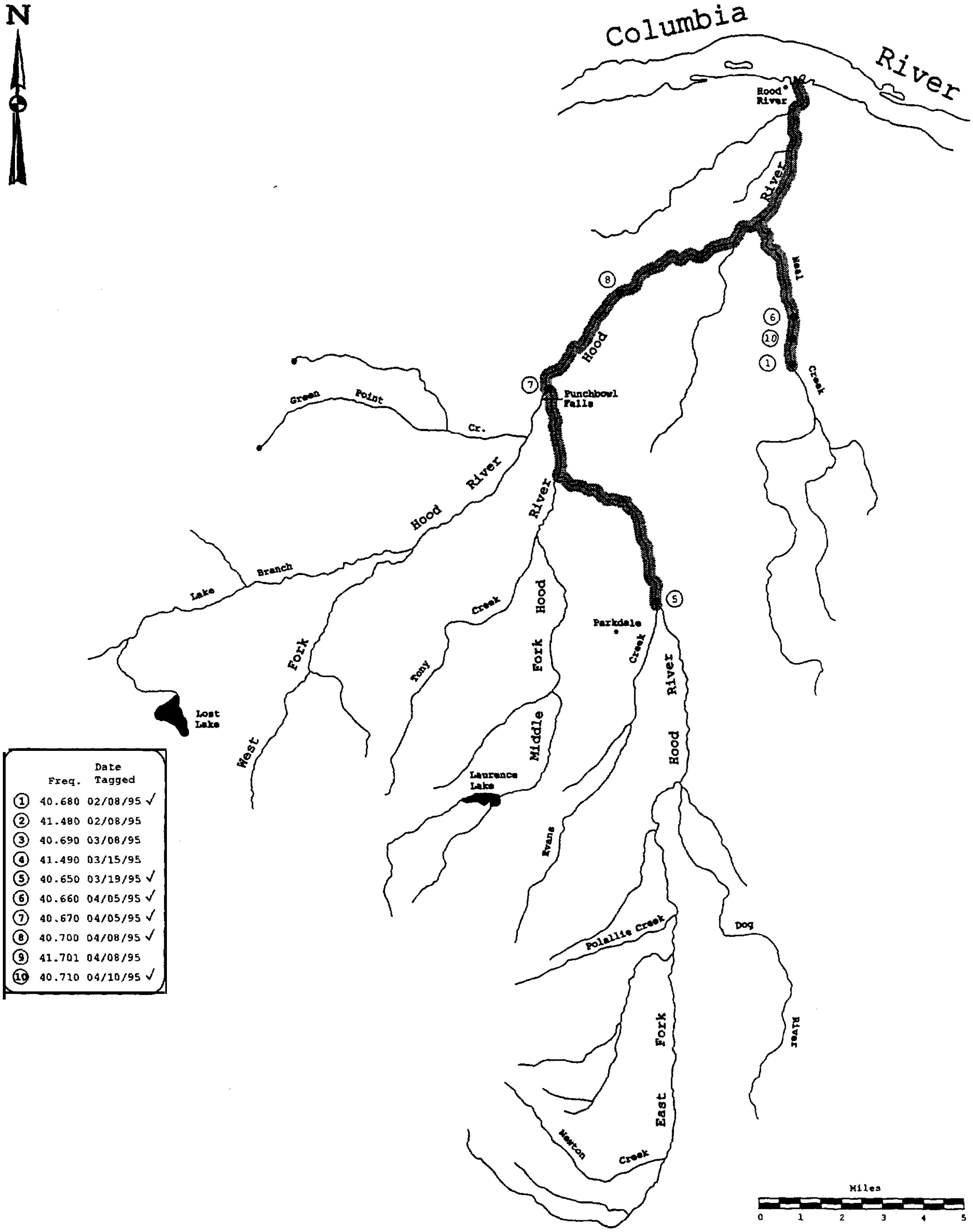


Figure 37. Maximum spatial distribution of radio-tagged wild adult winter steelhead during April 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged winter steelhead are from the 1994-95 run year.

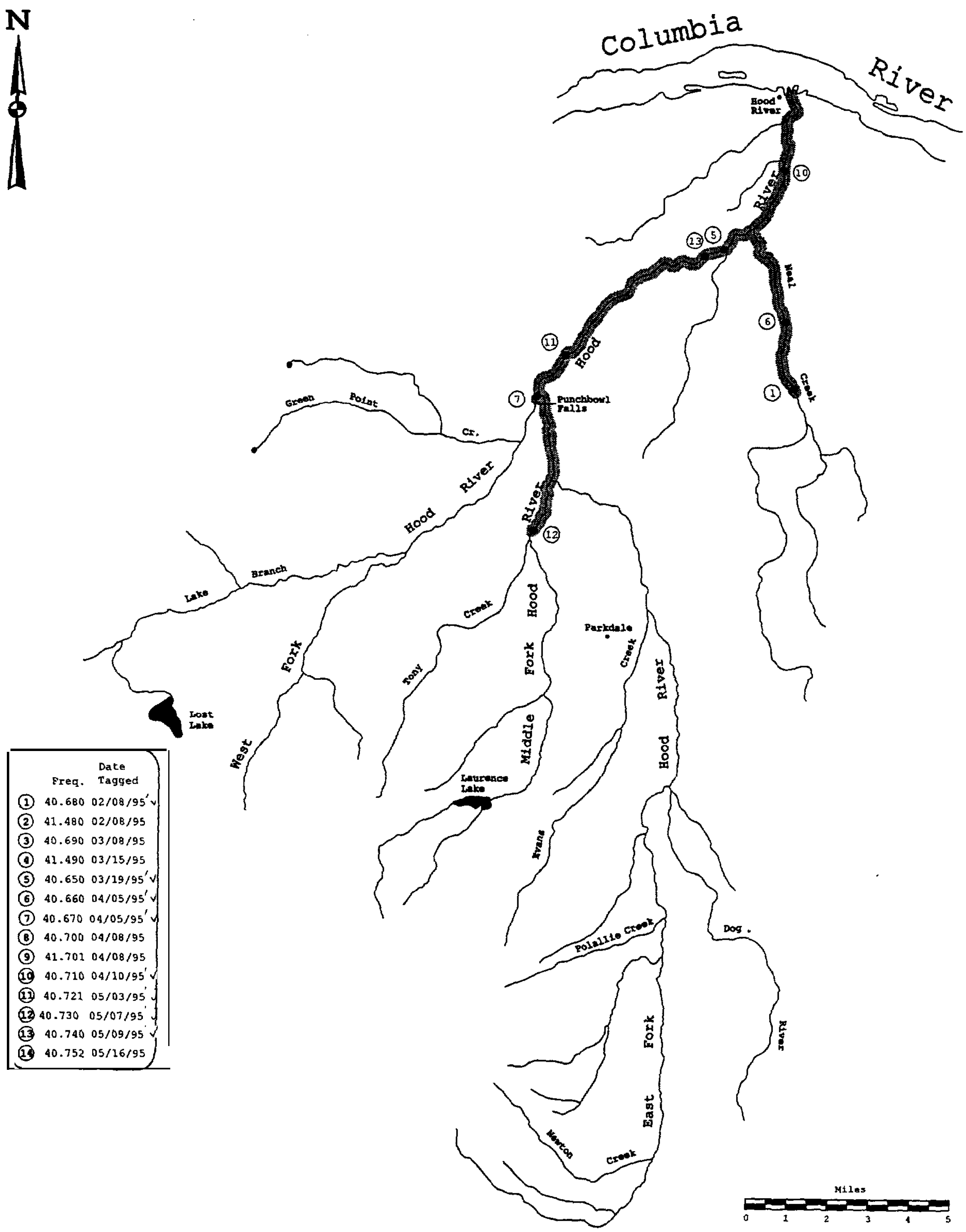


Figure 38. Maximum spatial distribution of radio-tagged wild adult winter steelhead during May 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged winter steelhead are from the 1994-95 run year.

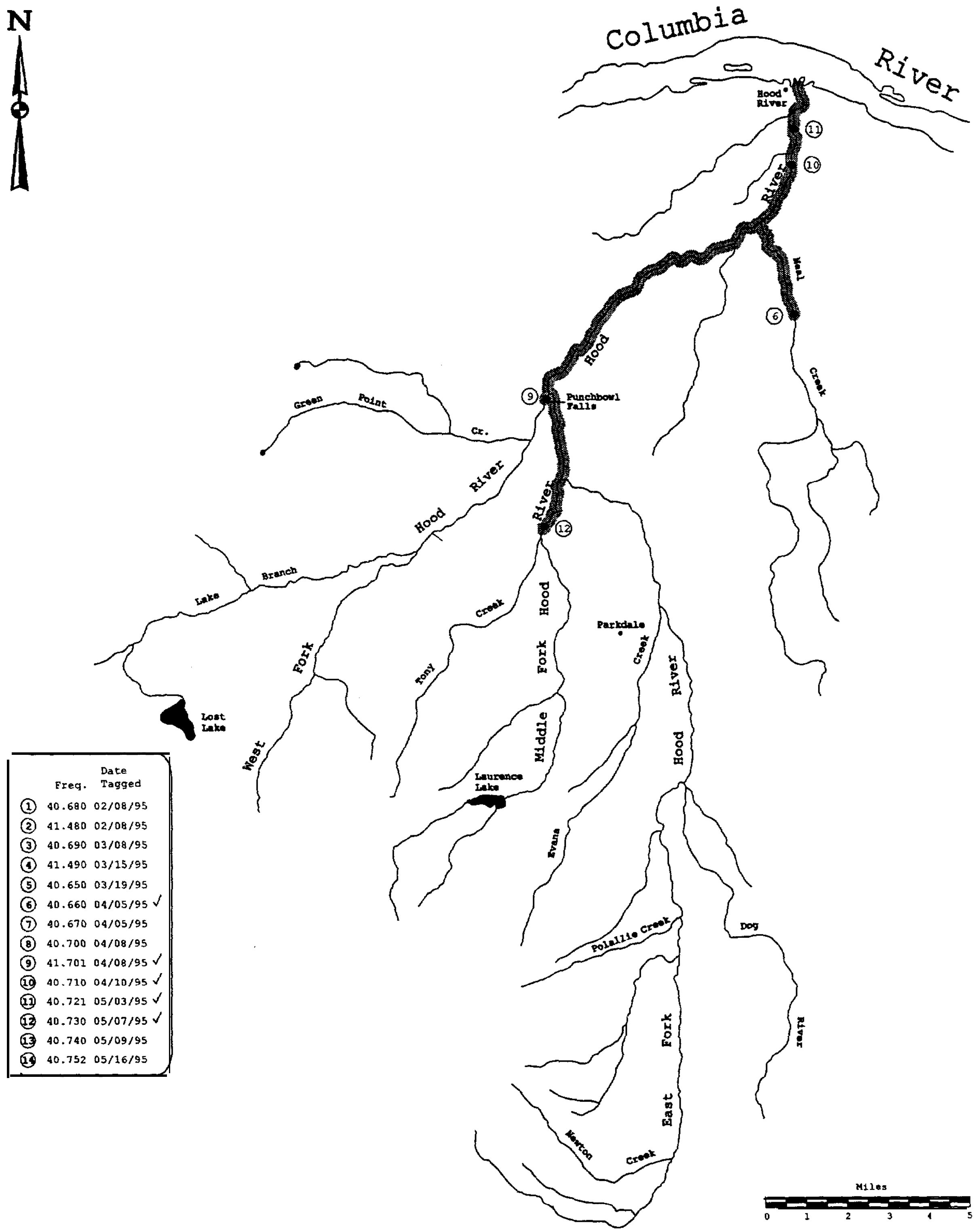


Figure 39. Maximum spatial distribution of radio-tagged wild adult. winter steelhead during June 1995. **Frequencies detected during the period are marked with a check** ("✓"). **Radio-tagged winter steelhead are from the** 1994-95 **run year.**

Table 30. Bimonthly counts of upstream migrant jack and adult spring chinook salmon captured at the Powerdale Dam trap, by run year. Counts are boldfaced for the bimonthly period in which the median date of migration occurred in each origin category.

Origin,	April		May		June		July		August		September		October		
run year	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-31	01-15	16-30	01-15	16-31	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
1995	0	0	0	2	4	2	4	4	0	0	1	1	0	0	18
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	265
1995	0	0	0	6	30	10	11	3	0	1	1	0	0	0	62
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
1995	0	0	0	0	3	1	0	1	0	2	0	1	0	0	8
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
1995	0	0	0	0	0	0	1	0	0	1	0	2	0	0	4

Table 31. Jack and adult spring chinook salmon escapements to the Powerdale Dam trap by origin. stock, run year, and age category. Fish of unknown origin were allocated to origin categories based on scale analysis and the ratio of fish of known origin (see METHODS).

Origin, stock, run year	Total escapement	Freshwater.total age								
		1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6
Natural,										
Hood River,[a]										
1992	37	0	1	23						0
1993	44	0	1	16						0
1994	34	1	2	15						1
1995	21	0	4	1						0
Subbasin hatchery,										
Carson,										
1992	415	--	--	--						0
1993	461	--	--	--						0
1994	261	--	--	--						0
1995	36	--	--	--						1
Deschutes.										
1993	3	--	--	--						--
1994	5	--	--	--						--
1995	27	--	--	--						--
Stray hatchery,										
Unknown,										
1992	1	--	--	1	--	0	0	0	--	--
1993	2	--	--	2	--	0	0	0	--	--
1994	10	--	--	0	--	10	0	0	--	--
1995	8	--	--	0	--	0	3	5	--	--

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

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

Table 32. Jack and adult spring chinook salmon escapements to the Powerdale Dam trap by origin, stock, brood year, and total age. (Percent return is in parentheses. Brood years are bold faced for those years in which brood year specific estimates of escapement are complete. Estimates are based on returns in the 1992-95 run years.1

Origin, stock, brood year[a]	Smolt production	Total age				
		Age 2	Age 3	Age 4	Age 5	Age 6
Natural.						
Hood River.[b]						
1986	--		--	--	--	0
1987	--		--	--	4	0
1988	--		--	31	20	1
1989	--		1	22	10	0
1990	—	0	1	20	14	--
1991	--	1	2	3	—	--
1992	--	1	4	--	--	--
1993	--	0	--	--	—	--
Subbasin hatchery,						
Carson.						
1986	149.939		--	--	—	0
1987	134.047		--	—	18 (0.01)	0
1988	197,988	--	--	394 (0.20)	232 (0.12)	0
1989	125.432	--	3 (.002)	214 (0.17)	16 (0.01)	1 (.001)
1990	163.295	0	15 (.009)	245 (0.15)	35 (0.02)	—
Deschutes.						
1991	75.205	3 (.004)	5 (.007)	23 (0.03)	—	—
1992[c]	0		--	--	--	—
1993	170.004	4 (.002)	--	--	--	—

[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 for naturally produced fish. 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 naturally produced fish from the 1990 brood will be available upon completion of the 1996 run year. Complete brood year specific estimates of escapement for hatchery production releases are available beginning with the 1989 brood release of the Carson stock.

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

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

Table 33. Age composition (percent) of jack and adult spring chinook salmon sampled at the Powerdale Dam trap by origin, stock. and run year. (Estimates in a given run year may not add to 100% due to rounding error.)

Origin, stock. run year	N	Freshwater.total age								
		1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6
Natural.										
Hood River,[a]										
1992	34	0	2.9	61.8	2.9	0	--	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
1995	18	0	16.7	5.6	16.7	0	--	11.1	50.0	0
Subbasin hatchery,										
Carson,										
1992	390	--	--	--	--	0	0.8	94.9	4.4	0
1993	451	--	--	--	--	--	3.3	46.3	50.3	0
1994	258	--	--	--	--	--	--	93.8	6.2	0
1995	34	--	--	--	--	--	--	--	97.1	2.9
Deschutes.										
1993	3	--	--		--	100	--	--	--	--
1994	5	--	--		--	b	100	--	--	--
1995	23	--	--		--	16.0	b	84.0	--	--
Stray hatchery,										
Unknown,										
1992	1	--	--	100	--	0	0	0	--	
1993	2	--	--	100	--	0	0	0	--	
1994	10	--	--	D	--	100	0	0	--	--
1995	8	--	--	0	--	0	37.5	62.5	--	--

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

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

Table 34. Mean fork length (cm) of jack and adult spring chinook salmon in the 1995 run year by origin, sex. and age category. Fish were sampled at the Powerdale Dam trap.

Origin. sample pop.. statistic	Freshwater.total age 1.3	1.4	1.5	2.2	2.4	2.5	2.6	Sample[a] mean
Natural,								
Female,								
N	3	--	2	--	2	6	--	13
Mean	68.00	--	95.00	--	72.50	91.42	--	83.65
STD	5.07	--	4.24	--	5.66	3.79	--	12.17
Range	63.5-73.5	--	92.0-98.0	--	68.5-76.5	87.0-96.5	--	63.5-98.0
Male,								
N		1	1	--	--	3	--	5
Mean	--	80.0	85.0	--	--	101.50	--	93.90
STD		--	--	--	--	6.61	--	11.55
Range		80.0	85.0	--	--	96.5-109.0	--	80.0-109.0
Total,								
N	3	1	3	--	2	9	--	18
Mean	68.00	80.0	91.67	--	72.50	94.78	--	86.50
STD	5.07	--	6.51	--	5.66	6.73	--	12.58
Range	63.5-73.5	80.0	85.0-98.0	--	68.5-76.5	87.0-109.0	--	63.5-109.0
Subbasin hatchery.[b]								
Jacks.								
N	--	--	--	4	--	--	--	4
Mean		--	--	26.00	--	--	--	26.00
STD		--	--	3.74	--	--	--	3.74
Range		--	--	21.0-30.0	--	--	--	21.0-30.0
Female.								
N		--	--	--	17	21	--	39
Mean		--	--	--	74.29	89.86	--	83.09
STD		--	--	--	6.93	5.73	--	9.94
Range		--	--	--	58.0-87.0	83.5-106.0	--	58.0-106.0
Male.								
N		--	--	--	4	12	1	19
Mean		--	--	--	76.62	95.79	85.0	90.79
STD		--	--	--	4.39	9.65	--	11.12
Range		--	--	--	73.0-83.0	82.5-113.0	85.0	73.0-113.0
Total,								
N		--	--	4	21	33	1	62
Mean		--	--	26.00	74.74	92.02	85.0	al.77
STD		--	--	3.74	6.49	7.81	--	18.14
Range		--	--	21.0-30.0	58.0-87.0	82.5-113.0	85.0	21.0-113.0

[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 and 2.4 spring chinook salmon are returns from releases of Deschutes stock hatchery spring chinook salmon. Other age categories are returns from Carson stock releases of spring chinook salmon.

Table 35. Mean fork length (cm) of jack and adult spring chinook salmon by origin, stock, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1995).]

Origin, stock, brood year	Freshwater.total age								
	1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6
Natural,									
Hood River,[a]									
1987	--	--	--	86 (1)	--	--	--	85 (3)	--
1988	--	--	81 (21)	91 (10)	--	--	72 (8)	88 (8)	92 (1)
1989	--	71 (1)	82 (15)	96 (5)	--	--	87 (6)	79 (5)	--
1990	--	78 (1)	77 (14)	92 (3)	--	--	72 (5)	95 (9)	--
1991	--	62 (2)	80 (1)	--	66 (1)	--	72 (2)	--	--
1992	30 (1)	68 (3)	--	--	--	--	--	--	--
Subbasin hatchery,									
Carson,									
1987				--	--	--	--	89 (17)	--
1988				--	--	--	74 (370)	89 (227)	--
1989				--	--	56 (3)	83 (209)	82 (16)	85 (1)
1990				--	--	52 (15)	75 (242)	92 (33)	--
Deschutes,									
1991				--	30 (3)	52 (5)	75 (21)	--	--
1992[b]	--	--	--	--	--	--	--	--	--
1993	--	--	--	--	26 (4)	--	--	--	--

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

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

Table 36. Mean weight (kg) of jack and adult spring chinook salmon in the 1995 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	2.4	2.5	2.6	
Natural.								
Female,								
N	3	--	2	--	2	6	—	13
Mean	4.23	--	10.45	--	4.60	8.93	—	7.42
STD	0.83	--	0.78	--	1.13	0.67	—	2.65
Range	3.3-4.9	--	9.9-11.0	--	3.8-5.4	7.7-9.5	--	3.3-11.0
Male,								
N		1	1	--	--	3	--	5
Mean		5.7	7.3	--	--	10.10	—	8.66
STD		—	—	--	--	0.95	--	2.16
Range		5.7	7.3	--	--	9.1-11.0	--	5.7-11.0
Total,								
N	3	1	3	--	2	9	—	18
Mean	4.23	5.7	9.40	—	4.60	9.32	--	7.76
STD	0.83	--	1.90	—	1.13	0.92	--	2.52
Range	3.3-4.9	5.7	7.3-11.0	--	3.8-5.4	7.7-11.0	--	3.3-11.0
Subbasin hatchery.[b]								
Jacks,								
N	--	--	--	1	—	--	--	1
Mean	--	--	--	0.3	--	--	--	0.3
STD	--	--	--	--	—	--	--	--
Range	--	—	—	0.3	--	--	--	0.3
Female,								
N	--	—	—	--	15	20	--	36
Mean	--	--	--	—	4.83	8.26	--	6.86
STD		--	--	—	1.37	1.25	--	2.16
Range		--	—	—	3.4-7.9	6.4-11.2	--	3.4-11.2
Male,								
N		--	--	—	4	11	1	18
Mean		--	—	—	5.02	9.02	7.4	7.91
STD	--	—	--	--	1.20	1.82	—	2.24
Range		—	--	--	4.3-6.8	6.2-12.2	7.4	4.3-12.2
Total,								
N		—	--	1	19	31	1	55
Mean		--	--	0.3	4.87	8.53	7.4	7.08
STD		--	--	--	1.30	1.49	--	2.39
Range	--	--	--	0.3	3.4-7.9	6.2-12.2	7.4	0.3-12.2

[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 and 2.4 spring chinook salmon are returns from releases of Deschutes stock hatchery spring chinook salmon. Other age categories are returns from Carson stock releases of spring chinook salmon.

Table 37. Mean weight (kg) of jack and adult spring chinook salmon by origin. stock, brood year, and age category. [Sample size is in parentheses. Sample statistics. by run year. are presented in previous tables and in Olsen et al. (1995).]

Origin, stock. brood year	Freshwater.total age								
	1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6
Natural,									
Hood River,[a]									
1988	--	--	--	--	--	--	--	--	9.5 (1)
1989	--	--	--	10.1 (5)	--	--	--	6.2 (5)	--
1990	--	--	5.4 (13)	9.4 (3)	--	--	4.9 (5)	9.3 (9)	--
1991	--	2.9 (2)	5.7 (1)	--	--	--	4.6 (2)	--	--
1992	0.3 (1)	4.2 (3)	--	--	--	--	--	--	--
Subbasin hatchery,									
Carson.									
1989	--	--	--	--	--	--	--	6.7 (16)	7.4 (1)
1990	--	--	--	--	--	--	5.3 (235)	8.5 (31)	--
Deschutes.									
1991	--	--	--	--	--	1.6 (5)	4.9 (19)	--	--
1992[b]	--	--	--	--	--	--	--	--	--
1993	--	--	--	--	0.3 (1)	--	--	--	--

[a] Developed from Deschutes and Carson stock hatchery production releases.
[b] No hatchery fish were released from the 1992 brood (see HATCHERY PRODUCTION, Production Releases).

Table 38. Jack and adult spring chinook salmon sex ratios as a percentage of females by origin. stock. run year. and age category. Fish were sampled at the Powerdale Dam trap. (Sample size is in parentheses.)

Origin, stock, run year	Freshwater.total age								
	1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6
Natural,									
Hood River,[a]									
1992	--	0 (1)	67 (21)	100 (1)	--	--	25 (8)	67 (3)	--
1993	--	0 (1)	73 (15)	80 (10)	0 (1)	--	67 (6)	50 (8)	--
1994	0 (1)	0 (2)	36 (14)	60 (5)	--	--	60 (5)	40 (5)	100 (1)
1995	--	100 (3)[b]	0 (1)	67 (3)	--	--	100 (2)	67 (9)	--
Subbasin hatchery,									
Carson,									
1992	--	--	--	--	--	0 (3)	74 (370)	71 (17)	--
1993	--	--	--	--	--	47 (15)[b]	71 (209)	61 (227)	--
1994	--	--	--	--	--	--	64 (242)	62 (16)	--
1995	--	--	--	--	--	--	--	64 (33)	0 (1)
Deschutes.									
1993	--	--	--	--	0 (3)	--	--	--	--
1994	--	--	--	--	c	40 (5)[b]	--	--	--
1995	--	--	--	--	0 (4)	c	81 (21)	--	--

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

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

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

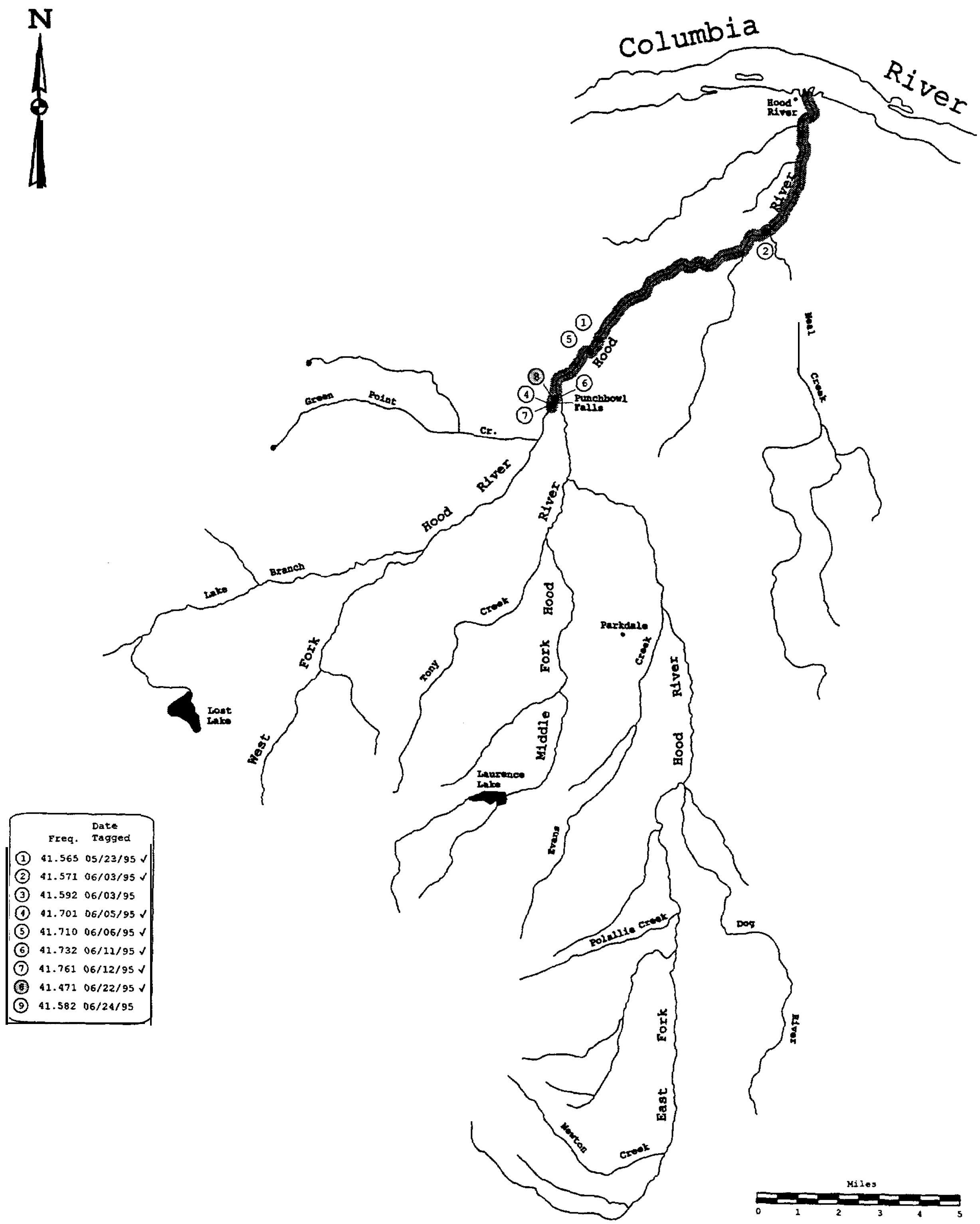


Figure 40. Maximum spatial distribution of radio-tagged natural and hatchery adult spring chinook salmon during June 1995. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced salmon.

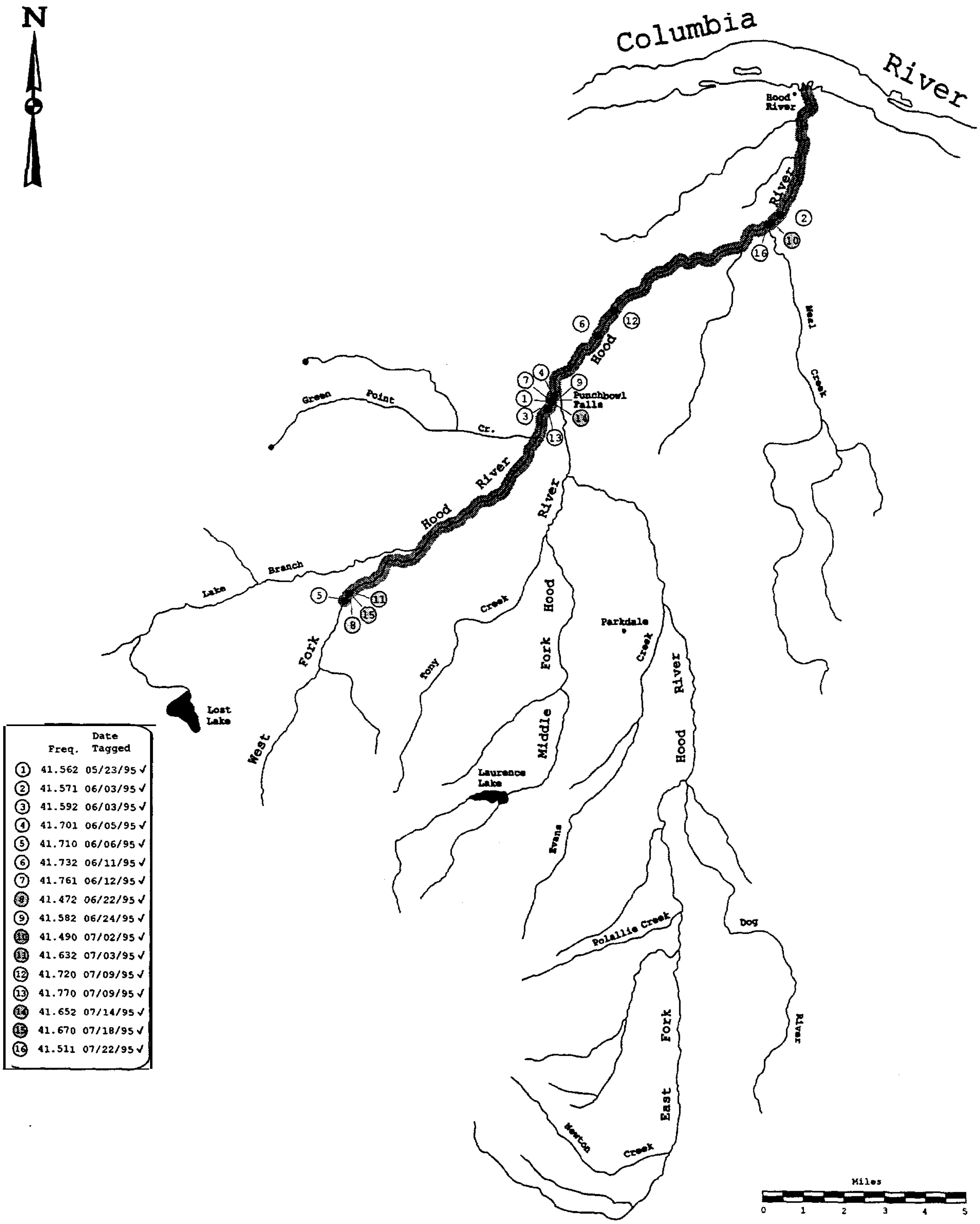


Figure 41. Maximum spatial distribution of radio-tagged natural and hatchery adult spring chinook salmon during July 1995. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced salmon.

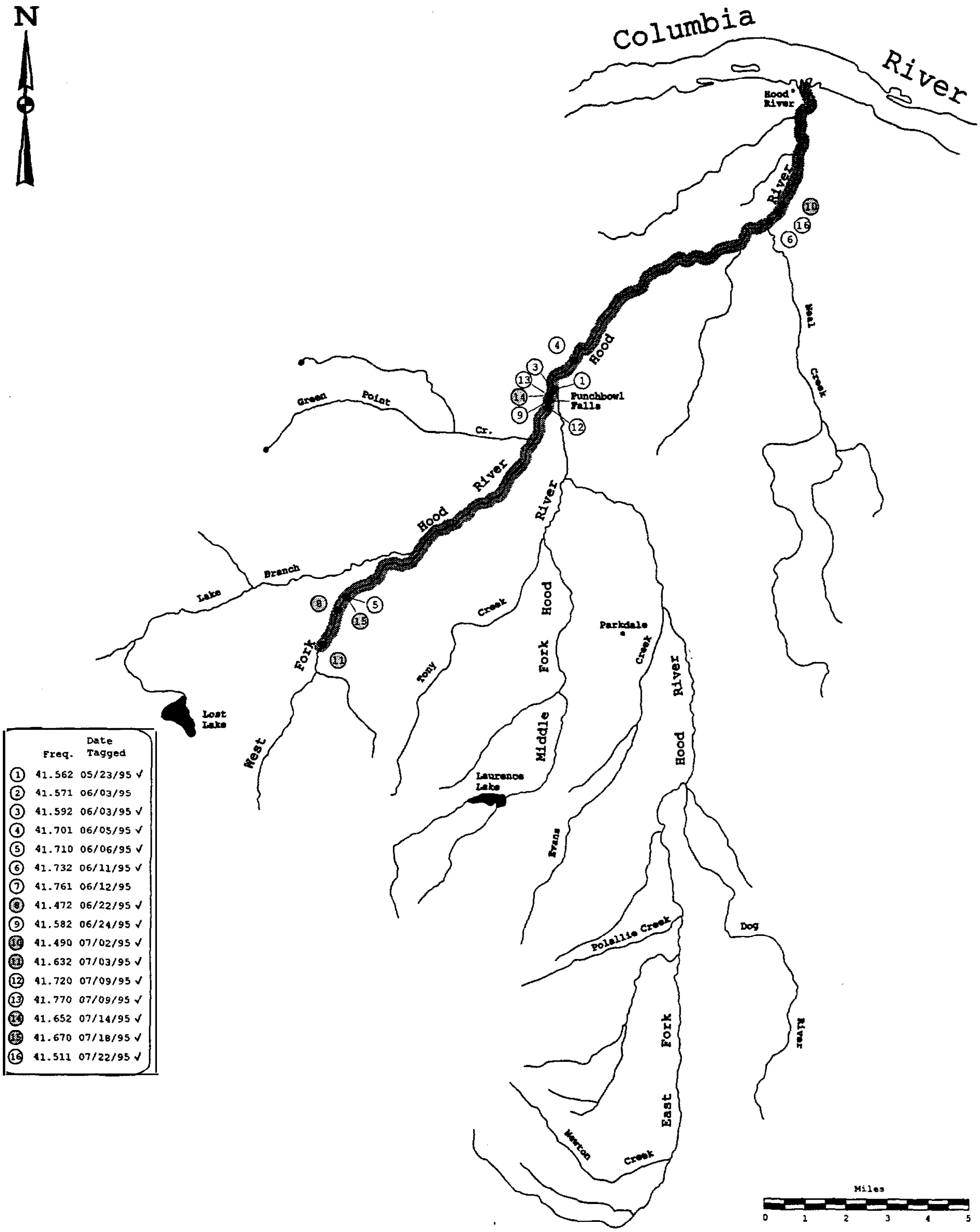
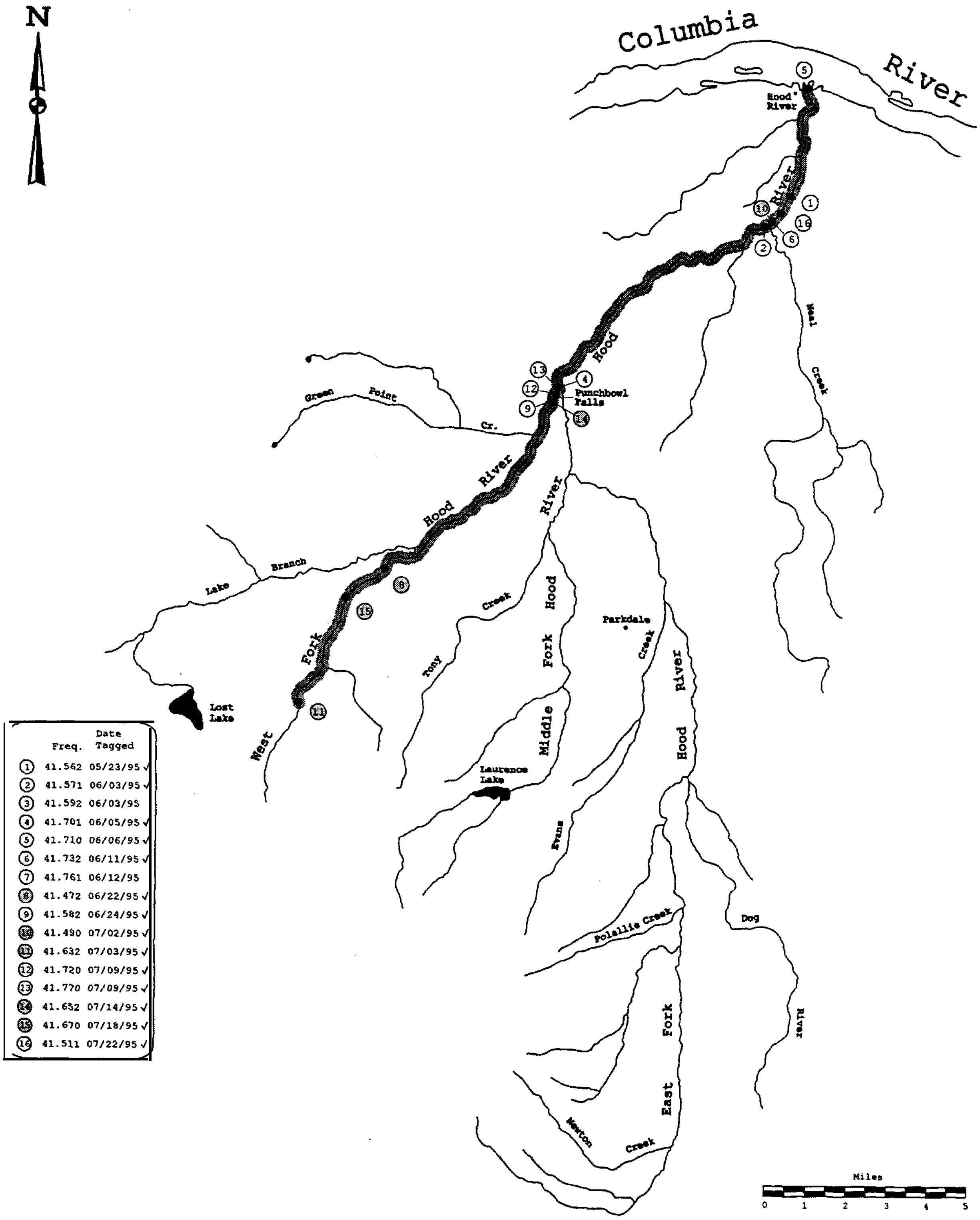


Figure 42. Maximum spatial distribution of radio-tagged natural and hatchery adult spring chinook salmon during August 1995. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced salmon.



	Freq.	Date Tagged
1	41.562	05/23/95 ✓
2	41.571	06/03/95 ✓
3	41.592	06/03/95
4	41.701	06/05/95 ✓
5	41.710	06/06/95 ✓
6	41.732	06/11/95 ✓
7	41.761	06/12/95
8	41.472	06/22/95 ✓
9	41.582	06/24/95 ✓
10	41.490	07/02/95 ✓
11	41.632	07/03/95 ✓
12	41.720	07/09/95 ✓
13	41.770	07/09/95 ✓
14	41.652	07/14/95 ✓
15	41.670	07/18/95 ✓
16	41.511	07/22/95 ✓

Figure 43. **Maximum spatial distribution of radio-tagged natural and hatchery adult spring chinook salmon during September 1995. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced salmon.**

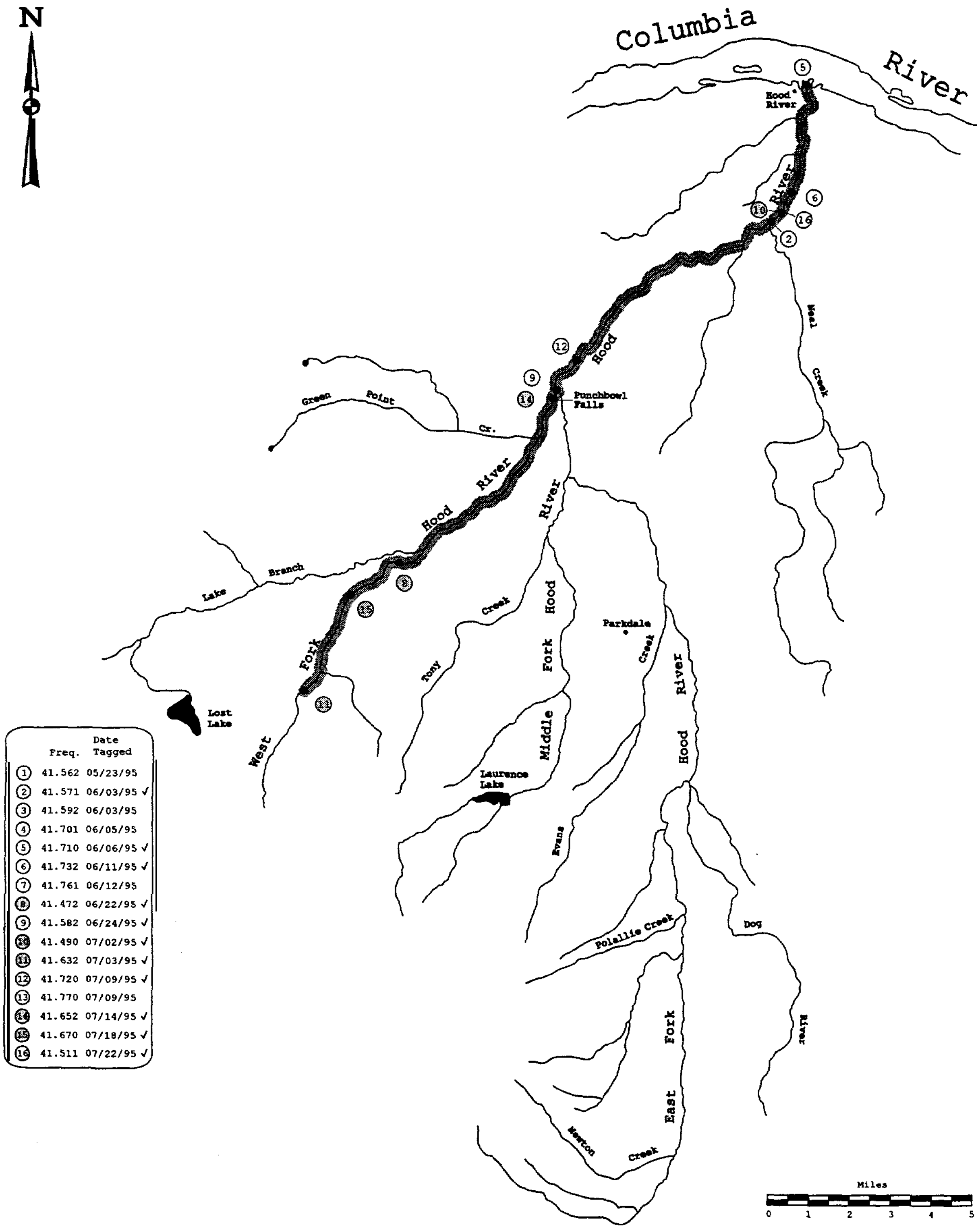


Figure 44. Maximum spatial distribution of radio-tagged natural and hatchery adult spring chinook salmon during October 1995. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced salmon.

Table 39. Bimonthly counts of upstream migrant jack and adult fall chinook salmon captured at the Powerdale Dam trap. by origin and run year. Counts are boldfaced for the bimonthly period in which the median date of migration occurred in each origin category.

Origin.	July		August		September		October		November		December		
run year	01-15	16-31	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	Total
Natural,													
1992	0	0	4	1	2	7	1	1	0	0	0	0	16
1993	0	0	2	1	2	0	0	0	0	0	0	0	6
1994[a]	0	6	2	0	0	13	3	1	0	0	0	0	25
1995[b]	0	4	0	1	3	0	0	0	0	0	0	0	8
Stray hatchery,													
1992	0	0	0	0	2	1	2	1	0	0	0	0	6
1993	0	0	0	0	2	1	1	0	0	0	0	0	4
1994[a]	0	0	0	0	0	6	1	0	0	0	0	0	7
1995[b]	0	0	0	0	2	2	0	0	0	0	0	0	4
Unknown,													
1994[a]	0	0	0	0	0		2	1	1	0	0	0	7

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

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

Table 40. Jack and adult fall chinook salmon escapements to the Powerdale Dam trap by origin. run year, and age category. Fish of unknown origin were allocated to origin categories based on scale analysis, size, and the ratio of fish of known origin (see METHODS).

Origin. run year	Total escapement	Freshwater.total ase								
		1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	2.6
Natural,										
1992	16	2	2	10	1	1	0	0	0	--
1993	6	0	1	3	2	0	0	0	0	--
1994	32	2	4	19	2	0	1	2	2	--
1995	8	1	0	1	1	0	1	2	2	--
Stray hatchery.										
1992	6	1	3	2	0	--	--	0	--	--
1993	4	0	1	2	1	--	--	0	--	--
1994	7	0	0	5	0	--	--	2	--	--
1995	4	0	0	1	0	--	--	3	--	--

Table 41. Age composition (percent) of jack and adult fall chinook salmon sampled at the Powerdale Dam trap by origin and run year. (Estimates in a given run year may not add to 100% due to rounding error.)

Origin, run year	N	Freshwater.total age 1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	2.6
Natural,										
1992	16	12.5	12.5	62.5	6.2	6.2	0	0	0	--
1993	6	0	16.7	50.0	33.3	0	0	0	0	__
1994	25	8.0	16.0	48.0	8.0	0	4.0	8.0	8.0	--
1995	8	12.5	0	12.5	12.5	0	12.5	25.0	25.0	--
Stray hatchery,										
1992	5	20.0	40.0	40.0	0	--	__	0	--	--
1993	4	0	25.0	50.0	25.0	__	--	0	--	--
1994	6	0	0	66.7	0	__	--	33.3	--	__
1995	4	0	0	25.0	0	__	--	75.0	__	--

Table 42. Mean fork length (cm) of jack and adult fall 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
	1.2	1.3	1.4	1.5	1.6	
Natural.						
Jacks,						
N	2	--				2
Mean	42.50	--	--			42.50
STD	2.83	--				2.83
Range	40.5-44.5	--				40.5-44.5
Female,						
N	--	2	5	--	1	8
Mean	--	66.50	81.80		85.5	78.44
STD	--	0.71	6.66			9.02
Range	--	66.0-67.0	72.5-91.0	--	85.5	66.0-91.0
Male.						
N	—	—	5	1		6
Mean	--	--	83.80	96.0		85.83
STD	--	—	10.75	—		10.83
Range	—	—	65.5-93.5	96.0		65.5-96.0
Total.						
N	2	2	10	1	1	16
Mean	42.50	66.50	82.80	96.0	85.5	76.72
STD	2.83	0.71	8.50		--	16.39
Range	40.5-44.5	66.0-67.0	65.5-93.5	96.0	85.5	40.5-96.0
Stray hatchery						
Jacks,						
N	1	--		--	--	1
Mean	44.5	--			--	44.5
STD	—	--				—
Range	44.5	--	--	--	--	44.5
Female.						
N	—	2	2			5
Mean	—	64.50	77.50		--	70.00
STD	—	6.36	7.78			8.51
Range	--	60.0-69.0	72.0-83.0			60.0-83.0
Total,						
N	1	2	2	--		6
Mean	44.5	64.50	77.50			65.75
STD	—	6.36	7.78			12.90
Range	44.5	60.0-69.0	72.0-83.0			44.5-83.0

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

Table 43. Mean fork length (cm) of jack and adult fall 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 aoe 1.3	1.4	1.5	Sample mean
Natural,				
Female,				
N		3	2	5
Mean		78.83	89.50	83.10
STD		3.82	7.78	7.52
Range		75.5-83.0	84.0-95.0	75.5-95.0
Male,				
N	1			1
Mean	52.5			52.5
STD				--
Range	52.5			52.5
Total,				
N	1	3	2	6
Mean	52.5	78.83	89.50	78.00
STD	--	3.82	7.78	14.19
Range	52.5	75.5-83.0	84.0-95.0	52.5-95.0
Stray hatchery,				
Female.				
N		1	1	2
Mean		66.5	76.5	71.50
STD	--	--	--	7.07
Range	--	66.5	76.5	66.5-76.5
Male.				
N	1	1		2
Mean	70.5	75.0		72.75
STD		--		3.18
Range	70.5	75.0	--	70.5-75.0
Total,				
N	1	2	1	4
Mean	70.5	70.75	76.5	72.12
STD		6.01		4.53
Range	70.5	66.5-75.0	76.5	66.5-76.5

Table 44. Mean fork length (cm) of jack and adult fall 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							Sample[a] mean
	1.2	1.3	1.4	1.5	2.3	2.4	2.5	
Natural.								
Jacks.								
N	2	--	--	--	1	--	--	3
Mean	52.75	--	--	--	57.0	--	--	54.17
STD	6.01	--	--	--	--	--	--	4.91
Range	48.5-57.0	--	--	--	57.0	--	--	48.5-57.0
Females.								
N	--	3	8	2	--	2	2	17
Mean	--	69.50	79.88	91.00	--	82.00	83.25	80.00
STD	--	9.34	3.94	4.95	--	0.00	6.72	7.73
Range	--	61.0-79.5	73.5-85.0	87.5-94.5	--	82.0-82.0	78.5-88.0	61.0-94.5
Males.								
N	--	1	4	--	--	--	--	5
Mean	--	62.5	85.00	--	--	--	--	80.50
STD	--	--	7.16	--	--	--	--	11.82
Range	--	62.5	75.0-92.0	--	--	--	--	62.5-92.0
Totals.								
N	2	4	12	2	1	2	2	25
Mean	52.75	67.75	81.58	91.00	57.0	82.00	83.25	77.00
STD	6.01	8.39	5.50	4.95	--	0.00	6.72	11.80
Range	48.5-57.0	61.0-79.5	73.5-92.0	87.5-94.5	57.0	82.0-82.0	78.5-88.0	48.5-94.5
Stray hatchery.								
Females.								
N	--	--	4	--	--	2	--	6
Mean	--	--	79.88	--	--	77.75	--	79.17
STD	--	--	2.78	--	--	0.35	--	2.42
Range	--	--	76.0-82.5	--	--	77.5-78.0	--	76.0-82.5
Males.								
N	--	--	--	--	--	--	--	1
Mean	--	--	--	--	--	--	--	62.0
STD	--	--	--	--	--	--	--	--
Range	--	--	--	--	--	--	--	62.0
Totals.								
N	--	--	4	--	--	2	--	7
Mean	--	--	79.88	--	--	77.75	--	76.71
STD	--	--	2.78	--	--	0.35	--	6.85
Range	--	--	76.0-82.5	--	--	77.5-78.0	--	62.0-82.5

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

Table 45. Mean fork length (cm) of jack and adult fall chinook salmon in the 1995 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	1.4	1.5	2.3	2.4	2.5	Sample mean
Natural,							
Jacks,							
N	1	--	--	1	--	--	2
Mean	47.0	--	—	62.0	--	--	54.50
STD	—	--	--	--	--	--	10.61
Range	47.0	--	--	62.0	--	--	47.0-62.0
Females,							
N	—	1	1	—	1	--	3
Mean	—	89.0	89.0	--	71.0	--	83.00
STD	—	--	--	--	--	--	10.39
Range	—	89.0	89.0	—	71.0	--	71.0-89.0
Males,							
N	—	--	--	—	1	2	3
Mean	—	--	—	—	87.5	90.00	89.17
STD	—	--	—	--	--	8.49	6.17
Range	—	--	—	--	87.5	84.0-96.0	84.0-96.0
Totals,							
N	1	1	1	1	2	2	8
Mean	47.0	89.0	89.0	62.0	79.25	90.00	78.19
STD	--	--	—	--	11.67	8.49	16.72
Range	47.0	89.0	89.0	62.0	71.0-87.5	84.0-96.0	47.0-96.0
Stray hatchery							
Females,							
N	--	1	—	—	2	—	3
Mean	—	72.5	—	—	75.50	—	74.50
STD	--	—	—	—	2.12	—	2.29
Range	—	72.5	--	—	74.0-77.0	—	72.5-77.0
Males,							
N	--	—	—	--	1	--	1
Mean	—	—	—	—	82.0	—	82.0
STD	—	—	—	—	--	—	—
Range	--	—	—	—	82.0	—	82.0
Totals,							
N	—	1	--	--	3	—	4
Mean	—	72.5	—	—	77.67	--	76.38
STD	--	--	—	--	4.04	--	4.19
Range	--	72.5	—	—	74.0-82.0	—	72.5-82.0

Table 46. Mean fork length (cm) of jack and adult fall chinook salmon by origin, brood year, and age category. (Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables.)

Origin, brood year	Freshwater.total age								
	1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	2.6
Natural,									
1986	--			--	86 (1)	--	--	--	--
1987	--	--		96 (1)	--	--	--	--	--
1988	--	--	83 (10)	90 (2)	--	--	--	--	--
1989	--	66 (2)	79 (3)	91 (2)	--	--	--	83 (2)	--
1990	42 (2)	52 (1)	82 (12)	89 (1)	--	--	82 (2)	90 (2)	--
1991		68 (4)	89 (1)	--	--	57 (1)	79 (2)	--	--
1992	53 (2)			--	--	62 (1)			
1993	47 (1)			--	--	--	--	--	--
Stray hatchery,									
1988			78 (2)	76 (1)	--	--		--	--
1989	--	64 (2)	71 (2)	--	--	--	--	--	--
1990	44 (1)	70 (1)	80 (4)	--	--	--	78 (2)	--	--
1991		--	72 (1)				78 (3)	--	--
1992									
1993									

Table 47. Mean weight (kg) of jack and adult fall 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 aoe 1.2	1.3	1.4	1.5	2.3	2.4	2.5	Sample[a] mean
Natural.								
Jacks.								
N	2	--	--	--	1	--	--	3
Mean	2.00	--	--	--	2.5	--	--	2.17
STD	0.99	--	--	--	—	--	--	0.76
Range	1.3-2.7	--	--	--	2.5	--	--	1.3-2.7
Female.								
N	--	3	8	2	—	2	2	17
Mean	--	4.47	6.79	9.50	--	6.75	7.35	6.76
STD	—	1.75	1.38	1.70	—	1.20	2.19	1.94
Range	--	3.0-6.4	5.0-8.4	8.3-10.7	—	5.9-7.6	5.8-8.9	3.0-10.7
Male.								
N	--	1	4	—	--	—	—	5
Mean	--	3.2	7.40	--	--	—	—	6.56
STD	--	--	2.14	—	—	--	—	2.64
Range	--	3.2	4.8-10.0	—	--	--	--	3.2-10.0
Total.								
N	2	4	12	2	1	2	2	25
Mean	2.00	4.15	6.99	9.50	2.5	6.75	7.35	6.17
STD	0.99	1.56	1.60	1.70	—	1.20	2.19	2.45
Range	1.3-2.7	3.0-6.4	4.8-10.0	8.3-10.7	2.5	5.9-7.6	5.8-8.9	1.3-10.7
Stray hatchery,								
Female.								
N	--	--	4	—	—	2	—	6
Mean	--	--	6.82	—	—	6.40	—	6.68
STD	--	--	0.67	—	—	0.57	—	0.62
Range	--	--	6.2-7.5	—	—	6.0-6.8	—	6.0-7.5
Male.								
N	--	--	--	—	--	--	—	1
Mean	—	--	--	—	—	—	—	3.2
STD	--	--	--	—	--	--	—	--
Range	--	--	--	--	—	--	--	3.2
Total,								
N	--	--	4	--	—	2	--	7
Mean	--	--	6.82	--	—	6.40	—	6.19
STD	--	--	0.67	--	—	0.57	—	1.43
Range	--	--	6.2-7.5	--	--	6.0-6.8	—	3.2-7.5

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

Table 48. Mean weight (kg) of jack and adult fall chinook salmon in the 1995 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater.total age						Sample mean
	1.2	1.4	1.5	2.3	2.4	2.5	
Natural,							
Jacks.							
N	1	--	--	1	--	--	2
Mean	1.4	--	--	2.9	--	--	2.15
STD	--	--	--	--	--	--	1.06
Range	1.4	--	--	2.9	--	--	1.4-2.9
Female.							
N	--	1	1	--	1	--	3
Mean	--	8.9	9.1	--	5.4	--	7.80
STD	--	--	--	--	--	--	2.08
Range	--	8.9	9.1	--	5.4	--	5.4-9.1
Male.							
N	--	--	--	--	1	2	3
Mean	--	--	--	--	6.4	9.70	8.60
STD	--	--	--	--	--	2.55	2.62
Range	--	--	--	--	6.4	7.9-11.5	6.4-11.5
Total,							
N	1	1	1	1	2	2	8
Mean	1.4	8.9	9.1	2.9	5.90	9.70	6.69
STD	--	--	--	--	0.71	2.55	3.37
Range	1.4	8.9	9.1	2.9	5.4-6.4	7.9-11.5	1.4-11.5
Stray hatchery.							
Female,							
N	--	1	--	--	2	--	3
Mean	--	5.1	--	--	5.35	--	5.27
STD	--	--	--	--	1.06	--	0.76
Range	--	5.1	--	--	4.6-6.1	--	4.6-6.1
Male.							
N	--	--	--	--	1	--	1
Mean	--	--	--	--	6.9	--	6.9
STD	--	--	--	--	--	--	--
Range	--	--	--	--	6.9	--	6.9
Total.							
N	--	1	--	--	3	--	4
Mean	--	5.1	--	--	5.87	--	5.68
STD	--	--	--	--	1.17	--	1.03
Range	--	5.1	--	--	4.6-6.9	--	4.6-6.9

Table 49. Mean weight (kg) of jack and adult fall chinook salmon by origin, brood year, and age category. (Sample size is in parentheses Sample statistics, by run year, are presented in previous tables.)

Origin, brood year	Freshwater.total age								
	1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	2.6
Natural.									
1989	--	--	--	9.5 (2)	--	--	--	7.4 (2)	--
1990	--	--	7.0 (12)	9.1 (1)	--	--	6.8 (2)	9.7 (2)	--
1991	--	4.2 (4)	8.9 (1)	--	--	2.5 (1)	5.9 (2)	--	--
1992	2.0 (2)	--	--	--	--	2.9 (1)	--	--	--
1993	1.4 (1)	--	--	--	--	--	--	--	--
Stray hatchery.									
1990	--	--	6.8 (4)	--	--	--	6.4 (2)	--	--
1991	--	--	5.1 (1)	--	--	--	5.9 (3)	--	--

Table 50. Jack and adult fall chinook salmon sex ratios as a percentage of females by origin. run year. and age category. Fish were sampled at the Powerdale Dam trap. (Sample size is in parentheses.)

Origin. run year	Freshwater.total age								
	1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	2.6
Natural.									
1992	0 (2)	100 (2)[a]	50 (10)	0 (1)	100 (1)	--	—	--	—
1993	—	0 (1)	100 (3)	100 (2)	--	--	—	—	--
1994	0 (2)	75 (4)[a]	67 (12)	100 (2)	—	0 (1)	100 (2)	100 (2)	--
1995	0 (1)	--	100 (1)	100 (1)	--	100 (1)[a]	50 (2)	0 (2)	—
Stray hatchery.									
1992	100 (1)[a]	100 (2)[a]	100 (2)	--	—	--	—	--	—
1993	—	0 (1)	50 (2)	100 (1)	—	--	—	—	--
1994	—	—	100 (4)	--	—	--	100 (2)	—	--
1995	—	--	100 (1)	--	—	--	67 (3)	--	--

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

Table 51. Bimonthly counts of upstream migrant jack and adult coho salmon captured at the Powerdale Dam trap. by origin and run year. Counts are boldfaced for the bimonthly period in which the median date of migration occurred in each origin category.

Origin. run year	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	Total
Natural,											
1992	0	0	1	11	5	4	1	0	0	0	22
1993	0	0	0	0	0	0	0	0	0	0	0
1994[a]	0	0	0	0	1	0	0	0	0	0	1
1995[b]	0	0	3	1	4	3	0	0	0	0	11
Stray hatchery.											
1992	0	1	6	37	12	12	11	0	0	0	79
1993	0	0	0	3	10	10	0	3	2	0	28
1994[a]	0	0	3	15	11	23	0	0	0	0	52
1995[b]	0	1	0	12	15	11	0	0	0	0	39
Unknown.											
1992	0	0	0	1	0	1	0	0	0	0	2
1993	0	1	2	1	0	0	0	0	1	0	5
1994[a]	0	0	1	0	0	2	0	0	0	0	3
1995[b]	0	0	0	0	1	0	0	0	0	0	1

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

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

Table 52. 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 aoe		
		2.2	2.3	3.4
Natural.				
1992	23	--	23	0
1993	0	--	0	0
1994	1	--	1	0
1995	11	--	10	1
Stray hatchery,				
1992	80	13	67	--
1993	33	0	33	__
1994	55	3	52	--
1995	40	4	36	--

Table 53. Age composition (percent) of jack and adult coho salmon sampled at the Powerdale Dam trap by origin and run year.

Origin, run year	N	Freshwater.total age		
		2.2	2.3	3.4
Natural,				
1992	22	--	100	0
1993	0	--	__	0
1994	1	--	100	0
1995	11	--	90.9	9.1
Stray hatchery.				
1992	79	16.5	83.5	__
1993	28	0	100	--
1994	52	5.8	94.2	--
1995	38	10.5	89.5	__

Table 54. Mean fork length (cm) of jack and adult coho salmon in the 1995 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]
	2.2	2.3	3.4	mean
Natural,				
Female.				
N	--	5	1	6
Mean	--	61.30	60.0	61.08
STD	--	8.81		7.90
Range	--	50.0-71.0	60.0	50.0-71.0
Male,				
N	--	5	--	5
Mean	--	69.00	--	69.00
STD	--	10.14		10.14
Range	--	55.0-82.5	--	55.0-82.5
Total,				
N	--	10	1	11
Mean	--	65.15	60.0	64.68
STD	--	9.83	--	9.46
Range	--	50.0-82.5	60.0	50.0-82.5
Stray hatchery,				
Jacks.				
N	4		--	4
Mean	39.75			39.75
STD	2.47		--	2.47
Range	37.0-42.5			37.0-42.5
Female,				
N	--	7		7
Mean	--	69.57		69.57
STD	--	3.19		3.19
Range	--	64.5-73.0		64.5-73.0
Male.				
N	--	27		27
Mean	--	67.50	--	67.50
STD	--	6.54		6.54
Range	--	56.0-83.0		56.0-83.0
Total,				
N	4	34	--	39
Mean	39.75	67.93	--	65.09
STD	2.47	6.02	--	10.36
Range	37.0-42.5	56.0-83.0		37.0-83.0

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

Table 55. Mean fork length (cm) of jack and adult coho salmon by origin, brood year. and age category. Fish were sampled at the Powerdale Dam trap. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables. Olsen et al. (1994), and Olsen et al. (1995).]

Origin, brood year	Freshwater.total age		
	2.2	2.3	3.4
Natural.			
1989	--	58 (22)	--
1990	--	--	--
1991	--	56 (1)	60 (1)
1992	--	65 (10)	--
Stray hatchery.			
1989	--	58 (66)	--
1990	38 (13)	65 (28)	--
1991	--	69 (49)	--
1992	39 (3)	68 (34)	
1993	40 (4)	--	--

Table 56. Mean weight (gm) of jack and adult coho salmon in the 1995 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
	2.2	2.3	3.4	
Natural,				
Female,				
N		5	1	6
Mean		2.72	2.7	2.72
STD		1.21	--	1.08
Range		1.4-4.1	2.7	1.4-4.1
Male.				
N	--	5	--	5
Mean	--	3.88	--	3.88
STD		1.60	--	1.60
Range		2.0-6.4		2.0-6.4
Total.				
N		10	1	11
Mean		3.30	2.7	3.25
STD		1.47	--	1.41
Range	--	1.4-6.4	2.7	1.4-6.4
Stray hatchery.				
Jacks,				
N	4			4
Mean	0.80			0.80
STD	0.16			0.16
Range	0.6-1.0			0.6-1.0
Female,				
N	--	7	--	7
Mean		3.83		3.83
STD		0.67		0.67
Range		2.7-4.7		2.7-4.7
Male.				
N	--	27		27
Mean		3.46		3.46
STD		1.15		1.15
Range		2.1-6.5		2.1-6.5
Total.				
N	4	34		39
Mean	0.80	3.53		3.26
STD	0.16	1.07		1.31
Range	0.6-1.0	2.1-6.5		0.6-6.5

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

Table 57. Mean weight (kg) of jack and adult coho salmon by origin, brood year, and age category. Fish were sampled at the Powerdale Dam trap. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1995).]

Origin, brood year	Freshwater.total aoe 2.2	2.3	3.4
Natural.			
1989	--	--	—
1990	--	--	--
1991	--	1.8 (1)	2.7 (1)
1992	—	3.3 (10)	--
Stray hatchery,			
1989	--	--	--
1990	--	--	--
1991	—	3.7 (49)	--
1992	0.7 (3)	3.5 (34)	—
1993	0.8 (4)	--	—

Table 58. Jack and adult coho salmon sex ratios as a percentage of females by origin, run year, and age category. Fish were sampled at the Powerdale Dam trap. (Sample size is in parentheses.)

Origin, run year	Freshwater.total age 2.2	2.3	3.4
Natural.			
1992	--	64 (22)	--
1993	--	--	—
1994	--	0 (1)	--
1995	--	50 (10)	100 (1)
Stray hatchery,			
1992	62 (13)[a]	36 (66)	--
1993	--	21 (28)	—
1994	33 (3)[a]	43 (49)	--
1995	0 (4)	21 (34)	--

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

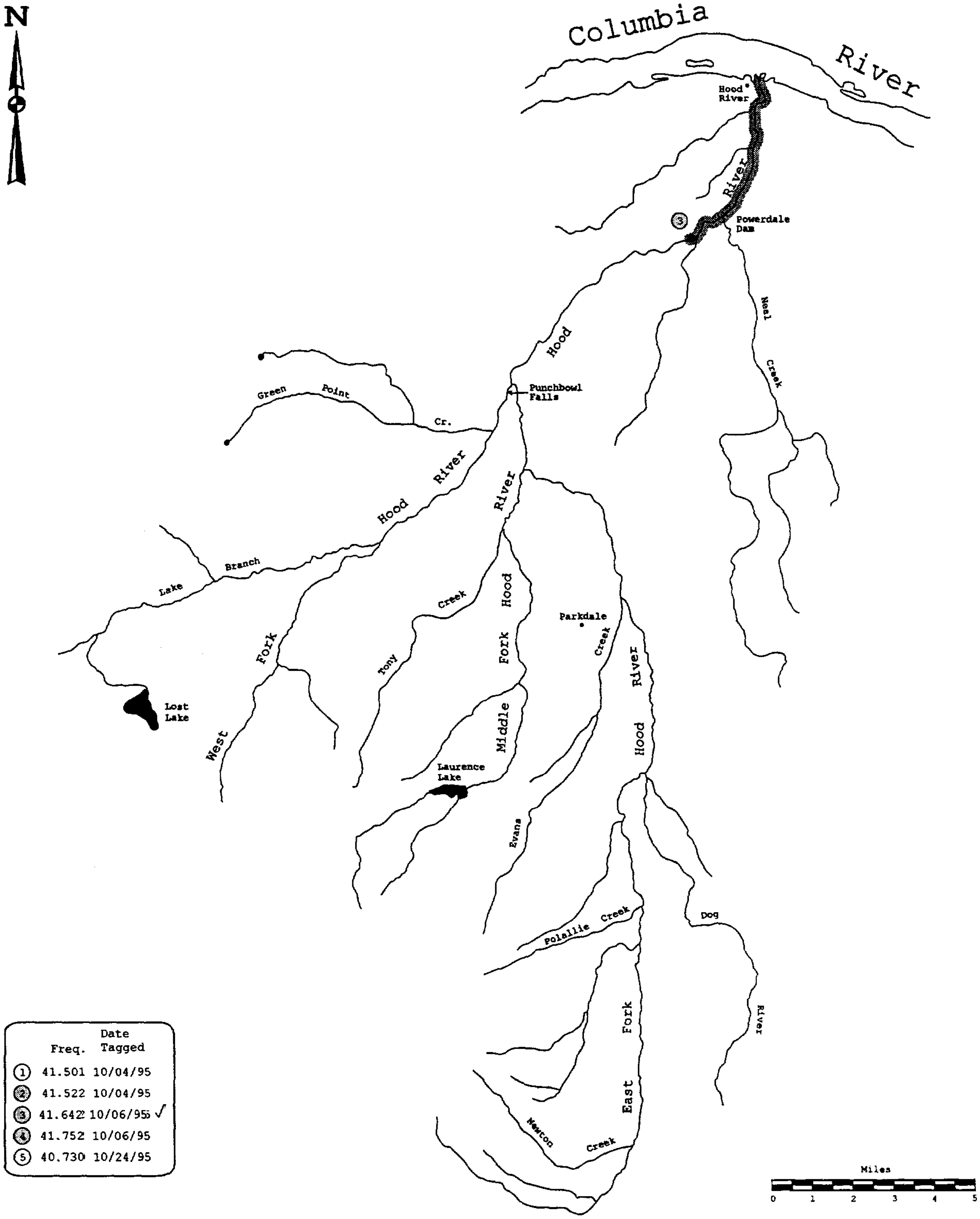


Figure 45. Maximum spatial distribution of radio-tagged natural and hatchery adult coho **salmon during October** 1995. **Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify hatchery produced** coho **salmon.**

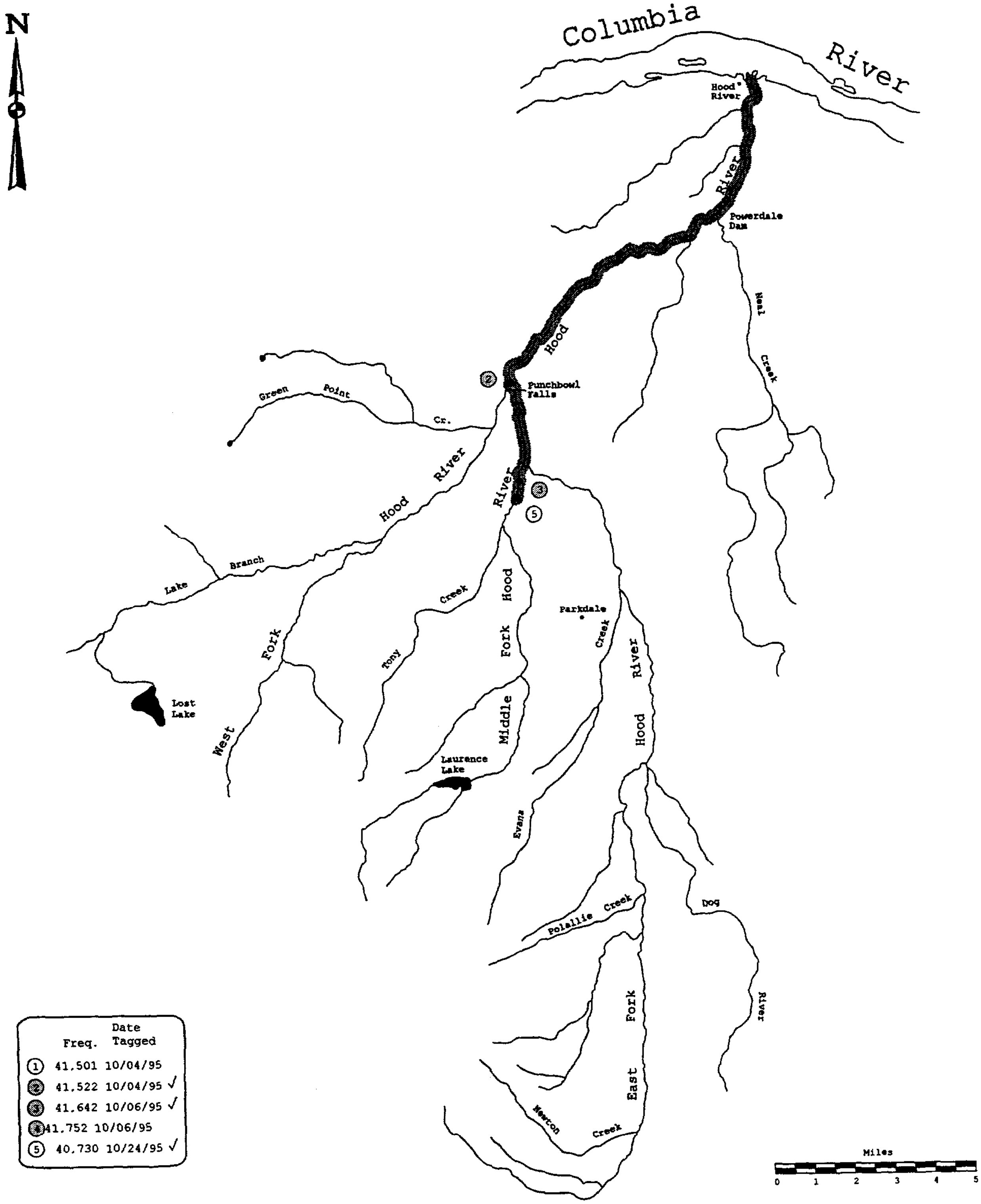


Figure 46. Maximum spatial distribution of radio-tagged natural and hatchery adult coho salmon during November 1995. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify hatchery produced coho salmon.

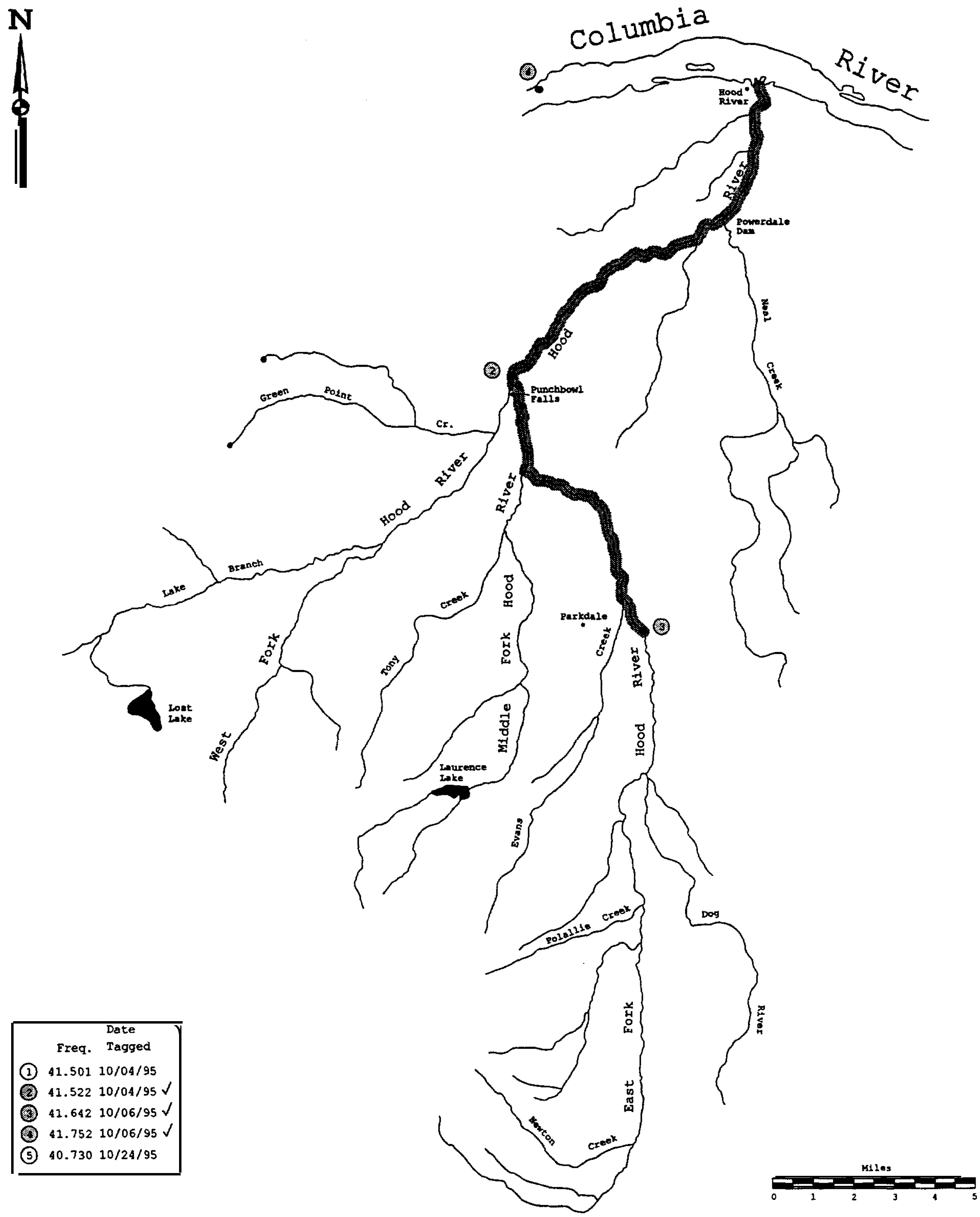


Figure 47. Maximum spatial distribution of radio-tagged natural and hatchery adult coho salmon during December 1995. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced coho salmon.

Table 59. Summary of winter steelhead broodstock collection and egg take in the Hood River subbasin. With the exception of the 1990-91 run year, all hatchery broodstock was collected from the wild component of the adult winter steelhead run escaping to the Powerdale Dam trap.

Run year	Number of females	Number of males	Family groups	Number of spawnings	Total egg take	Number of smolts	Egg to smolt survival
1990-91[a]	3	1	3	2	11,858	4,595	38.8%
1991-92	18	21	57	6	50,748	48,985	96.5%
1992-93	16	18	78	6	62.150	38.034	61.2%
1993-94	26	28	70	8	95.043	42,860	45.1%
1994-95	18	19	47	8	63.790	--	--

[a] Hatchery broodstock was collected from both wild and Dig creek stocks of adult winter steelhead.

Table 60. 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
1987	AD	--	04/04-05/88	4.7	17,249	Hood River
1987	AD	--	04/08/88	4.4	5.500	West Fork Hood River
1987	AD	--	04/04/88	4.5	5,400	West Fork Hood River
1987	AD	--	04/06/88	4.6	10.324	West Fork Hood River
1987	A0	--	04/04-05/88	4.7	17.188	West Fork Hood River
1987	AD	--	04/07/88	5.0	12.350	West Fork Hood River
1988	AD	--	04/07/89	5.3	12.826	Hood River
1988	AD	--	04/11/89	5.5	13.630	Hood River
1988	AD	--	05/02-03/89	4.3	10.213	West Fork Hood River
1988	AD	--	04/10/89	5.3	19.504	West Fork Hood River
1988	AD	--	04/06-12/89	5.5	32.853	West Fork Hood River
1989	AD	--	04/04/90	5.3	4.876	Hood River
1989	AD	--	04/11/90	6.5	10.660	Hood River
1989	AD	--	04/04-05/90	5.3	25,422	West Fork Hood River
1989	AD	--	04/03/90	5.4	5.940	West Fork Hood River
1989	AD	--	04/03-09/90	5.5	20.306	West Fork Hood River
1989	AD	--	04/06/90	5.7	14.591	West Fork Hood River
1990	AD	--	04/29/91	5.4	7,020	Hood River
1990	AD	--	04/30/91	5.5	14.743	Hood River
1990	AD	--	04/24/91	5.8	7.013	Hood River
1990	AD	--	04/22/91	5.2	12,787	West Fork Hood River
1990	AD	--	04/23/91	5.3	6,943	West Fork Hood River
1990	AD	--	04/24/91	5.5	6,869	West Fork Hood River
1990	AD	--	04/23/91	5.6	6,776	West Fork Hood River
1990	AD	--	04/23/91	5.8	14.981	West Fork Hood River
1991	AD	--	04/08/92	4.8	5,880	Hood River
1991	AD	--	04/07/92	5.2	12,870	Hood River
1991	AD	--	04/06/92	5.4	13.365	Hood River
1991	AD	--	04/08/92	5.5	6,958	Hood River
1991	AD	--	04/07/92	4.7	15,082	West Fork Hood River
1991	A0	--	04/07/92	5.2	15.023	West Fork Hood River
1991	AD	--	04/06/92	5.4	13.750	West Fork Hood River
1991	AD	--	04/08/92	5.5	17.045	West Fork Hood River
1992	AD	--	04/07-08/93	6.0	33.570	West Fork Hood River
1992	AD	--	05/04/93	6.3	17.955	West Fork Hood River
1992	AD	--	05/05/93	6.5	19.403	West Fork Hood River

Table 60. 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	4.8	5.880	West Fork Hood River
1993	A0	--	03/30-31/94	5.2	12.402	West Fork Hood River
1994	AD	--	04/11/95	4.6	13,600	West Fork Hood River
1994	AD	--	04/10-11/95	5.3	46,232	West Fork Hood River
1994	AD	--	04/12/ 95	5.5	16.498	West Fork Hood River

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

[b] Ad = Adipose.

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

Table 61. 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
1989	Ad	--	04/12/90	4.7	4.253	Middle Fork Hood River
1989	Ad	--	04/12/90	4.7	7,755	East Fork Hood River
Gnat Creek,						
1987	No mark	--	04/22/88	5.6	28.000	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,						
1991	Ad	--	03/31/92	4.6	4,595	East Fork Hood River
Hood River,						
Oak Springs,						
1992	Ad-LP	--	04/06/93	5.8	15,225	Middle Fork Hood River
1992	Ad-LP	--	04/06/93	6.0	15.420	East Fork Hood River
1992	Ad-LP	--	04/06/93	5.6	18,340	East Fork Hood River
1993	Ad-LM	--	04/12-13/94	4.5	7,423	East Fork Hood River
1993	Ad-LV;07-05-36	--	04/12-13/94	4.5	6.863	East Fork Hood River
1993	Ad-LV;07-05-37	--	04/12-13/94	4.5	6.189	East Fork Hood River
1993	Ad-LM	--	04/12/94	5.4	2.414	East Fork Hood River
1993	Ad-LV;07-05-38	--	04/12/94	5.4	6,445	East Fork Hood River
1993	Ad-LV;07-05-39	--	04/12/94	5.4	6.531	East Fork Hood River
1993	Ad-LP	--	06/28/94	5.0	2,169	East Fork Hood River
1994	Ad-LV;07-08-63	--	04/19-20/95	5.1	10.534	East Fork Hood River
1994	Ad-LV;07-09-16	--	04/19-20/95	5.1	10,367	East Fork Hood River
1994	Ad-LV;07-09-17	--	04/19/95	5.4	3.426	East Fork Hood River
1994	Ad-LV;07-09-17	--	04/19/95	5.8	7.707	East Fork Hood River
1994	Ad-LV;07-09-18	--	04/19/95	5.4	3.331	East Fork Hood River
1994	Ad-LV;07-09-18	--	04/19/95	5.8	7.495	East Fork Hood River

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

Table 62. Hatchery juvenile spring chinook salmon releases in the Hood River subbasin by brood year[a].

Life history stage, broodstock. hatchery, brood year	Fin clip[b] or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released	Release location
Fingerling,						
Carson.						
Irrigon.						
1985	No mark	--	06/18/86	23.0	92.680	West Fork Hood River
Smolt.						
Carson,						
Bonneville						
1986	No mark	--	03/14/88	9.4	11.724	West Fork Hood River
1986	No mark	--	03/14/88	9.7	30.895	West Fork Hood River
1986	No mark	--	03/14/88	10.1	11.644	West Fork Hood River
1986	No mark	--	03/14/88	10.2	12.288	West Fork Hood River
1986	No mark	--	03/14/88	10.5	4.988	West Fork Hood River
1986	No mark	--	03/14/88	10.8	9.150	West Fork Hood River
1986	No mark	--	03/14/88	11.1	14.570	West Fork Hood River
1986	Ad;07-42-57	--	03/14/88	11.2	34.548	West Fork Hood River
1986	Ad;07-42-57	--	03/14/88	11.4	14.443	West Fork Hood River
1986	Ad;07-42-57	--	03/14/88	11.6	5.689	West Fork Hood River
1987	No mark	--	03/09/89	10.0	33,013	West Fork Hood River
1987	No mark	--	03/09/89	10.8	31,828	West Fork Hood River
1987	No mark	--	03/09/89	11.0	7.419	West Fork Hood River
1987	Ad;07-42-58	--	03/09/89	11.0	24.698	West Fork Hood River
1987	No mark	--	03/09/89	11.1	8.568	West Fork Hood River
1987	Ad;07-42-58	--	03/09/89	11.1	28,521	West Fork Hood River
1988	Ad;07-52-23	--	03/13/90	9.4	23.970	West Fork Hood River
1988.	No mark	--	03/12-13/90	9.9	42,565	West Fork Hood River
1988	No mark	--	03/13/90	10.0	20.799	West Fork Hood River
1988	Ad;07-52-23	--	03/13/90	10.0	10.650	West Fork Hood River
1988	No mark	--	03/12/90	10.1	11.209	West Fork Hood River
1988	No mark	--	03/12/90	10.2	13.973	West Fork Hood River
1988	Ad;07-52-23	--	03/14/90	10.2	10.761	West Fork Hood River
1988	No mark	--	03/12-13/90	10.3	30.483	West Fork Hood River
1988	Ad;07-52-23	--	03/14/90	10.4	14.144	West Fork Hood River
1988	No mark	--	03/12/90	10.5	7,770	West Fork Hood River
1988	No mark	--	03/12/90	10.8	11.664	West Fork Hood River
1989	Ad;07-55-30	--	03/25/91	9.4	53.614	West Fork Hood River
1989	No mark	--	03/25/91	9.8	29.399	West Fork Hood River
1989	No mark	--	03/25/91	11.2	42.419	West Fork Hood River
1990	No mark	--	04/02/92	9.7	41,647	West Fork Hood River
1990	No mark	--	04/02/92	9.9	62,954	West Fork Hood River
1990	Ad;07-56-59	--	04/02/92	10.2	58,694	West Fork Hood River

Table 62. 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	Ad;07-33-35	--	04/01/93	11.2	11.760	West Fork Hood River
1991	Ad;07-33-35	--	04/01/93	11.3	34,685	West Fork Hood River
1992[c]	--	--	--	--	--	--
Round Butte,						
1991	Ad;07-50-22 R2	--	04/08-09/93	6.7	28.760	West Fork Hood River
1992c	--	--	--	--	--	--
1993	Ad;07-05-49	- -	04/04-05/95	13.1	13,111	West Fork Hood River
1993	Ad;07-05-49	- -	04/03-04/95	13.2	13.211	West Fork Hood River
1993	Ad;07-05-49	- -	04/03/95	13.7	12.865	West Fork Hood River
1993	Ad;07-05-49	- -	04/04/95	13.8	13.175	West Fork Hood River
1993	No mark	--	04/04-05/95	13.1	29.455	West Fork Hood River
1993	No mark	--	04/03-04/95	13.2	29,682	West Fork Hood River
1993	No mark	--	04/03/95	13.7	28.905	West Fork Hood River
1993	No mark	--	04/04/95	13.8	29.600	West Fork Hood River

[a] The 1986 brood release is the first production release of hatchery spring chinook smolts into the Hood River subbasin.
[b] Ad = Adipose.
[c] No hatchery spring chinook salmon were released from the 1992 brood.

Table 63. Estimated numbers of hatchery summer and winter steelhead smolts migrating past a juvenile migrant trap located at RM 4.5 in the mainstem Hood River. (Population estimators and sampling period are in Appendix B.)

Race, brood year	Hatchery production release	Estimated number of smolts past mainstem migrant trap: Estimate[a]	95% C.I.	% of production release: Estimate	Range
Summer.					
1993	90.042	38,234	26,260 - 50.209	42.5	29 - 56
1994	76,330	47.281	3.162 - 91.400	61.9	4 - 100
Winter.					
1993	38.034	12,201	5.739 - 18.664	32.1	15 - 49
1994	42.860	16,344	1.173 - 31.515	38.1	3 - 74

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

Statistic, size group, brood year	N	Mean	Range	95% C.I.
FL (mm),				
Small,				
1993[b]	130	183.8	115 - 234	± 4.2
Medium,				
1993	192	193.1	82 - 283	± 3.9
1994	207	185.7	116 - 234	± 2.7
Large,				
1993	185	200.2	144 - 246	± 2.9
1994	200	196.9	138 - 247	± 2.5
Weight (gms),				
Small,				
1993	129	69.5	16.0 - 145.5	± 4.8
Medium,				
1993	192	87.2	6.1 - 236.4	± 4.6
1994	207	72.8	16.5 - 154.0	± 3.1
Large,				
1993	185	91.1	33.1 - 168.5	± 3.8
1994	199	86.2	29.6 - 172.1	± 3.2
CF,[b]				
Small,				
1993	129	1.06	0.88 - 1.22	± 0.006
Medium,				
1993	192	1.15	0.97 - 1.35	± 0.005
1994	207	1.10	0.94 - 1.25	± 0.01
Large,				
1993	185	1.10	0.93 - 1.31	± 0.005
1994	199	1.10	0.97 - 1.24	± 0.01

[a] Juveniles were sampled approximately one week prior to release in mid-April

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

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

Table 65. Estimates of mean fork length (FL: mm), weight (gm), and condition factor (CF) for downstream migrant hatchery spring chinook salmon and summer and winter steelhead released into the Hood River subbasin. (Estimates are for 1993 brood hatchery spring chinook salmon and 1994 brood hatchery summer and winter steelhead sampled at the mainstem migrant trap.)

Statistic, race/species	Sampling period	N	Mean	Range	95% C.I.
FL (mm),					
Spring chinook	04/06-04/10/95	108	144.6	126 - 180	± 2.1
Summer steelhead	04/12-10/03/95	622	208.3	103 - 270	± 1.3
Winter steelhead	04/20-07/04/95	394	208.0	152 - 261	± 1.5
Weight (gm),					
Spring chinook	04/06-04/10/95	108	34.2	21.8 - 66.2	± 1.7
Sumner steelhead	04/12-10/03/95	615	89.5	25.9 - 193.5	± 1.7
Winter steelhead	04/20-07/04/95	385	89.4	29.8 - 198.6	± 1.1
CF,[a]					
Spring chinook	04/06-04/10/95	108	1.11	0.99 - 1.32	± 0.01
Summer steelhead	04/12-10/03/95	614	0.97	0.70 - 1.21	± 0.01
Winter steelhead	04/20-07/04/95	385	0.97	0.77 - 1.31	± 0.01

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

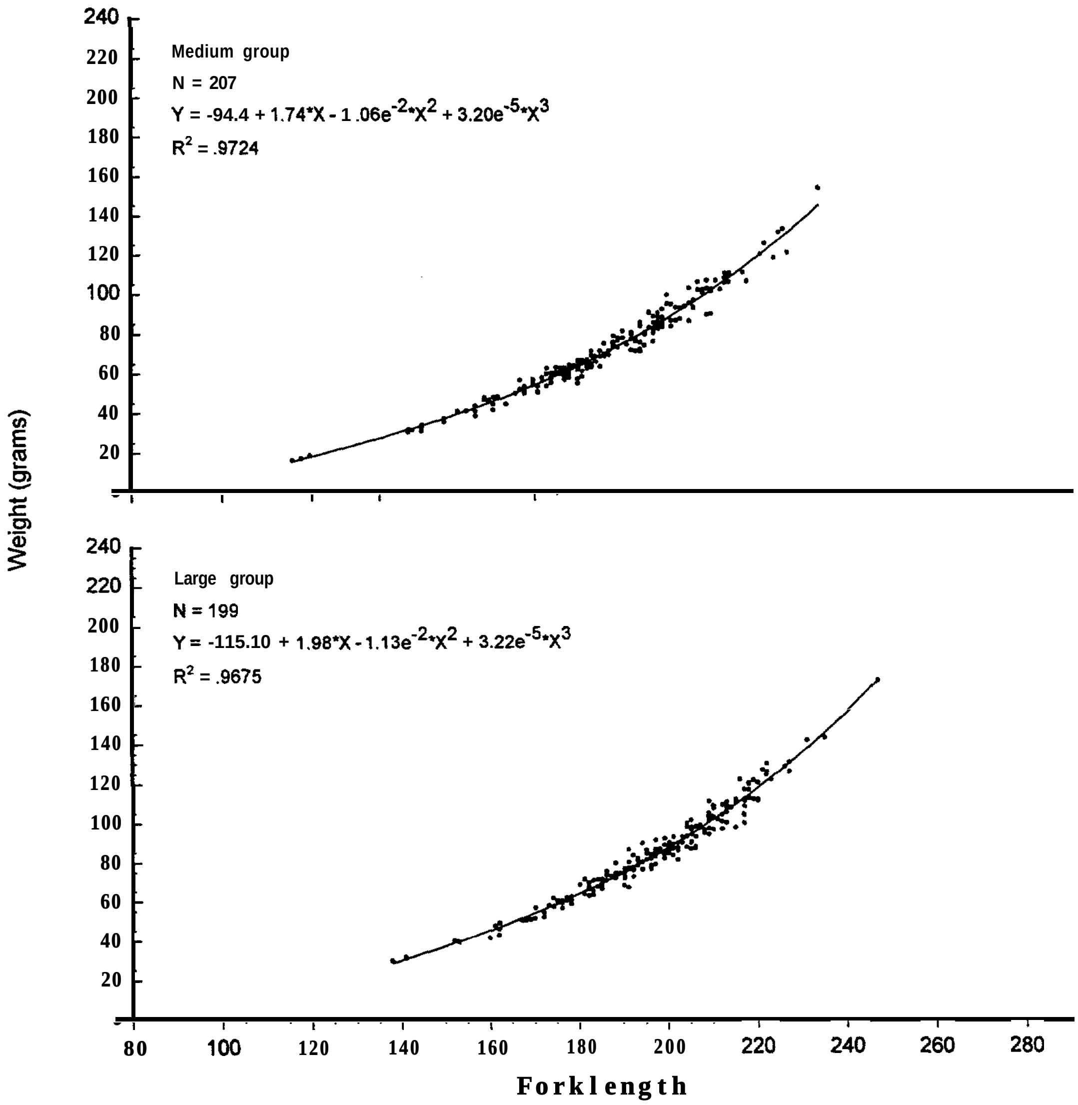


Figure 48. Length x weight regression of medium- and large-sized groups of Hood River stock hatchery winter steelhead released into the Hood River subbasin **from Oak Springs Hatchery,** 1995.

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APPENDIX A

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

Appendix Table A-1. Removal estimates of population nunbers for two size categories of rainbow-steelhead sampled in selected reaches of stream located in the Hood River subbasin. 1994. Included are nunbers of fish sampled in each pass.

Location. sampling area	Sampling date	River mile	Reach length (ml	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	± 1.6
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	±37.4	117	41	16	182.8	± 8.9	391.5	84.8
Lake Branch	09/22/94	0.2	63.0	187	77	35	324.2	±17.3	67	30	11	116.5	± 9.8	440.7	±19.8
Lake Branch	09/21/94	4.0	65.0	5	4	5	17.9[d]	—	52	18	5	77.6	± 4.5	95.5	± 8.4
Lake Branch	08/30/94	7.0	60.0	10	3	0	13.1	c	9	6	0	15.7	c	28.6	c
Red Hill Cr	09114194	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	± 2.2
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	39.5	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 R.	09/08/94	0.5	60.0	48	12	3	64.0	± 2.5	53	14	3	71.1	± 2.6	135.1	± 3.6
EFk Hood R.	09/12/94	5.5	60.0	60	18	4	83.8	± 3.4	14	4	1	19.4	c	103.2	± 3.8
EFk Hood R.	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 Zippln (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 assunptions 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 sun of the estimated population sizes in each size category.

[c] Estimated population size too small to accurately estimate confidence limits (see 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. Removal estimates of population numbers for two size categories of cutthroat trout sampled in selected reaches of stream located in the Hood River subbasin. 1994. Included are numbers 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 R.	09/08/94	0.5	60.0	3	3	0	6.5	c	1	0	0	1.0	c	7.4	c
EFk Hood R.	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	± 6.7
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	± 5.1

[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 sun of the estimated population sizes in each size category.

[c] Estimated population size too small to accurately estimate confidence limits (see 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 Table A-3. Removal estimates of population numbers for two size categories of rainbow-steelhead sampled in selected reaches of stream located in the Hood River subbasin, 1995. Included are nunbers 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 lenoth					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	08/22/95	0.0	60.0	7	6	2	19.0	c	4	1	0	5.0	c	22.5	c
Neal Creek	08/23/95	1.5	60.0	9	0	1	10.1	c	7	5	1	14.5	c	23.9	c
Neal Creek	08/28/95	5.0	60.0	66	36	7	116.3	± 8.7	9	3	0	12.1	c	128.0	± 8.2
Lenz Creek	09/06/95	0.5	60.0	0	0	0	0	--	0	0	0	·0	—	0	--
West Fork.															
Greenpoint Cr	09/07/95	1.0	71.0	71	37	8	123.7	± 8.9	64	19	9	96.1	± 5.9	219.6	±10.4
Lake Branch	09/20/95	0.2	60.0	230	92	26	364.8	±12.1	32	6	4	43.0	c	407.6	i12.3
Lake Branch	09/26/95	4.0	60.0	14	8	1	24.3	c	40	12	7	62.5	± 5.8	86.8	± 6.8
Lake Branch	08/31/95	7.0	60.0	11	6	4	26.5	c	35	12	—	53.3	±10.9	68.2	± 9.0
Red Hill Cr	09/13/95	1.0	60.0	2	0	0	2.0	c	16	2	0	18.0	c	20.0	c
McGee Creek	08/18/95	0.5	65.0	6	1	1	8.3	c	19	3	1	23.2	c	31.4	c
Elk Creek	08/21/95	0.5	69.7	30	12	9	59.1	i12.4	27	7	2	36.7	c	93.4	± 8.3
Middle Fork.															
Tony Creek	09/18/95	1.0	60.0	26	3	0	29.0	c	4	0	0	4.0	c	33.0	
East Fork,															
EFk Hood R.	09/14/95	0.5	60.0	23	9	--	37.8	c	25	9	--	39.1	c	76.8	i15.6
EFk Hood R.	09/12/95	5.5	60.0	61	6	--	67.7	± 2.0	5	7	--	14.5[d]	c	82.2	± 5.4
EFk Hood R.	09/11/95	20.2	60.0	0	—	--	0[e]	--	0	--	--	0[e]	—	0[e]	--
Dog River	08/30/95	0.5	60.0	5	1	2	9.6	c	3	0	0	3.0	c	11.7	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 sun of the estimated population sizes in each size category.

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

[d] Population estimate for rb-st greater than or equal to 85mm was determined by subtracting the estimate for the smaller size category from the estimated total.

[e] Only one pass made. Estimate assumed to be 0

Appendix Table A-4. Removal estimates of population nunbers for two size categories of cutthroat trout sampled in selected reaches of stream located in the Hood River subbasin. 1995. Included are numbers 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	08/23/95	1.5	60.0	0	0	0	0	--	0	0	1	1.0[d]	--	1.0[d]	e
Neal Creek	08/28/95	5.0	60.0	3	3	3	13.0[c]	--	2	1	1	5.8	e	--	--
Lenz Creek	09/06/95	0.5	60.0	0	0	0	0	--	0	0	0	0	--	0	--
Middle Fork,															
Tony Creek	09/18/95	1.0	60.0	8	4	2	16.0	e	29	11	2	43.3	e	58.6	±4.8
Bear Creek	08/29/95	0.6	60.0	19	11	5	41.0	e	54	18	5	79.5	±4.3	118.4	±7.8
East Fork.															
EFk Hood R.	09/14/95	0.5	60.0	6	2	--	9.0	e	1	0	--	1.0	e	9.8	e
EFk Hood R.	09/11/95	20.2	60.0	0	—	--	0[f]	—	0	--	--	0[f]	--	0[f]	--
Dog River	08/30/95	0.5	60.0	2	0	0	2.0	e	15	4	0	19.1	e	21.1	e
Tilly Jane Cr	09/22/95	0.1	60.0	55	14	7	78.6	±4.4	35	3	1	39.1	e	116.8	±3.3
Robinhood Cr	09/08/95	1.0	60.0	45	7	2	54.3	i1.3	30	7	2	39.6	e	93.9	i2.1

[a] The standard error formula in Zippin (19581 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] Estimate was derived by expanding the population estimate for the upper size category by the lower:upper size category ratio observed in the sample population.

[d] Estimate assumed to be one.

[e] Estimated population size too small to accurately estimate confidence limits (see Zippin 1958).

[f] Only one pass made. Estimate assumed to be 0.

APPENDIX B

Parameters Used to Estimate Rainbow-Steelhead Migrants to the Mainstem Migrant Trap

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

Origin, race, year	Sampling period	M	C	R	Percent recapture
Wild,					
Unknown,[a]					
1994	03/23-07/31/94	354	418	14	3.9
1995	03/30-07/31/95	226 (337)	248	6 (5)	2.7 (1.4)
Hatchery,					
Sumner,					
1994	03/23-07/31/94	1.110	1.410	40	3.6
1995	03/30-07/31/95	1.100 (1.296)	1.470	19 (9)	1.7 (0.7)
Winter,					
1994	03/23-07/31/94	429	453	15	3.5
1995	03/30-07/31/95	460 (1.256)	500	3 (23)	0.7 (1.8)

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

APPENDIX C

Summary of Fish Biomass per m^2 and m^3 at Selected Sampling Sites in the Hood River Subbasin

Appendix Table C-l. Estimates of surface area (m^2/100 m), density (fish/1000 m^2), and biomass (grams/100 m^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 (i.e.. rb-st and cutthroat trout) are presented in Appendix A.)

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	587.8	0	20	68(9)	0	0	85	0	2,456	2.629	0	246(117)	0	90	0	709	1.045
Neal Cr	5.0	493.1	0	296	122(7)	0	3	0	0	542	963	0	282(--)	14	0	0	252	548
Lenz 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	744	0	0	0	201	945
Lake Branch	0.2	1.294.7	0	397	143(1)	0	0	0	0	1.238	1,778	0	431(17)	0	0	0	829	1.260
Lake Branch	4.0	1.200.3	0	23[b]	99	0	0	0	0	861	983	0	418	0	0	0	703	1.121
Lake Branch	7.0	702.7	0	31	37	0	0	0	22	891	981	0	84	0	0	32	388	504
Red Hill Cr	1.0	341.6	0	33b	73	0	0	0	0	0	106	0	261	0	0	0	0	261
McGee Cr	0.5	728.7	0	50	79	0	0	0	0	62	191	0	155	0	0	0	49	204
Elk Cr	0.5	600.3	15	46	59	0	0	0	0	135	255	8	207	0	0	0	96	311
Middle Fork.																		
MFk Hood R.	1.8	844.8		—	--	—	—	--	—	—	--	—	--	--	--	—	--	--
MFk Hood R.	4.5	992.9	0	45	22	0	0	0	0	63	130	0	79	0	0	0	34	113
MFk Hood R.	9.5	795.0		—	—	—	—	--	—	—	—		--	--	--	--	--	--
Tony Creek	0.7	551.7	—	--	—	—	--	—	—	—	--		--	--	--	—	—	--
Tony Creek	1.0	595.9	0	17	54	46	85	0	0	198	400	0	115	163	0	0	116	394
Bear Cr[c]	0.6	645.4	0	0	0	55	223	0	0	0	278	0	0	377	0	0	0	377
East Fork.																		
EFk Hood R.[d]	0.5	1.337.1	1[e]	80	89(4)	a	1	1	0	189	369	1[e]	338(43)	5	1	0	126	471
EFk Hood R.[d]	5.5	707.1	0	198	46(12)	0	0	0	0	509	753	0	167(47)	0	0	0	414	595
EFk Hood R.	5.9	1,475.0		—	—	—	--	—	--	—	--		--	--	—	--	—	--
EFk Hood R.	20.2	887.0	0	0	2	0	4	0	0	2	8	0	11	14	0	0	3	28
Bog 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	38	113	0	17	406	574	0	0	172	0	2	280	454
Robinhood Cr	1.0	327.9	0	0	0	155	238	0	0	460	853	0	0	637	0	0	233	870

[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.

Appendix Table C-Z. Estimates of volume (m^3/100 m), density (fish11000 m^3), and biomass (grams/100 m^3) for resident 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 nunbers for each pass (i.e.. rb-st and cutthroat trout) are presented in Appendix A.)

Location, sampling area	River mile	m^3/100 m	Fish/1000 m^3 ChSp	Rb-St <85mm	Rb-St ≥85mm	Cutthroat <85mm	Cutthroat ≥85mm	Coho	Brook trout	cot	Total	Grams/100 m^3 ChSp	Rb-St	Ct	Coho	Brook trout	Cot	Total
Mainstem.																		
Neal Cr	0.2	129.5	--	—	—	--	--	--	—	--	--	--	--	--	--	--	--	--
Neal Cr	1.5	163.4	0	71	245(31)	0	0	307	0	8.839	9.462	0	888(421)	0	323	0	2,551	3.762
Neal Cr	5.0	74.2[b]	0	1.968	809(45)	0	22	0	0	3.606	6.405	0	1,869(--)	104	0	0	1,678	3.651
Lenz Cr	0.5	45.4	0	0	37	0	0	37	0	0	74	0	121	0	53	0	0	174
West fork.																		
Greenpoint Cr	1.0	115.4	0	2,913	2.401	0	0	0	0	1.744	7.058	0	6,271	0	0	0	1.697	7.968
Lake Branch	0.2	268.7	0	1.915	688(6)	0	0	0	0	5.963	8.566	0	2,076(80)	0	0	0	3.994	6.070
Lake Branch	4.0	201.6	0	137c	592	0	0	0	0	5.125	5.854	0	2,498	0	0	0	4.187	6.685
Lake Branch	7.0	63.7	0	343	411	0	0	0	241	9.825	10.820	0	938	0	0	352	4.281	5.571
Red Hill Cr	1.0	24.3	0	466[c]	1.027	0	0	0	0	0	1.493	0	3.676	0	0	0	0	3.676
McGee Cr	0.5	85.3[b]	0	428	673	0	0	0	0	534	1.635	0	1.320	0	0	0	421	1.741
Elk Cr	0.5	54.3[b]	166	508	657	0	0	0	0	1.487	2,818	92	2.302	0	0	0	1.056	3.450
Middle Fork,																		
MFk Hood R.	1.8	303.0	—	--	--	—	—	—	--	—	--	--	--	—	--	—	--	--
MFk Hood R.	4.5	138.6	0	322	160	0	0	0	0	454	936	0	574	0	0	0	246	820
MFk Hood R.	9.5	162.8	--	--	--	--	—	—	--	—	--	—	—	—	--	--	--	--
Tony Cr	0.7	20.0	—	--	—	—	--	--	--	—	--	—	--	—	--	—	--	--
Tony Cr	1.0	61.2	0	163	528	452	825	0	0	1.925	3,893	0	1,123	1.581	0	0	1.131	3,835
Bear Cr[d]	0.6	73.2[b]	0	0	0	483	1.966	0	0	0	2.449	0	0	3,321	0	0	0	3.321
East Fork.																		
EFk Hood R.[e]	0.5	261.8	6[f]	407	453(19)	41	6	6	0	964	1.883	6[f]	1,720(221)	28	6	0	642	2.402
EFk Hood R.[e]	5.5	86.1	0	1.623	376(97)	0	0	0	0	4.183	6.182	0	1,365(388)	0	0	0	3,403	4,887
EFk Hood R.	5.9	388.2	--	—	--	--	--	--	—	--	--	--	--	--	--	—	—	--
EFk Hood R.	20.2	163.1	0	0	10	0	20	0	0	10	40	0	53	72	0	0	16	141
Dog River[d]	0.7	54.3[b]	0	0	0	615	922	0	0	1.999	3,536	0	0	2,442	0	0	1.196	3,638
Tilly Jane Cr	0.1	42.5	0	0	0	376	1.113	0	172	4.016	5.677	0	0	1,695	0	25	2.770	4,490
Robinhood Cr	1.0	58.7	0	0	0	866	1.331	0	0	2.569	4.766	0	0	3,564	0	0	1.299	4,863

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

[b] Only four depths taken to estimate volume.

[c] Population estimates for the lower size category here determined by subtracting the estimate for the larger size category from the estimated total population.

[d] 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.

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

[f] May be a coho salmon mls-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.

Appendix Table C-3. Estimates of surface area (m^2/100 m), density (fish/1000 m^2), and biaaass (grams/100 m^2) for resident salmonids[a] and non-salmonids[a] sampled at selected sites in the Hood River subbasin, 1995. (Estimates for hatchery produced steelhead are in parentheses. Sampling dates, reach lengths, and removal numbers for each pass (i.e.. rb-st and cutthroat trout) are presented in Appendix A.)

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	0.0	824.4	23	38	10	0	0	0	0	304	375	35	40	0	0	0	27	102
Neal Cr	1.5	521.3	0	32	46	0	3[b]	0	0	5.120	5.201	0	182	8	0	0	1,556	1.746
Neal Cr	5.0	548.0	0	354	37	40[c]	18	0	0	883	1.332	0	197	60	0	0	416	673
Lenz Cr	0.5	351.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West Fork.																		
Greenpoint Cr	1.0	1,010.4	0	172	134	0	0	0	0	156	462	0	424	0	0	0	139	563
Lake Branch	0.2	1.290.1	0	471	56(3)	0	0	0	0	548	1.075	0	258(29)	0	0	0	340	598
Lake Branch	4.0	1,205.5	0	34	86	0	0	0	0	467	587	0	177	0	0	0	210	387
Lake Branch	7.0	709.7	0	62	125	0	0	0	33	1.627	1.847	0	345	0	0	61	501	907
Red Hill Cr	1.0	334.0	0	10	90	0	0	0	0	0	100	0	221	0	0	0	0	221
McGee Cr	0.5	769.4	0	17	46	0	0	0	0	145	208	0	171	0	0	0	145	316
Elk Cr	0.5	632.2	0	134	83	0	0	0	0	108	325	0	202	0	0	0	104	306
Middle Fork,																		
MFk Hood R.	4.5	1.150.6	--	—	--	--	—	--	--	--	--	--	—	--	—	--	--	--
MFk Hood R.	9.5	704.4		—	--	--	--	--	--	--	—	--	--	—	--	--	--	—
Tony Cr	1.0	536.7	0	90	12	50	134	0	0	140	426	0	51	400	0	0	131	582
Bear Cr	0.6	558.3	0	0	0	122	237	0	0	0	359	0	0	501	0	0	0	501
East Fork.																		
EFk Hood R.	0.5	1.436.6	0	44	45(1)	10	1	0	0	84	184	0	109(15) 1	1	0	0	47	167
EFk Hood R.[d]	5.5	1.133.9	0	100	21(10)	0	0	0	0	149	270	0	82(55)	0	0	0	92	174
EFk Hood R.[e]	20.2	1.046.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dog River	0.7	579.6	0	28	9	6	55	0	0	262	360	0	31	185	0	0	157	373
Tflly Jane Cr	0.1	622.2	0	0	0	211	105	0	5	1.275	1.596	0	0	272	0	5	612	889
Robinhood Cr	1.0	320.2	0	0	0	283	206	0	0	982	1,471	0	0	582	0	0	422	1.004
Rogers Cr	0.2	143.3		—	—	--	—	--	--	—	--		—	—	—	—	--	—

[a] ChSp = spring chinook, Rb-St = rainbow-steelhead, Cot = Cottid, Ct = cutthroat trout.
[b] Estimate derived based on total catch.
[c] Population estimate was derived by expanding the population estimate for the upper size category by the lower:upper size category ratio observed in the sample population
[d] Population estimate for wild rb-st greater than or equal to 85mm was determined by subtracting the estimate for the smaller size category fran the estimated total.
[e] Only one pass was made. Population estimate was assuned to be zero for all species.

Appendix Table C-4. Estimates of volume (m³/100 m), density (fish/1000 m³), and biomass (grams1100 m³) for resident salmonids[a] and non-salmonids[a] sampled at selected sites in the Hood River subbasin. 1995. (Estimates for hatchery produced steelhead are in parentheses. Sampling dates, reach lengths, and removal numbers for each pass (i.e., rb-st and cutthroat trout) are presented in Appendix A.)

Location. sampling area	River mile	m³/100 m	Fish/1000 m³ ChSp	Rb-St <85mm	Rb-St ≥85mm	Cutthroat <85mm	Cutthroat ≥85mm	Coho	Brook trout	cot	Total	Grams1100 m³ ChSp	Rb-St	Ct	Coho	Brook trout	Cot	Total
Mainstem.																		
Neal Cr	0.0	183.5	103	173	45	0	0	0	0	1.364	1.685	157	182	0	0	0	119	458
Neal Cr	1.5	131.2	0	128	,184	0	13b	0	0	20.344	20.669	0	730	33	0	0	6.182	6,945
Neal Cr	5.0	82.4	0	2,352	245	263[c]	117	0	0	5,873	8.850	0	1.306	390	0	0	2,764	4.460
Lenz Cr	0.5	78.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West Fork,																		
Greenpoint Cr	1.0	133.5	0	1.305	1.014	0	0	0	0	1,177	3,496	0	3.208	0	0	0	1.048	4.256
Lake Branch	0.2	307.1	0	1.980	233(11)	0	0	0	0	2.303	4.516	0	1.079(120)	0	0	0	1.429	2.508
Lake Branch	4.0	237.8	0	170	438	0	0	0	0	2.369	2.977	0	897	0	0	0	1.067	1.964
Lake Branch	7.0	109.2	0	404	813	0	0	0	212	10.576	12.005	0	2.246	0	0	392	3,259	5.897
Red Hill Cr	1.0	24.4	0	137	1.229	0	0	0	0	0	1.366	0	3.016	0	0	0	0	3.016
McGee Cr	0.5	118.8	0	107	300	0	0	0	0	936	1.343	0	1.115	0	0	0	936	2.051
Elk Cr	0.5	73.1	0	1.160	720	0	0	0	0	936	2.816	0	1,752	0	0	0	902	2.654
Middle Fork,																		
MFk Hood R.	4.5	257.0	--	--	--	--	--	--					—	—	—	--	--	—
MFk Hood R.	9.5	138.4	—		--	--		—	--	--	--		--	--	—	--	--	--
Tony Cr	1.0	61.8	0	783	108	432	1.169	0	0	1.214	3.706	0	454	3.485	0	0	1.137	5.076
Bear Cr	0.6	65.8	0	0	0	1.038	2,014	0	0	0	3.052	0	0	4.261	0	0	0	4.261
East Fork.																		
EFk Hood R.	0.5	507.6	0	124	128(3)	30	3	0	0	238	523	0	311(44)	3 2	0	0	132	475
EFk Hood R.[d]	5.5	296.5	0	381	81(39)	0	0	0	0	570	1.032	0	314(211)	0	0	0	354	668
EFk Hood R.[e]	20.2	265.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dog River	0.7	45.4	0	353	110	73	702	0	0	3.346	4.584	0	376	2.354	0	0	2,001	4.731
Tilly Jane Cr	0.1	47.2	0	0	0	2.774	1.380	0	71	16.801	21.026	0	0	3.572	0	77	8.066	11,715
Robinhood Cr	1.0	61.7	0	0	0	1.468	1.070	0	0	5.098	7.636	0	0	3.023	0	0	2.193	5.216
Rogers Cr	0.2	21.4	--	—	--	—	--	—	—	—	--	--	--	—	--	--	--	--

[a] ChSp = spring chinook, Rb-St = rainbow-steelhead, Cot = Cottid. Ct = cutthroat trout.
[b] Estimate derived based on total catch.
[c] Population estimate was derived by expanding the population estimate for the upper size category by the lower:upper size category ratio observed in the sample population
[d] Population estimate for wild rb-st greater than or equal to 85mm was determined by subtracting the estimate for the smaller size category from the estimated total.
[e] Only one pass was made. Population estimate was assumed to be zero for all species.

APPENDIX D

Length x Weight Regression Coefficients for Fish Sampled in the Hood River Subbasin

Appendix Table D-1. Regression coefficients and coefficient of multiple determination for second and third order polynomial functions[a] defined by the regression of weight on length for rainbow-steelhead sampled at selected locations in the Hood River subbasin. by area and river mile.

Location. Area. Year	RM	Sample Size	Regression coefficients b_0	b1	b2	b3	Range of independent variable X	R2
Mainstem.								
Neal Cr.								
1995	0	21	-5.6414	2.2860*10-l	$-2.9205*10^{-3}$	$2.3571*10^{-5}$	46-148	.9972
1994	1.5	27	20.1214	$-5.0545*10^{-1}$	$3.9989*10^{-3}$	$6.3696*10^{-7}$	67-203	9958
1995	1.5	23	-18.1375	$6.6836*10^{-1}$	$-7.3978*10^{-3}$	$3.7550*10^{-5}$	54-182	.9952
1994	5.0	104	$-3.2042*10^{-1}$	$1.9167*10^{-2}$	$-2.3061*10^{-4}$	$1.1458*10^{-5}$	42-165	.9863
1995	5.0	121	7.2869	$-3.0748*10^{-1}$	$3.8412*10^{-3}$	$-2.0223*10^{-6}$	38-160	.9924
West Fork.								
Greenpoint Cr								
1994	1.0	212	1.4530	$-3.6656*10^{-2}$	$3.1484*10^{-4}$	$9.7839*10^{-6}$	44-215	.9957
1995	1.0	203	-1.4418	$6.1076*10^{-2}$	$-7.5679*10^{-4}$	$1.3950*10^{-5}$	40-192	.9903
Lake Branch.								
1994	0.2	253	-10.6760	$3.5100*10^{-1}$	$-3.5245*10^{-3}$	$2.0989*10^{-5}$	46-242	.9964
1995	0.2	220	-5.6578	$2.2177*10^{-1}$	$-2.5029*10^{-3}$	$1.9063*10^{-5}$	39-172	9864
1994	4.0	56	-79.4645	2.0806	$-1.6907*10^{-2}$	$5.3721*10^{-5}$	70-210	.9776
1995	4.0	81	3.0583	$-1.0288*10^{-1}$	$1.2600*10^{-3}$	$6.2476*10^{-6}$	59-192	.9950
1994	7.0	18	3.9968	$-1.5682*10^{-1}$	$1.6401*10^{-3}$	$5.8559*10^{-6}$	38-209	.9977
1995	7.0	69	2.2413	$-9.5845*10^{-2}$	$1.0990*10^{-3}$	$7.2198*10^{-6}$	30-236	.9925
Red Hill Cr.								
1994	1.0	15	47.4733	-1.0203	$6.4493*10^{-3}$	--	81-205	.9993
1995	1.0	20	7.4697	$-3.1043*10^{-1}$	$3.4673*10^{-3}$	$-1.5597*10^{-7}$	35-188	.9936
McGee Cr.								
1994	0.5	48	-8.0983	$2.8437*10^{-1}$	$-3.0610*10^{-3}$	$2.1462*10^{-5}$	51-197	.9979
1995	0.5	31	$9.8845*10^{-1}$	$-2.8407*10^{-2}$	$1.8927*10^{-4}$	$1.1251*10^{-5}$	31-206	.9841
Elk Cr.								
1994	0.5	27	-1.6782	$5.8475*10^{-2}$	$-5.8395*10^{-4}$	$1.2722*10^{-5}$	35-228	.9978
1995	0.5	62	$8.3891*10^{-3}$	$-1.9877*10^{-3}$	$-2.9564*10^{-5}$	$1.1507*10^{-5}$	30-174	.9919
Middle Fork,								
MFk Hood R..								
1994	4.5	25	-5.0846	$1.3928*10^{-1}$	$-9.8032*10^{-4}$	$1.2978*10^{-5}$	58-176	.9983
Tony Cr.								
1994	1.0	19	-3.5411	$1.5036*10^{-1}$	$-1.9446*10^{-3}$	$1.8155*10^{-5}$	41-148	.9884
1995	1.0	33	$4.9313*10^{-1}$	$4.6901*10^{-3}$	$-4.1367*10^{-4}$	1.4445*10-5	36-182	9987
East Fork.								
EFk Hood R..								
1994	0.5	97	1.8433*10-l	$-1.4608*10^{-2}$	$2.8844*10^{-4}$	$1.0046*10^{-5}$	45-200	.9914
1995	0.5	66	-5.0097	$2.1240*10^{-1}$	$-2.6466*10^{-3}$	$2.1621*10^{-5}$	54-186	.9975
1994	5.5	68	-11.3845	$4.0749*10^{-1}$	$-4.4589*10^{-3}$	$2.4655*10^{-5}$	52-157	9767
1995	5.5	79	5.9150	$-2.6242*10^{-1}$	$3.4551*10^{-3}$	$-8.6360*10^{-7}$	30-161	.9860
Dog River.								
1995	0.7	11	3.7310	$-1.9136*10^{-1}$	$2.8451*10^{-3}$	--	35-143	.9923

[a] Polynomial functions are $\hat{Y} = b_0 + b_1X + b_2X^2$ (i.e.. 2°) and $\hat{Y} = b_0 + b_1X + b_2X^2 + b_3X^3$ (i.e.. 3°) where Y is the estimated weight at length (X).

Appendix Table D-2. Regression coefficients and coefficient of multiple determination for second and third order polynomial functions[a] defined by the regression of weight on length for cutthroat trout sampled at selected locations in the Hood River subbasin. by area and river mile.

Location. Area. Year	RM	Sample Size	Regression coefficients b_0	b_1	b_2	b_3	Range of independent variable X	R^2
mainstem.								
Neal Creek.								
1995	5.0	13	3.0582	$-1.8630*10^{-1}$	$2.8475*10^{-3}$		53-159	.9864
Middle Fork.								
Tony Cr.								
1994	1.0	24	11.5193	$-3.9035*10^{-1}$	$4.0910*10^{-3}$	$-3.0804*10^{-6}$	48-178	.9961
1995	1.0	56	-5.9636	$2.0300*10^{-1}$	$-2.1947*10^{-3}$	$1.8827*10^{-5}$	51-205	.9828
Bear Cr.								
1994	0.6	74	-10.0744	$3.4036*10^{-1}$	$-3.5601*10^{-3}$	$2.1449*10^{-5}$	58-190	.9812
1995	0.6	112	-3.4768	$1.5935*10^{-1}$	$-1.9673*10^{-3}$	$1.7454*10^{-5}$	34-170	.9799
East Fork,								
EFk Hood R..								
1994	0.5	4	10.7781	-3.1904*10-l	$3.1468*10^{-3}$	--	68-114	.9999
1995	0.5	9	9.3531	$-3.0119*10^{-1}$	$3.1567*10^{-3}$	--	62-191	.9999
Dog River.								
1994	0.7	30	$-6.4065*10^{-1}$	$5.0255*10^{-2}$	$-6.0473*10^{-4}$	$1.2742*10^{-5}$	42-203	.9935
1995	0.7	21	-19.7984	$4.6293*10^{-1}$	$-2.9956*10^{-3}$	$1.5783*10^{-5}$	69-238	9966
Tilly Jane Cr.								
1994	0.1	25	6.3276	$-2.3135*10^{-1}$	$2.5873*10^{-3}$	$1.0387*10^{-6}$	44-165	.9874
1995	0.1	114	1.2119	$-6.0256*10^{-2}$	$1.0264*10^{-3}$	$5.6638*10^{-6}$	30-183	.9848
Robinhood Cr.								
1994	1.0	54	1.1186	$-4.0764*10^{-2}$	$3.6773*10^{-4}$	$9.5484*10^{-6}$	39-200	.9957
1995	1.0	90	1.0441	$-5.0096*10^{-2}$	$6.7671*10^{-4}$	$7.6914*10^{-6}$	22-210	.9952

[a] Polynomial functions are $\hat{Y} = b_0 + b_1X + b_2X^2$ (i.e.. 2^0) and $\hat{Y} = b_0 + b_1X + b_2X^2 + b_3X^3$ (i.e.. 3^0) where $\hat{Y}$ is the estimated weight at length (X).

Appendix Table D-3. Regression coefficients and coefficient of multiple determination for second and third order polynomial functions[a] defined by the regression of weight on length for sculpins sampled at selected locations in the Hood River subbasin. by area and river mile.

Location. Area. Year	RM	Sample Size	Regression coefficients b_0	b_1	b_2	b_3	Range of independent variable X	R^2
mainstem.								
Neal Creek,								
1995	0.0	86	$4.4969*10^{-1}$	$-3.0165*10^{-2}$	$6.5185*10^{-4}$	$8.1635*10^{-6}$	26- 82	.9615
1994	1.5	52	$-9.6086*10^{-1}$	$6.3794*10^{-2}$	$-1.0500*10^{-3}$	$2.6336*10^{-5}$	27- 66	.9291
1995	1.5	106	-3.4454	$2.2453*10^{-1}$	$-4.4678*10^{-3}$	$4.1374*10^{-5}$	25- 80	.9305
1994	5.0	25	24.0020	-1.1227	$1.6890*10^{-2}$	$-6.8977*10^{-5}$	45- 99	.9756
1995	5.0	43	$5.1580*10^{-1}$	$-1.7534*10^{-2}$	$-9.1492*10^{-5}$	$1.4939*10^{-5}$	24-110	.9761
West Fork,								
Greenpoint Cr.								
1994	1.0	60	6.6279	$-1.7236*10^{-1}$	$1.0858*10^{-3}$	$1.2189*10^{-5}$	52-115	.9721
1995	1.0	56	$7.1442*10^{-1}$	$-2.9596*10^{-2}$	$1.5146*10^{-4}$	$1.3133*10^{-5}$	28-116	.9837
Lake Branch,								
1994	0.2	51	6.4784	$-2.1843*10^{-1}$	$2.2817*10^{-3}$	$3.5145*10^{-6}$	52-111	.9686
1995	0.2	54	2.5814	$-1.5088*10^{-1}$	$2.5187*10^{-3}$	$-1.7321*10^{-6}$	27-103	.9739
1994	4.0	81	22.3301	$-8.6500*10^{-1}$	$1.0504*10^{-2}$	$-2.8931*10^{-5}$	52-126	.9734
1995	4.0	131	2.0402	$-1.2376*10^{-1}$	$2.1163*10^{-3}$	$3.4385*10^{-7}$	25-117	.9837
1994	7.0	51	2.5193*10-l	$-1.8662*10^{-2}$	$3.0346*10^{-4}$	$1.0015*10^{-5}$	40-101	.9632
1995	7.0	210	1.1997	$-4.8185*10^{-2}$	$5.3011*10^{-4}$	$9.0533*10^{-6}$	36- 96	.9716
McGee Cr.								
1994	0.5	16	-2.3792	$1.4777*10^{-1}$	$-2.8586*10^{-3}$	$2.7691*10^{-5}$	48-123	.9950
1995	0.5	42	13.7591	$-5.3561*10^{-1}$	$6.3980*10^{-3}$	$-1.2698*10^{-5}$	47-129	.9772
Elk Cr.								
1994	0.5	25	$3.8641*10^{-1}$	$-1.8013*10^{-2}$	$7.8375*10^{-5}$	$1.3100*10^{-5}$	43-115	.9905
1995	0.5	22	7.1630	$-3.2714*10^{-1}$	$4.4679*10^{-3}$	$-6.3181*10^{-6}$	53-132	.9945
Middle Fork,								
MFk Hood R..								
1994	4.5	21	-8.1680	$3.3002*10^{-1}$	$-4.5270*10^{-3}$	$3.2058*10^{-5}$	56-112	.9826
Tony Cr.								
1994	1.0	51	5.0309	$-2.4207*10^{-1}$	$3.7096*10^{-3}$	$-5.3533*10^{-6}$	40-112	.9741
1995	1.0	41	2.0800	$-1.1913*10^{-1}$	$1.8958*10^{-3}$	$3.6624*10^{-6}$	26-121	.9545
East Fork.								
EFk Hood R..								
1994	0.5	95	4.0734	$-2.1133*10^{-1}$	$3.4266*10^{-3}$	$-4.1743*10^{-6}$	35-120	.9853
1995	0.5	51	$1.8122*10^{-1}$	$2.4497*10^{-2}$	$-1.2505*10^{-3}$	$2.4976*10^{-5}$	26-114	.9788
1994	5.5	25	12.5503	$-4.3553*10^{-1}$	$4.7560*10^{-3}$	$-3.1815*10^{-6}$	58-110	.9838
1995	5.5	62	1.5697	$-7.5078*10^{-2}$	$7.6186*10^{-4}$	$1.2320*10^{-5}$	23-112	.9873
Dog River,								
1994	0.7	33	-5.4740	$8.9894*10^{-2}$	$1.0557*10^{-3}$	--	52- 93	.7406
1995	0.7	31	4.738%	-2.1919*10-l	$3.1062*10^{-3}$	$-1.1593*10^{-6}$	45-105	.9804
Tilly Jane Cr.								
1994	0.1	32	-2.1577	$9.6831*10^{-2}$	$-1.6383*10^{-3}$	$2.0830*10^{-5}$	55-110	.9745
1995	0.1	127	-1.7603	$1.0062*10^{-1}$	$-1.8651*10^{-3}$	$2.2811*10^{-5}$	24-118	.9708
Robinhood Cr.								
1994	1.0	30	-1.8066	1.1157*10-l	$-2.1928*10^{-3}$	$2.5510*10^{-5}$	45- 96	.9770
1995	1.0	94	-2.4425	1.3094*10-l	$-2.4534*10^{-3}$	$2.6478*10^{-5}$	37-104	.9865

[a] Polynomial functions are $\hat{Y} = b_0 + b_1X + b_2X^2$ (i.e.. 2°) and $\hat{Y} = b_0 + b_1X + b_2X^2 + b_3X^3$ (i.e.. 3°) where $\hat{Y}$ is the estimated weight at length (X).

APPENDIX E

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

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

Species. run year	N	Predator scars	Net marks	Hook scars	Scrapes
Sumner steelhead.					
1993-94	1.356	576(42)	206(15)	44(3)	383(28)
1994-95	1,857	803(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	318	117(37)	8(3)	13(4)	57(18)
Spring chinook,					
1993	510	152(30)	14(3)	5(1)	158(31)
1994	310	88(28)	13(4)	10(3)	54(17)
1995	92	15(16)	4(4)	0	24(26)

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

REPORT B

HOOD RIVER AND PELTON LADDER
EVALUATION STUDIES

ANNUAL PROGRESS REPORT
1995

Prepared by:

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CONTENTS

INTRODUCTION

The Hood River Production Program (HRPP) was introduced in Report A. page 5. The HRPP is jointly implemented by the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWS) and the Oregon Department of Fish and Wildlife (ODFW). The primary goals of the HRPP are (1) to re-establish naturally sustaining spring chinook salmon using Deschutes stock in the Hood River subbasin. (2) rebuild naturally sustaining runs of summer and winter steelhead in the Hood River subbasin, (3) maintain the genetic characteristics of the populations, and (4) contribute to tribal and non-tribal fisheries, ocean fisheries, and the Northwest Power Planning Council's interim goal of doubling salmon runs.

The contract period for FY 95 was 1 October 1994 through 30 September 1995. Work implemented by Warm Springs staff during FY 95 included (1) genetic sampling (tissue, organ, and fin samples), (2) radio telemetry study in the lower Hood River, (3) habitat restoration and monitoring. (4) Oak Springs Hatchery evaluation studies, (5) Pelton ladder study design and coordination of ladder modifications, (6) management advice and guidance to Bonneville Power Administration and ODFW engineering on HRPP facilities, (7) assistance to BPA in preparation on the Hood River Environmental Impact Statement, and (8) preparing an annual report summarizing project objectives for FY 95.

HOOD RIVER

GENETICS

Resident and anadromous salmonids were sampled at selected sites in the Hood River and surrounding subbasins of the Columbia River (Table 1) in 1995 to collect tissue, organ, and fin samples. Samples collected in 1995, along with samples collected in 1993 and 1994. will be used to characterize trout populations by allozyme electrophoresis and morphology in the Hood River Basin and surrounding areas to determine if and where hybridization is occurring. Funding for the survey and analysis is being provided by ODFW. US Forest Service (USFS), and Bonneville Power Administration (BPA). The analysis is being contracted to Dr. Fred Allendorf at the University of Montana through the genetics program at ODFW.

Table 1. Whole juvenile fish collected in the Hood River and surrounding subbasins for genetic inventory and analysis. 1995.

Collection site	Date sampled	River mile	Species	Number	Map location
Oak Springs Hatchery	06/27	--	Summer Steelhead-Stock 40	31	----
Oak Springs Hatchery	06/27	----	Rainbow-Stock 53	30	----
Oak Springs Hatchery	10/05	---	Winter Steelhead-Stock 50	35	----
Roaring River Hatchery	06/27	---	Rainbow-Stock 13	30	----
Big Creek Hatchery	08/01	----	Winter Steelhead-Stock 13	32	----
Fifteenmile Creek	06/15	33.5	Rainbow-Steelhead	31	R13E/T1S SECT 33
Eightmile Creek	06/15	30.0	Rainbow	30	R1 1 E/T2S SECT 9
W.F. Hood River	06/15	4.5	Rainbow-Steelhead	7	R9E/T IN SECT 22
S.F. Mill Creek	07/13	10.0	cutthroat	26	R11E/T1S SECT 16
S.F. Mill Creek	07/13	2.0	Rainbow-Steelhead-Cutthroat	30	R12E/T1N SECT 33
Fivemile Creek	07/13	19.0	Cutthroat	30	R11E/T1S SECT 24

Provided in Appendix A is a preliminary report submitted to ODFW from Ron Gregg and Dr. Fred Allendorf (University of Montana). The report summarizes information completed as of January, 1996. Hood River subbasin streams are in bold print in the report. The report submitted is not a final report and should be referenced as a draft. Another preliminary report will follow in 1996, and once the analysis of all samples collected are finished, a final report will be completed.

The preliminary report by Gregg and Allendorf includes findings on the Hood River fish populations, such as: 1) the North Fork Greenpoint resident trout population appears to be pure rainbow trout, 2) the Pinnacle Creek resident trout population is largely cutthroat with some evidence of rainbow trout hybridization, and 3) Dog River, Emile Creek, Robinhood Creek, Pocket Creek, and Bucket Creek all show morphology and electrophoretic evidence consistent with pure cutthroat trout.

RADIO TELEMETRY

Abstract

A study to assess the upstream migration of adult salmonids in the lower Hood River was conducted from 1 June through 16 November, 1995. Radio telemetry was used to: 1) document migration of adult spring chinook salmon (Oncorhynchus tshawytscha) and summer steelhead (Oncorhynchus mykiss) in the lower Hood River (rivermile (RM) 0.0-4.0); 2) monitor the possible effects of streamflow in the bypass reach and the powerhouse tailrace. and 3) document fish movement through the fish ladder at Powerdale dam (Copper dam) and into the upper subbasin. Transmitters were placed in 10 hatchery spring chinook salmon and 26 hatchery summer steelhead at Powerdale dam (RM 4.0) and released at RM 0.5, near the mouth, and monitored as they migrated upstream. Only 23 radio-tagged summer steelhead were included in the analysis. Two summer steelhead regurgitated their tags. The other was released at the mouth and caught by anglers on the same day.

A total of eighteen (65%) summer steelhead and eight (80%) spring chinook salmon did not migrate back through the fish ladder at Powerdale dam (RM 4.0). Data indicated that both spring chinook salmon and summer steelhead were delayed below Powerdale dam. On average, spring chinook salmon spent 73.6 days directly below Powerdale dam while summer steelhead spent 12.8 days below the facility. Travel time from the point of release (RM 0.5) to below the dam (RM 3.6) averaged less for spring chinook salmon than that observed for summer steelhead. Average time required for summer steelhead was 20.4 days while spring chinook salmon needed on average 11.5 days to complete the distance. Several radio-tagged spring chinook salmon and summer steelhead made multiple trips through the bypass reach.

Turbidity, water temperature. flow, and weather conditions were measured during the study. Analysis of these parameters couldn't be correlated with migration of radio-tagged spring chinook salmon or summer steelhead in the lower Hood River.

Introduction

The lower Hood River radio telemetry study is a joint effort by the CTWS. ODFW, and PacifiCorp. Since 1991. a monitoring and evaluation program has been underway in the Hood River subbasin to collect life history and production information on stocks of anadromous salmonids in the subbasin. This program is part of the Hood River/Pelton Ladder Production Program (HRPP). The HRPP is funded by BPA. and jointly administered by the CTWS and ODFW.

PacifiCorp is involved in the radio telemetry study as part of the relicensing process for the Powerdale Project. The Federal Energy Regulatory Commission (FERC) issued the Powerdale Project license on 14 March, 1980. The license is effective for a period from 1 April, 1962 to 1 March, 2000. The FERC regulations specify a minimum 5-year, 3-stage consultation process for the preparation, filing, and processing of a new license application for an existing hydroelectric project. During the first stage of consultation. agency and tribal representatives expressed concern that PacifiCorp's operations may be effecting anadromous adult passage through the bypass reach (powerhouse (RM 1.0) to the diversion dam (RM 4.0)), causing fish to delay at the powerhouse tailrace, and the adequacy of the fish ladder (PacifiCorp 1995). In 1995, PacifiCorp entered into a cooperative radio telemetry study with CTWS and ODFW to address these concerns.

Powerdale dam is located at RM 4.0 on the mainstem Hood River. Constructed of concrete, it is approximately 22 feet in height with a sloping apron and a concrete fish ladder on the eastern bank. The dam diverts a portion of the river flow (500cfs) to a powerhouse located approximately 3.2 miles downstream.

In past years passage over Powerdale dam has generally been considered adequate. At times, however, fish can be falsely attracted to flows passing over the dam spillway or through the trash chute at the dam's western end (O'Toole and ODFW, 1991a). Recently, continued observations of steelhead jumping at the spill from the dam indicated there were fundamental problems with a new ladder entrance configuration constructed by PacifiCorp in 1994 (Nelson, unpublished data, 1996). Minor modifications were attempted with mixed results. The consensus among all agency managers, involved in the management of the Hood River. and PacifiCorp agreed that additional structural changes to the fishway and attraction water system were necessary. Work began in December, 1995, to reconfigure the auxiliary attraction water.

Methods

Spring chinook salmon and summer steelhead adults were captured at the Powerdale dam fish trap; anesthetized with carbon dioxide: identified; sexed; measured; and weighed. A radio transmitter was inserted orally into the fishes gut cavity, just past the esophagus, using a small PVC pipe as a guide. Each radio-tagged spring chinook salmon or summer steelhead were also marked with two floy tags, just below the dorsal fin. Double floy-tagging allowed visual identification of fish that had been fitted with a radio transmitter in case of tag ejection before reentering the fish ladder.

Spring chinook salmon and summer steelhead were collected randomly throughout the entire run. The goal was to tag 30 hatchery spring chinook salmon and 30 hatchery summer steelhead. but only 10 spring chinook salmon and 26 summer steelhead were tagged. Radio tags with a frequency of 41 MHZ were used for spring chinook salmon and radio tags with a frequency of 40 MHZ were used for summer steelhead. This allowed biologists in the field to identify fish species more effectively and to separate data in the office more efficiently.

All radio telemetry study fish were transported downstream in a portable liberation tank and released at RM 0.5 (lower railroad crossing). This site was chosen, instead of the mouth of the river, in an attempt to prevent fish from leaving the Hood River subbasin and straying into the Columbia River. Also, this prevented further delay of fish migration.

Radio-tagged spring chinook salmon and summer steelhead were monitored daily from the mouth of the Hood River to the diversion dam by one person (Figure 1). This section of river was sampled using a hand-held receiver and directional antenna to locate radio tagged spring chinook salmon and summer steelhead. Landmarks were established every tenth of mile using a hip chain. For example. the mouth of the Hood River was RM 0.0 and the final destination, Powerdale dam, was at RM 4.0. for a total of 40 units. Fish locations were recorded to the nearest unit of stream.

Radio tagged spring chinook salmon (Figure 2) and summer steelhead (Figure 3) were separated into three main categories for summarizing the data: 1) fish that were passed above the dam, 2) fish that were lost at some time during the study (caught by a fisherman. left the Hood River subbasin, or a malfunctioned tag). and 3) fish that were still active in the lower Hood River at studies end.

Each day of monitoring included collecting a turbidity sample. A set location was determined and the daily sample was taken from that location. A tempmentor, located in the fish ladder at Powerdale dam, was used to record hourly temperatures. Mean daily flows were documented as measured at the U.S. Geological Survey (USGS) Stream Gaging Station located at Tucker Bridge (RM 6.1) on the Hood River. In addition, weather conditions (clear, partly cloudy, overcast with light rain, and stormy). were also recorded. All information collected was recorded in a daily log and entered into a computer for summary (Appendix B).

Once the radio-tagged spring chinook salmon and summer steelhead reached the fish ladder, they were passed above the dam with the radio tags still in place. Radio tracking above Powerdale dam, monitored by ODFW research, was to track the spatial distribution in the subbasin.

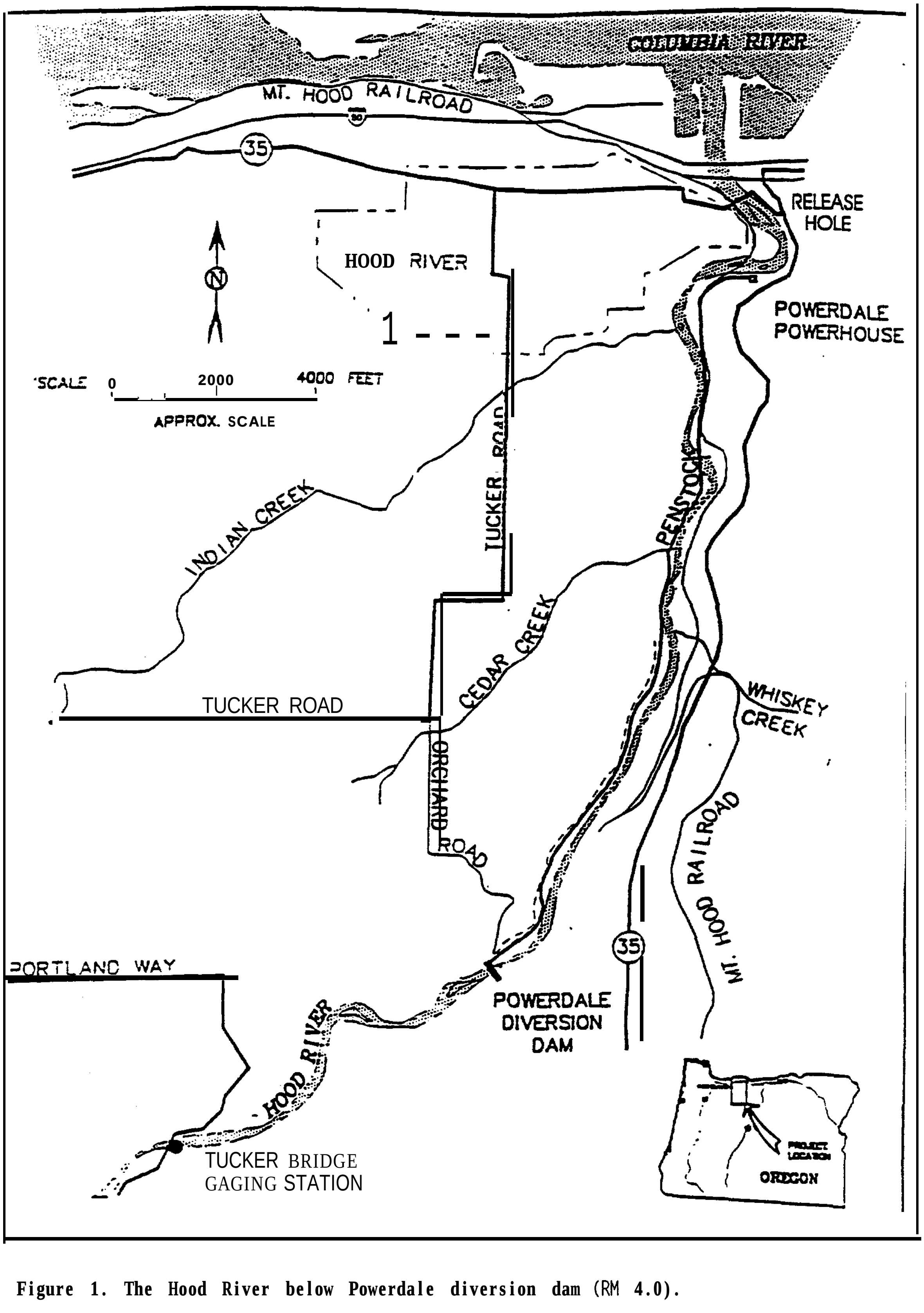

Figure 1. The Hood River below Powerdale diversion dam (RM 4.0).

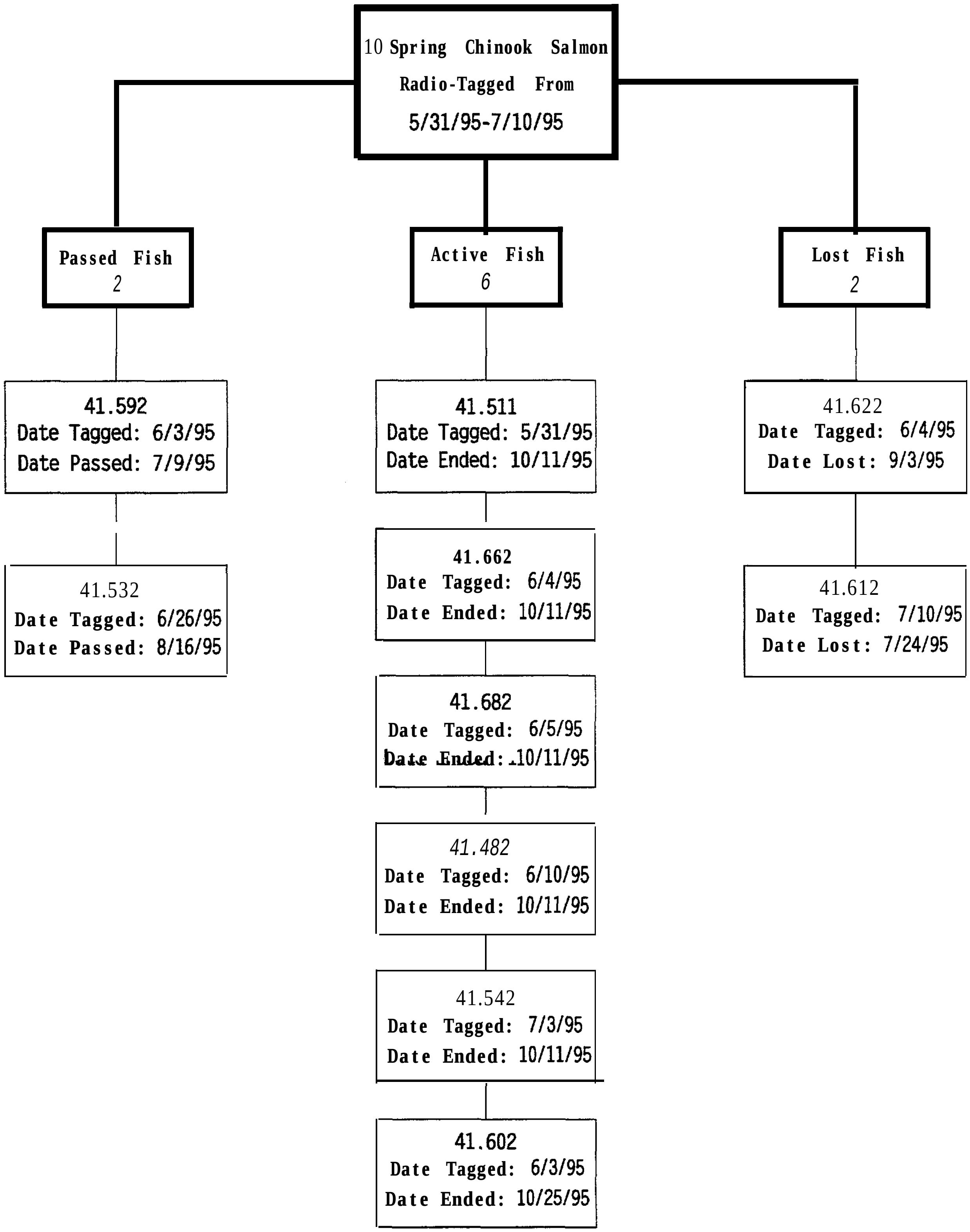

Figure 2. Flow chart for radio-tagged spring chinook salmon showing fish classification, tagging frequencies, and date information.

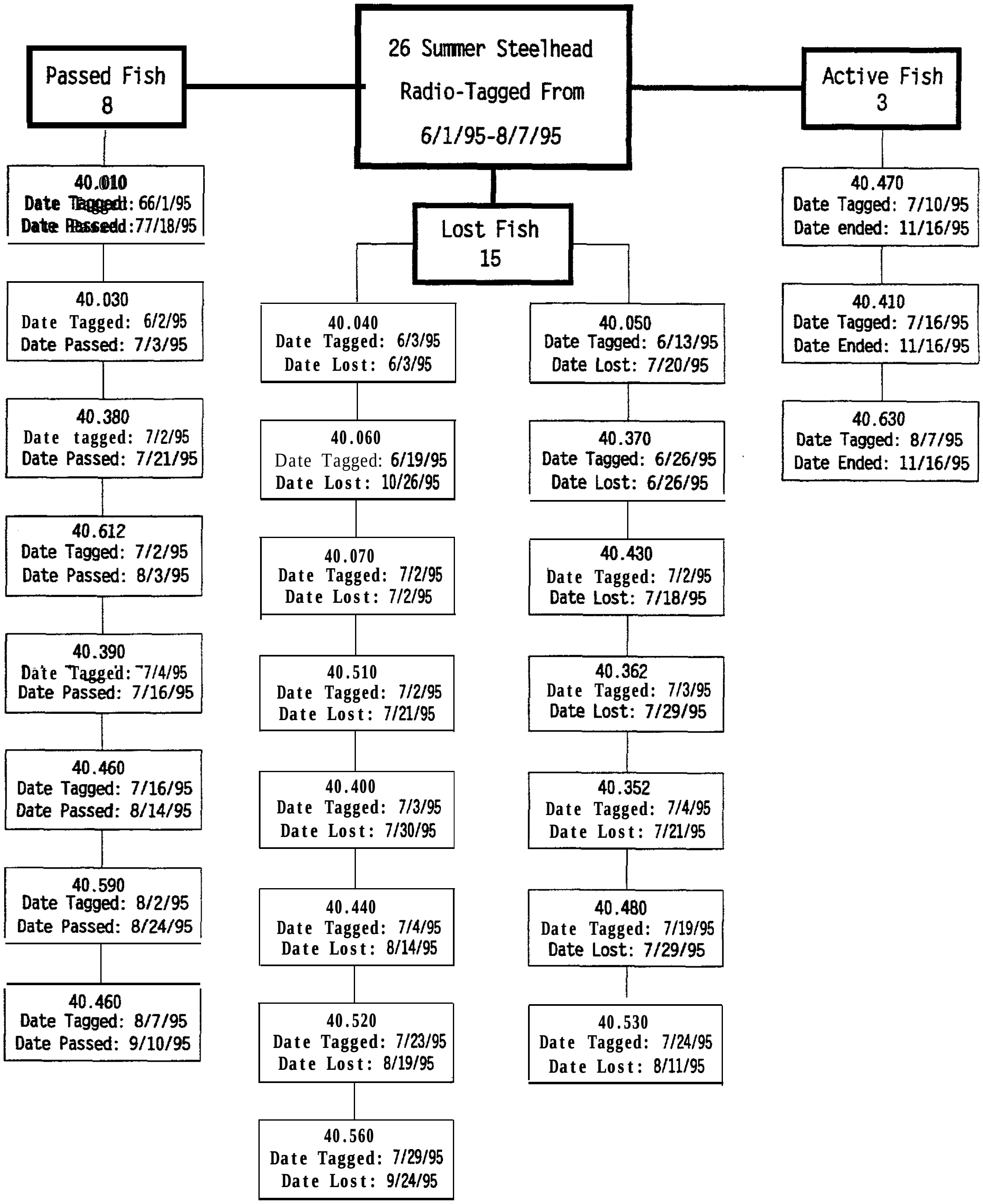

Figure 3. Flow chart for radio-tagged summer steelhead showing fish classification, tagging frequencies, and date information,

Results

Spring Chinook Salmon: A total of 10 spring chinook salmon were radio-tagged between 31 May and 10 July, 1995 and were monitored until 25 October, 1995. By 11 October, 1995, five of the six remaining spring chinook salmon still transmitting a signal below Powerdale dam were felt to have died, either from pre- or post-spawning related mortality. The sixth radio-tagged spring chinook salmon (frequency 41.602 MHZ) showed movement until 25 October. 1995. Typically, spring chinook salmon on the Hood River have completed spawning by mid October (personal communication on 12/4/95 with Rod French, ODFW, The Dalles, Oregon). This particular fish may have been a hatchery stray.

The migrational pattern for the radio-tagged spring chinook salmon showed two (20%) passed Powerdale dam. Of the eight spring chinook salmon remaining below the dam, six continued to be active and two were lost (Table 2). On average it took 43.5 days for the two spring chinook salmon to migrate from the release site at RM 0.5 until they passed through the ladder at Powerdale dam (RM 4.0). Mean average estimates of days in the vicinity of the tailrace. days to dam, days at dam, trips downriver once at the dam, and days per trip for all spring chinook salmon are presented in Table 2.

Percent of time spent at each tenth of mile. in the lower Hood River, was similar for all categories of tagged spring chinook salmon (Figure 4). Tagged spring chinook salmon spent most of the time between RM 0.5-1.0 and RM 3.7-3.95. Tagged spring chinook salmon would hold in the lower section (RM 0.5-1.0) and then migrate quickly to the upper area (RM 3.7-3.95) and hold below Powerdale dam. Radio-tagged spring chinook salmon spent 4.2 percent of the time holding in the vicinity of the tailrace and 71.4 percent of the time holding below Powerdale dam. For this study. the tailrace includes RM 0.9 and 1.0 and holding below Powerdale dam includes RM 3.6-3.95.

Analysis of measured parameters (turbidity. temperature, weather conditions, and flow) showed no correlation with migration of radio-tagged spring chinook salmon in the lower Hood River.

Table 2. Migrational patterns for the Hood River spring chinook salmon in the lower Hood River (RM 0.0-4.0), 1995. Table shows mean number of days.

Type	n	Days at[a] tailrace	Days to[b] dam	Days at[c] dam	Number[d] of trips	Days per[e] trip
Passed	2	.5(.5)	7(0)	35.5(35.5)	0	0
Active	6	5.2(5.7)	11.5(2)	11.5(11.5)	1.5(13)	12.9(13)
Lost	2	4(4.5)	14(10)	14(11.5)	1.5(2)	3.3(2)
Total	10	4(4.4)	11.5(12)	67.6(73.6)	1.2(15)	10.5(15)

[a] Number of days (using a correction factor for unsampled days) is in parenthesis. Estimates are based on sampled days and the percent of time spent at each given location. The correction factor is figured by taking unsampled days times the percent of time spent at each given location on sampled days. Days at tailrace includes RM 0.9 and 1.0.

[b] Fish are considered at the dam once fish reaches RM 3.6 (transition hole). Assumes unsampled days doesn't effect given numbers. Days not sampled are in parenthesis.

[c] Number of days (using a correction factor for unsampled days) is in parenthesis. Estimates are based on sampled days and the percent of time spent at each given location. The correction factor is figured by taking unsampled days times the percent of time spent at each given location on sampled days. Days at dam includes RM 3.6-3.95.

[d] A trip is taken when a fish drops below RM 3.6 (transition hole). Assumes unsampled days doesn't effect given numbers. Days not sampled are in parenthesis.

[e] Assumes unsampled days does not effect given numbers. Days not sampled are in parenthesis.

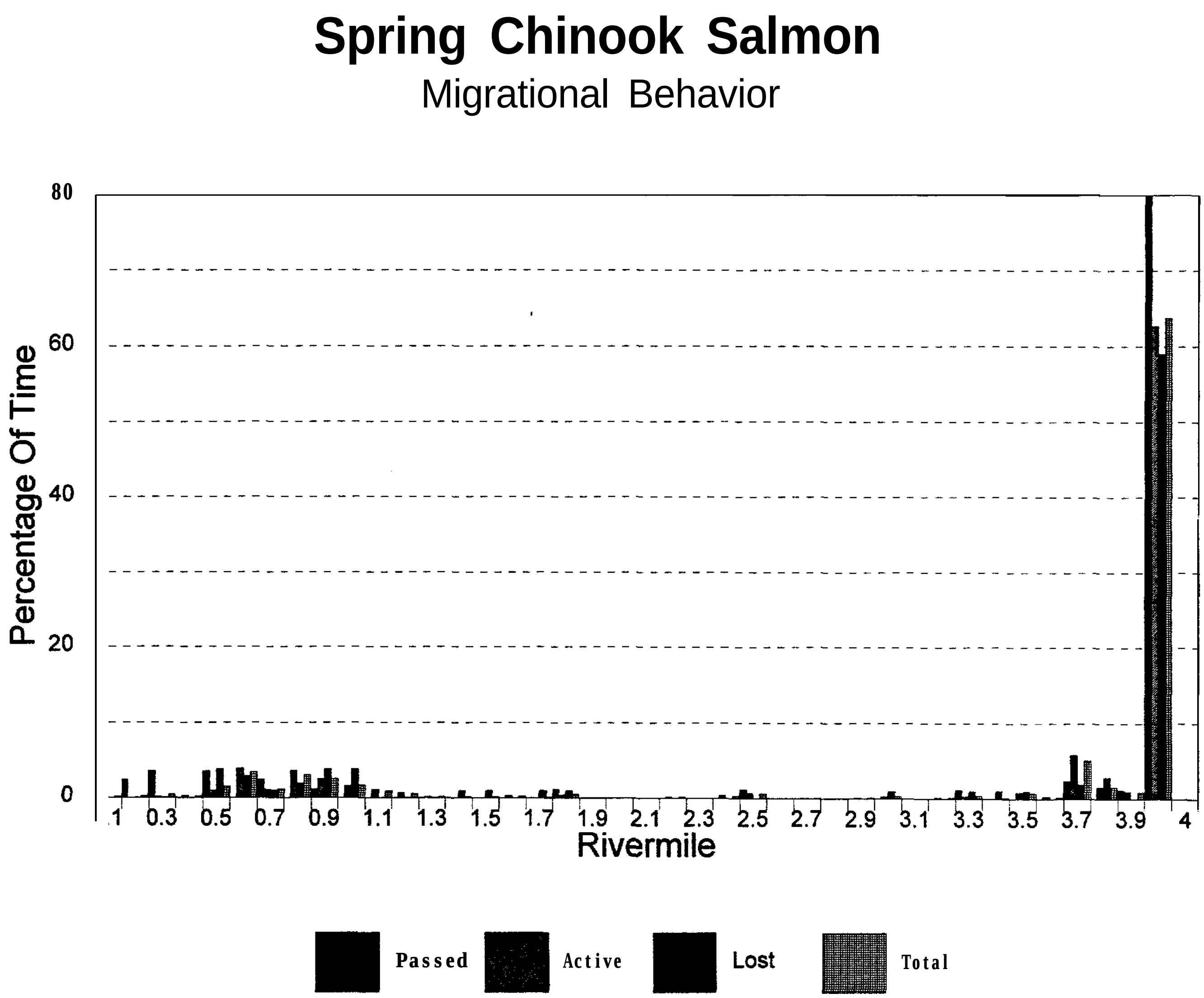

Figure 4. The percentage of time radio-tagged spring chinook salmon used each tenth of a mile during the lower Hood River telemetry study, 1995.

Summer Steelhead: A total of 26 hatchery summer steelhead were radio-tagged between 1 June and 7 August, 1995 and were monitored until 16 November, 1995. Thirteen radio-tagged summer steelhead were male and thirteen were female.

Migrational patterns for summer steelhead show eighteen (69%) summer steelhead did not pass the fish ladder at Powerdale dam, including fifteen that were lost and three that were still active at the end of the sampling period. A higher percentage of radio-tagged summer steelhead moved through the fish ladder than spring chinook salmon. Eight (31%) radio-tagged summer steelhead passed the ladder (Table 3). Time required for the radio-tagged summer steelhead to complete migration from the release site (RM 0.5) until they passed through the ladder (RM 4.0) ranged from 12-47 days with an average of 28.3 days to complete the distance. Mean average estimates of days in the vicinity of the tailrace. days to dam, days at dam, trips downriver once at the dam, and days per trip for all radio-tagged summer steelhead are presented in Table 3.

The percentage of time spent at each tenth of a mile, in the lower Hood River, is displayed in Figure 5. Most time was spent between RM 0.5-1.2 (tailrace) and RM 3.8-3.95 (Powerdale dam). Summer steelhead seemed to utilize more stream area in the lower Hood River than radio-tagged spring chinook salmon. Data indicates that 11.3 percent of the time steelhead spent holding in the vicinity of the tailrace and 26 percent of the time holding below Powerdale dam. For this study the tailrace includes RM 0.9 and 1.0 and holding below Powerdale dam includes RM 3.6-3.95.

Analysis of measured parameters (turbidity. temperature, weather conditions, and flow) showed no correlation with migration of radio-tagged summer steelhead in the lower Hood River.

Table 3. Migrational patterns for radio-tagged summer steelhead in the lower Hood River (RM 0.0-4.0), 1995. Table shows mean number of days.

Type	n	Days at tailrace	Days to[b] dam	Days at[c] dam	Number[d] of trips	Days per[e] trip
Passed	8	3.9(4.3)	13.9(5)	6.6(7.3)	.8(17)	8.8(17)
Active	3	10.3(12.8)	69.0(3)	11.3(14.0)	1.0(48)	26(48)
Lost	12	4.2(4.5)	9.0(2)	14.3(15.5)	.3(1)	3.7(1)
Total	23	4.9(5.6)	20.4(10)	11.2(12.8)	.5(66)	11.8(66)

[a] Number of days (using a correction factor for unsampled days) is in parenthesis. Estimates are based on sampled days and the percent of time spent at each given location. The correction factor is figured by taking unsampled days times the percent of time spent at each given location on sampled days. Days at tailrace includes RM 0.9 and 1.0.

[b] Fish are considered at the dam once fish reaches RM 3.6 (transition hole). Assumes unsampled days doesn't effect given numbers. Days not sampled are in parenthesis. Results only includes summer steelhead which reached the dam by end of study (passed = 8. active = 2. lost = 4. total = 14).

[c] Number of days (using a correction factor for unsampled days) is in parenthesis. Estimates are based on sampled days and the percent of time spent at each given location. The correction factor is figured by taking unsampled days times the percent of time spent at each given location on sampled days. Days at dam includes RM 3.6-3.95.

[d] A trip is defined as a fish dropping below RM 3.6 (transition hole). Assumes unsampled days doesn't effect given numbers. Days not sampled are in parenthesis.

[e] Assumes unsampled days doesn't effect given numbers. Days not sampled are in parenthesis

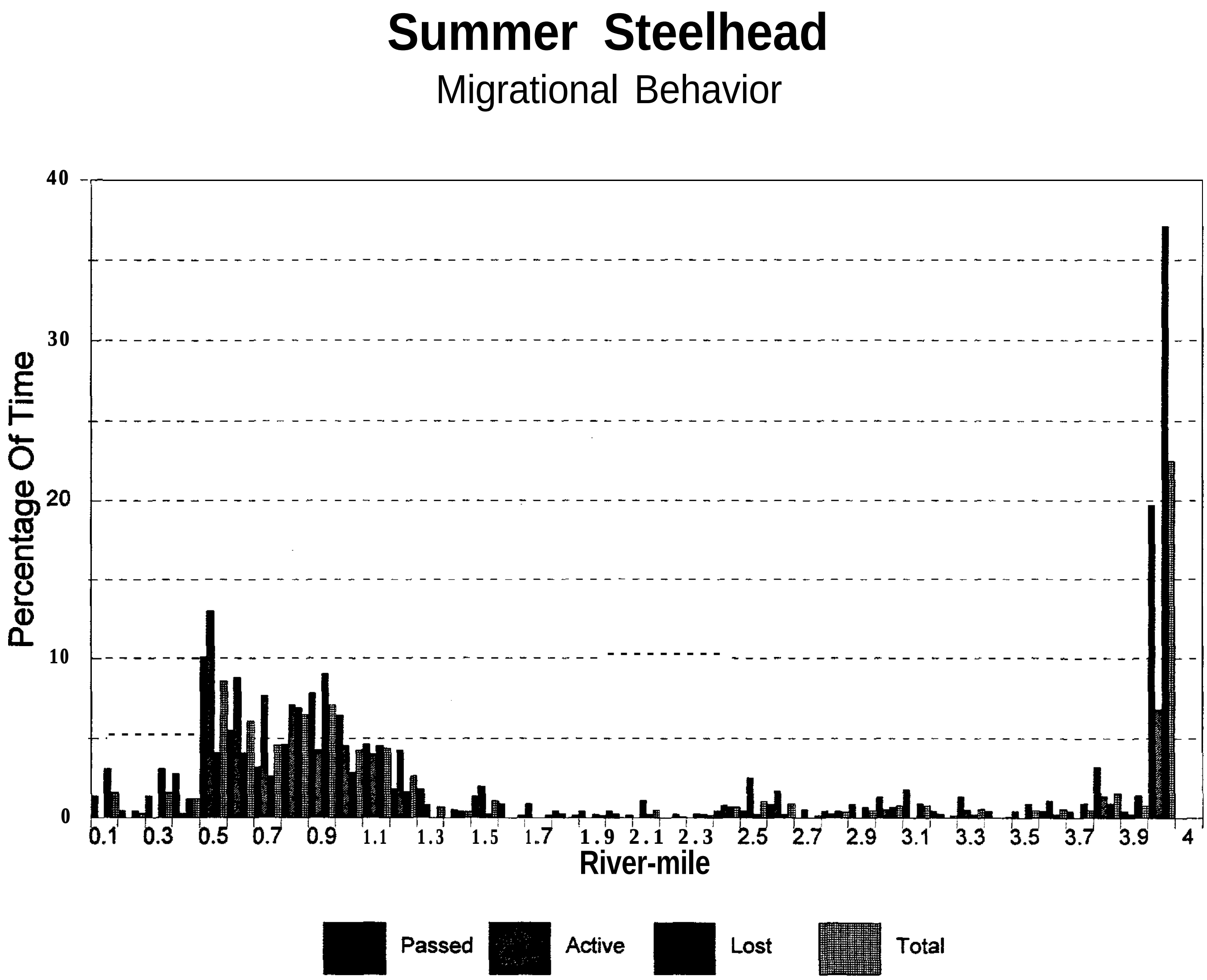

Figure 5. The percentage of time radio-tagged summer steelhead used each tenth of a mile during the lower Hood River telemetry study, 1995.

Discussion

The radio telemetry data collected on radio-tagged spring chinook salmon and summer steelhead showed a considerable delay in migration at Powerdale dam. Both species were continuosly observed throughout the summer jumping at the spill of the dam. The information collected throughout the 1995 study indicates the ladder was not functioning adequately. Several minor modifications were performed to improve the ladder entrance for these fish, however, they didn't improve passage. Work began in December, 1995, to reconfigure the auxiliary attraction water.

Ladder passage problems at Powerdale dam seemed to effect radio-tagged spring chinook salmon more than radio-tagged summer steelhead. Average days at the dam (RM 3.6-3.95) were considerably higher for spring chinook salmon (73.6 days) than summer steelhead (12.8 days). Also, spring chinook salmon took more trips (spring chinook salmon or summer steelhead dropping below RM 3.6 once they have reached the dam) downriver after reaching the dam than summer steelhead.

Of the radio-tagged summer steelhead and spring chinook salmon that reached Powerdale dam, a higher percentage of summer steelhead passed the ladder than spring chinook salmon. Fourteen radio-tagged summer steelhead reached the dam: eight of the fourteen summer steelhead passed the ladder with an average of 7.3 days below the dam. Two summer steelhead were still active in the lower river when the study ended and four summer steelhead were lost. All radio-tagged spring chinook salmon (10) reached the dam, but only two entered the ladder with an average of 35.5 days below the dam. Two spring chinook salmon were lost and the other six were assumed to be dead by studies end. Data indicates that summer steelhead eventually were able to locate the entrance, but not in a timely matter. Spring chinook salmon had considerable difficulty locating the ladder entrance.

No behavioral changes of radio-tagged spring chinook salmon or summer steelhead. from sampling techniques and the tagging procedure, were recognized as hindering fish passage through the ladder at Powerdale dam. This is solely based on the performance of the fourteen radio-tagged summer steelhead that reached Powerdale dam. Eight of the fish passed after some delay, two still existed in the lower river after the study ended and may pass at a later date, and four were lost (2 were known to be caught and 2 were assumed caught based on location when missing). Summer steelhead were using the ladder but were having difficulty locating it. Since radio-tagged spring chinook salmon appear to have more difficulty locating the ladder entrance than summer steelhead. an assumption was made that no behavioral changes have occurred and only passage problems exist.

It wasn't determined if radio-tagged spring chinook salmon or summer steelhead delayed or falsely attracted to the powerhouse discharge channel. Data shows radio-tagged spring chinook salmon spent on average 4.4 days and summer steelhead spent 5.6 days in the vicinity of the tailrace. The area considered to be at the tailrace was RM 0.9 and 1.0. Fish also utilized the areas below RM 0.9 (RM 0.5-0.8) and above RM 1.0 (RM 1.1-1.2). The lower reach of stream (RM 0.5-1.2) consists mostly of pools that provide good holding habitat. Good holding habitat may be the reason why fish are holding near the tailrace, not due to the flow discharge. Further studies of this area are needed to determine delay caused by the powerhouse tailrace.

Based on flow data from the Tucker Bridge gauging station (Appendix Table B.3). minimum flows required of PacifiCorp in the lower bypass reach were seldom exceeded during the telemetry study. On two occasions during the study, CTWS personnel, observed fish struggling to migrate past a riffle at approximately RM 2.5. Minimum flows, sometimes as little as 100 CFS (1 August-30 November), may not be adequate enough for fish migration through the reach (RM 1.1-4.0).

Recommendations

The study should be conducted again in 1996 for the following reasons: 1) to evaluate the fish ladder at Powerdale dam after modifications are complete, 2) to better monitor migratory behavior in the lower Hood River (specifically in the vicinity of the powerhouse tailrace), and 3) to provide another year of evaluations to compare with data collected in 1995.

A radio telemetry fixed station for monitoring radio-tagged spring chinook salmon and summer steelhead at the powerhouse tailrace is needed. The fixed station would record radio-tagged spring chinook salmon and summer steelhead that moved into the tailrace. Data collected from the fixed station could verify delay time at the tailrace and the potential cause. High flow events in the Hood River in February, 1996. have re-configured the powerhouse tailrace and the river channel. What effects these disturbances have had on migration patterns is unknown.

HABITAT

Introduction

The CTWS staff for the HRPP were involved in habitat related functions throughout 1995. Data was gathered to refine the smolt carrying capacity in the Hood River subbasin. Project staff spent time evaluating habitat improvement potential in the Hood River subbasin, primarily in the East Fork Hood River and Neal Creek (tributary to the Mainstem). Most landowners were eager to work with CTWS staff towards potential habitat improvement. One fencing project was arranged with Neal Creek landowner Roy Kirby, but lack of funding and time has delayed this project until 1996. This will be a joint project with the Salmon Corps program from Warm Springs. Water temperature monitoring continues within the Hood River subbasin. Also, Hobo Temp's have been installed to monitor water temperatures at the future adult brood holding and spawning site near Parkdale.

Carrying Capacity

Current smolt carrying capacity for the Hood River subbasin was determined by the subbasin planners using a computer simulation model developed by the Northwest Power Planning Council (NPPC) called the Tributary Parameters Model (TPM). Input was provided to the subbasin planners on habitat ratings and stream characteristics by a technical committee. The technical committee was comprised of personnel from the ODFW. U.S. Fish and Wildlife Service, USFS, Soil Conservation Service, National Marine Fisheries Service, and CTWS. Smolt production capacity was estimated at 24,000 spring chinook, 32.000 summer steelhead, and 31,000 winter steelhead (ODFW & CTWS, 1990). This estimate was based on a subjective evaluation of the quality of habitat on selected reaches throughout the watershed and on assumptions held of spatial distribution for each population.

The approach used to estimate carrying capacity for the subbasin planning process had several limitations. At the time estimates were generated, no quantitative and little qualitative information was available to accurately rate the quality of habitat within the Hood River subbasin for any given reach of stream. Also, many assumptions were made about the spatial distribution for each population. Further, there was little or no information available to validate estimates of the various model parameters and a lack of any quantitative information specific to Hood River stocks (Department of Natural Resources (CTWS), 1993).

Current numbers of summer and winter steelhead and spring chinook salmon smolts migrating from the Hood River subbasin (Report A) are far less than numbers estimated by the subbasin planners as the smolt carrying capacity. These low outmigrant numbers support the need for supplementation. The HRPP will continue to refine carrying capacity numbers to determine if the Hood River Master Plan's run size and spawner escapement goals are achievable. Knowledge of carrying capacity will be useful in developing strategies to optimize subbasin escapement.

Stream habitat data, spatial distribution data, and population estimates, along with surface area, were collected in 1995 to assist in refining carrying capacity numbers. Habitat surveys and summaries on the Hood River watershed have been completed for most anadromous salmonid bearing tributaries. Surveys were conducted on USFS managed land by the Hood River Ranger District and on private and some public lands by ODFW. Data collected by USFS, using the Hankin and Reeves survey type. were converted into a format used by ODFW since significant portions of the subbasin had been mapped using this methodology. Also, habitat inventory data collected from streams on national forest lands can be converted into the ODFW format. A data base of summarized habitat will help in analyzing the watershed habitat quality for carrying capacity and assist managers in potential habitat restoration plans. Locations of areas surveyed, by agency and year, are presented in Report A.

Spatial distribution data for anadromous salmonid and resident trout will be useful in the analysis of carrying capacity. A variety of methods have been used in collecting spatial distribution information. Radio telemetry studies have been used to estimate the distribution of adult spring chinook salmon, coho, and winter and summer steelhead. Also, some adult information exists from spawning ground surveys conducted by the USFS. The distribution of juvenile salmonids was estimated using electroshocking. snorkeling, and migrant screw trapping techniques. This information and data will help define habitat use type for each salmonid species.

Population estimates and surface area measurements were collected by CTWS and ODFW in 1994 and 1995 (Report A). This information provides a better understanding of smolt production capacity (i.e., smolts/m^2) for various reaches of stream in the Hood River subbasin.

There is no commonly accepted model for estimating carrying capacity. The HRPP will expand on the TPM's concept by refining several parameters in the model based on stock specific information. This technique will be used to estimate carrying capacity, however it requires reviewing and updating annually to increase its accuracy. Many variables are involved and considerable attention must be given to each one. Two alternative carrying capacity models have been discussed and can be used to evaluate the existing model. One method is regressing brood year specific estimates of smolt production with brood year specific estimates of spawner escapement. Project staff will be looking for some optimum level of smolt production. This model will require monitoring smolt production and spawner escapement for several years to develop the regression curve and to account for between-year-variation in smolt production. Estimates of selected environmental factors will be included in the regression to determine which, if any, of the environmental factors, that we propose monitoring, currently limit carrying capacity in the subbasin. The other alternative is measuring smolt production using migrant traps. Accumulative numbers of smolts outmigrating on a year to year basis could be graphed. Carrying capacity would be estimated at the point when outmigration stabilizes for a period of years and a trend could be recognized.

Habitat Restoration Project

Kirby Fencing Project: Time was spent evaluating the Hood River watershed for potential habitat projects. Finding a potential habitat improvement opportunity was ideal in encouraging other landowners to improve habitat in the Hood River subbasin. Although other opportunities exist in the Hood River subbasin. tribal staff focused on the potential of the Roy Kirby property. This location was chosen for several reasons: 1) the landowner was willing to cooperate in any way to assist in fish enhancement on Neal Creek, 2) recovery of the fenced in riparian zone will occur quickly. providing an example to other landowners what they can do to help fisheries habitat on the Hood River, and 3) easy access makes this project one that can be completed quickly and cost efficiently and still benefit fisheries on the Hood River. This property is currently being leased by Lloyd Phillips for grazing cattle. The site is located on Neal Creek, approximately RM 3.0, near the junction of highway 35 (East side) and Moore Road. Permission was granted to fence approximately one eighth mile of Neal Creek. One stream crossing will be installed for access to the west side of Neal Creek for grazing. An existing watering pond on the property will limit usage of Neal Creek for livestock watering.

This particular project was planned to be completed by the Salmon Corps program of Warm Springs in 1995. but was postponed due to a lack of funding and time constraints. The project has been rescheduled for 1996. The Salmon Corps program is working in cooperation with the HRPP.

Project monitoring will include fish population surveys and photo points in the project area. Photos will detail visual changes over the long-term of the fencing project. While population surveys will document the response to long term riparian improvements.

The Habitat Restoration Plan for the Hood River subbasin will be developed in 1996 by HRPP tribal staff. This plan will be in cooperation with the Mt. Hood National Forest, ODFW, Hood River County, Hood River Irrigation Districts, and the private landowners.

Water Temperatures

Introduction: Water temperatures have been monitored by CTWS staff since 1990 in the mainstem, West Fork, and East Fork Hood River and since 1994 in the Middle Fork. Water temperature monitoring at Roger's Spring, located on the Middle Fork Hood River where the Parkdale facility will be located, began in May, 1995. Water temperatures at the Parkdale site are needed to evaluate using a mixture of Middle Fork and Roger's Spring water to hold winter and summer steelhead and spring chinook salmon brood prior to spawning. Also, water temperature data will be used in evaluating the potential for winter and summer steelhead and spring chinook salmon to spawn in Roger's Spring.

Methods: Ryan Tempmentors are used to collect water temperature information on the mainstem. East Fork, West Fork, and Middle Fork Hood River. Temperature data is recorded every two hours. The thermographs data are downloaded into a computer approximately every three months. Downloaded data (minimum, maximum, mean temperature1 is summarized for each day. This information is then summarized monthly and printed into a table format.

At the Parkdale site near the Middle Fork, Hobo Temperature Loggers were used to collect water temperatures. Data has been collected in Roger's Spring where broodstock is held prior to spawning and also in a mixed water zone comprised of Roger's Spring and the Middle Fork Hood River. The Middle Fork water originates from Coe Branch, Elliot Branch. and Clear Branch Reservoir then is mixed with Roger's Spring after entering the Middle Fork Irrigation District powerhouse. Two other locations were monitored initially but were discontinued because of vandalism and theft problems. These problem areas were at the mouth of Roger's Spring, where it enters the Middle Fork Hood River, and the Middle Fork Hood River directly below the confluence of Roger's Spring and the Middle Fork. Temperature data is recorded every half hour. Hobo Temperature Loggers are downloaded approximately every two months. Downloaded data is summarized for each day, recording the minimum, maximum, and average mean temperature.

Results: Minimum, maximum, and average water temperatures collected on the mainstem, East Fork, Middle Fork. and West Fork Hood River are presented in Tables 4-7. Bottom et al. (1985) presents temperature preferences (46°F-59°F) and danger zones (<33°F or >68°F) for rearing and incubating anadromous salmonids. Average water temperatures collected on the mainstem. East Fork, Middle Fork. and West Fork Hood River, don't indicate problem areas to date. Maximum water temperatures on the East Fork Hood River during summer months (June. July, and August) have exceeded upper limits (>68°F) preferred by salmonids, but the average temperatures have been within preferred guidelines.

Minimum, maximum, and average mean temperatures collected from Roger Spring Hobo Temp's are presented in Appendix C. Water temperatures for Roger's Spring between 2 May-28 December, 1995. where broodstock is held, averaged between 39.2°F-41.7°F with a minimum of 38.5°F and a maximum of 43°F (Appendix Table C.4). Water temperatures for the mixed water zone comprised of Roger's Spring and Middle Fork Hood River between 15 May-20 December, 1995, averaged between 37.6°F-52.2°F with a minimum of 32.8°F and a maximum of 56.7°F (Appendix Table C.3).

Table 4. Minimum, maximum, and average water temperatures collected on the mainstem Hood River. 1990-95.

Year, Statistic	JAN	FEB	MAR	APR	MAY	JUN	JUL.	AUG	SEP	OCT	NOV	DEC
1990,												
Min.							11.0*	11.2	10.0	5.8	4.3	-0.1
Max.							18.2*	18.5	16.4	13.2	9.6	6.4
Avg.							14.9*	14.8	13.2	8.6	6.6	3.0
1991,												
Min.	0.0	3.7	2.6	4.1	6.0	7.8	11.3	11.6	8.6	2.4	3.3	2.8
Max.	5.9	8.1	10.0	11.8	13.4	16.0	17.6	18.8	15.9	13.4	9.4	7.5
Avg.	2.9	5.5	5.6	7.5	9.5	11.7	14.5	15.0	12.6	8.5	6.1	5.0
1992,												
Min.	2.6	3.7	4.7	5.2	6.6	12.6’	**	**	**	**	2.9’	0.1
Max.	7.1	8.5	11.3	13.1	17.1	16.8*					7.4*	5.5
Avg.	5.0	6.1	7.6	8.8	12.0	14.5*					5.1*	3.0
1993,												
Min.	-0.1	-0.1	0.1	4.9	6.4	8.6	10.7	10.1	7.5	5.6*	-2.0	1.6
Max.	5.1	6.1	8.1	9.8	13.4	13.3	16.3	18.0	16.1	13.0*	8.6	6.0
Avg.	1.9	3.2	4.7	6.9	9.9	11.6	13.1	14.0	12.0	9.4*	3.6	3.6
1994,												
Min.	2.1	0.1	3.2*	5.2	6.6	8.5	10.3	12.0	10.0	3.0	-0.1’	1.7
Max.	6.4	6.4	10.0*	12.3	15.9	17.3	19.6	19.0	15.9	13.6	8.0*	6.6
Avg.	4.6	3.6	5.9’	8.3	10.9	12.5	15.4	15.3	13.0	8.8	5.2*	4.7
1995,												
Min.	0.7	0.9	2.7	5.0	7.4	8.2	11.0	10.2	8.9	6.9*		
Max.	6.8	8.1	9.2	11.3	15.4	16.7	17.9	18.3	27.7	11.8*		
Avg.	4.1	5.6	6.2	8.0	10.5	12.1	14.4	13.8	13.1	9.8*		

* Incomplete month of data.

* * Equipment malfunction.

Table 5. Minimum, maximum, and average water temperatures on the West Fork Hood River, 1990-95.

Year, Statistic	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1990,												
Min.							8.5	9.1	8.1	5.0	4.1	-0.4
Max.							15.4	15.6	13.6	11.5	8.6	5.7
Avg.							11.8	11.9	10.8	7.5	6.2	2.9
1991,												
Min.	-0.3	3.4	1.9	3.2	4.8	5.7	8.7	9.0	6.9	1.7	2.9**	1.8
Max.	5.3	6.4	8.0	9.8	11.1	13.6	15.0	15.5	13.1	11.3	8.5**	6.6
Avg.	2.9	4.8	4.5	5.8	7.3	9.0	11.4	12.0	10.2	7.2	5.6**	4.5
1992,												
Min.	1.8	3.5	4.1	4.1	5.7	8.2	10.0	8.4	7.1	4.8	3.3	1.7
Max.	6.0	6.7	9.7	10.7	14.3	17.1	16.8	16.6	13.6	11.3	8.9	4.8
Avg.	4.1	5.1	6.3	7.2	9.8	11.9	12.8	12.5	10.2	8.1	6.1	3.4
1993,												
Min.	0.7	0.0	0.4	4.4	4.9	7.2	8.2	5.8	5.8	5.1	0.0	0.7
Max.	4.2	5.1	7.4	7.7	11.6	13.4	13.4		13.2	11.0	7.6	5.3
Avg.	2.1	2.7	4.5	5.8	8.0	9.4	10.2	9.7	9.7	8.0	3.3	3.1
1994,												
Min.	2.3	0.0	2.8	4.1	5.0	6.6	8.1	9.7	8.4	5.2	2.6	1.6
Max.	5.6	5.0	7.6	10.0	13.4	14.1	16.7	15.6	12.7	11.6	6.7	5.3
Avg.	4.1	2.8	4.5	6.3	8.8	9.7	12.2	12.2	10.8	7.7	4.6	3.8
1995,												
Min.	0.8	0.6	2.1	3.6	5.3	6.7	8.8	8.3	7.4	6.5*		
Max.	4.7	6.5	7.4	9.5	13.1	13.9	15.3	15.2	13.3	10.3*		
Avg.	3.2	4.3	4.6	5.9	8.3	9.6	11.6	11.1	10.6	8.6*		

* Incomplete month of data.

** Equipment malfunction.

Table 6. Minimum, maximum, and average water temperatures collected on the East Fork Hood River, 1990-95.

Year, Statistic	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1990,												
Min.							9.3	9.5	7.4	3.7	2.7	
Max.							20.4	21.1	18.0	13.6	9.3	
Avg.							14.7	14.8	12.7	7.7	5.6	
1991,												
Min.												
Max.												
Avg.												
1992,												
Min.			3.5*	3.2	4.7	8.2	**	8.5	6.4	3.0	1.3	-0.1
Max.			14.7*	13.4	18.7	22.0	**	22.8	18.7	12.4	8.4	4.8
Avg.			7.6*	7.9	11.0	14.4	**	15.5	11.7	8.5	4.8	2.0
1993,												
Min.	-0.2	2.0*	-0.1	3.8	5.0	6.7	**	**	5.3	4.1	-0.1	0.2
Max.	4.6	5.6*	8.3	10.7	13.4	17.1	**	**	17.4	12.7	8.3	5.6
Avg.	1.3	3.6*	4.7	6.7	8.8	10.5	**	**	11.2	8.4	2.7	2.5
1994,												
Min.	1.1	-0.4	1.9	3.8	4.4	6.5	8.3	10.3	8.5	3.8	0.9	0.4
Max.	6.1	5.9	10.3	12.8	15.3	18.3	21.6	20.6	17.1	13.0	6.4	5.9
Avg.	3.7	2.8	5.2	7.5	9.3	11.6	15.0	15.1	12.7	7.5	3.9	3.5
1995,												
Min.	-0.2	-0.1	1.5	4.2*								
Max.	6.2	7.7	9.0	10.3*								
Avg.	3.1	4.6	5.0	7.0*								

* Incomplete month of data.

** Equipment malfunction.

Table 7. Minimum, maximum, and average water temperatures collected on the Middle Fork Hood River, 1994-95.

Year, statistic	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1994,												
Min.	1.9*	-0.1	2.4	4.6	6.0	5.6	5.4	7.3	8.0	4.9	1.8	1.0
Max.	4.3'	5.7	8.9	11.3	13.8	14.7	14.6	14.1	14.0	12.3	5.7	5.2
Avg.	3.0*	3.3	4.8	7.1	8.8	9.7	10.2	10.4	10.4	7.5	3.9	3.3
1995,												
Min.	0.04	0.7	2.0	4.6*								
Max.	4.6	6.1	7.8	8.8*								
Avg.	2.9	3.9	4.6	6.3*								

* Incomplete month of data.

** Equipment malfimction.

ENGINEERING

Powerdale Dam Access Road

Construction of the access road to the Powerdale dam adult fish facility site began in June, 1995 and is completed except for paving, which will occur in 1996. Property for the construction of this road was purchased by BPA from Pearl Wickland, Bickford Orchards, and Pacific Power & Light. The entrance to the road is on the west side of Highway 35. approximately four miles south of the town of Hood River. The road, designed to minimize potential impacts to the adjacent orchard, skirts the outer fringe of the orchard.

Powerdale Dam Adult Fish Facility

Construction of the Powerdale dam adult fish facility began on 25 September, 1995 and is projected for completion by November, 1996. The facility will be constructed on one-half acre of project land, east of Powerdale dam, in an area previously impacted by flooding in 1964 and 1977 and dam construction. Funding will be provided by BPA. Construction includes:

1) adult fish trap and sorting pond adjacent to the existing ladder,
2) an elevator to distribute fish to:
   return pipe to river,
   adult holding and recovery ponds,
   and a fish truck,
3) holding ponds and associated service buildings,
4) water conveyance system for ponds and elevator,
5) electrical supply access to new facilities.

Powerdale Dam Fish Ladder Emergency Construction

During the fish facilities construction, PacifiCorp reconfigured the auxiliary attraction water into the lower part of the fish ladder. Continual adult passage problems in 1995 prompted this action. Construction began in December, 1995, and were scheduled for completion by late February, 1996.

The fish ladder was shutdown from 1 January, 1996, until 15 February, 1996, for the ladder modification work along with the adult fish facility construction. The ladder was also shut down for a short time period prior to the 1 January, 1996 shutdown. This occurred while contractors for PacifiCorp made modifications to the fish ladder entrance.

Parkdale Adult Holding Pond And Egg Collection Facility

The proposed facility on Roger's Spring Creek near Parkdale will be used to hold and spawn winter and summer steelhead and spring chinook salmon adults and to acclimate winter steelhead and spring chinook salmon juveniles prior to release. This site was chosen because of the excellent water quality. As of late December, 1995, BPA was negotiating to purchase approximately 4 hectares (10 acres), of which about half will be developed. BPA will fund facility construction, operation, and maintenance. BPA will handle all engineering design, either with BPA engineers or with an engineering consultant for BPA. with technical assistance from ODFW.

The facilities will consist of two adult holding ponds with inside dimensions of about 12.5 by 2.5 by 1.2 meters (41ft. x 8ft. x 4ft.), two concrete juvenile acclimation ponds with inside dimensions of about 24 by 2.5 by 1.2 meters (80ft. x 8ft. x 4ft.), associated piping from the powerhouse tailrace to the ponds and from the ponds back to the creek. and a small weir and trap in Roger's Spring Creek just below the outfall of the power plant.

Also proposed is a building about 33 by 6 meters (108ft. x 20ft.) which will contain an office, spawning and storage area, and a bunkhouse for other project personnel; and a 2-bedroom house for a full-time, on-site employee. A septic field for the residences and accommodations for effluent from the holding ponds will be needed. A new well and associated piping will provide water for the residences. In addition, approximately 600 meters (1,975ft.) of roads and access approaches about 4 meters (12ft.) wide are needed. Roads, access, and parking spaces will be covered with crushed rock or other suitable material. The existing access road to the site will also be graveled and graded.

When the adult holding and juvenile acclimation ponds are in full operation, they will require about 0.15 m^3/s (5.3 cfs) of water. The acclimation ponds will be used April through mid-May each year. They alone will require 0.09 m^3/s (3.3 cfs) of water each day of this period. The adult holding ponds will be used year-round and will require a constant flow of about 2 cfs.

Construction of these facilities will begin in 1997. The facilities will allow holding and spawning spring chinook salmon and winter and summer steelhead adults captured in the Powerdale fish trap. The facilities could acclimate and release up to 80.000 spring chinook and 40,000 winter steelhead smolts when needed. Some of the juveniles being acclimated at Toll Bridge Park (E.F. Hood River) and Dry Run Bridge (W.F. Hood River) could be acclimated here to distribute fish throughout the subbasin.

OAK SPRINGS HATCHERY EVALUATION

Introduction

The percent coded-wire tag retention and clipping results on Hood River stock hatchery winter steelhead have been evaluated by HRPP personnel since the 1994 brood year. These fish are reared at Oak Springs Hatchery (OSH) where coded-wire tagging and clipping takes place. All tagging is contracted through the ODFW tagging and clipping program. Hatchery winter steelhead production at OSH was graded into two size groups small and large prior to tagging in late October. Each size group was reared in a separate raceway at OSH. Typically, pond L3 is the medium group and pond L4 is the large group.

Methods

Coded-wire tag retention is evaluated using a coded-wire tag detector. A subsample of fish from ponds L3 and L4 were sampled and the tag was either present or absent. For clipping evaluations, a random sample of marked fish were sampled from ponds L3 and L4 to evaluate the quality of mark combinations used on hatchery winter steelhead. Hatchery juveniles were examined and classified as 1) not clipped (>75% remains). 2) poor clips (25-75%) or 3) clipped (less than 25% remains) based on a subjective evaluation of each mark group present in the ponds.

Results

Samples taken by ODFW tagging personnel on tag retention and clipping results (not reported in the 1993 annual report) were good for the 1993 brood year (Table 8). For the 1994 brood year, percent tag retention (Table 9) and clipping (Table 10) results were considered poor. Pond L3 on 28 November, 1994, had a tag loss of 4.2 percent. Initially, pond L4 had a tag loss of 11.1 percent on 28 November, 1994. These results seemed high by project staff and was reevaluated on 5 April, 1995. and showed an even higher tag loss of

13.4 percent. The 1994 brood of hatchery winter steelhead was marked with an adipose (Ad) and left ventral (LV) clip. Clipping results were very poor for the 1994 brood (Table 10). The percentage of poor Ad clips for pond L3 on 28 November, 1994. were 10 percent and poor LV clips were three percent. Also, two percent of the marked hatchery winter steelhead adiposes were not clipped. Results for pond L4 for the 1994 brood year were similar to pond L3. On 5 April 1995, clipping results showed nine percent of the steelhead had poor Ad clips and two percent had poor LV clips. Also. one percent of the marked winter steelhead checked had adiposes that were not clipped.

Tag retention (Table 9) and clipping (Table 10) results for the 1995 brood year were much better than the results of the 1994 brood year. Coded wire tag retention was 100 percent for pond L3 and 97.1 percent for pond L4. The 1995 brood of hatchery winter steelhead were clipped with an Ad-LV and right maxillary (RM). All clips except LV clips were excellent (Table 10). Results showed 25 percent of pond L3 had poor LV clips and two percent had no LV clips.

Table 8. Percent tag retention and clipping results for the 1993 brood year winter steelhead reared at Oak Springs Hatchery. (Ad = adipose, LV = left ventral)

Broodstock, hatchery, brood year	Tag code	Fin clip	Date	Percent tag retention	Percent fin clip
Hood River, oak springs,					
1993	07-05-36	Ad-LV	14-Oct-93	99.7	99.4
1993	07-05-37	Ad-LV	14-Oct-93	100	99.7
1993	07-05-38	Ad-LV	19-Oct-93	89.2	99.7
1993	07-05-39	Ad-LV	19-Oct-93	99.4	99.2

Table 9. Percent coded-wire tag retention, tag code, and clipping information for winter steelhead at Oak Springs Hatchery. (adipose = Ad, left ventral = LV. right maxillary = RM)

Broodstock, hatchery, brood year	Pond	Tag code	Fin clip	Date sampled	Percent tag retention
Hood River, oak springs,					
1994	L-3	07-08-63 07-09-16	Ad-LV	28-Nov-94	95.8
1994	L-4	07-09-17 07-09-18	Ad-LV	28-Nov-94	88.9
1994	L-4	07-09-17 07-09-18	Ad-LV	05-Apr-95	86.6
1995	L-3	07-1 1-31	Ad-LV-RM	12-Jan-96	100
1995	L-4	07-1 1-32	Ad-LV-RM	12-Jan-96	97.1

Table 10. Clipping results for winter steelhead at Oak Springs Hatchery. (Percent of total number sampled is in parentheses. Ad = adipose, LV = left ventral, RM = right maxillary.)

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

Discussion

Continued monitoring of tag retention and clipping at OSH is necessary. Poor tag retention and clipping results for the 1994 brood winter steelhead resulted in a more careful evaluation of tagging and clipping procedures at OSH. Though most tagging and clipping problems were eliminated for the 1995 brood, there still were problems with poor and no LV clips. If poor tagging and clipping continues, HRPP personnel need to optimize quality in the program.

COMPLIANCE WITH THE NATIONAL ENVIRONMENTAL POLICY ACT

When the Northwest Power Planning Council (NPPC) approved the Hood River Production and the Pelton Ladder Master Plans, they directed BPA to move ahead with implementation contingent upon a finding of no significant impact in an environmental analysis. A categorical exclusion was completed in 1992 for the Hood River Production Program. The categorical exclusion included both the Hood River and the Pelton ladder. Items excluded on the Hood River included:

1. design and construction of fish monitoring facilities at Powerdale dam,
2. modifications of bypass system at Farmers Irrigation District diversion for smolt monitoring facilities,
3. baseline population estimates,
4. production estimates,
5. habitat condition surveys,
6. carrying capacity estimates, and
7. genetic studies.

The item excluded on the Pelton ladder included:

1. physical modification of Pelton ladder for additional rearing ponds.

BPA determined that the actual release of hatchery fish for the Hood River Supplementation Program needed additional environmental analysis.

In the spring of 1995. BPA filed a Notice of Intent (NOI) to proceed with an Environmental Impact Statement (EIS) for the supplementation portion of the program. Public scoping meetings were held in April, 1995 in Portland, Hood River, and Warm Springs, Oregon. No significant or highly controversial issues were raised during the scoping process. Work on the draft EIS continued through February, 1996. The draft EIS is scheduled to be distributed for public review in March, 1996. The EIS is being developed as a cooperative effort between BPA. CTWS. and ODFW. The tentative schedule for completion is:

February 5, 1996	Draft EIS finalized
February 20, 1996	Signature by BPA administrator
March 4. 1996	Draft EIS mailed out
March 15, 1996	Notice in federal register (opens comment period
April 2 & 4, 1996	Public meetings in Hood River and Warm Springs
April 29, 1996	Close of comment period

Development of the EIS final draft will be dependent upon the amount of comments received. Acclimation releases of hatchery spring chinook salmon and winter steelhead smolts scheduled for Spring of 1996, will be covered under a categorical exclusion to be prepared by mid January, 1996.

PELTON LADDER

INTRODUCTION

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

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

Engineering design and construction of Pelton ladder modifications by ODFW was the primary focus for this contract period. Pelton ladder is located in the Deschutes River subbasin, at approximately RM 98. The ladder was modified to create three new cells (figure 6) for rearing Deschutes stock hatchery spring chinook salmon. Fish reared in the new cells, L-4 and L-5, will be released into the Hood River. New cell L-6 (uppermost cell). will be used as an experimental study group for release into the Deschutes River. The study group will be used to evaluate how size at time of release effects 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 (Olsen et al. 1994). Upon completion of the Pelton ladder studies. juvenile spring chinook salmon reared in the new cell (L-6) will be used for increasing production in the Hood River. The year 2000 would be the earliest that juvenile spring chinook salmon reared in Pelton ladder cell L-6 could be released into the Hood River.

ENGINEERING

Pel ton Ladder Modifications

Contractors working for ODFW engineers have completed most modifications to Pelton ladder. Modifications that were completed in October and November, 1994, include: the headbox, orifice gates, bypass and discharge pipe, alarm set-up, and light installation. Discharge piping at the base of the newly constructed cells will allow for isolated discharge of water from the upper section water to the adjacent regulatory reservoir (Figure 6). Also, the construction of the bypass pipe will allow eight cfs of water to be piped around the new cells to the old cells, which replicates the existing rearing strategy in each section. The bypass pipe will also eliminate possible water quality and disease transfer problems associated with direct passage of rearing water from the upper section over the fish rearing in the lower section.

Design, construction, and installation of the drop-in rotary fish screens, located at the downstream end of each fish rearing cell. were completed and installed in September, 1995, prior to fish being transferred to the ladder from Round Butte Hatchery (RBH). Bird screens have been designed and the bids have been sent out for construction of the bird screens. Construction of the bird screens should be completed by December, 1995. Due to a limited budget and the expense of other modifications that occurred at Pelton ladder, the purchase and installation of emergency pumps have been put on hold by ODFW engineers and project staff.

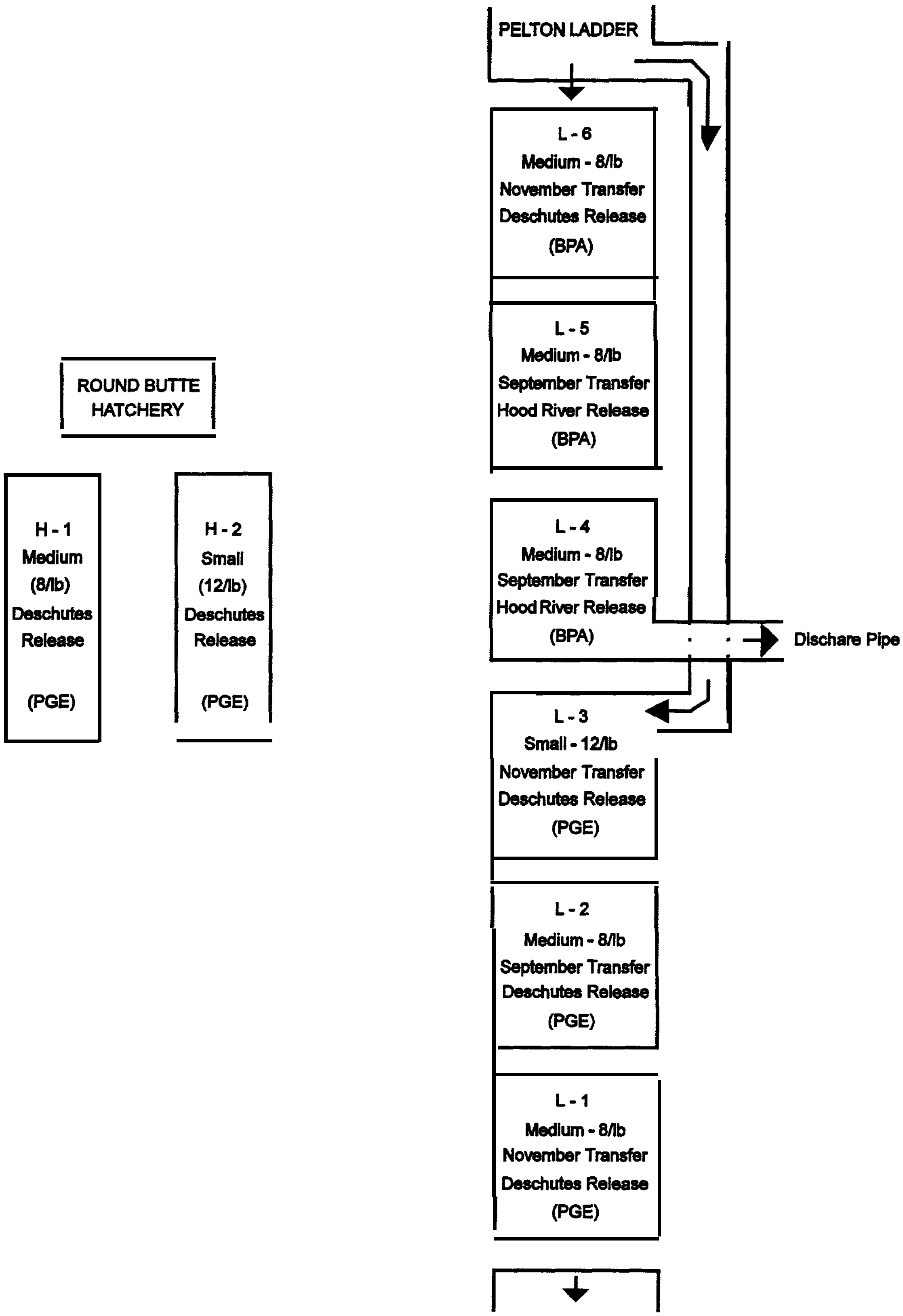

Figure 6. Ponding plan for RBH/Pelton ladder to accommodate production of study fish.

DISCUSSION

Deschutes hatchery spring chinook salmon broodstock are collected annually at Pelton trap by Round Butte Hatchery (ODFW) staff. Spring chinook salmon adults are spawned and eggs are incubated, hatched, and raised at RBH to fingerling size. Three ponds of spring chinook salmon fingerlings were moved to the Pelton ladder in September, 1995. Three more ponds of spring chinook salmon fingerlings were moved in November, 1995. Two other ponds of spring chinook salmon fingerlings were left to be reared at RBH. Table 11 shows cell location of ponded fish from RBH. including sizes, numbers, and differential coded wire tags and clips. Spring chinook salmon juveniles that are reared in Pelton ladder, cells L-4 and L-5, are to be released into the Hood River. All other cells are to be released into the Deschutes. Spring chinook salmon juveniles reared from September, 1995, to April, 1996, at Pelton ladder are from the 1994 brood.

Table 11. Cell or pond location of spring chinook at Pelton ladder and Round Butte Hatchery, 1995. (Ad = adipose, RV = right ventral, L = ladder, H = hatchery.)

Pond	Ship to ladder	Pond or cell number	Size (fish/lb.)	Number	Tag code - clip
H-IA		H-l		22,100	07-09-37 - Ad
H-1B		H-2		33,118	07-09-36 - Ad
H-7	Nov. 13	L-l	13.6	66,181	07-09-35 - Ad
H-2	Sept. 25	L-2	21.4	63,916	07-09-33 - Ad
H-3	Nov. 15	L-3	14.2	63,782	07-09-34 - Ad
H-10	Sept. 28	L-4	29.7	63,784	07-11-30 - Ad-RV
H-8	Sept. 27	L-5	29.4	63,885	07-l1-30 - Ad-RV
H-4	Nov. 14	L-6	24.3	95,885	07-09-38 - Ad

Tribal staff, with assistance from ODFW, will begin monitoring new cells in 1996. Studies have been proposed to determine if the new section will adversely impact the old section and to provide basic information about rearing conditions in the Pelton ladder. Both agencies will also continue to evaluate the potential for additional fish rearing in the ladder.

RECOMMENDATIONS

The purchase and installation of emergency pumps at Pelton ladder need to be considered in future budgets. Emergency pumps would only be used if there was a loss of water supply to the fish rearing cells. When considering emergency pumps, project staff should consider needs for future additional cells.

Coded-wire tag groups for Deschutes stock hatchery spring chinook salmon being reared in FY 96 at Pelton ladder (cells L-4 and L-5) for release into the Hood River, have the same tag code. Separate tag groups for cells L-4 and L-5 is recommended for tagging in FY 96 and will benefit future studies, by allowing project staff to compare post-release survival rates between these two cells for the Pelton study. Also, project staff will make comparisons between variable acclimation releases into the Hood River.

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APPENDIX A

SYSTEMATICS OF *ONCORHYNCHUS* SPECIES IN THE VICINITY OF MT. HOOD: PRELIMINARY REPORT TO OREGON DEPARTMENT OF FISH AND WILDLIFE

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Introduction

Hybridization between fish species has been well documented (Hubbs 1955. Schwartz 1972, 1981). Many species of salmonids freely hybridize. Interbreeding between rainbow trout and cutthroat trout results in introgression and hybrid swarms destroying the genetic integrity of both native species (Behnke 1979; Allendorf and Phelps 1981: Busack and Gall 1981: Bartley and Gall 1991; Carmichael et al. 1993). Rainbow trout and cutthroat trout coexist along the west coast of North America including the Columbia River basin and tributaries such as the Hood River.

The Hood River basin drains the north slope of the 11,000 foot Mount Hood of the Cascade Mountains of Oregon. Mount Hood is a young active volcano thought to have erupted as recently as 200 years ago.

The Hood River is near the transition area of inland and coastal forms of both rainbow trout and cutthroat trout. Coastal cutthroat trout (*Oncorhynchus clarki clarki*) are found in the Columbia basin from the coast to Fifteenmile Creek. Westslope cutthroat trout (*O. clarki lewisi*) are located east of the Hood River in the John Day River. Coastal rainbow trout (*O. mykiss irideus*) occupy western drainages while inland redband rainbow trout (*O. mykiss gairdneri*) are found from the Deschutes River east. The distributions are further confused in this area by the many barriers to fish passage. It is thought that some areas contain ancient redband rainbow trout in the upper regions while coastal rainbow trout have invaded the lower regions (Currens et al., 1990).

The purpose of this study was to examine trout populations by allozyme electrophoresis and morphology in the Hood River basin and surrounding areas to determine if and where hybridization is occurring.

Electrophoresis is a commonly used technique in determining hybridization among taxa. Previous studies have shown differences between the taxa in question.

*CK-A2** is particularly useful in distinguishing between rainbow trout and cutthroat trout. Leary et al., (1987) found rainbow trout to be fixed for the *CK-A2*100* allele while cutthroat trout show only the *CK-A2*84* allele.

PEP-A* shows large frequency differences between rainbow trout and cutthroat trout. An average of four steelhead hatcheries showed the *PEP-A2*100* allele at a frequency of 0.949 while an average of four hatchery coastal cutthroat trout populations had this allele at a frequency of 0.099 (Campton and Utter 1985).

Previous studies also show species differences at the *sMEP-2** locus. Campton and Utter (1985) found the *sMEP-2*100* allele in hatchery steelhead at a frequency of 0.983 but in hatchery coastal cutthroat trout at a frequency of 0.028. Leary et al., (1987) reports the *sMEP-2*100* allele to be fixed in rainbow trout and westslope cutthroat trout, but absent from coastal cutthroat trout.

The *IDDH* locus is also shown to be variable between taxa. Hatchery steelhead are fixed for the *IDDH*100* allele, but hatchery coastal cutthroat trout have this allele at a frequency of 0.100 (Campton and Utter 1985). Leary et al., (1987) found the *IDDH*100* allele frequency to be 0.965 in rainbow trout and only 0.500 in coastal cutthroat trout.

Not only is electrophoresis used to detect differences between rainbow trout and cutthroat trout, but also between inland redband rainbow trout and coastal rainbow trout. Inland redband rainbow trout show a higher frequency of *LDH-B22*76* allele and less variation at the *sSOD-1* locus (Allendorf 1975; Wishard et al., 1984).

Traditionally, morphology and more specifically meristics has been used to distinguish taxa. Coastal cutthroat trout are generally thought to be finer scaled, have fewer pyloric ceca and a greater frequency of basibranchial teeth than the rainbow trout which coexists with them (Behnke 1979). Another use of meristics is to test for levels of fluctuating asymmetry. Increased levels of asymmetry result from perturbations during development due to environmental or genetic reasons (Leary et al.. 1984, 1985a, 1985b).

METHODS AND MATERIALS

Collection

Collections from 19 trout populations in the Hood River basin, Sandy River basin and surrounding areas were collected in September or August of 1993. The specimens were stored at -40 C until electrophoresis could be performed.

Allozyme electrophoresis

We assayed 20 enzyme systems coding for 42 loci in eye, liver, and muscle tissue by starch gel electrophoresis according to Utter et al.. 1974 (Table 1). Electrophoretic buffers and stains followed Allendorf et al.. (1977). Nomenclature follows Shaklee et al.. (1990).

Morphological counts

In populations that showed evidence of hybridization we measured all fish >100mm. In other populations we selected five fish at random from the fish which were >100mm.

After removing tissues for electrophoresis we preserved the fish in 10% formalin for several days and then rinsed them with water. We strained the gill rakers and basibranchial teeth overnight in alizarin red dissolved in 3% potassium hydroxide. We counted three single meristic characters: number of pyloric ceca, number of lateral line scales, and presence or absence of basibranchial teeth. We also counted four bilateral traits: number of pectoral fin rays, number of pelvic fin rays, number of gill rakers on the upper limb of the first gill arch, and number of gill rakers on the lower limb of the first gill arch. We counted the number of lateral line scales on the left side only: the bilateral characters were counted on both the left and right sides.

Statistical analyses

We examined similarity between populations using principle component analysis (PCA). PCA provides an easy way to visualize the similarities between samples. Points that are closer together on the plot are more similar than they are to points which are more distant. PCA was performed separately on the allozyme data and morphological data. For the allozyme data PCA was performed on the allele frequency of the *100 allele using the covariance matrix since all data was scaled from 0 to 1. The morphological data was not uniformly scaled so the correlation matrix was used for PCA. For the bilateral traits only the left side was used so the data was not weighted too heavily on these variables.

We used paired t-tests to test if hybrid populations had greater mean asymmetry than either pure rainbow trout or cutthroat trout populations.

RESULTS AND DISCUSSION

Allozyme

Twenty loci showed variation in at least one population (Table 2). Of these twenty loci, eighteen had heterozygotes and both of the homozygotes easily distinguishable. For the *CK-A2** locus the **100/*100* homozygote and the **100/*84* heterozygote are difficult to distinguish (see Utter et al., 1979 for details on CK expression). For this locus the allele frequency was determined by the square root of the frequency of **84/*84* homoizygotes. This method tends to underestimate the frequency of cutthroat trout alleles (*CK-A2*84*) in a sample. *PEP-A* is similar to *CK-A2**, except for *PEP-A** the **100/*110* heterozygote resembles the **110/*110* homozygote. In this case the square root of the **100/*100* homozygotes is used and the frequency of the rainbow trout allele (*PEP-A*100*) is underestimated.

PCA showed four populations: North Fork Greenpoint, Little Sandy River, Mill Creek, and Buck Creek to be distinct from the rest (Figures 1 and 2). These populations are largely rainbow trout and will be discussed later in more detail.

Morphology

The PCA for meristic data (Figure 3) separates the same four populations as the PCA for allozyme data. However the PCA for meristics and the PCA for allozymes do not show the same relationship between the other populations.

One way ANOVA shows that all traits are show significant differences between populations. If we use the electrophoretic data to distinguish rainbow trout and cutthroat trout populations and pool the populations only the number of pectoral fin rays, the number of pyloric ceca and the number of lower gill rakers differ significantly. As expected the number of pyloric ceca is greater for rainbow trout than cutthroat trout. However, the number of lateral line scales is contrary to what is expected. Although not significant the mean number of lateral line scales is less for coastal cutthroat trout than it is for rainbow trout (Table 4).

Basibranchial teeth are absent from rainbow trout but present in 82%-100% of westslope cutthroat trout (Leary et al., in press). Similarly we found basibranchial teeth are absent from rainbow trout but are found in varying frequencies (1.00-0.20) in coastal cutthroat trout.

Hybridization

The samples can be divided into four groups: pure rainbow trout, rainbow trout introgressed with cutthroat trout, and pure cutthroat trout (Table 3).

North Fork Greenpoint is the only sample from the Hood basin that appears to be pure rainbow trout. This population is fixed for the rainbow trout allele at *CK-A2* and *sMEP-2*100* allele and has a high frequency of *IDDH*100* and *PEP-A*100* alleles. Morphologically this sample has the highest number of pyloric ceca and pelvic fin rays and complete absence of basibranchial teeth. The high frequency of *LDH-B2*76* allele and lack of variation at sSOD-1 indicates that this population is likely to be interior redband rainbow trout. This sample was collected above a high falls located on lower Greenpoint Creek where interior redband rainbow trout are likely to be found.

Little Sandy River is the other sample that appears to be pure rainbow trout. Fixation for the rainbow trout allele at *CK-A2** and *PEP-A*100* allele and high frequency of *IDDH*100* and *sMEP-2*100* alleles indicate rainbow trout. This sample also has the highest counts of pectoral fin rays and lower gill rakers, a high number of pyloric ceca and absence of basibranchial teeth. The frequency of the *LDH-B2*76* allele is not characteristic of redband rainbow trout.

Mill Creek appears to be rainbow trout with some introgression of cutthroat trout alleles. *CK-A2** shows evidence of cutthroat trout alleles and *IDDH**, *sMEP-2**, and *PEP-A** show a greater frequency of alleles common to cutthroat trout. The number of pectoral fin rays, pyloric ceca, and lower gill rakers are intermediate between to rainbow trout and cutthroat trout and basibranchial teeth were found in low frequency. The high frequency of *LDH-B2*76* alleles suggest redband trout.

The Buck Creek sample is confusing. Fixation for the *IDDH*100* allele and absence of basibranchial teeth suggest rainbow trout. However, the frequency of cutthroat trout alleles at *CK-A2**, *sMEP-2**, and *PEP-A** indicate some hybridization with cutthroat trout.

Four populations: Pinnacle Creek, South Fork Salmon River, Boulder Creek, and Bull Run Reservoir #1 are largely cutthroat trout with some evidence of rainbow trout hybridization. These populations are characterized by low frequency of the *CK-A2*100* allele which is completely absent from pure cutthroat trout samples. These populations also have low frequencies of the **100* allele at the *sMEP-2** and *PEP-A** loci.

Fivemile Creek, Dog River, Emile Creek, Robinhood Creek, Pocket Creek, Bucket Creek, Lady Creek, Still Creek, Bull Run Reservoir #2, Bull Run Lake, and Bull Run River all show morphology and electrophoretic evidence consistent with pure cutthroat trout. They are fixed for the *CK-A2*84* allele and *sMEP-2*100* and *PEP-A*100* alleles are either absent or in low frequency.

Fluctuating asymmetry

Mill Creek and Bull Run Reservoir had significantly greater fluctuating asymmetry than either pure cutthroat trout or pure rainbow trout (Figure 4). The reasons for increased asymmetry is unknown. It may be related to environmental stress or genetic imbalance due to hybridization in these populations.

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Table 1. Enzymes. Enzyme commission (E.C.) numbers and loci.

Enzyme name	E.C. No.	Locus
Aspartate aminotransferase	2.6.1.1	sAAT-1*
		sAAT-2*
		sAAT-3.4*
Alcohol dehydrogenase	1.1.1.1	ADH*
Adenylate kinase	2.7.4.3	AK-1*
		AK-2*
Creatine kinase	2.7.3.2	CK-A1*
		CK-A2*
		CK-B*
		CK-C1*
		CK-C2*
Gylceraldehyde-3-phosphate dehydrogenase	1.2.1.12	GAPDH-3*
		GAPDH-4*
N-acetyl-beta-glucosaminidase	3.2.1.30	bGLUA
Glycerol-3-phosphate dehyrogenase	1.1.1.8	G3PHD-1*
		G3PHD-2*
Glucose-6-phosphate isomerase	5.3.1.9	GPI-A*
		GPI-B1*
		GPI-B2*
L-iditol dehydrogenase	1.1.1.14	IDDH*
Isocitrate dehydrogenase	1.1.1.42	mIDHP-1*
		mIDHP-2*
		sIDHP-1.2*
L-Lactate dehydrogenase	1.1.1.27	LDH-A1*
		LDH-A2*
		LDH-B1*
		LDH-B2*
		LDH-C*
Malate dehydrogenase	1.1.1.37	sMDH-A1.2*
		sMDH-B1.2*
Malic enzyme	1.1.1.40	mMEP-2*
		sMEP-1.2*
Dipeptidase	3.4.-.-	PEP-A*
Tripeptide aminopeptidase	3.4.-.-	PEP-B*
Phosphogluconate dehydrogenase	1.1.1.44	PGDH*
Phosphoglycerate kinase	2.7.2.3	PGK-2*
Phosphoglucomutase	5.4.2.2	PGM-1*
		PGM-2*
Superoxide dismutase	1.15.1.1	sSOD-1*
Xanthine dehydrogenase	1.1.1.204	XDH*

Table 2. Polymorphic loci (for lociwith two alleles only the frequency of the *100 allele is shown).

	sAAT-3,4	ADH	CK-A2	CK-C2	bGLUA 1	bGLUA 2	bGLUA 3	GPI-A	GPI-B1	GPI-B2	IDDH 1	IDDH 2	IDDH 3	sIDHP-1,2 1	sIDHP-1,2 2	sIDHP-1,2 3	sIDHP-1,2 4	sIDHP-1,2 5
1 Fivemile Cr.	0.640	1.000	0	0.433	1.000	0	0	0.794	1.000	0.882	0.221	0	0.779	0.324	0.419	0.257	0	[illegible]
3 Mill Cr.	0.953	1.000	0.823	1.000	1.000	0	0	0.938	0.984	0.969	0.875	0	0.125	0.531	0.352	0.117	0	[illegible]
4 Dog R.	0.931	1.000	0	1.000	1.000	0	0	0.845	1.000	0.828	0.207	0	0.793	0.397	0.500	0.103	0	
5 Emile Cr.	0.618	1.000	0	1.000	1.000	0	0	0.824	1.000	1.000	0.088	0	0.912	0.426	0.493	0.074	0	[illegible]
6 Pinnacle Cr.	0.875	1.000	0.087	1.000	1.000	0	0	0.150	1.000	1.000	0.050	0	0.950	0.417	0.392	0.117	0	[illegible]
7 NF Greenpoint	1.000	1.000	1.000	1.000	1.000	0	0	1.000	1.000	1.000	0.957	0	0.043	0.707	0.279	0.007	[illegible]	
8 Robinhood Cr.	0.695	1.000	0	1.000	1.000	0	0	0.547	0.969	0.828	0.188	0	0.813	0.469	0.500	0.008	0	[illegible]
9 Pocket Cr.	0.650	1.000	0	1.000	1.000	0	0	0.678	1.000	0.956	0.100	0.900	0	0.506	0.494	0	0	
10 Bucket Cr.	0.500	1.000	0	1.000	1.000	0	0.	0.614	1.000	1.000	1.000	0	0	0.500	0.500	0	0	[illegible]
11 Lady Cr.	0.508	1.000	0	1.000	0.967	0.017	0.017	0.600	1.000	1.000	0.017	0	0.983	0.392	0.500	0.033	[illegible]	[illegible]
12 SF Salmon R.	0.733	1.000	0.247	1.000	0.950	0	0.050	0.867	1.000	1.000	0.267	0	0.733	0.575	0.358	0.067	[illegible]	[illegible]
13 Boulder Cr.	0.603	1.000	0.030	1.000	0.971	0	0.029	0.500	1.000	0.941	0.118	0.029	0.853	0.471	0.500	0.015	[illegible]	[illegible]
14 Still Cr.	0.355	0.919	0	1.000	0.984	0.016	0	0.387	0.968	1.000	0.419	0	0.581	0.491	0.483	0.017	[illegible]	[illegible]
15 Little Sandy	1.000	1.000	1.000	1.000	1.000	0	0	1.000	1.000	1.000	0.933	0	0.067	0.210	0.185	0.137	[illegible]	[illegible]
16 Bull R Res#2	0.717	1.000	0	1.000	1.000	0	0	0.633	1.000	0.867	0.234	0.766	0	0.469	0.508	0.008	[illegible]	[illegible]
17 Bull R Res#1	0.620	1.000	0.010	1.000	0.969	0	0.031	0.833	1.000	0.958	0.242	0	0.758	0.461	0.438	0.047	[illegible]	[illegible]
18 Bull Run L.	0.594	1.000	0	1.000	1.000	0	0	0.470	1.000	1.000	0.106	0.894	0	0.470	0.523	0	[illegible]	[illegible]
19 Bull Run R.	0.569	1.000	0	1.000	1.000	0	0	0.362	1.000	1.000	0.069	0	0.931	0.457	0.448	0.034	[illegible]	[illegible]
20 Buck Cr.	0.938	1.000	0.711	1.000	1.000	0	0	0.958	1.000	0.958	1.000	0	0	0.705	0.295	0	0	[illegible]

	LDH-B2	MDH-B1 1	MDH-B1 2	MDH-B1 3	sMEP-1	sMEP-2	PEP-A	PEP-B	PGDH	PGK-2	PGM-2	sSOD-1 1	sSOD-1 2	sSOD-1 3	N
1 Fivemile Cr.	0.971	1.000	0	0	1.000	0.147	0.030	0.824	1.000	0	0.676	0.956	0.044	0	34
3 Mill Cr.	0.625	1.000	0	0	1.000	0.924	0.694	0.953	1.000	0.594	0.969	0.844	0.156	0	32
4 Dog R.	1.000	1.000	0	0	1.000	0	0.017	0.966	1.000	0	0.810	1.000	0	0	29
5 Emile Cr.	1.000	1.000	0	0	1.000	0	0	0.368	0.985	0	0.559	0.559	0.441	0	34
6 Pinnacle Cr.	1.000	1.000	0	0	1.000	0.250	0	1.000	1.000	0	0.917	0.450	0.550	0	30
7 NF Greenpoint	0.457	0.900	0	0.100	0.971	1.000	0.831	0.986	1.000	0.271	1.000	1.000	0	0	35
8 Robinhood Cr.	1.000	0.984	0	0.016	0.984	0.031	0	0.625	1.000	0	0.297	0.641	0.359	0	32
9 Pocket Cr.	1.000	1.000	0	0	1.000	0	0	0.822	1.000	0.544	0.700	0.811	0.189	0	45
10 Bucket Cr.	1.000	1.000	0	0	1.000	0	0	0.543	1.000	0	0.286	0.857	0.143	0	35
11 Lady Cr.	0.967	1.000	0	0	0.800	0.033	0	0.850	1.000	0	0.283	0.833	0.167	0	30
12 SF Salmon R.	0.950	0.900	0.100	0	0.950	0.317	0.087	0.667	1.000	0.200	0.429	0.350	0.650	0	30
13 Boulder Cr.	0.941	0.824	0.147	0.029	1.000	0.029	0.093	0.912	1.000	0	0.294	0.882	0.118	0	17
14 Still Cr.	1.000	0.952	0.048	0	1.000	0	0	0.906	0.984	0	0.097	0.800	0.200	0	31
15 Little Sandy	0.950	1.000	0	0	1.000	0.950	1.000	1.000	1.000	0	1.000	0.900	0.067	0.033	30
16 Bull R Res#2	1.000	1.000	0	0	1.000	0	0	0.500	1.000	0	0.633	0.700	0.300	0	33
17 Bull R Res#1	1.000	0.958	0.031	0.010	1.000	0.042	0.021	0.396	1.000	0.010	0.417	0.927	0.073	0	30
18 Bull Run L.	1.000	0.939	0	0.061	0.939	0.076	0	0.424	1.000	0	0.909	0.803	0.197	0	33
19 Bull Run R.	1.000	0.879	0	0.121	1.000	0	0	0.655	1.000	0	0.828	0.741	0.259	0	29
20 Buck Cr.	1.000	1.000	0	0	0.708	0.875	0.711	0.958	1.000	0.250	1.000	0.542	0.458	0	12

Table 3. Loci used to distinguish cutthroat trout, coastal rainbow trout, and inland rainbow trout.

	CK-A2	IDDH 1	IDDH 2	IDDH 3	sMEP-2	PEP-A	LDH-B2	sSOD-1 1	sSOD-1 2	sSOD-1 3
7 NF Greenpoint	1.000	0.957	0	0.043	1.000	0.831	0.457	1.000	0	0
15 Little Sandy	1.000	0.933	0	0.067	0.950	1.000	0.950	0.900	0.067	0.033
3 Mill Cr.	0.823	0.875	0	0.125	0.924	0.694	0.625	0.844	0.156	0
20 Buck Cr.	0.711	1.000	0	0	0.875	0.711	1.000	0.542	0.458	0
12 SF Salmon R.	0.247	0.267	0	0.733	0.317	0.087	0.950	0.350	0.650	0
6 Pinnacle Cr.	0.087	0.050	0	0.950	0.250	0	1.000	0.450	0.550	0
13 Boulder Cr.	0.030	0.118	0.029	0.853	0.029	0.093	0.941	0.882	0.118	0
17 Bull R Res#1	0.010	0.242	0	0.758	0.042	0.021	1.000	0.927	0.073	0
1 Fivemile Cr.	0	0.221	0	0.779	0.147	0.030	0.971	0.956	0.044	0
4 Dog R.	0	0.207	0	0.793	0	0.017	1.000	1.000	0	0
5 Emile Cr.	0	0.088	0	0.912	0	0	1.000	0.559	0.441	0
8 Robinhood Cr.	0	0.188	0	0.813	0.031	0	1.000	0.641	0.359	0
9 Pocket Cr.	0	0.100	0.900	0	0	0	1.000	0.811	0.189	0
10 Bucket Cr.	0	1.000	0	0	0	0	1.000	0.857	0.143	0
11 Lady Cr.	0	0.017	0	0.983	0.033	0	0.967	0.833	0.167	0
14 Still Cr.	0	0.419	0	0.581	0	0	1.000	0.800	0.200	0
16 Bull R Res#2	0	0.234	0.766	0	0	0	1.000	0.700	0.300	0
18 Bull Run L.	0	0.106	0.894	0	0.076	0	1.000	0.803	0.197	0
19 Bull Run R.	0	0.069	0	0.931	0	0	1.000	0.741	0.259	0

Table 4. Morphological data (for bilateral traits only counts from the left side are shown). Basi shows the frequency of individuals with basbranchial teeth.

	N	pyloric ceca	lateral line	pect. fins	pelvic fins	upper gill	lower gill	basi
7 NF Greenpoint	5	51.80	127.40	13.40	9.40	7.20	12.20	0.00
15 Little Sandy	5	41.40	126.80	13.80	9.40	7.00	12.40	0.00
3 Mill Cr.	22	35.59	122.50	13.68	9.73	6.86	11.73	0.18
20 Buck Cr.	11	37.18	118.91	13.45	9.82	6.91	11.73	0.00
12 SF Salmon R.	30	32.47	120.23	13.23	9.40	6.90	10.56	0.66
6 Pinnacle Cr.	20	30.85	126.05	13.05	9.05	5.50	11.05	0.80
13 Boulder Cr.	17	30.29	120.59	12.82	9.12	6.71	11.47	1.00
17 Bull R Res#1	18	33.06	121.39	13.28	9.22	6.67	11.83	0.74
1 Fivemile Cr.	5	34.20	122.60	12.40	9.00	6.60	11.20	1.00
4 Dog R.	5	33.20	126.00	12.60	8.80	6.80	10.80	0.40
5 Emile Cr.	5	26.60	121.60	12.80	9.40	6.20	11.80	0.40
8 Robinhood Cr.	5	32.80	123.40	12.40	9.00	6.40	11.20	0.60
9 Pocket Cr.	5	30.80	123.40	12.60	9.20	6.80	11.60	0.20
10 Bucket Cr.	5	30.00	126.00	12.20	9.00	7.00	11.80	0.20
11 Lady Cr.	5	31.60	121.20	13.20	9.00	6.40	11.40	0.60
14 Still Cr.	5	30.60	119.40	12.40	9.00	6.00	11.00	0.40
16 Bull R Res#2	5	36.20	122.00	13.00	9.00	6.60	11.80	0.60
18 Bull Run L.	5	29.40	119.60	12.40	9.00	7.00	11.80	0.20
19 Bull Run R.	5	28.60	121.60	12.80	9.20	6.40	11.40	0.80

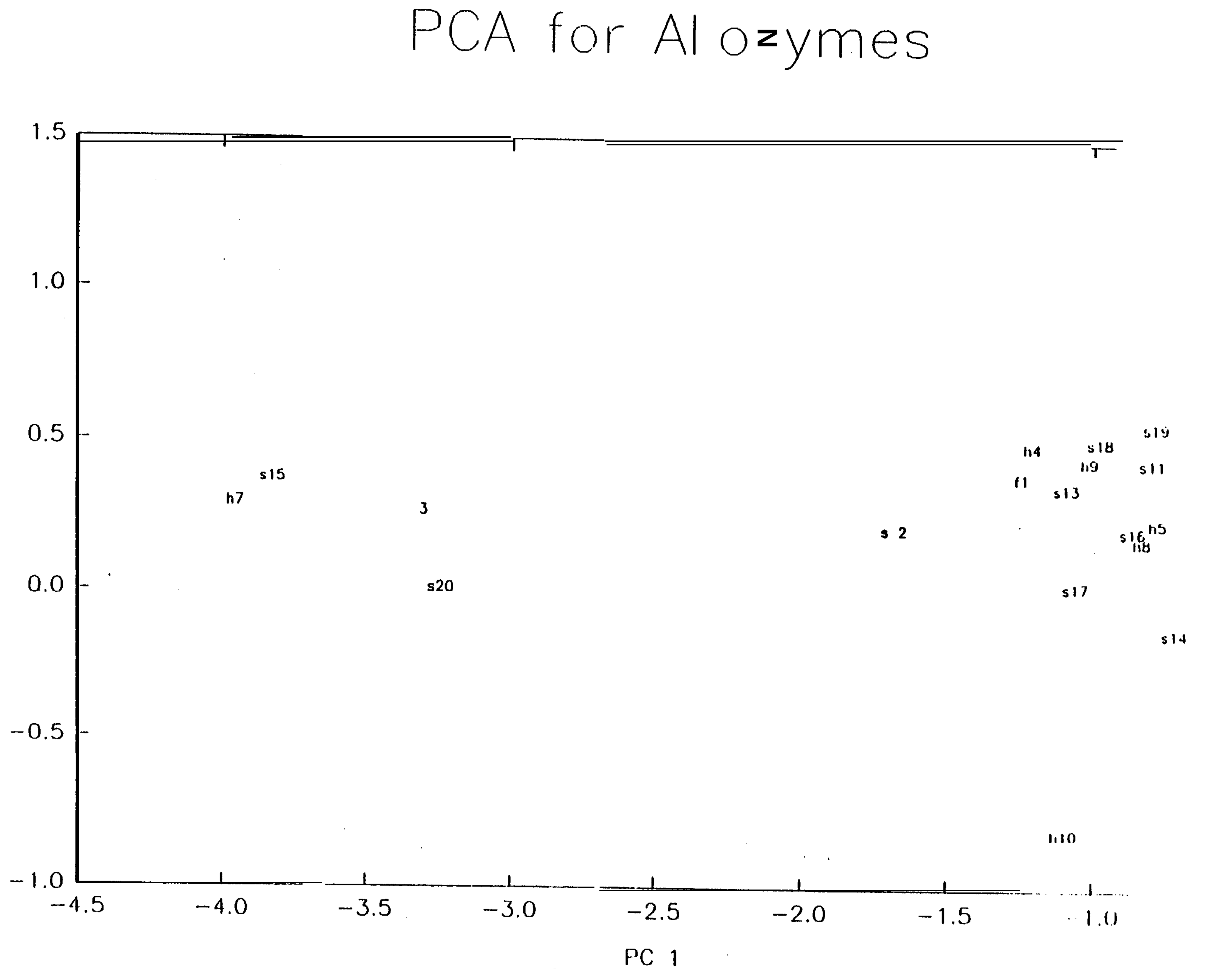


Figure 1. Plot of first two principle component scores from allele frequency data.

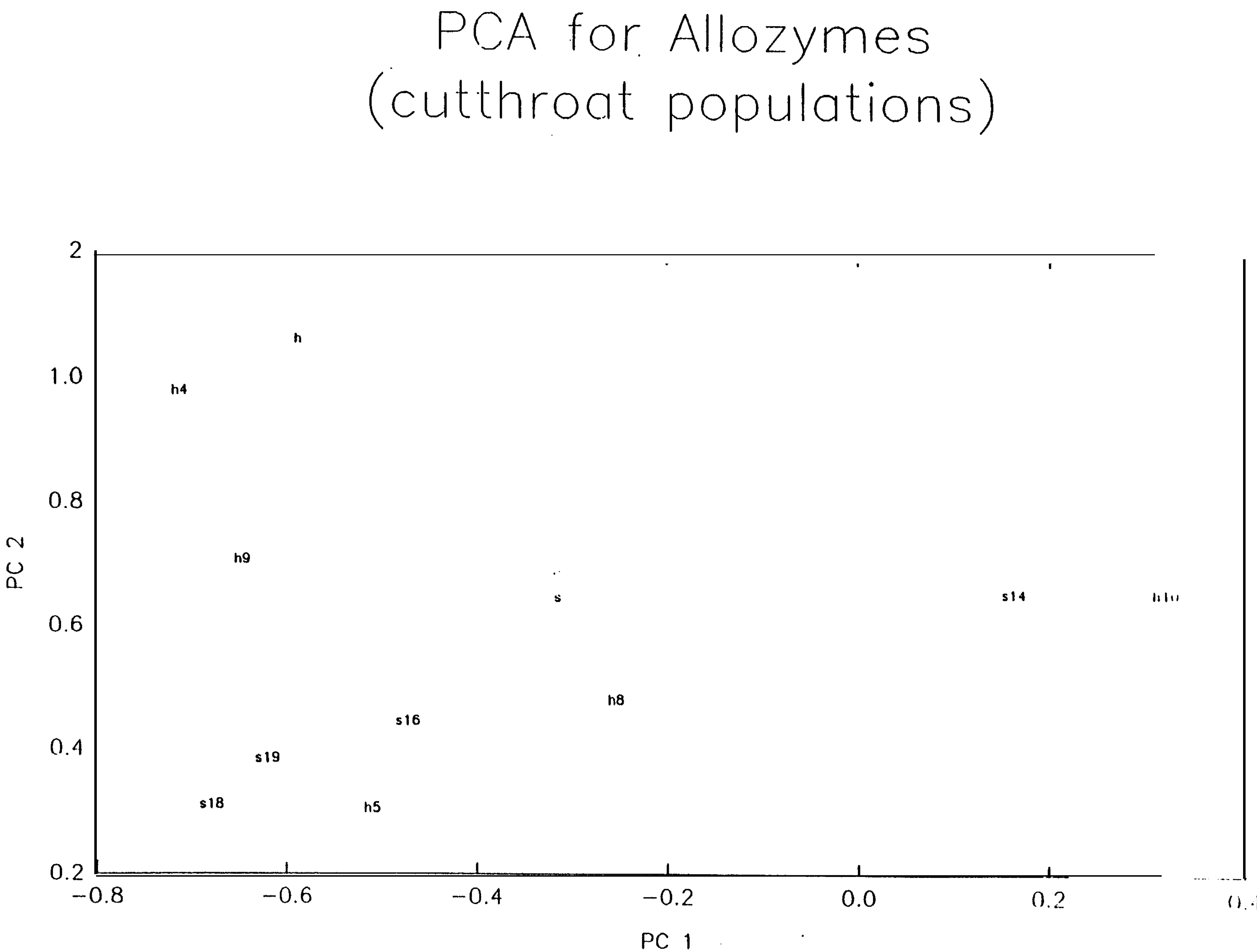
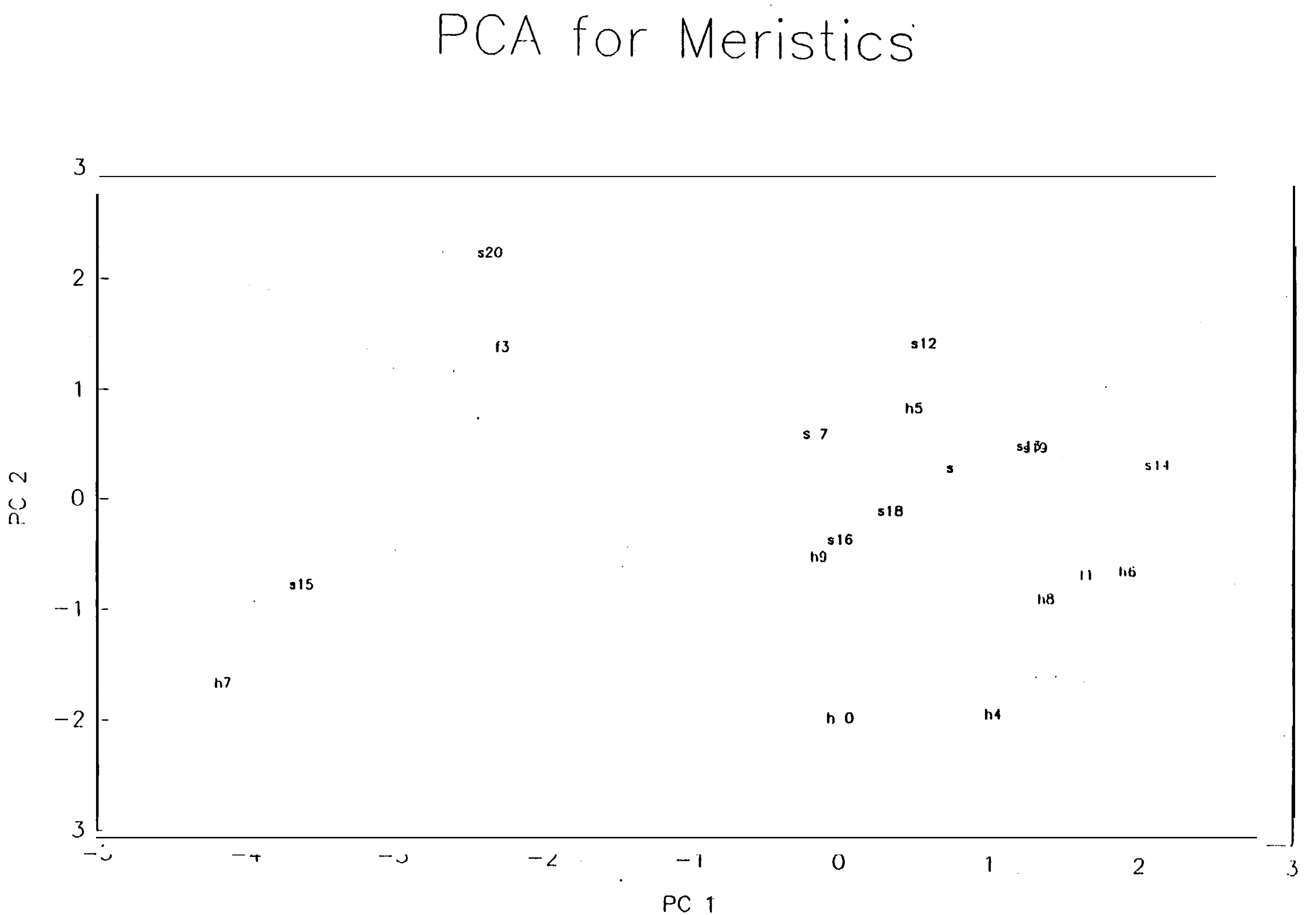


Figure 2. Plot of first two principle component scores from allele frequncy data for pure cutthroat population



Fifure 3. Plot of first two principle component scores from morphological data.

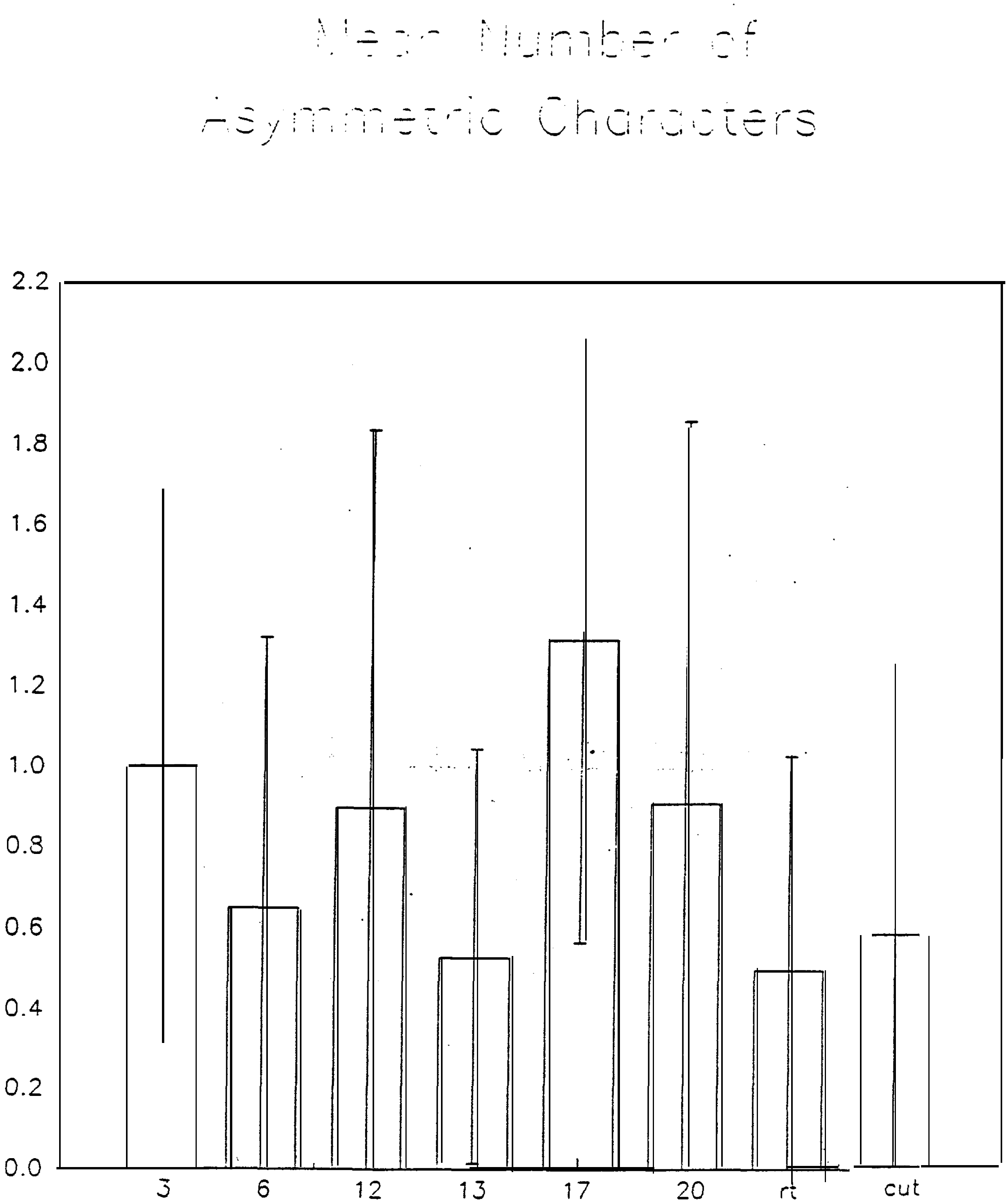


Figure 4. Mean number of asymmetric characters for hybrid populations and pure rainbow trout and cutthroat trout.

APPENDIX B

Radio telemetry data collected
on the lower Hood River

Appendix Table B-1. Tagging data and observed daily locations for radio-tagged spring chinook in the lower Hood River, 1995.

FREQUENCY	41.511	41.592	41.602	41.622	41.662	41.682	41.482	41.532	41.542	41.612
SEX	Female	Female	Female	Female	Female	Female	Female	Female	Female	Female
LENGTH	84.5	87.0	80.0	77.0	91.5	91.0	66.0	101.0	83.5	98.0
WEIGHT	6.5	9.3	7.3	5.5	9.4	8.4	3.4	N.A.	6.4	11.0
DATE TAGGED	05/31/95	06/03/95	06/03/95	06/04/95	06/04/95	06/05/95	06/10/95	06/26/95	07/03/95	07/10/95

OBSERVED DAILY LOCATION

	FREQENCY									
DATE	41.511	41.592	41.602	41.622	41.662	41.682	41.482	41.532	41.542	41.612
06/01/95	0.1									
06/02/95	0.3									
06/03/95	0.8									
06/04/95	0.9	0.3	0.5							
06/05/95		0.3	0.6	0.6	0.6					
06/06/95	3.3	0.3	0.6	0.6	0.6	0.7				
06/07/95	3.8	0.2	0.6	0.6	0.6	0.6				
06/08/95	3.3	0.2	0.6	0.5	0.6	0.5				
06/09/95	2.9	0.5	0.5	0.5	0.5	0.5				
06/10/95	3.2	0.9	0.4	0.5	1.0	0.9				
06/11/95	3.8	1.8	0.4		1.2	0.9	0.4			
06/12/95	3.8	3.3	0.9		2.5	1.0	1.8			
06/13/95	3.9	3.9	1.1		3.7	0.9	3.9			
06/14/95	3.95	3.95	1.1		2.5	0.9	3.95			
06/15/95	3.95	3.95	1.6		0.6	0.9	3.95			
06/16/95	3.95	3.95	1.8		1.0	1.0	2.4			
06/17/95		3.95	3.0		0.8	0.9	2.2			
06/18/95		3.95	3.95		0.6	0.8	2.4			
06/19/95	3.95	3.95	3.95		0.6	0.9	2.5			
06/20/95	3.95	3.95	3.95		0.5	0.9	2.5			
06/21/95	3.95	3.95	3.95	0.5	0.6	1.0				
06/22/95	3.95	3.95	3.95	0.9	0.6	1.0				
06/23/95	3.95	3.95	3.95	1.0	0.8	0.9				
06/24/95	3.9	3.95	3.95	0.9	0.9	0.9	0.7			
06/25/95	3.95	3.95	3.95	1.0	3.95	1.0	3.95			
06/26/95	3.95	3.95	3.95	1.0	3.95	1.1	3.95			
06/27/95	3.95	3.95	3.95	3.5	3.95	0.9	3.95	0.5		

Appendix Table B-1. continued.

DATE	41.511	41.592	41.602	41.622	41.662	41.682	41.482	41.532	41.542	41.612
	OBSERVED DAILY LOCATION FREQUENCY									
06/28/95	3.95	3.95	3.95	3.95	3.95	0.9	3.95	0.5		
06/29/95	3.95	3.95	3.95	3.95	3.95	1.1		0.7		
06/30/95	3.95	3.95	3.95	3.95	3.95	0.8	1.0	0.7		
07/01/95	3.95	3.95	3.95	3.95	3.95	0.9		2.5		
07/02/95	3.95	3.95	3.95	3.95	3.95	0.9	0.8	3.95		
07/03/95	3.95	3.95	3.95	3.8	3.8	2.4		3.95		
07/04/95	3.95	3.95	3.95	3.95	3.95	3.95	0.6	3.95	0.6	
07/05/95	3.95	3.95	3.95	3.95	3.95	3.95	1.0	3.7	0.5	
07/06/95	3.95	3.95	3.95	3.95	3.95	3.95		3.95	1.0	
07/07/95	3.95	3.95	3.95	3.95	3.95	3.95	0.7	3.95		
07/08/95	3.95	3.95	3.95		3.7	3.95		3.95	0.7	
07/09/95	3.7	PASSED	3.95	3.95	3.95	3.95		3.95	3.95	
07/10/95	1.1		3.95	3.4	3.95	3.95		3.95	3.95	
07/11/95	1.8		3.95	3.95	3.95	3.95		3.95	3.95	0.9
07/12/95	3.95		3.95	3.8	3.8	3.95	0.8	3.95	3.95	0.8
07/13/95	3.95		3.95	3.95	3.95	3.95	0.8	3.95	3.95	0.9
07/14/95	3.95		3.95	3.95	3.95	3.95		3.95	3.95	1.8
07/15/95	3.95		3.95	3.95	3.8	3.95		3.95	3.95	3.3
07/16/95	3.95		3.95	3.7	3.9	3.95		3.95	3.95	3.95
07/17/95	3.95		3.95	3.95	3.95	3.95		3.95	3.95	3.95
07/18/95	3.95		3.95	3.95	3.95	3.95		3.95	3.95	3.95
07/19/95	3.95		3.95	3.95	3.9	3.95		3.95	3.95	3.0
07/20/95	3.95		3.95	3.95	3.95	3.95		3.95	3.95	1.7
07/21/95	3.95		3.95	3.95	3.95	3.95		3.95	3.95	0.7
07/22/95	3.95		3.95	3.95	3.8	3.95		3.95	3.95	
07/23/95	3.95		3.95	3.95	3.95	3.95		3.95	3.95	
07/24/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	0.8
07/25/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
07/26/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
07/27/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
07/28/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
07/29/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
07/30/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
07/31/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	

Appendix Table B-1. continued.

DATE	41.511	41.592	41.602	41.622	41.662	41.682	41.482	41.532	41.542	41.612
	OBSERVED DAILY LOCATION FREQUENCY									
08/01/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
08/02/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
08/03/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
08/04/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
08/05/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
08/06/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
08/07/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
08/08/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
08/09/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
08/10/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
08/11/95	3.95		3.95	3.95		3.95		3.95	3.95	
08/12/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
08/13/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
08/14/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
08/15/95	3.95		3.95	3.95	3.95	3.95	3.95	3.95	3.95	
08/16/95	3.95		3.95	3.95	3.95	3.95	3.95	PASSED	3.95	
08/17/95	3.95		3.95	3.95	3.95	3.95	3.95		3.95	
08/18/95	3.95		3.95	3.95	3.95	3.95	3.95		3.95	
08/19/95	3.8	3.95	3.8	3.95	3.95	3.95			3.95	
08/20/95	3.8		3.95	3.95	3.95	3.95	3.95		3.95	
08/21/95	3.8		3.95	3.95	3.95	3.95	3.95		3.95	
08/22/95	3.7		3.95	3.95	3.95	3.95			3.95	
08/23/95	3.7		3.0	3.95	3.95	3.95			3.95	
08/24/95	3.7		3.5	3.95	3.95	3.95			3.95	
08/25/95	3.7		3.5	3.95	3.95	3.95	3.95		3.95	
08/26/95	3.7		3.5	3.95	3.95	3.95	3.95		3.95	
08/27/95	3.7		1.6	3.95	3.95	3.95	3.95		3.95	
08/28/95	3.5		2.5	3.95	3.95	3.95	3.95		3.95	
08/29/95	3.5			3.95	3.95	3.95	3.95		3.95	
08/30/95	3.7		1.2	3.95	3.95	3.95	3.95		3.95	
08/31/95	3.7		1.0	3.95	3.95	3.95	3.95		3.95	
09/01/95	3.7		1.0	1.5	3.95	3.95	3.95		3.95	
09/02/95	3.7		1.1	1.0	3.95	3.95			3.95	
09/03/95	3.7		0.9	1.4	3.95	3.95			3.95	

Appendix Table B-1. continued

DATE	41.511	41.592	41.602	41.622	41.662	41.682	41.482	41.532	41.542	41.612
	OBSERVED DAILY LOCATION FREQUENCY									
09/04/95	3.7		0.8		3.95	3.95			3.95	
09/05/95	3.6		0.8		3.95	3.95	3.95		3.95	
09/06/95	3.7		0.8		3.95	3.95	3.95		3.95	
09/07/95	3.5		0.8		3.95	3.95	3.95		3.95	
09/08/95	3.7		0.9		3.95	3.95	3.95		3.95	
09/09/95	3.7		0.8		3.95	3.95	3.95		3.95	
09/10/95	3.7		0.8		3.95	3.95	3.95		3.95	
09/11/95	3.7		0.6		3.95	3.95	3.95		3.95	
09/12/95	3.7		0.7		3.95	3.95	3.95		3.95	
09/13/95	3.7		0.8		3.95	3.95	3.95		3.95	
09/14/95	3.7		0.8		3.95	3.95	3.95		3.95	
09/15/95	3.7		0.8		3.95	3.95	3.95		3.95	
09/16/95	3.7		0.8		3.95	3.95			3.95	
09/17/95	3.6		0.8		3.95	3.95			3.95	
09/18/95	3.7		0.8		3.95	3.95			3.95	
09/19/95	3.7		0.8		3.95	3.95			3.95	
09/20/95	3.7		0.8		3.95	3.95	3.95		3.95	
09/21/95	3.7		0.8		3.95	3.95			3.95	
09/22/95	3.7		0.6		3.95	3.95			3.95	
09/23/95	3.7		0.6		3.95	3.95			3.95	
09/24/95	3.7		0.6		3.95	3.95			3.95	
09/25/95	3.7		0.6		3.95	3.95			3.95	
09/26/95	3.7		0.6			3.95			3.95	
09/27/95	3.7		0.6		3.95	3.95			3.95	
09/28/95	3.7		0.6		3.95	3.95			3.95	
09/29/95	3.7		0.6		3.95	3.95			3.95	
09/30/95	3.7		0.6		3.95	3.95			3.95	
10/01/95	3.7		0.6			3.95			3.95	
10/02/95	3.7		0.6		3.95	3.95			3.95	
10/03/95	3.8		0.6		3.95	3.95	3.95		3.95	
10/04/95	3.8		0.8		3.95	3.95	3.95		3.95	
10/05/95	3.7		0.8		3.95	3.95	3.95		3.95	
10/06/95	3.7		0.8		3.95	3.95	3.95		3.95	
10/07/95										

Appendix Table B- 1. continued.

DATE	41.511	41.592	41.602	41.622	41.662	41.682	41.482	41.532	41.542	41.612
					OBSERVED DAILY LOCATION FREQUENCY					
10/08/95										
10/09/95	3.7		0.7		3.95	3.95			3.95	
10/10/95	3.7		0.7		3.95	3.95			3.9	
10/11/95	3.7		0.7		3.95	3.95			3.9	
10/12/95										
10/13/95										
10/14/95										
10/15/95	3.7		3.95		3.95	3.95			3.9	
10/16/95	3.7		1.3		3.95	3.95			3.95	
10/17/95	3.7		1.2		3.95	3.95			3.95	
10/18/95	3.7		1.2		3.95	3.95			3.9	
10/19/95	3.7		1.2		3.9	3.95			3.9	
10/20/95	3.7		1.1		3.9	3.95			3.95	
10/21/95										
10/22/95										
10/23/95										
10/24/95	3.7		1.1		3.95	3.95			3.95	
10/25/95	3.7		0.8		3.95	3.95			3.95	
10/26/95	3.7		0.8		3.95	3.95			3.95	
10/27/95	3.7		0.8		3.95	3.95			3.95	
10/28/95										
10/29/95										
10/30/95										
10/31/95										
11/01/95										
11/02/95										
11/03/95	3.7		0.8		3.9	3.95			3.95	
11/04/95										
11/05/95										
11/06/95										
11/07/95										
11/08/95										
11/09/95										
11/10/95	3.7		0.8		3.95	3.95			3.95	

Appendix Table B-1. continued.

DATE	OBSERVED DAILY LOCATION FREQUENCY 41.511	41.592	41.602	41.622	41.662	41.682	41.482	41.532	41.542	41.612
11/11/95										
11/12/95										
11/13/95										
11/14/95										
11/15/95										
11/16/95			0.8		3.95	3.95			2.1	

Appendix Table B-2. Tagging data and observed daily locations for radio-tagged summer steelhead in the lower Hood River, 1995.

FREQUENCY	40.010	40.030	40.040	40.050	40.060	40.370	40.070
SEX	Female	Male	Male	Female	Male	Male	Male
LENGTH	63.5	73.5	80.5	69.0	81.0	77.5	80.0
WEIGHT	2.7	4.1	5.4	3.1	5.5	4.7	5.1
DATE TAGGED	06/01/95	06/02/95	06/03/95	06/13/95	06/19/95	06/26/95	07/02/95

OBSERVED DAILY LOCATION

	FREQUENCY						
DATE	40.010	40.030	40.040	40.050	40.060	40.370	40.070
06/01/95							
06/02/95	0.8						
06/03/95	0.9	0.5					
06/04/95	0.9	0.6	0.5				
06/05/95		0.7	0.5				
06/06/95	2.4	0.6	0.6				
06/07/95	2.5	0.6	0.6				
06/08/95	2.6	0.6	0.5				
06/09/95	2.9	0.5	0.5				
06/10/95	3.3	0.6	0.7				
06/11/95	3.8	0.6	0.6				
06/12/95	3.3	0.8	0.5				
06/13/95	3.1	0.9	0.5				
06/14/95	3.1	0.9	0.5	0.5			
06/15/95	3.8	1.1	0.6	0.5			
06/16/95	3.95	2.0	0.6	0.9			
06/17/95	3.95	3.0	0.6	0.9			
06/18/95	3.95	3.2	0.5	0.9			
06/19/95	3.4	3.8	0.5	0.9			
06/20/95	3.1	3.8	0.5	0.9	0.5		
06/21/95	3.1	3.95	0.5	0.9	0.6		
06/22/95	3.0	1.1	0.5	1.1	0.2		
06/23/95	1.1	1.0	0.5	0.9	1.1		
06/24/95	1.1	1.0	0.5	1.0	1.1		
06/25/95	1.3	0.9	0.5	1.0	1.1		
06/26/95	1.5	3.3	0.5	1.0	1.5	HARVESTED	
06/27/95	1.6	3.95	0.5	1.1	3.6		

Appendix Table B-2. continued.

	OBSERVED DAILY LOCATION						
	FREQUENCY						
DATE	40.010	40.030	40.040	40.050	40.060	40.370	40.07
06/28/95	**1.6**	**3.95**	0.5	1.1	3.95		
06/29/95	1.3	3.95	0.5	0.8	3.95		
06/30/95	1.5	3.8	0.5	0.9	3.95		
07/01/95	**1.3**	**3.95**	0.5		3.95		
07/02/95	***1.0***	***3.95***	0.5	0.6	3.95		
07/03/95	**1.0**	**PASSED**	0.5	0.8	3.95		0.5
07/04/95			0.5	0.8	3.0		0.6
07/05/95			0.5	0.8	3.95		0.5
07/06/95			0.5	1.0	2.8		0.5
07/07/95			0.5	0.8	2.9		0.7
07/08/95			0.5	0.8	2.8		0.5
07/09/95			0.5	0.8	3.1		0.5
07/10/95			0.5	0.8	3.1		
07/11/95			0.5	0.8	3.1		
07/12/95			0.5	0.9	3.1		
07/13/95			0.5	0.8	3.0		
07/14/95			0.5	0.8	3.0		
07/15/95			0.5	0.8	3.3		
07/16/95			0.5	0.8	3.5		
07/17/95			0.5	0.8	3.5		
07/18/95			0.5	0.8	3.95		
07/19/95			0.5	0.3	3.95		
07/20/95			0.5	0.8	3.95		
07/21/95			0.5	0.3	3.95		0.5
07/22/95			0.5	0.2	3.95		0.6
07/23/95			0.5	0.3	3.95		0.6
07/24/95			0.5		3.95		
07/25/95			0.5	0.4	3.95		
07/26/95			0.5		3.95		
07/27/95			0.5		3.95		
07/28/95			0.5	0.1	3.95		
07/29/95			0.5	0.3	3.95		
07/30/95			0.5	0.3	3.95		
07/31/95			0.5	0.3	3.95		

Appendix Table B-2. continued.

DATE	OBSERVED DAILY LOCATION FREQUENCY 40.010	40.030	40.040	40.050	40.060	40.370	40.070
08/01/95			0.5	0.3	3.95		
08/02/95			0.5	0.3	3.95		
08/03/95			0.5	0.3	3.95		
08/04/95			0.5	0.4	3.95		
08/05/95			0.[illegible]	0.3	3.95		
08/06/95			0.5	0.3	3.95		
08/07/95			0.5	0.3	3.95		
08/08/95			0.5	0.3	3.95		
08/09/95			0.5	0.3	3.95		
08/10/95			0.5	0.3	3.95		
08/11/95			0.5	0.3	3.95		
08/12/95			0.5	0.3	3.95		
08/13/95			0.5	0.2	3.95		
08/14/95			0.5	0.2	3.95		
08/15/95			0.5	0.3	3.95		
08/16/95			0.5	0.3	3.95		
08/17/95			0.5	0.3	3.95		
08/18/95			0.5	0.3	3.95		
08/19/95			0.5	0.2	3.95		
08/20/95			0.5	0.3	3.95		
08/21/95			0.5	0.2	3.95		
08/22/95			0.4	0.3	3.95		
08/23/95			0.5	0.3	3.95		
08/24/95			0.5	0.3	3.95		
08/25/95			0.5	0.3	3.95		
08/26/95			0.5	0.3	3.95		
08/27/95			0.5	0.3	3.95		
08/28/95			0.5	0.3	3.95		
08/29/95			0.5	0.3	3.95		
08/30/95			0.5	0.3	3.95		
08/31/95			0.5	0.3	3.95		
09/01/95			0.5	0.3	3.95		
09/02/95			0.5	0.2	3.95		
09/03/95			0.5	0.3	3.95		

Appendix Table B-2. continued.

DATE	40.010	40.030	40.040	4d.050	40.060	40.370	40.070
			OBSERVED DAILY LOCATION FREQUENCY				
09/04/95			0.4	0.3	3.95		
09/05/95			0.5	0.3	3.95		
09/06/95			0.5	0.3	3.95		
09/07/95			0.5	0.3	3.95		
09/08/95			0.5	0.3	3.95		
09/09/95			0.5	0.3	3.95		
09/10/95			0.5	0.3	3.95		
09/11/95			0.5	0.3	3.95		
09/12/95			0.5	0.3	3.95		
09/13/95			0.5	0.3	3.95		
09/14/95			0.5	0.3	3.95		
09/15/95			0.5	0.3	3.95		
09/16/95			0.5	0.3	3.95		
09/17/95			0.4	0.3	3.95		
09/18/95			0.4	0.3	3.95		
09/19/95			0.5	0.3	3.95		
09/20/95			0.5	0.3	3.95		
09/21/95			0.5	0.3	3.95		
09/22/95			0.5	0.3	3.95		
09/23/95			0.5	0.3	3.95		
09/24/95			0.5	0.2	3.95		
09/25/95			0.5	0.3	3.95		
09/26/95			0.5	0.2	3.95		
09/27/95			0.5	0.2	3.95		
09/28/95			0.5	0.2	3.95		
09/29/95			0.5	0.2	3.95		
09/30/95			0.5	0.1	3.95		
10/01/95			0.5	0.1	3.95		
10/02/95			0.5	0.1	3.95		
10/03/95			0.5	0.1	3.95		
10/04/95			0.5	0.1	3.95		
10/05/95			0.5	0.1	3.95		
10/06/95			0.5	0.1	3.95		
10/07/95							

Appendix Table B-2. continued.

DATE	OBSERVED DAILY LOCATION FREQUENCY 40.010	40.030	40.040	40.050	40.060	40.370	40.070
10/08/95							
10/09/95			0.5	0.1	3.95		
10/10/95			0.5	0.1	3.95		
10/11/95			0.5	0.1	3.95		
10/12/95							
10/13/95							
10/14/95							
10/15/95			0.5	0.1	3.95		
10/16/95			0.5	0.1	3.95		
10/17/95			0.5	0.1	3.95		
10/18/95			0.5	0.1	3.95		
10/19/95			0.5	0.1	3.9		
10/20/95			0.5	0.1	3.9		
10/21/95							
10/22/95							
10/23/95							
10/24/95			0.5	0.1	3.9		
10/25/95			0.5	0.1	3.7		
10/26/95			0.5	0.1	3.5		
10/27/95			0.5	0.1			
10/28/95							
10/29/95							
10/30/95							
10/31/95							
11/01/95							
11/02/95							
11/03/95			0.5	0.1			
11/04/95							
11/05/95							
11/06/95							
11/07/95							
11/08/95							
11/09/95							
11/10/95			0.5	0.1			

Appendix Table B-2. continued.

DATE	OBSERVED DAILY LOCATION FREQUENCY						
	40.010	40.030	40.040	40.050	40.060	40.370	40.070
11/11/95							
11/12/95							
11/13/95							
11/14/95							
11/15/95							
11/16/95			0.2	0.1			

Appendix Table B-2. continued.

FREQUENCY	40.380	40.430	40.510	40.612	40.400	40.362	40.352
SEX	Female	Female	Female	Female	Female	Male	Male
LENGTH	69.5	82.0	68.5	68.0	69.0	66.0	69.0
WEIGHT	2.7	5.5	3.3	3.5	3.2	2.9	3.6
DATE TAGGED	07/02/95	07/02/95	07/02/95	07/02/95	07/03/95	07/04/95	07/04/95

OBSERVED DAILY LOCATION

	FREQUENCY						
DATE	40.380	40.430	40.510	40.612	40.400	40.362	40.352
06/01/95							
06/02/95							
06/03/95							
06/04/95							
06/05/95							
06/06/95							
06/07/95							
06/08/95							
06/09/95							
06/10/95							
06/11/95							
06/12/95							
06/13/95							
06/14/95							
06/15/95							
06/16/95							
06/17/95							
06/18/95							
06/19/95							
06/20/95							
06/21/95							
06/22/95							
06/23/95							
06/24/95							
06/25/95							
06/26/95							
06/27/95							

Appendix Table B-2. continued.

DATE	OBSERVED DAILY LOCATION FREQUENCY 40.380	40.430	40.510	40.612	40.400	40.362	40.352
06/28/95							
06/29/95							
06/30/95							
07/01/95							
07/02/95							
07/03/95	0.5	0.6	0.3	0.3			
07/04/95	0.3	1.0	0.1	0.5	0.1	0.6	
07/05/95	1.2	1.2	0.9	0.7		0.3	0.1
07/06/95	1.0		0.9	0.7	0.1	1.2	
07/07/95	1.0	3.95	1.1	0.4	1.0	0.8	0.6
07/08/95	3.6	3.95	1.2	0.6	0.9	0.8	
07/09/95	3.8	3.9		0.8		0.9	0.5
07/10/95	1.7	3.8		0.7	0.9	0.8	0.4
07/11/95	0.1	3.95	0.1	0.8	0.9	0.8	0.2
07/12/95	0.1	3.95	0.1	0.8	1.0	0.8	0.5
07/13/95	0.2	3.95	0.6	0.6	1.0	0.9	0.6
07/14/95	0.1	3.95	0.6	0.7	1.0	0.9	0.4
07/15/95	0.9	1.1	0.9	0.6	1.2	0.9	0.1
07/16/95	1.0		1.2	0.9	1.1	0.8	
07/17/95	1.5	3.95	1.1	0.9	1.1	0.9	0.4
07/18/95	1.8	3.1	1.1	0.9		0.9	0.4
07/19/95	3.7		1.0	0.9	1.0	0.8	0.8
07/20/95	3.95		1.0	0.8	0.9	0.8	0.8
07/21/95	PASSED		0.7	0.8	0.9	0.8	0.7
07/22/95				0.8	0.9	0.6	
07/23/95				0.8	1.1	0.9	
07/24/95						0.9	
07/25/95				0.9	0.4	0.9	
07/26/95				1.2	0.9	1.1	
07/27/95				2.6	0.9	1.1	
07/28/95				3.95	0.9	1.1	
07/29/95				3.95	1.2	1.1	
07/30/95					1.1		
07/31/95				3.95			

Appendix Table B-2. continued.

	OBSERVED DAILY LOCATION						
	FREQUENCY						
DATE	40.380	40.430	40.510	40.612	40.400	40.362	40.352
08/01/95				3.95			
08/02/95				3.95			
08/03/95				PASSED			
08/04/95							
08/05/95							
08/06/95							
08/07/95							
08/08/95							
08/09/95							
08/10/95							
08/11/95							
08/12/95							
08/13/95							
08/14/95							
08/15/95							
08/16/95							
08/17/95							
08/18/95							
08/19/95							
08/20/95							
08/21/95							
08/22/95							
08/23/95							
08/24/95							
08/25/95							
08/26/95							
08/27/95							
08/28/95							
08/29/95							
08/30/95							
08/31/95							
09/01/95							
09/02/95							
09/03/95							

Appendix Table B-2. continued.

DATE	OBSERVED DAILY LOCATION FREQUENCY 40.380	40.430	40.510	40.612	40.400	40.362	40.352
09/04/95							
09/05/95							
09/06/95							
09/07/95							
09/08/95							
09/09/95							
09/10/95							
09/11/95							
09/12/95							
09/13/95							
09/14/95							
09/15/95							
09/16/95							
09/17/95							
09/18/95							
09/19/95							
09/20/95							
09/21/95							
09/22/95							
09/23/95							
09/24/95							
09/25/95							
09/26/95							
09/27/95							
09/28/95							
09/29/95							
09/30/95							
10/01/95							
10/02/95							
10/03/95							
10/04/95							
10/05/95							
10/06/95							
10/07/95							

Appendix Table B-2. continued.

	OBSERVED DAILY LOCATION						
	FREQUENCY						
DATE	40.380	40.430	40.510	40.612	40.400	40.362	40.352
10/08/95							
10/09/95							
10/10/95							
10/11/95							
10/12/95							
10/13/95							
10/14/95							
10/15/95							
10/16/95							
10/17/95							
10/18/95							
10/19/95							
10/20/95							
10/21/95							
10/22/95							
10/23/95							
10/24/95							
10/25/95							
10/26/95							
10/27/95							
10/28/95							
10/29/95							
10/30/95							
10/31/95							
11/01/95							
11/02/95							
11/03/95							
11/04/95							
11/05/95							
11/06/95							
11/07/95							
11/08/95							
11/09/95							
11/10/95							

Appendix Table B-2. continued.

	OBSERVED DAILY LOCATION						
	FREQUENCY						
DATE	40.380	40,430	40.510	40.612	40.400	40.362	40.352
11/11/95							
11/12/95							
11/13/95							
11/14/95							
11/15/95							
11/16/95							

Appendix Table B-2. continued.

FREQUENCY	40.390	40.440	40.470	40.410	40.460	40.480	40.520
SEX	Female	Male	Female	Male	Female	Female	Male
LENGTH	67.0	65.0	80.0	86.0	70.0	75.0	N.A.
WEIGHT	3.1	3.3	4.9	N.A.	3.4	4.0	N.A
DATE TAGGED	07/04/95	07/04/95	07/10/95	07/16/95	07/16/95	07/19/95	07/23/95

OBSERVED DAILY LOCATION

	FREQUENCY						
DATE	40.390	40.440	40.470	40.410	40.460	40.480	40.520
06/01/95							
06/02/95							
06/03/95							
06/04/95							
06/05/95							
06/06/95							
06/07/95							
06/08/95							
06/09/95							
06/10/95							
06/11/95							
06/12/95							
06/13/95							
06/14/95							
06/15/95							
06/16/95							
06/17/95							
06/18/95							
06/19/95							
06/20/95							
06/21/95							
06/22/95							
06/23/95							
06/24/95							
06/25/95							
06/26/95							
06/27/95							

Appendix Table B-2. continued.

	OBSERVED DAILY LOCATION						
	FREQUENCY						
DATE	40.390	40.440	40.470	40.410	40.460	40.480	40.520
06/28/95							
06/29/95							
06/30/95							
07/01/95							
07/02/95							
07/03/95							
07/04/95							
07/05/95	0.6	0.5					
07/06/95	0.4	0.5					
07/07/95	0.6	0.7					
07/08/95	0.7						
07/09/95		0.5					
07/10/95		0.5					
07/11/95	1.0	0.5	0.5				
07/12/95	1.0	0.5	0.5				
07/13/95	1.0	0.6	0.7				
07/14/95	3.5	0.5	0.6				
07/15/95	3.95	0.6	0.6				
07/16/95	PASSED	0.6	0.7				
07/17/95		0.7	0.7	0.5	0.5		
07/18/95		0.9	0.6	0.5	0.5		
07/19/95		1.1	1.0	1.0	0.9		
07/20/95		1.2	0.5	0.6	1.0	0.3	
07/21/95		0.9	0.8	0.6	0.9	0.9	
07/22/95		2.9	0.6	0.9	1.3	0.9	
07/23/95		3.95	0.6	1.0	2.8	0.7	
07/24/95		3.9	0.7	1.0	3.9	0.5	0.5
07/25/95		3.95	0.7	0.9	3.95	0.9	0.5
07/26/95		3.95	0.7		3.95	0.9	0.6
07/27/95		3.95	0.7	0.9	3.95	0.9	0.6
07/28/95		3.95	0.8	1.1	1.0	0.9	0.1
07/29/95		3.95	0.8	1.0	1.1	1.4	0.1
07/30/95		3.95	0.8	0.9	3.95		0.1
07/31/95		3.95	0.7	0.9	0.9		0.3

Appendix Table B-2. continued.

DATE	40.390	40.440	40.470	40.410	40.460	40.480	40.520
	OBSERVED DAILY LOCATION						
	FREQUENCY						
08/01/95		3.95	0.8	0.9	0.9		0.1
08/02/95		3.95	0.8	0.9	0.8		0.1
08/03/95		3.95	0.8	1.1	1.1		0.1
08/04/95		3.95	0.8	1.1	2.9		0.3
08/05/95		3.95	0.8	1.1	3.95		0.3
08/06/95		2.5	0.8	0.8	3.95		0.3
08/07/95		2.6	0.8	0.9	3.95		0.3
08/08/95		2.4	0.8	0.9	3.95		0.3
08/09/95		2.4	0.8	0.9	3.95		0.3
08/10/95		2.4	0.8	0.8	3.95		0.6
08/11/95		2.4	0.6	0.6	3.95		0.7
08/12/95		2.4	0.7	0.8	3.95		0.5
08/13/95		2.4	0.5	0.8	3.95		0.6
08/14/95		HARVESTED	0.7	0.8	PASSED		0.7
08/15/95			0.7	1.0			0.7
08/16/95			0.8	1.0			0.7
08/17/95			0.8	1.0			0.7
08/18/95			0.8	1.0			0.8
08/19/95			0.7	0.8			HARVESTED
08/20/95			0.7	0.8			
08/21/95			0.6	0.9			
08/22/95			0.5	0.9			
08/23/95			0.5	0.9			
08/24/95			0.5	1.0			
08/25/95			0.5	1.0			
08/26/95			0.5	1.0			
08/27/95			0.5	1.0			
08/28/95			0.7	1.0			
08/29/95			0.9	1.0			
08/30/95			0.7	1.0			
08/31/95			0.7	2.7			
09/01/95			0.7	2.7			
09/02/95			0.7	3.0			
09/03/95			0.7	3.0			

Appendix Table B-2. continued.

	OBSERVED DAILY LOCATION						
	FREQUENCY						
DATE	40.390	40.440	40.470	40.410	40.460	40.480	40.520
09/04/95			0.4	3.2			
09/05/95			0.5	3.95			
09/06/95			0.5	3.95			
09/07/95			0.5	3.95			
09/08/95			0.5	3.95			
09/09/95			0.5	3.95			
09/10/95			0.5	3.95			
09/11/95			0.5	3.95			
09/12/95			0.5	3.95			
09/13/95			0.5	3.95			
09/14/95			0.5	3.95			
09115195			0.5	3.95			
09/16/95			0.5	3.8			
09/17/95			0.6	3.95			
09/18/95			0.6	3.95			
09/19/95			0.6	3.95			
09/20/95			0.6	3.95			
09/21/95			0.6	3.95			
09/22/95			0.6	3.95			
09/23/95			0.6	3.95			
09/24/95			0.6	3.95			
09/25/95			0.6	3.95			
09/26/95			0.6	3.95			
09/27/95			0.6	3.8			
09/28/95			0.6	3.8			
09/29/95			0.6	3.8			
09/30/95			0.6	3.6			
10/01/95			0.6	3.6			
10/02/95				3.6			
10/03/95				3.6			
10/04/95			2.1	2.8			
10/05/95			*3.95*	2.4			
10/06/95			*3.95*	2.4			
10/07/95							

Appendix Table B-2. continued.

	OBSERVED DAILY LOCATION FREQUENCY						
DATE	40.390	40.440	40.470	40.410	40.460	40.480	40.520
10/08/95							
10/09/95			3.95	2.6			
10/10/95				1.2			
10/11/95			2.6	2.5			
10/12/95							
10/13/95							
10/14/95							
10/15/95			3.3	2.5			
10/16/95			3.3	2.5			
10/17/95			3.9	2.5			
10/18/95			2.6	2.5			
10/19/95			1.5	2.5			
10/20/95			1.5	2.5			
10/21/95							
10/22/95							
10/23/95							
10/24/95			2.1	2.4			
10/25/95			2.3	2.5			
10/26/95			2.6	2.1			
10/27/95			2.6	2.1			
10/28/95							
10/29/95							
10/30/95							
10/31/95							
11/01/95							
11/02/95							
11/03/95			2.6	2.5			
11/04/95							
11/05/95							
11/06/95							
11/07/95							
11/08/95							
11/09/95							
11/10/95			2.0	0.9			

Appendix Table B-2. continued.

	OBSERVED DAILY LOCATION						
	FREQUENCY						
DATE	40.390	40.440	40.470	40.410	40.460	40.480	40.520
11/11/95							
11/12/95							
11/13/95							
11/14/95							
11/15/95							
11/16/95			3.8				

Appendix Table B-2. continued.

FREQUENCY	40.530	40.560	40.590	40.630	40.640
SEX	Male	Female	Male	Male	Female
LENGTH	64.5	63.5	84.0	71.0	70.0
WEIGHT	3.0	2.6	6.0	3.6	3.2
DATE TAGGED	07/24/95	07/29/95	08/02/95	08/07/95	08/07/95

OBSERVED DAILY LOCATION

	FREQUENCY				
DATE	40.530	40.560	40.590	40.630	40.640
06/01/95					
06/02/95					
06/03/95					
06/04/95					
06/05/95					
06/06/95					
06/07/95					
06/08/95					
06/09/95					
06/10/95					
06/11/95					
06/12/95					
06/13/95					
06/14/95					
06/15/95					
06/16/95					
06/17/95					
06/18/95					
06/19/95					
06/20/95					
06/21/95					
06/22/95					
06/23/95					
06/24/95					
06/25/95					
06/26/95					
06/27/95					

Appendix Table B-2. continued.

	OBSERVED DAILY LOCATION				
	FREQUENCY				
DATE	40.530	40.560	40.590	40.630	40.640
06/28/95					
06/29/95					
06/30/95					
07/01/95					
07/02/95					
07/03/95					
07/04/95					
07/05/95					
07/06/95					
07/07/95					
07/08/95					
07/09/95					
07/10/95					
07/11/95					
07/12/95					
07/13/95					
07/14/95					
07/15/95					
07/16/95					
07/17/95					
07/18/95					
07/19/95					
07/20/95					
07/21/95					
07/22/95					
07/23/95					
07/24/95					
07/25/95	0.3				
07/26/95	0.3				
07/27/95	0.3				
07/28/95	0.6				
07/29/95					
07/30/95		0.5			
07/31/95		0.5			

Appendix Table B-2. continued.

DATE	OBSERVED DAILY LOCATION FREQUENCY 40.530	40.560	40.590	40.630	40.640
08/01/95		0.7			
08/02/95		0.8			
08/03/95		1.4	0.7		
08/04/95		2.9	0.5		
08/05/95		3.5	0.3		
08/06/95		3.95	0.5		
08/07/95		3.95	0.5		
08/08/95		3.95	0.5	0.6	0.5
08/09/95		3.95	0.5	0.6	0.5
08/10/95		3.95	0.5	0.6	0.5
08/11/95	1.9	3.95	0.4	0.5	0.5
08/12/95		3.95	0.4	0.6	0.5
08/13/95		3.95	0.5	0.7	0.9
08/14/95		3.8	0.6	0.7	1.0
08/15/95		3.95	0.4	0.5	1.0
08/16/95		3.95	0.5	0.5	1.1
08/17/95		3.95	0.5	0.7	1.1
08/18/95		3.95	0.5	0.7	1.1
08/19/95		3.95	0.4		0.9
08/20/95		3.95	0.5	0.7	1.0
08/21/95		3.95	1.0	0.8	1.1
08/22/95		3.8	3.0	0.5	1.2
08/23/95		3.7		0.6	1.2
08/24/95		3.95	PASSED	0.5	1.7
08/25/95		3.95		0.5	1.9
08/26/95		3.95		0.5	3.95
08/27/95		3.95		0.5	3.95
08/28/95		3.95		0.7	3.8
08/29/95		3.95		0.5	3.95
08/30/95		3.95		0.5	3.95
08/31/95		3.95		0.5	3.95
09/01/95		3.95		0.6	3.95
09/02/95		3.7		0.7	3.95
09/03/95		3.9		0.5	3.95

Appendix Table B-2. continued.

DATE	OBSERVED DAILY LOCATION FREQUENCY 40.530	40.560	40.590	40.630	40.640
09/04/95		3.8		0.5	3.95
09/05/95		3.95			3.95
09/06/95		3.95			3.95
09/07/95		3.95		0.5	3.95
09/08/95		3.95		0.5	3.95
09/09/95		3.95		0.5	3.95
09/10/95		3.95		0.5	PASSED
09/11/95		3.95		0.5	
09/12/95		3.95		0.5	
09/13/95		3.95		0.5	
09/14/95		3.95		0.5	
09/15/95		3.95		0.5	
09/16/95		3.95		0.7	
09/17/95				1.1	
09/18/95		3.95		1.5	
09/19/95				1.3	
09/20/95		3.95		1.5	
09/21/95		3.95		1.8	
09/22/95		3.95		1.5	
09/23/95		3.95		1.5	
09/24/95		HARVESTED		1.5	
09/25/95				1.3	
09/26/95				1.4	
09/27/95				1.4	
09/28/95				1.2	
09/29/95				1.2	
09/30/95				1.1	
10/01/95				1.2	
10/02/95				1.1	
10/03/95					
10/04/95				1.1	
10/05/95				1.1	
10/06/95				1.1	
10/07/95					

Appendix Table B-2. continued.

DATE	OBSERVED DAILY LOCATION FREQUENCY 40.530	40,560	40.590	40.630	40.640
10/08/95					
10/09/95				1.2	
10/10/95				1.2	
10/11/95				1.2	
10/12/95					
10/13/95					
10/14/95					
10/15/95				1.2	
10/16/95				1.2	
10/17/95				1.2	
10/18/95				1.2	
10/19/95				1.2	
10/20/95				1.3	
10/21/95					
10/22/95					
10/23/95					
10/24/95				1.2	
10/25/95				1.2	
10/26/95				1.1	
10/27/95				1.2	
10/28/95					
10/29/95					
10/30/95					
10/31/95					
11/01/95					
11/02/95					
11/03/95				1.1	
11/04/95					
11/05/95					
11/06/95					
11/07/95					
11/08/95					
11/09/95					
11/10/95				1.1	

Appendix Table B-2. continued.

DATE	OBSERVED DAILY LOCATION FREQUENCY 40.530	40.560	40.590	40.630	40.640
11/11/95			,		
11/12/95					
11/13/95					
11/14/95					
11/15/95					
11/16/95				1.1	

Appendix Table B-3. Environmental parameters measured during the lower Hood River telemetry study, 1995

DATE	TURBIDITY (NTU)	WEATHER[a]	WATER TEMPERATURE (°C)	FLOW[b] TUCKER BRIDGE[c] (cfs)	FLOW[b] BYPASS REACH[d] (cfs)
06/01/95	3.3	1	12.6	696	196
06/02/95	3.5	2	13.3	668	170
06/03/95	3.7	1	13.0	623	170
06/04/95	3.1	3	12.1	630	170
06/05/95	3.1	3	10.8	656	170
06/06/95	2.5	3	8.7	708	208
06/07/95	3.5	3	9.9	758	258
06/08/95	3.1	1	11.0	687	187
06/09/95	2.8	1	12.0	638	170
06/10/95	3.1	3	11.4	585	170
06/11/95	3.3	1	11.4	586	170
06/12/95	2.6	2	11.6	533	170
06/13/95	2.1	3	11.0	534	170
06/14/95		4	10.5	564	170
06/15/95	3.2	4	10.5	629	170
06/16/95	3.5	3	11.1	571	170
06/17/95	3.1	2	12.0	549	170
06/18/95	2.1	2	11.1	603	170
06/19/95	1.1	2	10.5	592	170
06/20/95	2.3	2	10.6	619	170
06/21/95	1.4	2	11.5	598	170
06/22/95	1.9	1	12.5	565	170
06/23/95	1.9	1	13.5	544	170
06/24/95	2.7	1	14.4	543	170
06/25/95	3.1	1	14.5	542	170
06/26/95	3.7	1	14.5	531	170
06/27/95	3.6	1	13.9	507	170
06/28/95	2.1	1	14.0	479	170
06/29/95	2.3	1	14.1	483	170
06/30/95	2.9	1	14.3	482	170
07/01/95	4.5	1	14.9	505	130
07/02/95	14.3	2	14.0	540	130

Appendix Table B-3. continued.

DATE	TURBIDITY (NTU)	WEATHER[a]	WATER TEMPERATURE (°C)	FLOW[b] TUCKER BRIDGE[c] (cfs)	BYPASS R (cfs
07/03/95	57.5	2	13.4	624	130
07/04/95	41.7	1	13.1	550	130
07/05/95	38.4	1	13.7	520	130
07/06/95	14.1	4	13.5	496	130
07/07/95	12.4	2	13.3	481	130
07/08/95	5.8	1	14.8	509	130
07/09/95	19.7	4	13.7	743	243
07/10/95	63.6	2	12.4	690	190
07/11/95	13.19	1	12.9	521	130
07/12/95	16.1	1	13.6	452	130
07/13/95	7.9	1	13.2	417	130
07/14/95	7.7	1	13.9	401	130
07/15/95	8.1	1	14.6	397	130
07/16/95	7.5	1	13.2	392	130
07/17/95	14.7	1	15.4	434	130
07/18/95	15.5	1	15.2	447	130
07/19/95	16.5	1	15.3	448	130
07/20/95	44.0	1	15.7	495	130
07/21/95	25.2	1	16.1	480	130
07/22/95	39.8	1	15.7	475	130
07/23/95	27.4	2	14.9	443	130
07/24/95	11.3	2	15.4	404	130
07/25/95	12.6	1	15.3	373	130
07/26/95	10.9	2	15.6	393	130
07/27/95	14.5	1	14.9	417	130
07/28/95	17.1	1	15.4	376	130
07/29/95	16.5	1	14.7	360	130
07/30/95	8.5	1	13.6	316	130
07/31/95	7.1	1	14.2	299	130
08/01/95	6.3	1	15.3	300	100
08/02/95	11.0	1	15.8	334	100
08/03/95	11.5	1	15.7	347	100
08/04/95	25.0	1	16.2	338	100
08/05/95	23	1	16.3	347	100

Appendix Table B-3. continued.

DATE	TURBIDITY (NTU)	WEATHER[a]	WATER TEMPERATURE (°C)	FLOW[b] TUCKER BRIDGE[c] (cfs)	BYPASS REACH[d] (cfs)
08/06/95	39.0	2	14.8	380	100
08/07/95	32.0	2	13.2	471	100
08/08/95	24.5	1	13.1	367	100
08/09/95	16.7	1	13.6	288	100
08/10/95	5.3	3	13.2	293	100
08/11/95	12.8	1	13.4	310	100
08/12/95	7.8	1	13.4	274	100
08/13/95	6.5	2	12.3	256	100
08/14/95	6.7	1	13.2	251	100
08/15/95	6.7	2	14.1	287	100
08/16/95	11.5	1	13.0	291	100
08/17/95	7.7	2	12.4	290	100
08/18/95	11.3	1	12.1	271	100
08/19/95	8.6	1	13.0	246	100
08/20/95	6.2	1	14.1	247	100
08/21/95	9.2	1	14.2	250	100
08/22/95		1	14.2	252	100
08/23/95	7.9	1	13.8	256	100
08/24/95	7.5	1	12.9	252	100
08/25/95	6.2	1	12.8	237	100
08/26/95	4.5	1	13.3	236	100
08/27/95	6.5	1	13.1	236	100
08/28/95	6.1	1	13.5	240	100
08/29/95	20.5	2	13.8	251	100
08/30/95	7.9	1	13.1	264	100
08/31/95	6.5	1	13.6	250	100
09/01/95	5.7	1	14.0	253	100
09/02/95	11.8	1	14.3	263	100
09/03/95	15.5	1	14.6	272	100
09/04/95	16.8	2	14.7	283	100
09/05/95	55.8	2	14.3	257	100
09/06/95	11.6	2	13.0	249	100
09/07/95	20.9	2	14.2	392	100
09/08/95	11.7	1	13.8	293	100

Appendix Table B-3. continued.

DATE	TURBIDITY (NTU)	WEATHER[a]	WATER TEMPERATURE (°C)	FLOW[b] TUCKER BRIDGE[c] (cfs)	BYPASS REACH[d] (cfs)
09/09/95	7.7	1	13.5	284	100
09/10/95	9.3	1	13.6	271	100
09/11/95	**11.3**	1	15.4	274	100
09/12/95	11.6	1	14.6	254	100
09/13/95	8.5	1	13.2	249	100
09/14/95	7.6	1	13.5	253	100
09/15/95	17.2	1	13.8	286	100
09/16/95	21.0	1	**14.1**	**296**	100
09/17/95	**17.6**	1	14.1	304	100
09/18/95	13.6	1	13.4	291	100
09/19/95	18.2	1	13.2	292	100
09/20/95	29.5	1	13.2	288	100
09/21/95	15.1	1	**11.9**	**249**	**100**
09/22/95	6.9	1	10.5	238	100
09/23/95	6.2	1	10.4	236	100
09/24/95	6.2	1	10.7	235	100
09/25/95	6.2	1	12.1	242	100
09/26/95	7.1	1	**11.6**	246	100
09/27/95	10.3	2	11.8	383	100
09/28/95	21.9	4	12.3	365	100
09/29/95	8.88	2	11.4	373	100
09/30/95	7.5	2	11.6	370	100
10/01/95	7.7	1	**10.4**	359	100
10/02/95	4.9	2	11.1	329	100
10/03/95	44.5	2	11.2	761	261
10/04/95	35.5	1	**10.3**	528	100
10/05/95	12.9	1	9.2	413	100
10/06/95	6.25	1	9.5	369	100
10/07/95			9.8	343	100
10/08/95			***9.7***	330	**100**
10/09/95	***3.9***	1	10.1	322	100
10/10/95	3.5	2	10.3	313	100
10/11/95		*1*	**10.3**	971	471
10/12/95			***9.0***	876	376

Appendix Table B-3. continued.

DATE	TURBIDITY (NTU)	WEATHER[a]	WATER TEMPERATURE (°C)	FLOW[b] TUCKER BRIDGE[c] (cfs)	BYPASS REACH (cfs)
10/13/95			8.0	638	138
10/14/95			8.4	533	100
10/15/95	6.5	1	9.4	524	100
10/16/95	6.3	3	10.5	600	100
10/17/95	6.0	4		655	155
10/18/95	15.4	1		840	340
10/19/95	4.3	1		700	200
10/20/95	4.5	3		562	100
10/21/95				605	105
10/22/95				598	100
10/23/95				521	100
10/24/95	3.1	2		460	100
10/25/95	2.5	2		431	100
10/26/95	70.5	2		1020	520
10/27/95	10.7	1		661	161
10/28/95				534	100
10/29/95				483	100
10/30/95				490	100
10/31/95				464	100
11/01/95				449	100
11/02/95				432	100
11/03/95	6.5	1		420	100
11/04/95				421	100
11/05/95				464	100
11/06/95				757	257
11/07/95				1180	680
11/08/95				3200	2700
11/09/95				2570	2070
11/10/95	12.3	2		1660	1160
11/11/95				11000	10500
11/12/95				4470	3970
11/13/95				4580	4080
11/14/95				2840	2340
11/15/95				2050	1550

Appendix Table B-3. continued.

DATE	TURBIDITY (NTU)	WEATHER[a]	WATER TEMPERATURE (°C)	FLOW[b] TUCKER BRIDGE[c] (cfs)	FLOW[b] BYPASS REACH[d] (cfs)
11/16/95	13.9	2		1720	1220

[a] Weather was classified with codes 1-4. Code 1 = clear, code 2 = partly cloudy, code 3 = overcast with light rain, and code 4 = stormy.

[b] Flow doesn't account for Neal Creek or tributaries below Powerdale dam.

[c] Mean daily flows as measured from the USGS gaging station, located at Tucker bridge (RM 6.11, on the Hood River. (cfs = cubic feet per second).

[d] Bypass reach flow is recorded two ways: Either 1) subtracting 500 cfs (water diverted by PacifiCorp at Powerdale dam (RM 4.0) for powerhouse operation) from the mean daily flow as measured from the USGS gaging station, located at Tucker bridge (RM 6.1). on the Hood River or 2) minimum flow required by PacifiCorp in the bypass reach (RM 1.0-4.0) on the Hood River. Minimum flow requirements during the radio telemetry study were 170 cfs for 1 June-30 June, 130 cfs for 1 July-31 July, and 100 cfs for 1 August-16 November.

APPENDIX C

Water temperature data collected
at the Parkdale site

Appendix Table C-l. Minimum, maximum, and average water temperatures collected in Roger's Spring, tributary to the Middle Fork Hood River. 6/9/95-7/17/95.

DATE	MINIMUM	MAXIMUM	AVERAGE	COMMENTS
06\09\95	45.26	47.21	46.54	Not a 24hr. sample
06\10\95	44.99	46.93	45.66	
06\11\95	43.59	47.76	45.38	
06\12\95	44.15	46.65	45.18	
06\13\95	43.87	44.99	44.53	
06\14\95	44.43	45.26	44.83	
06\15\95	44.71	46.37	45.31	
06\16\95	44.43	48.32	46.14	
06\17\95	46.1	48.04	46.9	
06\18\95	45.54	46.65	46.17	
06\19\95	45.54	46.93	46.21	
06\20\95	45.82	47.21	46.44	
06\21\95	45.82	48.32	46.77	
06\22\95	45.82	49.16	46.94	
06\23\95	44.99	49.72	46.87	
06\24\95	45.82	50.56	47.65	
06\25\95	45.54	50.28	47.35	
06\26\95	45.26	48.88	46.81	
06\27\95	44.99	48.6	46.56	
06\28\95	45.26	48.32	46.58	
06\29\95	45.54	48.04	46.63	
06\30\95	45.54	48.32	46.58	
07\01\95	46.1	48.6	47.02	
07\02\95	46.37	48.6	47.18	
07\03\95	46.37	48.6	47.07	
07\04\95	46.37	48.32	47.11	
07\05\95	46.37	48.32	47.17	
07\06\95	46.37	47.76	46.89	
07\07\95	46.37	48.88	47.71	
07\08\95	46.37	51.11	48.51	
07\09\95	45.82	48.6	47.41	
07\10\95	47.21	48.88	47.8	
07\11\95	47.48	50.56	48.53	
07\12\95	46.65	49.72	48.03	
07\13\95	45.82	48.04	46.81	
07\14\95	45.54	50.28	47.34	
07\15\95	44.99	50	47.08	
07\16\95	45.82	50.84	48.04	
07\17\95	48.32	49.16	48.78	Not a 24hr. sample

Appendix Table C-2. **Minimum, maximum, and average water temperatures collected in the Middle Fork Hood River directly below the confluence of Roger's Spring Creek.** 6/10/95-9/12/95.

DATE	MINIMUM	MAXIMUM	AVERAGE	COMMENTS
06\10\95	45.26	47.76	46.43	Not a 24hr. sample
06\11\95	43.87	48.88	46.01	
06\12\95	44.43	48.32	46.29	
06\13\95	44.71	46.1	45.48	
06\14\95	44.99	46.1	45.54	
06\15\95	44.99	46.93	45.81	
06\16\95	44.99	49.44	46.87	
06\17\95	46.1	48.88	47.3	
06\18\95	45.26	46.93	46.07	
06\19\95	44.99	47.48	46.1	
06\20\95	45.54	47.48	46.44	
06\21\95	45.26	49.44	47.09	
06\22\95	45.54	50.56	47.62	
06\23\95	45.26	51.39	48.1	
06\24\95	46.65	53.06	49.45	
06\25\95	46.37	52.78	49.21	
06\26\95	46.1	52.5	49.04	
06\27\95	45.82	51.94	48.75	
06\28\95	46.37	52.22	49.05	
06\29\95	46.37	53.06	49.24	
06\30\95	46.65	53.9	49.75	
07\01\95	46.65	53.9	49.98	
07\02\95	46.93	52.5	49.17	
07\03\95	45.82	51.67	47.81	
07\04\95	44.99	51.39	47.63	
07\05\95	44.99	52.78	48.36	
07\06\95	45.54	47.76	46.4	Not a 24hr. sample
07\18\95	49.72	54.18	52.05	Not a 24hr. sample
07\19\95	48.04	53.9	50.52	
07\20\95	48.04	57.53	51.72	
07\21\95	47.76	56.13	50.87	
07\22\95	46.93	55.3	49.87	
07\23\95	45.54	55.3	49.84	
07\24\95	46.37	55.3	50.26	
07\25\95	46.1	57.25	51.27	
07\26\95	47.21	55.3	50.83	
07\27\95	45.54	55.02	49.84	
07\28\95	46.93	57.25	51.3	
07\29\95	45.54	52.5	48.69	
07\30\95	44.43	54.18	49.13	
07\31\95	46.1	56.41	50.93	
08\01\95	48.32	58.09	52.63	
08\02\95	48.04	56.13	51.29	
08\03\95	46.65	56.69	51.16	
08\04\95	47.48	57.53	51.86	
08\05\95	47.21	56.13	51.18	
08\06\95	46.65	54.18	49.07	

Appendix Table C-2. Continued.

DATE	MINIMUM	MAXIMUM	AVERAGE	COMMENTS
08\07\95	44.15	48.6	46.28	
08\08\95	44.99	53.34	48.72	
08\09\95	45.54	55.02	49.92	
08\10\95	47.48	50	48.81	
08\11\95	46.37	53.34	49.55	
08\12\95	46.93	52.78	49.29	
08\13\95	44.99	52.22	48.44	
08\14\95	46.65	56.41	51.13	
08\15\95	48.04	53.06	50.68	
08\16\95	46.93	52.22	49.05	
08\17\95	46.37	52.22	48.72	
08\18\95	44.99	53.9	49.36	
08\19\95	46.37	55.86	50.99	
08\20\95	48.6	56.97	52.36	
08\21\95	48.04	57.25	52.22	
08\22\95	47.48	56.13	51.54	
08\23\95	48.04	55.58	51.16	
08\24\95	45.54	53.9	49.36	
08\25\95	45.54	54.18	49.94	
08\26\95	46.65	54.18	50.22	
08\27\95	46.37	54.18	50.27	
08\28\95	48.04	54.18	50.84	
08\29\95	48.32	54.46	50.7	
08\30\95	46.1	53.9	49.7	
08\31\95	47.48	55.3	50.91	
09\01\95	48.04	56.13	51.55	
09\02\95	48.32	56.41	51.86	
09\03\95	48.6	56.41	51.98	
09\04\95	47.48	53.62	50.35	
09\05\95	47.76	54.46	50.64	
09\06\95	48.32	52.5	50.26	
09\07\95	47.48	53.06	50.14	
09\08\95	48.32	55.02	51.23	
09\09\95	48.6	55.58	51.52	
09\10\95	48.88	56.41	52.03	
09\11\95	49.16	56.69	52.23	
09\12\95	48.04	55.3	50.1	Not a 24hr. sample

Appendix Table C-3. Minimum, maximum, and average water temperatures for the mixed water zone comprised of Roger's Spring and Middle Fork Hood River. The Middle Fork Hood River water originates from Coe Branch, Elliot Branch, and Clear Branch Reservior. 05/15/95-12/20/95.

DATE	MINIMUM	MAXIMUM	AVERAGE	COMMENTS
05\15\95	43.59	48.88	46.38	Not a 24hr. sample
05\16\95	44.15	48.32	45.92	
05\17\95	43.31	47.48	45.04	
05\18\95	41.62	47.21	43.95	
05\19\95	42.18	48.32	44.61	
05\20\95	43.31	49.16	45.63	
05\21\95	44.15	48.6	45.95	
05\22\95	44.15	48.88	46.11	
05\24\95	[illegible]	[illegible]	46.15	
05\25\95	44.43	49.16	46.37	
05\26\95	44.71	49.44	46.61	
05\27\95	44.71	49.72	46.52	
05\28\95	44.99	49.44	46.9	
05\29\95	45.26	50	47.16	
05\30\95	44.99	49.16	46.54	
05\31\95	44.43	49.72	46.56	
06\01\95	**44.15**	**49.16**	46.16	
06\02\95	**44.99**	**49.72**	45.73	Not a 24hr. sample
06\05\95	**42.18**	44.99	43.8	Not a 24hr. sample
06\06\95	42.18	42.75	42.52	
06\07\95	42.75	44.99	43.63	
06\08\95	43.31	47.76	44.96	
06\09\95	43.59	47.21	45.24	
06\10\95	44.71	46.93	45.43	
06\11\95	43.03	47.74	**45.15**	
06\12\95	**43.59**	**46.93**	**44.96**	
06\13\95	43.59	44.71	44.33	
06\14\95	44.15	45.26	44.63	
06\15\95	44.15	46.37	45.07	
06\16\95	44.15	48.6	46.02	
06\17\95	46.1	48.04	46.8	
06\18\95	45.54	46.65	46.11	
06\19\95	45.26	47.21	46.17	
06\20\95	**45.82**	**47.21**	46.4	
06\21\95	45.54	48.6	46.73	
06\22\95	44.99	49.72	**46.82**	
06\23\95	44.11	50	46.83	
06\24\95	45.82	**51.11**	47.65	
06\25\95	45.26	50.56	47.27	
06\26\95	44.71	49.72	46.88	
06\27\95	45.26	49.44	46.85	
06\28\95	45.54	46.16	46.97	
06\29\95	45.82	49.16	47.1	
06\30\95	45.82	49.44	47.2	
07\01\95	47.21	47.76	**47.51**	

Appendix Table C-3. Continued.

DATE	MINIMUM	MAXIMUM	AVERAGE	COMMENTS
07\02\95	47.21	47.76	47.41	
07\03\95	47.21	47.76	47.45	
07\04\95	47.48	47.76	47.57	
07\05\95	47.48	48.6	47.91	
07\06\95	46.37	48.04	47.61	
07\07\95	47.21	48.6	47.98	
07\08\95	47.21	50.84	48.26	
07\09\95	47.48	50.28	48.15	
07\10\95	48.32	49.16	48.58	
07\11\95	47.76	50	47.78	
07\12\95	46.37	49.44	47.62	
07\13\95	45.26	47.76	46.4	
07\14\95	44.99	50	46.85	
07\15\95	44.43	50	46.67	
07\16\95	45.82	50.84	48.05	
07\17\95	48.88	50	49.49	Not a 24hr. sample
07\18\95	50.28	50.56	50.45	Not a 24hr. sample
07\19\95	50.28	51.11	50.57	
07\20\95	50.28	51.11	50.43	
07\21\95	49.72	50.56	50.11	
07\22\95	49.72	50.28	50.02	
07\23\95	49.72	50.56	50.03	
07\24\95	47.76	50.84	49.73	
07\25\95	47.21	51.11	48.82	
07\26\95	48.04	50.56	49.22	
07\27\95	47.21	50.56	49.62	
07\28\95	47.76	50.56	49.55	
07\29\95	46.1	48.88	47.28	
07\30\95	45.82	50	47.42	
07\31\95	45.54	50.84	47.65	
08\01\95	45.82	51.39	48.38	
08\02\95	47.76	50.84	50.17	
08\03\95	48.04	51.39	50.45	
08\04\95	47.76	51.39	50.45	
08\05\95	51.1	52.5	51.72	
08\06\95	51.39	52.5	51.9	
08\07\95	51.94	52.5	52.23	
08\08\95	47.21	52.5	48.87	
08\09\95	46.1	50	47.64	
08\10\95	46.65	51.94	48.82	
08\11\95	46.65	51.94	49.42	
08\12\95	45.54	48.6	46.85	
08\13\95	45.26	48.6	46.77	
08\14\95	46.65	51.67	48.78	
08\15\95	47.76	50.84	48.92	
08\16\95	47.48	49.16	48.08	
08\17\95	46.65	51.39	47.86	
08\18\95	46.1	50.56	48	
08\19\95	46.93	52.22	49.05	
08\20\95	48.04	52.78	49.74	

Appendix Table C-3. Continued.

DATE	MINIMUM	MAXIMUM	AVERAGE	COMMENTS
08\21\95	47.48	52.22	49.48	
08\22\95	47.48	52.5	49.62	
08\23\95	47.76	51.39	49.14	
08\24\95	46.65	50.84	48.34	
08\25\95	**46.65**	**51.67**	**48.69**	
08\26\95	46.37	51.11	48.53	
08\27\95	46.65	51.39	48.57	
08\28\95	46.65	50	48.14	
08\29\95	45.26	53.06	48.33	
08\30\95	47.21	53.62	50.72	
08\31\95	46.65	**51.94**	48.82	
09\01\95	**48.04**	**52.22**	**49.92**	
09\02\95	48.04	52.78	51.08	
09\04\95	**47.48**	**52.22**	50.73	
[illegible]	48.04	**51.39**	50.22	
09\05\95	46.37	51.11	49.09	
09\06\95	46.65	**51.94**	48.03	
09\07\95	46.93	53.06	50.68	
09\08\95	**46.37**	**47.57**	**50.28**	
09\09\95	45.54	49.44	47.08	
09\10\95	45.82	52.78	48.59	
09\11\95	46.93	52.78	50.13	
09\12\95	45.82	47.76	46.36	Not a 24hr. sample
09\14\95	45.26	52.5	50	Not a 24hr. sample
09\15\95	46.65	52.22	51.11	
09\16\95	48.32	51.67	50.92	
09\17\95	49.44	54.18	51.08	
09\18\95	45.26	51.11	48.4	
09\19\95	44.71	51.67	49.16	
09\20\95	44.99	52.5	49.03	
09\21\95	41.9	45.54	44.19	
09\22\95	41.62	45.82	43.66	
09\23\95	**41.9**	46.37	43.71	
09\24\95	42.47	47.76	44.67	
09\25\95	45.82	**48.32**	**46.85**	
09\26\95	44.71	48.32	46.29	
09\27\95	44.99	53.06	49.69	
09\28\95	44.71	53.62	49.08	
09\29\95	44.99	47.76	45.84	
09\30\95	44.71	51.94	47.23	
10\01\95	43.87	51.39	47.57	
10\02\95	44.43	50.56	46.95	
10\03\95	50.56	51.94	51.34	
10\04\95	43.03	52.22	47.31	
10\05\95	41.34	44.43	42.73	
10\06\95	42.47	45.26	43.58	
10\07\95	42.75	45.26	43.92	
10\08\95	43.31	45.54	44.18	
10\09\95				**Hobo out of water**
10\10\95				**Hobo out of water**

Appendix Table C-3. Continued.

DATE	MINIMUM	MAXIMUM	AVERAGE	COMMENTS
10\11\95				Hobo out of water
10\12\95				Hobo out of water
10\13\95				Hobo out of water
10\14\95	AZ.18	AU.54	43.55	
10\15\95	43.87	46.65	AA.97	
10\16\95	43.87	48.32	45.75	
10\17\95	42.47	47.48	44.26	
10\18\95	40.5	47.48	4 x 7	
10\19\95	39.65	43.59	40.85	
10\20\95	40.78	43.59	A7.09	
10\21\95	40.78	42.18	41.4	
10\22\95	39.65	A1.62	40.55	
10\23\95	40.5	43.03	41.47	
10\24\95	41.62	42.75	42.14	
10\25\95	41.9	45.54	42.77	
10\26\95	45.82	46.37	46.09	
10\27\95	40.78	45.82	43.09	
10\28\95	39.93	42.47	41.08	
10\29\95	39.65	41.06	40.54	
10\30\95	38.53	39.93	39.36	
10\31\95	37.4	38.81	38.08	
11\01\95	37.96	39.09	38.29	
11\02\95	37.4	38.53	37.83	
11\03\95	37.11	38.81	37.86	
11\04\95	37.68	39.37	38.39	
11\05\95	38.53	39.65	39.16	
11\06\95	37.68	39.37	38.73	
11\07\95	37.11	41.9	40.13	
11\08\95	41.9	43.03	42.44	
11\09\95	39.37	42.47	41.53	
11\10\95	39.09	40.21	39.42	
11\11\95	40.21	42.18	41.67	
11\12\95	41.34	41.62	41.58	
11\13\95	41.34	41.9	41.63	
11\14\95	41.9	41.9	41.9	
11\15\95	41.9	41.9	41.9	
11\16\95	41.62	41.9	41.75	
11\17\95	41.62	42.18	41.74	
11\18\95	41.34	42.18	41.87	
11\19\95	41.06	41.62	41.32	
11\20\95	41.06	41.34	41.08	
11\21\95	40.78	A1.34	41.02	
11\22\95	A1.34	41.9	41.59	
11\23\95	41.34	41.9	41.66	
11\24\95	41.9	42.75	42.14	
11\25\95	41.34	42.75	41.88	
11\26\95	40.78	41.34	41.11	
11\27\95	40.5	41.62	40.95	
11\28\95	41.62	42.18	42.03	
11\29\95	42.18	42.75	42.37	

Appendix Table C-3. Continued.

DATE	MINIMUM	MAXIMUM	AVERAGE	COMMENTS
11\30\95	42.18	42.75	42.41	
12\01\95	41.34	42.18	41.81	
12\02\95	41.06	41.34	41.16	
12\03\95	40.5	41.06	40.74	
12\04\95	40.21	40.78	40.37	
12\05\95	39.65	40.21	39.92	
12\06\95	39.09	39.65	39.44	
12\07\95	38.81	39.09	38.89	
12\08\95	37.68	38.81	38.25	
12\09\95	37.11	37.68	37.57	
12\10\95	37.4	37.96	37.61	
12\11\95	37.68	38.53	38.46	
12\12\95	38.25	39.09	38.76	
12\13\95	38.81	39.09	39.02	
12\14\95	38.53	39.09	38.83	
12\15\95	38.53	39.09	38.79	
12\16\95	38.53	38.81	38.66	
12\17\95	38.25	38.81	38.45	
12\18\95	38.25	38.53	38.36	
12\19\95	38.53	38.53	38.53	
12\20\95	38.53	38.53	38.53	Not a 24hr. sample

Appendix Table C-4. Minimum. maximum, and average water temperatures in Roger's Spring where broodstock is held. 05/02/95-12/28/95.

DATE	MINIMUM	MAXIMUM	AVERAGE	COMMENTS
05\02\95	40.78	41.34	40.93	Not a 24hr. sample
05\03\95	40.5	41.34	40.77	
05\04\95	40.78	40.78	40.78	
05\05\95	40.78	41.06	40.8	
05\06\95	40.78	41.34	40.89	
05\07\95	40.78	41.34	40.93	
05\08\95	40.78	41.06	40.87	
05\09\95	40.78	41.06	40.83	
05\10\95	40.78	41.06	40.85	
05\11\95	40.78	41.34	40.87	
05\12\95	40.5	41.34	40.8	
05\13\95	40.5	41.06	40.8	
05\14\95	40.5	41.34	40.93	
05\15\95	40.78	41.62	41.04	
05\16\95	40.78	41.34	40.97	
05\17\95	40.78	41.34	40.9	
05\18\95	40.78	41.34	40.91	
05\19\95	40.5	41.34	40.91	
05\20\95	40.78	41.34	40.98	
05\21\95	40.78	41.34	40.97	
05\22\95	40.78	41.34	40.98	
05\23\95	40.78	41.34	40.97	
05\24\95	40.78	41.34	40.97	
05\25\95	40.78	41.34	41.01	
05\26\95	40.78	41.34	40.98	
05\27\95	40.78	41.34	41	
05\28\95	40.78	41.34	41.03	
05\29\95	40.78	41.34	41.07	
05\30\95	40.78	41.62	41.11	
05\31\95	40.78	41.62	41.11	
06\01\95	40.78	41.34	41.04	
06\02\95	40.78	41.06	41.05	Not a 24hr. sample
06\03\95				No data collected
06\04\95				No data collected
06\05\95	41.06	41.34	41.16	Not a 24hr. sample
06\06\95	41.06	41.06	41.06	
06\07\95	41.06	41.34	41.18	
06\08\95	41.06	41.62	41.22	
06\09\95	41.06	41.62	41.26	
06\10\95	41.06	41.34	41.19	
06\11\95	41.06	41.62	41.22	
06\12\95	41.06	41.62	41.24	
06\13\95	41.06	41.34	41.14	
06\14\95	41.06	41.34	41.17	
06\15\95	41.06	41.34	41.19	
06\16\95	41.06	41.62	41.28	
06\17\95	41.06	41.62	41.28	
06\18\95	41.06	41.34	41.19	

Appendix Table C-4. Continued.

DATE	MINIMUM	MAXIMUM	AVERAGE	COMMENTS
06\19\95	41.06	41.34	41.23	
06\20\95	41.06	41.34	41.24	
06\21\95	41.06	41.62	41.36	
06\22\95	41.06	41.62	41.38	
06\23\95	41.06	41.62	41.4	
06\24\95	41.34	41.9	41.49	
06\25\95	41.34	41.9	41.47	
06\26\95	41.34	41.9	41.47	
06\27\95	41.06	41.62	41.4	
06\28\95	41.34	41.9	41.45	
06\29\95	41.34	41.9	41.46	
06\30\95	41.34	41.9	41.46	
07\01\95	41.34	41.9	41.5	
07\02\95	41.34	41.9	41.52	
07\03\95	41.34	41.9	41.46	
07\04\95	41.34	41.62	41.43	
07\05\95	41.34	41.62	41.45	
07\06\95	41.34	41.62	41.4	
07\07\95	41.34	41.62	41.4	
07\08\95	41.34	43.03	41.54	Checked Hobo, higher max.
07\09\95	41.34	41.62	41.41	
07\10\95	41.34	41.62	41.39	
07\11\95	41.34	41.62	41.43	
07\12\95	41.34	41.9	41.47	
07\13\95	41.34	41.62	41.45	
07\14\95	41.34	41.9	41.49	
07\15\95	41.34	41.9	41.45	
07\16\95	41.34	41.9	41.5	
07\17\95	41.34	41.9	41.51	
07\18\95	41.34	41.62	41.49	
07\19\95	41.34	41.9	41.52	
07\20\95	41.34	41.9	41.59	
07\21\95	41.34	41.9	41.6	
07\22\95	41.34	41.9	41.54	
07\23\95	41.34	41.9	41.56	
07\24\95	41.34	41.9	41.54	
07\25\95	41.34	41.9	41.59	
07\26\95	41.34	41.9	41.54	
07\27\95	41.34	41.9	41.5	
07\28\95	41.34	41.9	41.55	
07\29\95	41.34	41.9	41.47	
07\30\95	41.34	41.9	41.45	
07\31\95	41.34	41.9	41.49	
08\01\95	41.34	41.9	41.57	
08\02\95	41.34	41.9	41.54	
08\03\95	41.34	41.9	41.56	
08\04\95	41.34	41.62	41.36	Not a 24 hr. sample
08\05\95	41.34	41.9	41.63	
08\06\95	41.34	41.62	41.5	
08\07\95	41.34	41.62	41.42	

Appendix Table C-4. Continued.

DATE	MINIMUM	MAXIMUM	AVERAGE	COMMENTS
08\08\95	41.34	41.9	41.46	
08\09\95	41.34	41.9	41.47	
08\10\95	41.34	41.62	41.37	
08\11\95	41.34	41.62	41.45	
08\12\95	41.34	41.62	41.42	
08\13\95	41.34	41.62	41.41	
08\14\95	41.34	41.9	41.54	
08\15\95	41.34	41.62	41.45	
08\16\95	41.34	41.62	41.45	
08\17\95	41.34	41.62	41.41	
08\18\95	41.06	41.62	41.42	
08\19\95	41.34	41.9	41.47	
08\20\95	41.34	41.9	41.5	
08\21\95	41.34	41.9	41.54	
08\22\95	41.34	41.9	41.52	
08\23\95	41.34	41.9	41.53	
08\24\95	41.34	41.9	41.46	
08\25\95	41.34	41.9	41.52	
08\26\95	41.34	41.9	41.49	
08\27\95	41.34	41.9	41.46	
08\28\95	41.34	41.9	41.5	
08\29\95	41.34	41.9	41.47	
08\30\95	41.34	41.9	41.46	
08\31\95	41.34	41.9	41.51	
09\01\95	41.34	41.9	41.53	
09\02\95	41.34	41.9	41.57	
09\03\95	41.34	41.9	41.59	
09\04\95	41.34	41.9	41.65	
09\05\95	41.34	41.9	41.52	
09\06\95	41.34	41.62	41.56	
09\07\95	41.34	41.9	41.53	
09\08\95	41.34	41.9	41.47	
09\09\95	41.34	41.9	41.49	
09\10\95	41.34	41.9	41.54	
09\11\95	41.34	41.9	41.55	
09\12\95	41.34	41.9	41.5	
09\13\95	41.34	41.9	41.52	
09\14\95	41.34	41.62	41.42	Not a 24hr. sample
09\15\95	41.06	41.62	41.39	
09\16\95	41.34	41.62	41.4	
09\17\95	41.06	41.62	41.38	
09\18\95	41.06	41.62	41.3	
09\19\95	41.06	41.62	41.33	
09\20\95	41.06	41.62	41.4	
09\21\95	41.06	41.62	41.29	
09\22\95	41.06	41.62	41.24	
09\23\95	41.06	41.62	41.2	
09\24\95	41.06	41.62	41.24	
09\25\95	41.34	41.62	41.38	
09\26\95	41.06	41.34	41.25	

Appendix Table C-4. Continued.

DATE	MINIMUM	MAXIMUM	AVERAGE	COMMENTS
09\27\95	41.34	41.34	41.34	
09\28\95	41.06	41.34	41.24	
09\29\95	41.06	41.62	41.25	
09\30\95	41.06	41.34	41.28	
10\01\95	41.06	41.34	41.18	
10\02\95	41.06	41.62	41.27	
10\03\95	41.34	41.62	41.35	
10\04\95	41.06	41.34	41.22	
10\05\95	40.78	41.34	41.12	
10\06\95	41.06	41.34	41.18	
10\07\95	41.06	41.34	41.17	
10\08\95	41.06	41.34	41.17	
10\09\95	41.06	41.34	41.2	
10\10\95	41.06	41.62	41.31	
10\11\95	41.06	41.34	41.24	
10\12\95	40.78	41.34	41.13	
10\13\95	40.78	41.34	41.02	
10\14\95	41.06	41.34	41.17	
10\15\95	41.06	41.34	41.22	
10\16\95	41.06	41.34	41.32	
10\17\95	41.06	41.34	41.23	
10\18\95	40.78	41.34	41.12	
10\19\95	40.78	41.34	41.01	
10\20\95	40.78	41.34	41.08	
10\21\95	41.06	41.34	41.12	
10\22\95	40.78	41.34	41	
10\23\95	41.06	41.34	41.11	
10\24\95	41.06	41.34	41.14	
10\25\95	41.06	41.34	41.24	
10\26\95	41.34	41.62	41.35	
10\27\95	41.06	41.34	41.15	
10\28\95	40.78	41.34	41.03	
10\29\95	40.78	41.34	40.92	
10\30\95	40.5	41.06	40.83	
10\31\95	40.5	41.06	40.65	
11\01\95	40.5	41.06	40.62	
11\02\95	40.21	40.78	40.53	
11\03\95	40.21	40.78	40.5	
11\04\95	40.5	41.06	40.7	
11\05\95	40.78	41.34	41.03	
11\06\95	40.78	41.06	41.03	
11\07\95	40.78	41.62	41.22	
11\08\95	41.06	41.62	41.41	
11\09\95	40.78	41.34	41.03	
11\10\95	40.78	41.34	40.88	
11\11\95	41.06	41.9	41.38	
11\12\95	41.06	41.34	41.11	
11\13\95	41.06	41.34	41.11	
11\14\95	40.78	41.06	41	
11\15\95	40.78	41.06	40.8	

Appendix Table C-4. Continued.

DATE	MINIMUM	MAXIMUM	AVERAGE	COMMENTS
11\16\95	40.21	40.78	40.48	
11\17\95	40.21	40.5	40.22	
11\18\95	40.21	40.5	40.23	
11\19\95	40.21	40.5	40.24	
11\20\95	40.21	40.5	40.27	
11\21\95	40.21	40.5	40.37	
11\22\95	40.5	40.5	40.5	
11\23\95	40.5	40.78	40.54	
11\24\95	40.5	40.78	40.66	
11\25\95	40.5	40.78	40.7	
11\26\95	40.5	40.78	40.55	
11\27\95	40.5	40.78	40.55	
11\28\95	40.78	41.06	40.91	
11\29\95	40.5	40.78	40.75	
11\30\95	40.21	40.5	40.4	
12\01\95	39.93	40.21	40	
12\02\95	39.65	39.93	39.76	
12\03\95	39.37	39.65	39.6	
12\04\95	39.37	39.65	39.46	
12\05\95	39.37	39.37	39.37	
12\06\95	39.37	39.37	39.37	
12\07\95	39.37	39.65	39.42	
12\08\95	39.09	39.37	39.36	
12\09\95	38.53	39.37	39.2	
12\10\95	38.81	39.37	39.23	
12\11\95	39.09	39.65	39.61	
12\12\95	39.65	39.93	39.69	
12\13\95	39.65	39.93	39.71	
12\14\95	39.65	39.93	39.82	
12\15\95	39.65	39.93	39.85	
12\16\95	39.93	39.93	39.93	
12\17\95	39.93	39.93	39.93	
12\18\95	39.93	39.93	39.93	
12\19\95	39.93	39.93	39.93	
12\20\95	39.93	39.93	39.93	
12\21\95	39.93	39.93	39.93	
12\22\95	39.93	39.93	39.93	
12\23\95	39.93	39.93	39.93	
12\24\95	39.93	39.93	39.93	
12\25\95	39.93	39.93	39.93	
12\26\95	39.93	39.93	39.93	
12\27\95	39.65	39.93	39.92	
12\28\95	39.93	39.93	39.93	Not a 24hr. sample