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UMATILLA BASIN NATURAL PRODUCTION MONITORING AND EVALUATION

Annual Progress Report 1993- 1994

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ABSTRACT

This report summarizes the activities of the Umatilla Basin Natural Production Monitoring and Evaluation Project from September 30, 1993 to September 29, 1994. This program was funded by Bonneville Power Administration and is managed under the Fisheries Program, Department of Natural Resources, Confederated Tribes of the Umatilla Indian Reservation.

A total of 39.4 miles of stream habitat was inventoried on the Umatilla River, Squaw Creek, Camp Creek, and an un-named tributary of Camp Creek. The overall habitat quality of the Umatilla River and Squaw Creek was classified as poor. The overall habitat quality of Camp Creek and the un-named tributary was fair.

Fish surveys (removal method) were conducted on the streams inventoried for habitat. A total of 565 of 4,928 habitat units were sampled for fish using backpack electrofishers. The total population estimate of salmon and trout in all streams sampled was 74,972, and density was $0.0799/m^2$. The following number of fish species were captured: 6,400 naturally produced rainbow/steelhead ***(Oncoryhnchus** mykiss)*, 4 1 hatchery steelhead, 1,677 natural chinook salmon ***(0. tshawytscha),*** 89 natural coho salmon ***(0. kisutch),*** one bull trout (*Salvelinus confluentus*), 1,317 northern squawfish (***Ptychocheilus oregonensis),*** and 96 mountain whitefish ***(Prosopium williamsoni).*** The following number of fish species were visually estimated: 44,259 speckled dace ***(Rhinichthys** osculus)*, 28,737 redside shiner ***(Richardsonius** balteatus)*, 16,859 sculpin (*Cottus **spp.),*** 8,276 chiselmouth chub (*Acrocheilus **alutaceus),*** 4,949 sucker ***(Catostomus spp.),*** and four brown bullhead (*Ictalurus nebulosus*). No fish were captured from the following river sections; the un-named tributary of Camp Creek, and upstream from river Mile (RM) 3.1 (passage barrier) of Camp Creek. No salmonids were captured in the mainstem Umatilla River from RM 56.1 to RM 60.6.

Forty permanent index sites were established to monitor relative species abundance. Each site was electrofished in the spring, summer, and fall. A total of 44 additional presence/absence surveys were conducted during one or more of the three time periods. In addition to the species listed above, the following species were also captured: smallmouth bass ***(Micropterus dolomieui),*** carp (*Cyprinus **carpio),*** bluegill ***(Lepomis macrochirus),*** and mosquitofish ***(Gambusia** affinis)*. A total of 17 fish passage barriers (partial and complete) were documented.

During escapement surveys, 117 summer steelhead redds (2.0 redds/mile) were enumerated and flagged along 57.1 miles of stream. Seventy-four spring chinook salmon redds (1.43 redds/mile) were enumerated and flagged and 113 carcasses were sampled along 51.8 miles of the Umatilla River and tributaries. Of the 240 spring chinook salmon released above Three Mile Falls Dam, 47.1% were recovered during escapement surveys and 37.6% of the adipose clipped, coded wire tagged fish released above the Dam were recovered. Survival to spawning above Pendleton, based on sampling of carcasses, averaged 82.3% with highest survivals in headwater areas, where water temperatures were coldest, and lowest survival rates downriver where water temperatures often exceed 21°C.

Forty-four coho salmon redds were enumerated and flagged above Three Mile Falls Dam and 14 coho and one fall chinook salmon carcass sampled along 42.0 miles of stream. Below the dam, 50 fall chinook and 122 coho salmon carcasses were sampled..

The Umatilla River rotary screw trap, RM 79.5, operated 245 out of 277 days from October 10, 1993 through July 7, 1994, and captured 2,413 juvenile rainbow/steelhead, and 5,162 juvenile spring chinook salmon. The mean trap efficiency estimate was 12% for juvenile rainbow/steelhead and 36% for juvenile chinook salmon. The Meacham Creek rotary screw trap (RM 1.5) operated 183 out of 190 days from December 12, 1993 through June 22, 1994 and captured 4,959 juvenile rainbow/steelhead and 832 juvenile spring chinook. The mean trap efficiency estimate was 14% for juvenile steelhead and 36% for juvenile chinook. The pipe trap in Squaw Creek (RM ~ 1) operated 185 out of 201 days from December 4, 1993 through June 22, 1994 and captured 1,903 juvenile rainbow/steelhead and 46 juvenile chinook. The mean trap efficiency estimate was 24% for rainbow/steelhead and 22% for chinook. In addition, a total of 142 bull trout, 64 mountain whitefish, 7,469 redside shiners, 720 suckers, approximately 26,000 dace, 1,202 ‘sculpin, and 794 squaw fish were captured at the three traps sites combined.

During a five day evaluation of the WEID Canal juvenile bypass facility, a total of 23 naturally produced spring chinook salmon, 369 hatchery produced spring chinook salmon, and 124 naturally produced rainbow/steelhead were enumerated. Estimation of the salmonid emigration appears feasible at the WEID facility, but would be very labor intensive.

Harvest monitors logged 128 survey hours and conducted 20 angler interviews among five survey sections during the Tribal steelhead fishing

season. Surveys began April 1, 1994 and continued through May 2, 1994. No steelhead were observed in the creel. During telephone interviews, anglers reported catching 30 steelhead. Because no steelhead were observed in the creel, it was impossible to expand effort and catch rate data gathered during the survey. There was no chinook salmon fishery in the Umatilla River during 1994 because of the low number of returning adults.

Analysis of scales indicated that 49.2% of the Umatilla River naturally produced summer steelhead returning to spawn in 1994 were from the 1989 brood year and 41.3 % were from the 1990 brood. Over 79 % of the natural steelhead had spent two years rearing in freshwater, and 17.5% had reared for three years before emigration. The ages of juvenile rainbow/steelhead sampled during fish inventories ranged from 0 to 4 and from 87.8 % -98.3 % of rainbow/steelhead present in tributaries sampled were age 0 or 1.

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INTRODUCTION

The Umatilla Basin Natural Production Monitoring and Evaluation Project is funded by Bonneville Power Administration as directed by section 4(h) of the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (P.L. 96-501) and pursuant of measure 703 (F)(l)(b) of the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program (NPPC 1987). This report summarizes work completed during the contract year September 30, 1993 through September 29, 1994. Work was conducted by the Fisheries Program, Department of Natural Resources, Confederated Tribes of the Umatilla Indian Reservation (CTUIR). This project is one of several subprojects of the Umatilla River Basin Fisheries Restoration Master Plan (CTUIR 1984, Oregon Department of Fish and Wildlife, ODFW, 1986) orchestrated to rehabilitate salmon and steelhead runs; subprojects include:

Natural Production Monitoring and Evaluation (this project);
Watershed Enhancement and Rehabilitation;
Hatchery Construction and Operations;
Satellite Facility Construction and Operations for Juvenile Acclimation and Release and Adult Holding and Spawning;
Trapping and Hauling of Juvenile and Adult Salmonids Around Dewatered Reaches Below Irrigation Diversions;
Juvenile Passage Facility Construction and Operation;
Juvenile Passage Facility Evaluations;
Adult Passage Facility Construction and Operation;
Adult Passage Facility Evaluations, and
Flow Augmentation to Increase Instream Flows Below Irrigation Diversions.

The Umatilla River Basin Fisheries Restoration Master Plan identified the following three critical uncertainties that the Umatilla Basin Natural Production Monitoring and Evaluation project will address:

1) What is the observed natural production success and estimated natural production potential for spring chinook, fall chinook and coho salmon, and summer steelhead in the Umatilla River Basin?
2) Will supplementation enhance summer steelhead?
3) What extent will supplementation impact the genetic diversity and life history characteristics of native steelhead and resident trout?

The goal of the Umatilla Basin Natural Production Monitoring and Evaluation Project is to evaluate the implementation of the Umatilla Basin Fisheries Recovery Master Plan with respect to natural production, Tribal harvest, and genetic and ecological risk. Project objectives are listed below:

Objective 1. Estimate the amount and suitability of existing and potential spawning and rearing habitat for summer steelhead, spring and fall chinook salmon, and coho salmon

Objective 2. Determine species distribution, composition, abundance and densities of salmonids throughout the Umatilla River Basin.

Objective 3. Determine natural spawning success, spawning habitat utilization, prespawning mortality and the number of redds per adult anadromous salmonid passed above Three Mile Falls Dam by species.

Objective 4. Estimate natural smolt production and survival rates of anadromous salmonids at various life history stages.

Objective 5. Estimate Tribal harvest of adult salmon and steelhead returning to the Umatilla River Basin.

Objective 6. Determine salmonid age and growth.

Objective 7. Determine the genetic and ecological effects of supplementation on native steelhead and resident trout (this objective was not directly addressed in 1993-94).

Objective 8. Determine if hatchery supplementation enhances production of natural steelhead (this objective was not directly addressed in 1993-94).

The approach to the Umatilla Basin Natural Production Monitoring and Evaluation plan includes three phases. Phase one includes collecting baseline data relating to life histories, distribution, abundance, survival, natural production, habitat and the potential for the natural production of salmonids. Phase two involves intensive adaptive management and the development of a streamlined monitoring program to be developed and tested through

completion of tasks in phase one. Phase three consists of risk containment monitoring where the monitoring program will be employed. Phase one of the Umatilla Basin Natural Production Monitoring and Evaluation plan is scheduled for 1992-97. Phases two and three are scheduled to begin in 1997 and 2004 respectively.

DESCRIPTION OF PROJECT AREA

Summer steelhead, chinook and coho salmon were abundant in the Umatilla River prior to the 1900's. Irrigation and agricultural development throughout the basin in the early 1900's is believed to be the primary cause of the decline of steelhead and the extinction of salmon (Bureau of Reclamation 1988). Since 1855, aquatic and riparian habitats have been degraded through irrigation diversions, water extractions, channelization, livestock grazing, logging, agriculture and urban development (NPPC 1987).

The Umatilla River Basin in northeast Oregon comprises 1,465,600 acres of the 6,400,000 acres of ceded CTUIR land (Appendix A, Figure A-l, A-2). The Umatilla River originates on the west slope of the Blue Mountains, east of Pendleton, and flows 115 miles in a northwesterly direction to the Columbia River at RM 289. The Umatilla River Basin, hydrologic unit number 17070103 (USGS 1989), has a drainage area of 2,290 square miles. The mouth of the Umatilla River at Umatilla, Oregon is at approximately 270 feet elevation above mean sea level. The headwaters are as high as 4,950 feet. Annual precipitation averages 10 inches/year at Umatilla to 50 inches/year in the headwaters (Taylor 1993).

The basin can be roughly divided into two physiographic regions. The lower river, west of Pendleton, has cut a low valley into a broad upland plain called the Deschutes-Umatilla Plateau. Parent geologic materials of the plain are dominated by multiple layers of middle Miocene basalt flows, specifically, the Wanapum and Grand Ronde Basalts, originating 14 to 17 million years ago. Basalt bedrock outcroppings are common in the river channel and act as hydraulic controls that delay the deepening of the river channel and valley floor. On top of the Miocene basalts are Pleistocene and Holocene loess, alluvial and glaciofluvial deposits (NPPC 1990, Walker and MacLeod 1991). Currently, vegetation on the broad Deschutes-Umatilla Plateau include dryland crops and sagebrush-grass communities. Historically, deciduous trees were abundant in riparian areas on the valley floor; however, landuse practices over the last hundred years have cleared

most of these areas for irrigated agricultural and urban uses. Approximately 70 percent of riparian areas in the Umatilla River Basin were reported to be in need of improvement (ODFW 1987).

The region east of Pendleton is dominated by foot hills and the Blue Mountains. The Blue Mountains were created by lifting, faulting and folding of volcanic, sedimentary and metamorphic rock. The middle Miocene basalts of the lower river are also the dominant parent materials in the headwaters. The river and streams have cut steep-sided canyons into the layers of rock that form the higher elevations of the Blue Mountains. Exposed basalt fractures into blocks and plates while unexposed layers remain fairly impervious to water (Walker and MacLeod 1991). The combination of steep canyon walls and impervious bedrock lends to poor ground water recharge (NPPC 1990). U.S. Geological Service flow data from 1904 through 1994 show stream hydrographs that reflect the various features of the basin as described above. High flows regularly occur during rain storms and snow melt conditions. Extreme low flows are common during summer and dry conditions. This effect is less pronounced in the near pristine North Fork Umatilla Wilderness Area, apparently because of the lack of human disturbance, higher elevation of the headwaters, developed soils, large woody debris and climax plant communities. Vegetation distribution patterns upstream from Pendleton are typical for the Blue Mountains. Grasses and small shrubs dominate the drier, south facing slopes. Conifers dominate the north facing slopes, higher elevations. and moderately wet areas.

MATERIALS AND METHODS

HABITAT AND FISH INVENTORY

Knowing the quality and quantity of salmonid spawning and rearing habitat provides an indication of the total natural production potential of the basin (Objective 1). The principal measurable factors influencing presence and abundance of salmonids are expected to include stream flow, water temperature, water chemistry, cover, food and space. Monitoring habitat quality provides a baseline to monitor changes occurring seasonally as well as during watershed restoration or degradation. We examined historical flow and temperature data, and began monitoring temperatures intensively and inventorying aquatic habitat throughout the Umatilla River Basin. By

combining habitat surveys with fish inventories, we can further refine our knowledge and understanding of what is currently and potentially available in the basin. Measured habitat features will be examined in relation to salmonid distribution, abundance, growth and survival as surveys are completed during the next two years.

Flows

We examined correlations between flows and the number of adult natural summer steelhead returning to the Umatilla River two years later for 16 years of flow and return records (Hubbard et al. 1993 and other U.S. Geological Survey flow data records obtained from, Suzanne Miller, personal communication, U.S. Geological Survey, Portland, 1993). The number of returning adult natural steelhead was compared to mean annual and monthly flows at the Umatilla gage (RM 1.2). The flow year and steelhead return years are designated differently by convention and can be confusing. For example, the comparison between flows in water year 1990 (October 1989 to September 1990) and steelhead returns in 1992 (fall 1992 through spring 1993) was denoted as a two year lag. However, the actual number of months between spring flows during juvenile emigration and when the adult steelhead actually returned to the river would have been closer to 30 to 36 rather than 24 months. Correlation coefficients were calculated by using Pearson's product-moment correlation (Zarr 1984).

Temperatures

CTUIR, , U.S. Forest Service (USFS) and Bureau of Reclamation coordinated the deployment of 32 thermographs and four Hydromet stations in the Umatilla River Basin to maximize consistency and coverage without duplicating effort; data was shared by all cooperators as requested. Specifics regarding the location and deployment of these thermographs are summarized in Appendix C, Tables C-l through C-5. CTUIR thermographs were initialized in the lab and deployed in the field during November 1993. In August of 1994, we downloaded the data and re-deployed the units in the field with the use of a portable computer. New batteries were installed and the seals and clamps were cleaned inspected and changed as needed. Thermographs were sealed inside a water proof housing which was- placed inside a small cage made of expanded steel. Steel chains or cables anchored the units to a large tree or boulder on the bank. Thermographs and cables were concealed to minimize the probability of tampering by the public.

Photographs were taken and detailed descriptions of the location of each thermograph were written at the time of deployment. Detailed vicinity maps were drawn and 7.5' topographic maps were marked to indicate the instrument's location.

Habitat Inventory

The "Methods For Stream Habitat Surveys" document developed by (Moore et al. 1993) was used to inventory stream habitat. Habitat surveys were conducted during low stream flows from June 7, to September 28, 1994. A ranking system was used to classify habitat quality as good, fair, or poor.

To minimize variation in data within a stream survey, the same crew was used for the duration of each survey. A crew of two people worked in an upstream manner, dividing the valley into large scale reaches and the stream into individual habitat units.

Changes in reach classifications were made when major differences in valley form occurred or when tributaries (usually named) contributed a significant portion (15 % or greater) of the total flow to the stream being surveyed. At the start of each reach, surveyors recorded the following variables: landform, valley form, terrestrial vegetation, land use, and valley floor width (VWI). The VWI was the ratio of active channel width to valley floor width. Photographs (left and right riparian, and reach overview), water temperatures, flow classifications (high, medium or low) were taken at the start of each reach. Additional notes and photographs were taken throughout the survey to document habitat problems, passage concerns, irrigation diversions, and surface springs. Landmarks such as bridges or tributaries were photographed and noted to aid location of units identified and numbered in the habitat survey. A diary was kept with detailed information about each photograph.

Stream habitat units were classified with more detail than the reaches. The stream was separated into specific stream habitat units based on hydraulic changes of the channel. A habitat unit was a section of stream that had visually distinct hydraulic characteristics (exception: dry channel classification) from adjacent stream sections. The unit was then identified specifically (i.e. riffle with pockets, lateral scour pool, etc.). Each unit was assigned an identification number. The first unit was assigned the number one, and the following upstream units were numbered in a progressive, increasing sequence. If a unit was overlooked by a habitat crew but

identified by a fish survey crew, the length and width of the unit was measured and it was documented as an unclassified unit.

The following data was taken at each unit: estimated length and width, depth, slope, aspect, shade, substrate composition, large boulder count, wood rating (as pertaining to fish benefits) bank stability/composition percent undercut bank, percent flow in each channel(s), and channel type. If. a tributary or surface spring source entered a unit, water temperatures were taken from the spring itself and from the mainstem both upstream and downstream of the spring influence. At every tenth unit, additional variables were measured; measurement of unit length and width, height and width of the active channel, VWI, and multiple terrace characteristics. Every tenth unit was flagged so that survey crews could locate habitat units more readily during fish surveys. The entire stream channel throughout the length of the survey section was identified in this manner.

Riparian communities were inventoried and photographed every 30 habitat units. Procedure ‘was to extend a measuring-tape from mid-unit at the wetted margin across the riparian zone perpendicular to the stream channel for 30 m. These lateral belt transects were broken into six, 5 x 10 m zones, three on each side of the channel. Within each zone, data was taken on the following features: geomorphic surface type and slope, canopy closure, percent shrub cover, percent grass, tree groups (conifer or hardwood), tree count by breast height diameter class, and any pertinent notes.

Woody debris and root wads were tallied if they met minimum length (3 m) and diameter (15 cm) requirements. The tree species, length class, diameter, configuration and location in the channel were recorded.

Salmonid Density Estimates

Backpack electroshockers and blocknets were used to sample fish from a portion of the total number of units previously inventoried for habitat. In most cases, the units to be sampled for fish were selected from habitat data prior to entering the field. An exception was the process used for the Umatilla River, which required selecting units in the field because excessive depth, width, or instream cover limited the ability to effectively sample some units.

Units were sampled throughout the entire length of the habitat survey area. Units with a wide variety of physical characteristics were sampled (i.e. braided and single channels, shaded or unshaded, cover or lack of cover). The intent was to represent a stream’s habitat complexity within and between

unit-types. Fish surveys closely followed the time frame of the habitat surveys before changes in habitat occurred.

Juvenile trout and salmon were captured with dip nets and removed on successive electrofishing passes until a depletion rate of at least 50% was achieved between successive passes. A second pass was not done if no trout or salmon were captured or observed during the first pass. Care was taken to avoid startling fish from the unit before blocknets were secured.

Trout and salmon captured were placed in a livewell until the completion of each pass. Each was then identified, measured (fork length-nearest mm), and observed for fin clips. The difference between spring and fall chinook juveniles, rainbow trout and steelhead juveniles was not determined. Therefore fish were generically classified as chinook salmon or as rainbow/steelhead. Injuries and external indicators of disease or stress were noted.

Captured mountain whitefish were placed in a livewell until the completion of each pass. Fork lengths were measured and scale samples were taken from a portion of the catch. Northern squawfish were held separately until the unit was sampled completely. Other non-salmonids were not collected, but estimates were recorded of the number of each species observed during the first pass.

After a unit was completely sampled, salmonids were usually released into the area of the unit where most were caught. Occasionally, salmonids were released outside of the unit when poor fish health (black spot condition, etc.) seemed to result from inadequate habitat conditions in the unit. All captured northern squawfish were measured for fork length (nearest mm), and sacrificed to sample stomach contents to determine the degree of predation on juvenile salmonids. Scale samples were taken from a portion of the captured salmonids, representing a wide variety of sizes. Scales samples were also taken from all northern squawfish and salmonid mortalities and were placed in labeled mylar envelopes. Approximately 6 to 12 scales were removed from an area two rows above the lateral line, posterior to the dorsal fin, and anterior to the adipose fin. Water temperatures were taken in all units sampled.

To maximize equality of sampling effort between removal passes, the same individual operated the electroshocker in a similar manner for at least the same number of seconds used on the previous pass. Also, electroshocker settings (i.e. volts, pulse) were kept the same for each removal pass.

Electrofishing catch data and surface area measurements of the wetted channel (taken during the habitat surveys) were used with the Van Deventer and Platts (1989) maximum-likelihood method to estimate population sizes and densities of juvenile rainbow/steelhead and bull trout, chinook and coho salmon. The maximum-likelihood model calculated salmonid population estimates for each habitat type using the summation of the number of salmonids (excluding whitefish) captured on each pass. Summation was used to increase sample size because of low catch numbers and short stream sections. This improved the accuracy of the model in projecting a population estimate. Mean density for a habitat type was calculated by dividing the population estimate by the area electrofished. The population estimates for each habitat type were added together to estimate the total population of all units inventoried for habitat. If more than one salmonid species was captured from a stream, population estimates of each species were calculated by multiplying the percent of the total catch that each species comprised, by the total expanded population estimate of all species. Total mean density was calculated by dividing the total population estimate by the total area of all units inventoried for habitat.

In cases where a passage barrier existed, the data from the stream was separated into two sections: upstream of the barrier, and downstream of the barrier. The unit totals were tallied separately and density estimates were calculated for each section. Separate estimates were also done for the units within and outside of the upper and lower ranges of salmonid distribution.

Expanded estimates of mountain whitefish and northern squawfish were calculated by dividing the total area surveyed for habitat, by the total area electrofished, and multiplied by the number of each species captured. Expanded estimates of rough fish were calculated by taking the total area surveyed for habitat, divided by the total area electrofished, and multiplied by the visual estimate.

Salmonid Relative Abundance

Index Sites

Forty permanent index sites were chosen throughout the Umatilla River Basin to monitor annual and seasonal trends in the distribution and relative abundance of juvenile salmonids. Sites were assigned numbers 1 to 40 (Table E-23, Figure A-4). Each site was sampled during the following three time periods: March 16 to May 7, August 1 to 16, and November 10 to

December 8, 1994. Sampling will continue annually during the above time periods

A seemingly stable section of stream was chosen for the location of each index site to minimize changes in channel morphology and habitat types. Habitat inventory methodology was used to describe and classify the habitat. A typical permanent index site consisted of adjacent fast/slow water habitat types. A few sites included more than two habitat types. At each index site, during each of the three sampling periods, the length, width and depth of each habitat unit were measured. Mean depth was measured in fast water unit types, and maximum depth in slow water unit types. Other information collected at each site included; temperature (water, air), sky conditions, discharge (low, medium or high), water clarity, depth of visibility, and electrofishing time and settings (voltage, pulse).

Index site boundaries were marked with numbered tags corresponding to the assigned number of each index site. Tags were placed on living trees or wooden posts, preferably outside of the active channel in order to avoid the impacts of high flows and the possibility of tag loss. A detailed description of tag and site location was recorded and photographs were taken to document tag placement. A description of each index site was recorded and marked on a map.

Index sites were electrofished without blocknets by two persons making a single pass in an upstream direction. One person operated a backpack electroshocker that had a net built into the wand. A second person used a dip-net to capture salmonids. The captured salmonids were identified by species, measured (fork length-nearest mm), and observed for fin-clips and external indicators of disease prior to releasing them into the area where captured. Scale samples were taken from a subsample of salmonids (if present) of various lengths at each site. Estimated counts of each non-salmonid species were recorded.

The sampling order of the sites varied, and was based on water conditions. During the spring or fall sample periods, high flows, turbidity, or ice delayed the sampling of some sites until later in the sampling period. Sites 36, 37, and 40 were not sampled during the fall of 1994 because of snow and ice. All other sites were sampled during each of the three time periods. In summer, some sites were sampled early in the period to avoid dewatering during minimum flows. Index site 38 was dry during the summer of 1994.

Presence/Absence Sites

Forty-four presence/absence sites were electrofished in conjunction with the index site monitoring in 1994. A single presence/absence survey was conducted at 37 different sites (Table E-24). Coyote Creek and Chinaman's Slough were surveyed three times. Selected sites included sites in the Umatilla River Basin where little or no historical fish data had been collected. The intent of the presence/absence investigations was to supplement the index sites in determining salmonid distribution and relative abundance throughout the basin.

Surveyors electrofished intermittently through a section of stream and concentrated efforts in areas where the probability of capturing fish was high. The distance sampled was variable and could include multiple areas of a stream. The precise location of the area surveyed, distance surveyed and the seconds electrofished were recorded. Also, a detailed description of stream's current condition and potential was recorded. Photographs were taken to supplement the description. Fish were handled and data was recorded as described above for the index sites.

SPAWNING ESCAPEMENT SURVEYS

We conducted redd and carcass surveys throughout the basin for steelhead, spring chinook, fall chinook and coho salmon. The surveys provided an estimate of the number of completed redds and allowed the inspection and enumeration of carcasses. Examining carcasses yielded coded wire tags, age, sex, length data, egg retention and an estimate of the proportion of successful and unsuccessful spawners by reach. Prespawning surveys were conducted to examine prespawning mortalities and to get a general idea of the number and location of adults in holding areas and how these factors change as the spawning season progressed.

Repeated surveys were conducted in reaches found to be important spawning areas in earlier years (1991, 1992). Other areas were only surveyed one to three times during the spawning season. To minimize stress to adults, debris jams and other holding areas were not probed. Each surveyor examined three to four river miles a day. They walked in a down-stream direction and wore polarized glasses to maximize fish observing capabilities. The majority of the surveys were conducted by two or three principle people. However, on wide reaches and during peak spawning times, additional surveyors worked in pairs to ensure adequate coverage. To

maintain data quality and consistency, principle surveyors were paired with supplemental surveyors.

Redds were marked with orange or blue flagging. The date, species and the number of fish observed on the redd was written on the flagging. Attempts were made to place flags at least six feet above ground to minimize disturbance by livestock. For each observed redd, surveyors recorded in a data book the stream name, river mile, redd location and description, date and the specifics of any observed adults. All flagged redds were reviewed by our most experienced redd surveyors for consistency. The redd was not counted if it was judged to be incomplete. Judgement was based on size and shape of the redd, amount of rock moved and other factors.

Carcasses found during the survey were measured from the center of the eye to the end of the hypural plate (Mid-Eye to Hypural Plate or MEHP length) and fork length if possible. MEHP length was the preferred method for measuring lengths of spawning salmon as tail erosion and the protrusion of the upper and lower jaws during spawning can make fork length measurements inconsistent. We described obvious injuries and attempted to determine the cause of death. Samplers cut open the body cavity to determine sex, egg retention by females and spawning success of males. Approximately ten scales were sampled from two rows above the lateral line on the left side of the fish in a diagonal line between the posterior edge of the dorsal fin and the anterior edge of the anal fin. The tail of each fish sampled was removed to prevent re-sampling.

Surveyors also removed snouts to recover coded wire tags from carcasses with the appropriate fin clip(s) by removing the entire front portion of the head immediately anterior to the preopercle and above the lower jaw. Hatchery steelhead were adipose clipped; a left or right pelvic fin clip indicated a coded wire tag. Salmon with coded wire tags were adipose clipped. Pelvic clips identified hatchery fish. However, not all hatchery salmon were clipped. Snouts were placed in plastic bags with a snout card number. The snout card number linked each snout and coded wire tag with the scales and other data collected. Coded wire tag snouts and accompanying data were sent to ODFW's, Mark Processing Center in Clackamas for coded wire tag extraction and reading. Return rates and related data from fish with coded wire tags are presented by Rowan (1994).

Steelhead

Steelhead escapement surveys were conducted from February 15 through May 18, 1994. Surveyors walked 83.8 accumulated miles, during 25 survey days and expended 26 days of effort. Steelhead sampling and redd enumeration were conducted along 57.1 miles in areas listed in Table F-l. Steelhead escapement surveys were conducted in the Birch Creek Drainage by OWFD (Table F-2).

Spring Chinook Salmon

Spring chinook salmon escapement surveys were conducted from May 27 to September 26, 1994. Surveyors walked 305.6 accumulated miles, during 49 survey days and expended 89 days of effort. Twelve river reaches totaling 5 1.8 miles were surveyed from 1 to 12 times (Table F-3). Areas below Pendleton were not surveyed as flows from McKay Creek make survey conditions extremely poor.

Fall Chinook and Coho Salmon

Fall chinook and coho salmon escapement surveys were conducted from November 16 to December 30, 1993. Surveyors walked an accumulated 52.8 miles during 19 survey days and expended 35 days of effort. The areas surveyed were from RM 1.5 to 4.0 (Umatilla Footbridge to Three Mile Falls Dam) and from RM 15.5 to 37.0 and 59.5 to 80.0. Other areas were not surveyed because of poor survey conditions.

Most adult fall chinook salmon enumerated at the trap at Three Mile Falls Dam were taken to Minthorn Springs Brood Holding Facility. Only 33 adults were released to naturally spawn upriver. A total of 143 adult coho . salmon were hauled to various areas upriver and 738 were released at the Dam with an upper caudal punch.

JUVENILE SALMON-ID TRAPPING

Upriver Trapping

We employed two, five-foot diameter rotary screw traps, manufactured by E.G. Solutions, Inc., to estimate the number of juvenile salmonids emigrating past RM 79.5 of the Umatilla River (near the Imeques C-mem-ini-kern Acclimation Facility) and past RM 1.5 of Meacham Creek. Trapping was continuous except for repair and during high flow periods when debris loads were heavy. The Umatilla River trap was operated 245 of 277 days

from October 15, 1993 to July 19, 1994. The Meacham Creek trap was operated 183 of 190 days from December 15, 1993 to June 22, 1994 (Table G-l). Three pipe traps were operated 185 of 201 days in Squaw Creek (RM 1) from December 4, 1993 to June 22, 1994. All three traps were usually monitored on a daily basis. During high flows the traps were monitored throughout the day to remove debris and adjust the traps to changing flow conditions. During extreme debris loads, the traps were not operated.

Trapping data recorded included the following: date, time, water temperature, number captured (by species), fork length (mm), marks, clips, number marked and released, atmospheric and flow conditions, and comments regarding the effectiveness of the trap. Scales were taken from a sub-sample of captured salmonids. Workers gave salmonids one of ten temporary marks by clipping a notch in the margins of the caudal fin, anal fin, dorsal fin or a combination of the above. Non-salmonid species captured were counted (numbers were estimated if large numbers of dace or shiners were captured).

Marked salmonids were released approximately 1,000 yards above the rotary traps and 200 to 500 yards above the pipe traps to determine catch efficiencies. Usually, all captured salmonids were used for efficiency estimates, however, occasionally only 50 to 100 salmonids were marked and released if hundreds of a given species and age class were captured. Marked salmonids that were recaptured were counted, measured (fork length, mm) and released below the trap. Containment trials were conducted to determine the rate fish escaped from the livewell. Marked juvenile salmonids were placed in the livewell for 24 hours. The number of fish used for mark-recapture and containment trials depended on the number caught that day.

Assumptions required to estimate trap catch rate efficiencies and the number of salmonids migrating past the traps include: marked and unmarked salmonids were actively migrating past the trap; once fish were downstream of the trap, they did not return to risk capture again; previously captured, handled and marked fish released upstream of the trap had an equal probability of capture as naive unmarked fish; recaptured fish escaped from the livewell at the same rate as naive fish; marks on recaptured fish were correctly recognized and recorded by samplers, and finally, mortality of marked and released fish was insignificant ($\sim$ C 5 %) between the release site and the trap.

Downriver Trapping

The WEID Canal juvenile bypass facility was operated in the capture mode to determine the feasibility of enumerating the juvenile salmonid emigration from the Umatilla River at Three Mile Falls Dam. The facility was operated with 25 cfs of attraction flow and the five cfs orifice in place, from March 21 through March 25, 1994 except from March 24 at 6:30 PM to March 25 at 6:45 AM. All salmonids captured were enumerated by species, examined for marks, natural salmonids measured (fork length), and scales were collected from approximately 10% of the naturally produced steelhead smolts (based on external appearance). Salmonids captured in excellent condition were temporarily marked (utilizing a different mark on a daily basis) by removal of a small portion of the upper, lower or both lobes of the caudal fin and released 1 .O km above Three Mile Falls Dam from the east bank to determine capture efficiency of the facility. Concurrently, a video camera was operated in the east bank viewing window (adult fish ladder) to attempt to determine other important areas of downstream movement through Three Mile Falls Dam. Basic assumptions are described above.

HARVEST MONITORING

CTUIR fisheries personnel monitored the Tribal harvest of adult steelhead in the Umatilla River during April 1994. A roving creel survey with nonuniform probability sampling was incorporated for harvest monitoring. In addition, a selective phone survey was conducted during and after the season with all Tribal members known and presumed to have fished for steelhead. There was no Tribal season on spring chinook salmon during 1994. Harvest of fall chinook and coho salmon was not systematically monitored during the 1993-94 contract year because angling effort was minimal as a result of the poor adult returns.

Numerous survey strategies presented in the current literature were examined. Methods included a punch card system, check stations, airplane flights, walking and floating surveys, post-season phone surveys and roving creel surveys (Malvestuto et al. 1978, Malvestuto 1983). Options for the survey design were discussed with enforcement and creel personnel from CTUIR, and Idaho Department of Fish and Game. Problems and strengths associated with each method were identified. CTUIR selected a non-uniform probability stratified-random roving creel design in conjunction with an informal phone survey. We judged that this combination would give the best

information per unit effort while maintaining the best public relations possible with Tribal anglers. Furthermore, the surveys on the ground allowed the examination of harvested fish for the collection of coded wire tags, fork lengths, marks, tags, punches, scales, etc. Enforcement personnel also desired the presence of surveyors along the streams to minimize poaching and harassment of salmon.

The punch card, check stations, or formal randomized phone survey techniques were judged inappropriate as they would most likely be interpreted as infringements on Tribal fishing rights. Such methods would create compliance problems and generate negative public relations between the Tribal Fisheries Program and Tribal members. Determining the effectiveness of the aerial counts would require concurrent evaluations by ground surveys. A cooperative effort to evaluate aerial surveys is currently being explored by CTUIR, and Oregon State Police for the potential 1996 spring chinook salmon fishery.

The survey area included the mainstem of the Umatilla River from Pendleton to the mouth of the North Fork and Meacham Creek from the mouth to Camp Creek. Probability of use for weekend and weekday shifts were based on observations made in earlier years by Tribal enforcement and creel survey personnel. All week days were given the same probability of sampling (0.10). Weekend days were given a higher probability of sampling (0.25). Each day was broken up into three shifts, 0800 to 1200, 1200 to 1600, and 1600 to 2000 hours. Weekday shifts were given probability of sampling rates of 0.25, 0.30 and 0.45 for the morning, afternoon and evening shifts. Weekend shifts each had a sample probability of 0.33. Based on these combined rates of probability the sampling schedule was derived from a random number table.

Surveyors conducted instantaneous counts and interviews as they covered the route during their assigned survey time. Surveyors recorded the date, section number, start and end time of each trip, the current time and river mile where anglers were observed, the number of fisherman in the group, a description of the anglers' and their name(s) if possible. Automobile license plate numbers were also recorded as well as the time fisherman started fishing, the total hours fished, if the fishing trips were completed and the number of steelhead caught that day. Interviewers also asked fishermen how many steelhead they had caught to date for the entire season, and the names of other anglers that had caught steelhead that season.

The telephone survey was conducted during and after the steelhead season and was combined with person to person contact. We contacted steelhead anglers that had been interviewed during the creel surveys, as well as others that were known to have fished but not interviewed, or reported by others to have fished. Surveyors asked how many steelhead each angler caught, the number of fish reported during interviews, and the names of other anglers that might have also caught steelhead.

AGE AND GROWTH

Scales were collected from adult natural steelhead during spawning ground surveys and from natural brood taken to Minthorn Springs. Adult scales were aged using the European Method of age designation: (i.e. age 1.2 was a fish that migrated from freshwater during its second year of life, spent two winters rearing in the ocean and returned to freshwater to spawn at total age 4.)

Scales were taken from a subsample of captured juvenile salmonids. Approximately 10 scales were removed per fish. Juvenile scales were mounted between folded acetate in preparation to be interpreted with microprojection of 72x and/or 42x. A total of 219 juvenile rainbow/steelhead scales collected during biological sampling of Boston Canyon, Line, Buckaroo, and Meacham Creeks in 1993, and 404 scales collected during biological sampling of Camp and Squaw Creeks and the Mainstem Umatilla River in 1994 were aged. An additional 671 juvenile scales from index areas established in 1994 were aged. Scales were read by one or two scale readers and all questionable scales were reviewed by both scale readers. Differences in age interpretation were discussed and if the readers could not agree on an interpretation, the scale was eliminated from the sample. The age data, which were collected from a sample of the total salmonids captured during biological surveys (all were measured), were used to apportion age vs.length by 5 mm increments for all length samples collected during biological surveys, by tributary in 1993 and 1994. Index area juvenile rainbow/steelhead scale data was sorted by length and area.

RESULTS AND DISCUSSION

HABITAT AND FISH INVENTORY

Flows

A strong correlation exists between mean annual ($r = 0.913$) and spring flows ($r = 0.869$) at the Umatilla gage (RM 1.2) and the number of returning natural adult steelhead two years later from 198 1 to 1993 (Figures B-l and B-2). Adult returns prior to 1982 were not correlated to flows because counts were considered to be rough estimates (Jim Phelps, ODFW, personal communication). Flows affecting passage of adults has been examined and discussed by Volkman (1994).

Temperatures

Stream temperature profiles collected throughout the Umatilla River Basin are listed in graphic form in Appendix C. Temperatures in the headwaters were suitable for salmonid rearing throughout the year. In the winter, rearing temperatures are more favorable in the lower reaches than the upper reaches where stream temperatures were often below 5°C. Except for the areas influenced by springs and cooler tributaries, water temperatures become unsuitable for salmonids during the summer below RM 70 in the Umatilla River, below RM 6 in Meacham Creek and in the lower ends of most of the other tributaries. When the thermographs were checked during November of 1994, six of the units had failed because of faulty capacitors after the August deployment. These units were returned to the manufacture for repair. Very little temperature data was collected by the failed units.

Umatilla River Habitat Inventory

Habitat inventory surveys were conducted from the lower to upper Umatilla Indian Reservation boundaries, RM 56.1 to RM 8 1.8 (25.7 miles), from July 14 to September 28, 1994 (Table D- 1). Elevation ranged from 1,120 feet above mean sea level at the lower boundary to 2,120 feet at the upper boundary. The elevation changed at a rate of 39 feet per mile. The maximum water temperature recorded was 26°C. The overall habitat quality was poor based on ranking criteria (Table D-2).

Habitat data was separated into three river sections. The lower section (RM 56.1-59.2) comprised 7.04% of the total area, the middle section RM 59.2 to 60.5 was 22.60% of the total area, and the upper (RM 60.5 to 81.8)

accounted for 70.36% of the total area. Fifteen unclassified habitat units were overlooked by habitat survey crews, but were identified by fish survey crews. The total area of these units was 4,742 m^2. Two-thirds of all unclassified units were isolated pools with spring seeps, one-third were alcoves with spring seeps. These units were lateral to the mainstem, and of low visibility.

Lower, Middle, Upper Sections

Habitat in the lower river section from RM 56.1-59.2 was unsuitable for salmonids (Tables D-3 through D-6), mainly due to a maximum water temperature of 26°C. Habitat from RM 59.2 to 60.5 was unsuitable in the mainstem (Tables D-7-10), mainly due to a maximum temperature of 26°C, but marginal in surface spring units located lateral to the mainstem (max temp 21.5°C). Habitat from RM 60.5 to 8 1.8 was marginal in the mainstem (Tables D-l 1 through D-14), but generally adequate in most units with surface springs located lateral to the mainstem. The maximum mainstem water temperature was 23.5°C, but only 20°C in units with springs.

All Sections

The habitat conditions of the entire area surveyed from RM 56.1 to 81.8 are summarized below. The average slope per unit was 0.7 % (Table D-15). Slow water habitat comprises 58.94% of the area surveyed. Glide habitat was most common slow water type, followed by lateral scour pools, and straight scour pools. The average maximum depth of slow water habitat types was 0.58 m. Fast water habitat comprised 40.29% of the area. Riffle habitat was by far the most common fast water habitat type, followed by riffle with pockets, and rapid over boulders. The average depth of fast water habitat types was 0.23 m. Dry channel accounted for 0.75% of the area surveyed (Table D- 16).

Gravel (2 to 64 mm) was the most abundant type of substrate. It comprised 38% of the streambed area (Table D-17) and is utilized for spawning by adult steelhead, chinook and coho salmon. Gravel accounted for approximately 330,332 m^2 of streambed. This figure represented an estimate of the potential spawning habitat available. This would be a maximum estimate, because other factors such as cover, and adjacent habitat features, also dictate whether an area is suitable for spawning.

The majority of the riparian zone was made up of high, constraining terraces (48% to 53 %). Shrubs accounted for 37% of the ground cover in the riparian zone, 28 % was grasses (Table D-l 8). Many high terraces resulted from roads, railways and dikes. These terraces have eliminated the natural meandering pattern of the river making it unable to distribute energy of high flow events, which resulted in high sediment load, one of the suspected leading causes of egg mortality in the mainstem. Other causes are lack of stream flow, and high water temperatures.

Although terraces have constrained movement of the active channel, the wetted channel was very unstable. Secondary channels (braids) accounted for 41.34% of the channel length and 20.54% of the wetted area. The average width of the active channel was 2.16 times that of the wetted channel width, and 11.9% of the streambank length was eroding. The average width to depth ratio of the wetted channel for all unit-types was 23.26: 1. The width to depth ratio for riffle habitat was 52.8:1. Only 7.55% of the streambank length was classified as undercut (Table D-15).

Cattle grazing, and the removal of trees are primary reasons why canopy closure ranged from 17 %-23 % (Table D- 1 8), and the average open sky value per unit was 69 % (Table D-15). Hardwoods were dominant in the riparian zone transect, comprising an estimated 93.85 % of the total number of trees, but averaged only 2 trees/100 m^2. Most (72.13 %) were in the 3 to 15 cm diameter at breast height (DBH) range, and only 4.92% were 30 to 50 cm DBH or more (Table D-18). The lack of trees in the riparian zone correlated with the lack of large woody debris in the channel, which averaged only 2.4 pieces per 100 m (Table D-15) and provided very little fish habitat.

Sixteen water diversions were observed and examined. Fourteen were small-scale, screened irrigation systems (RM 56.9-68.5) that pumped water directly from the channel. Two were well systems that used spring/groundwater (RM 71-77.5) (Table D-19). The diversions and degraded habitat have impacted the surface flows in the mainstem, and have resulted in high water temperatures. Records dating back from 1915 indicate an accelerated decrease in the water table level. The legality and efficiency of each diversion should initially be investigated, then monitored for compliance. Corrective action should occur immediately to minimize impacts.

Managed use of the water right such as: correlating quantity of water with the amount of water available, restricted use during critical salmonid survival periods, and water source exchanges would improve mainstem water temperatures. Exchanges would involve the relocation of irrigation pumps from cold springs to the adjacent mainstem, upstream of the spring's confluence. This strategy would be beneficial if used on two surface springs located at RM 63.3 (Minthorn Springs) and at RM 65.2. Water temperatures in the springs were 6°C colder that the mainstem.

A total of 128 surface springs were identified, averaging 4.98 per RM. The greatest concentration of springs was located between RM 71 and RM 78.9. Fifty-eight springs were counted in this area, 13.62 per RM (Table D-20). Units with surface springs accounted for 4.80% of all habitat units. Water temperatures in the springs were up to 6°C colder than the mainstem.

Surface spring units with cool water temperatures were the most important summer rearing habitat for juvenile salmonids. It appears that high water temperature is the primary factor limiting summer distribution of juvenile salmonids in the mainstem Umatilla.

Umatilla River Salmonid Density Estimates

The Umatilla River was surveyed for fish from the lower to upper Umatilla Indian Reservation boundaries, RM 56.1 to 81.8, from August 22 to November 8, 1994. The maximum water temperature recorded in the mainstem during fish surveys was 26°C. While habitat was structurally similar throughout the 25.7 river miles, salmonid densities were not. The salmonid density estimates were derived by subsampling habitat units from reaches that are more or less similar in habitat and fish abundance. Therefore, the survey reach was separated into three sections for summarizing both habitat and fish inventory data. The lower section (RM 56.1-59.2) comprised 7.04% of the total area, the middle section RM 59.2-60.5 was 22.60% of the total area, and the upper (RM 60.5-81.8) accounted for 70.36% of the total. Fifteen habitat units were overlooked by habitat survey crews, but were identified by fish survey crews.

Lower River Section

Nine different habitat types and a total of 28 units were sampled. Although only 7.28% of the total area of this section was sampled, units appearing to have the highest salmonid holding potential were surveyed. No salmonids were captured or observed, therefore the salmonid population in

this section of river was estimated at zero (Table E-l).

Only three surface springs were surveyed in the 3.1 miles (0.97 per RM) of this section. This low number of springs may be a primary reason for lack of salmonids in this section. The maximum recorded water temperature was 26°C. Brett (1952) determined that the lethal temperature for juvenile chinook and coho salmon was 25.1°C. Black (1953) determined the upper lethal temperature of rainbow/steelhead fingerlings was 24°C. High water temperature was the suspected reason for the absence of salmonids in this section of river.

Middle River Section

The following numbers of naturally produced juveniles were captured: 12 chinook salmon, 5 rainbow/steelhead, and 3 coho salmon. None were captured from mainstem units, all were captured from surface spring units, adjacent to the mainstem. This indicates that cold springs were essential for survival in this section. The expanded population estimate for the section was 36 salmonids (Table E-2). The first salmonid of the survey was captured from an isolated pool with a spring seep, located lateral to the mainstem at RM 59.2, on August 25. The unit had a water temperature of 16.5°C, versus 20.5°C in the adjacent mainstem.

The maximum water temperature recorded from this section of the mainstem was 26°C. High water temperature was the suspected reason limiting salmonid distribution in the mainstem section of river. The cooler temperatures in the units with surface springs, located lateral to the mainstem, provided thermal refuges.

A falls commonly known as "Mission Falls" (RM 60.3) may be a partial upstream passage barrier to juvenile salmonids during low flows. A 1.2 m bedrock step had a slope of 36% and extended completely across the channel, perpendicular to the flow of the mainstem. The depth of the water averaged 0.25 m over the step. The barrier may be most detrimental to fish that migrate downstream to overwinter and later attempt to migrate upstream to avoid lethal summer stream temperatures but are unable to get to cooler water upstream.

Upper River Section

The following numbers of juvenile salmonids were captured: 2,065 natural rainbow/steelhead, 1,560 natural chinook salmon, 81 natural coho salmon, 41 hatchery steelhead, and 1 bull trout. The expanded population

estimate was 30,679 salmonids for this river section. Mean density was estimated at 0.0510 salmonids/m^2 (Table E-3).

The first salmonid captured from a mainstem unit without a visual surface spring seep was at Rm 60.6, on August 31. The unit was located in a well-shaded secondary channel. The water temperature was 20°C. This unit appears to have been the lower limit of salmonid distribution in the mainstem at the time. The low mean density of salmonids was probably due to high water temperature (235°C maximum). The lower limit may vary annually due to fluctuations in environmental conditions.

It was suspected that Parr Spring and Spring Creek, RM 61, provided the essential cooling required to support a mainstem salmonid population. These springs were located the furthest downstream of any large concentrations of surface springs.

Isolated pools with surface springs had the highest mean salmonid density (0. 1975/m^2) of all habitat types (Table E-3). The highest salmonid density in a single unit was 0.5829/m^2 , an isolated pool with a surface spring located at Minthorn Springs (RM 63.3). A total of 8 12 salmonids were captured from the unit, by far the most of any single unit. This unit was the most important summer rearing area for natural salmonids.

The only bull trout captured during the survey came from an isolated pool with a surface spring at RM 72.2. The water temperature of the unit was 14.5°C, versus 19°C on the mainstem. Of the units sampled, mean density was higher in unit-types with surface springs (i.e. riffle with surface spring) than similar unit-types without surface springs (i.e. riffle; Table E-3). Springs will be sampled more frequently and extensively in the future to better describe their seasonal importance as rearing areas for juvenile salmonids.

All Sections

A total of 3,769 juvenile salmonids were captured from 253 units sampled. The expanded population estimate for the total area surveyed was 30,715 salmonids. Species composition percentages were; 54.95% natural rainbow/steelhead, 41.71% natural chinook salmon, 2.23 % natural coho salmon, 1.09% steelhead trout, and 0.02% (n= 1) bull trout (Table E-4). Average fork lengths for natural juvenile rainbow/steelhead, chinook and coho salmon ranged from 78.88 to 88.89 mm. Average fork length of juvenile hatchery steelhead was 196.56 mm, and the bull trout was 218 mm. The shortest fork length (39 mm) and longest fork length (351 mm) were

measured from rainbow/steelhead (Table E-7, Figures E-l through E-4).

A total of 96 mountain whitefish were captured. The expanded population estimate was 1,249 fish (Table E-10). This was a conservative density estimate because of the expansion method used. Fork lengths ranged from 71 to 350 mm, and averaged 184.79 mm (Table E-l 1, Figure E-8). Three-fourths were captured from fast water habitat types. The highest density (0.0183 fish/m^2) was in riffle with pockets habitat. Whitefish were captured from RM 60.8 to 74.0. Most near RM 66.6 (Table E-12).

Electrofishing caused immediate mortality of 2.54% chinook salmon, 1.20% of coho salmon, 1.04% of whitefish, and 0.92% of rainbow/steelhead (Table E-13). Delayed mortality caused by electrofishing and handling was unknown.

Bird bites were observed on 27 captured fish, most of which were captured near RM 67.1. Mean fork length of fish with bird bites was 204 mm, but ranged from 87 to 375 mm. Bird bites occurred most frequently on juvenile hatchery rainbow/steelhead (7.32 %), whereas bites on natural rainbow/steelhead occurred at a rate of only 0.43%, a 17-fold difference (Table E-14). Explanations for the difference in bird bite frequency may have been the difference in sample size (2,071 natural, 41 hatchery), behavior of hatchery fish, or injuries sustained before release.

The next highest incidence of bird bites occurred with mountain whitefish (3.13%) (Table E-14). Their apparent preference for fast water habitat types (Table E-12), which generally consisted of shallow water, wide channel, and lack of overhead cover may have made them more susceptible to bird predation.

External blackspot condition was observed on: 46.43% of all captured natural coho salmon, 12.47% of natural chinook salmon, 4.49% of natural rainbow/steelhead, and 2.44% (n= 1, 180 mm) of hatchery rainbow/steelhead. The condition was not selective of a particular size of fish. Its occurrence was proportionate to abundance and length (Figures E-5 through E-7).

The expanded population estimate of non-salmonids was 1,060,276. The ratio of non-salmonids to trout/salmon was 34.52:1. These were conservative estimates because the expansion method used. Dace and shiner were the most abundant non-salmonids. These species comprised 76.22% of the total non-salmonid estimate (Table E-15).

A total of 1,3 17 northern squawfish were captured. Lengths ranged from 29 to 475 mm. Most fish were between 70 to 120 mm (Figure E-9).

Stomach contents from all captured squawfish were sampled. Most stomachs were either empty, or had unidentified remains. Contents generally varied with fish size. Plant-life and insects were consumed most often by small fish averaging 91 to 122 mm, small fish species (sculpin, dace, shiner) and snails were found most often in fish averaging 161 to 184, and larger fish species (sucker, squawfish) were consumed most often by fish averaging 313 to 320 mm. Only one stomach sample out of 1,317 contained a salmonid (0.08 %). A 58 mm natural rainbow/steelhead was sampled from the stomach of a 135 mm squawfish. This suggests that northern squawfish predation on salmonids was not significant in that reach during the survey (Table E-18).

Squaw Creek Habitat Inventory

Squaw Creek was inventoried for habitat from the mouth to forks, RM 0 to 10, from June 7 to July 22, 1994 (Table D-l). The elevation changed 112 feet per mile from 1,120 feet at the mouth to 1,640 feet at the forks. The maximum water temperature recorded was 225°C. The overall habitat quality was poor based on ranking criteria (Table D-2).

The most common valley form was floodplain, which was dominant in 60% of the reaches. The average gradient per unit was 1.7 % (Table D-21). Riffle habitat comprised 50.4% of the area surveyed (Table D-22). Fast water habitat comprised 58.97% of the total wetted area surveyed. Gravel was the most abundant type of substrate, accounting for 49% of the total streambed area (Table D-23). Shrubs and grasses accounted for 95% of the ground cover in the riparian zone. Hardwoods were most abundant in the riparian zone, comprising 60% of the tree growth. Eighty percent of which ranged in diameter from 3 to 15 cm (Table D-24). The estimated maximum area of potential spawning habitat based on adequate substrate size (gravel) was 28,886 m^2.

Squaw Creek had been impacted primarily by livestock grazing, which likely contributed to the following habitat conditions: 17.8 % of the streambank length was actively eroding, 3.81% of the length of both streambanks was undercut, 22.70% of the stream length was braided channel, the active channel width was 3.1 times the wetted channel width, a unit average of 40% open sky, average water depth of only 0.23 m, maximum water temperatures of 22 °C, only 3.4 pieces of large woody debris per 100 m (Table D-21), and 12.96% of the streambed area was dry (Table D-22).

Secondary impacts have resulted from a dirt road which extended the entire length of the survey area. The road was constructed very close to the

stream and has affected the morphology of the stream channel, and degraded the quality of numerous lateral springs. Tertiary impacts near the mouth of Squaw Creek include railroad and highway dikes and bridges. These structures appear to have affected the channel morphology not only at the site, but upstream and downstream as well.

Sauaw Creek Salmonid Density Estimates

Fish surveys were conducted from the mouth to forks, RM 0 to 10, from June 28 to August 3, 1994. The maximum water temperature recorded was 23°C. The following numbers of juvenile salmonids were captured from 189 units sampled: 3,464 natural rainbow/steelhead, 105 natural chinook salmon, and 5 natural coho salmon (60 to 90 mm, mean of 75 mm). The expanded population estimate was 37,611 salmonids, The mean density estimated for the entire area of stream was 0.6380 salmonids/m^2 (Table E-5). Average fork lengths for natural juvenile rainbow/steelhead, chinook and coho salmon ranged from 74.00 to 79.87 mm. Rainbow/steelhead had the shortest fork length (39 mm) as well as the longest fork length (320 mm). The length frequency histogram for rainbow/steelhead indicated two distinct age classes (Table E-8, Figures E-10 through E-12).

Electrofishing caused immediate mortality of 2.92 % natural rainbow/steelhead, and 0.95 % of natural chinook salmon (Table E-l 3). Delayed mortality caused by electrofishing and handling was unknown.

The expanded population estimate of non-salmonids was 215,397. The ratio of non-salmonids to trout/salmon was 5.73:1. Sculpin and dace were the most abundant non-salmonids. These species comprised 99.97% of the total non-salmonid estimate (Table E- 16).

Mean salmonid density of all slow water habitat types was estimated as 0.9677/m^2. Mean salmonid density of all fast water habitat types was estimated as 0.5301/m^2. Mean salmonid density in riffles, the most abundant habitat type, was only 0.4821/m^2 (Table E-19).

Camp Creek Habitat Inventory

Camp Creek was inventoried for habitat from the mouth to 362 m upstream from the falls, RM 0 to 3.3, from June 7 to July 6, 1994 (Table D-1). Elevation ranged from 2,240 feet at the mouth to 3,260 feet at RM 3.3. The elevation changed 309 feet per mile. Water temperatures ranged from 10 to 15°C. The overall quality of habitat was fair based on ranking criteria (Table D-2).

A 12 m high, natural bedrock falls with a slope of 42% was located at RM 3.1. Average depth of the water flowing over the bedrock was only 0.15 m. Habitat data was separated into two river sections because of the falls. The lower section extended from RM 0.0 to 3.1. Elevation ranged from 2,240 to 3,140 feet, and changed at a rate of 290 feet per mile. The upper section extended from RM 3.1 to 3.3. Elevation ranged from 3,140 to 3,260 feet, and changed at a rate of 600 feet per mile.

Downstream of the Passage Barrier

The valley was dominated by constraining terraces, which accounted for 91% of the area surveyed. A single channel occurred in 90.4% of the stream area. Channel depth averaged 0.26 m. Water temperature ranged from 10 to 15°C. The width of the active channel averaged 2.4 times the width of the wetted channel. The average slope per unit was 2.9%. The majority (91.3%) of the streambank length was stable. Undercut banks comprised 8.99% of total length of both streambanks. Open sky averaged only 27 % per unit. The number of pieces of woody debris averaged 7.9/100 m (Table D-25).

Fast water habitat comprised 74.5% of the area surveyed, of which riffles accounted for 55.9 % . Riffles with pockets comprised 40.44% of the total area (Table D-26). Slow water habitat types accounted for 24.2% of the area surveyed, of which scour pools accounted for 21.8 % (Table D-27). Gravel was the most abundant type of substrate, accounting for 32% of the total streambed area. The estimated maximum area of potential spawning habitat based on adequate substrate size (gravel) was 5,377 square meters. The mean density of large boulders ($>$ 0.5 m) was 0. $17/m^2$.

The average slope of the riparian zone was 32.33%. Shrubs covered 67 % of the riparian floor, while grasses covered 23 % . Conifers were dominant in the riparian zone, accounting for 54.90% of the tree growth, 80.23% of which ranged in diameter from 3 to 30 cm (Table D-28).

The lower reaches were impacted by cattle grazing, railroad facilities, and a dirt roadway to a minor degree. A 1.3 m high concrete irrigation dam was also documented at RM 0.4. It had a slope of 91% and was a passage concern at summer flows. The dam was no longer in use at the time of the survey.

Upstream of the Passage Barrier

Constraining terraces dominated the valley and stream channel, accounting for 98% of the area surveyed. Single stream channel accounted for 99.34 % of the area surveyed. There were no dry units. The average active channel width was 2.25 times the wetted channel width. Water depth averaged 0.27 m. The average slope per unit was 5.1%. Water temperature ranged from 9 to 15°C. Only 1.1% of the banks were classified as actively eroding, and 6.15% of the length of both streambanks was undercut. Open sky averaged only 25% per unit. The number of pieces of woody debris averaged 9.1/100 m (Table D-29).

Rapid habitat comprised 57.86% of the total area (Table D-30). Fast water habitat comprised for 65% of the area surveyed. Slow water habitat types accounted for 34.2% of the area surveyed, of which scour pools accounted for 33.3%. Gravel was the most abundant type of substrate, accounting for 27% of the total streambed area. The density of large boulders was $0.34/m^2$ (Table D-31).

The average slope of the riparian area was 42.67 % . Shrubs covered 75.33% of the riparian zone, grasses accounted for 18.33 %. Conifers comprised 86.54% of the riparian tree growth, 92.59% of which were between 3 and 30 cm in diameter (Table D-32).

The habitat upstream of the barrier was capable of supporting salmonid populations if not for the passage barrier. This area provided cold water, important to the survival of salmonids downstream. It also improved fish habitat downstream by contributing woody debris to the channel.

Camp Creek Salmonid Density Estimates

Fish surveys were conducted from the mouth to 382 m upstream of the falls, RM 0.0 to 3.3, from June 30 to July 21, 1994. The maximum water temperature recorded was 15°C. A natural falls located at RM 3.1 was determined to be an upstream passage barrier. Fish were present throughout the creek downstream of the barrier. No fish were captured or observed upstream of the barrier (Table E-21). Crayfish were present upstream of the barrier.

A total of 865 rainbow/steelhead were captured from 100 units sampled. The expanded population estimate was 6,646 rainbow/steelhead (Table E-6). Fork lengths ranged from 20 to 240 mm. Although most fish ranged from 35 to 40 mm (Figure E-15), the average fork length was 65.14 mm (Table E-9).

Electrofishing caused immediate mortality of 3.35% of the captured rainbow/steelhead (Table E- 13). Delayed mortality caused by electrofishing and handling was unknown.

Sculpin were the only non-salmonid captured. A total of 6,934 sculpin were estimated, a 1.04:1 ratio to salmonids (Table E-17).

The salmonid density estimated for the entire area of stream surveyed was $0.3955/m^2$. The salmonid density of slow water habitat types was $0.6120/m^2$. Of which, backwater pools had an estimated salmonid density of $1.044/m^2$, the highest of any habitat type. This suggests that an increase in the quantity of the slow water habitat may increase the salmonid population in the creek. The salmonid density of fast water types was estimated as $0.3464/m^2$. The salmonid density of riffle habitat was $0.3792/m^2$, whereas the density of rapid habitat was only $0.251\ 1/m^2$ (Table E-20).

Camp Creek Tributary Habitat Inventory

The un-named tributary enters Camp Creek from the north at RM 1.7. It was surveyed from the mouth to the first tributary to the east, RM 0 to RM 0.4, from July 8 to July 11, 1994 (Table D-l). Elevation ranged from 2,620 feet at the mouth to 2,740 feet at RM 0.4. Elevation changed 300 feet per mile. This tributary contributed about 15 % of the total flow in Camp Creek. The overall habitat quality was fair based on ranking criteria (Table D-2).

The average depth of the wetted channel averaged 0.05 m. The maximum depth was 0.35 m. Water temperatures ranged from 9 to 11°C. Bank condition was extremely good, only 0.2% of the length of both banks were actively eroding. Open sky averaged 27% per unit. The number of pieces of woody debris averaged 6.3/mile (Table D-33). A total of 59.8% of the channel area was dry. Scour pools and rapids were the most common wetted habitat types, comprising 75.08 % of the total area (Table D-34). Gravel was the most abundant type of substrate, it accounted for 38% of the streambed. The estimated maximum area of potential spawning habitat based on adequate substrate size (gravel) was 255 square meters. The density of large boulders was $0.5887/m^2$ (Table D-35).

The average surface slope of the riparian zone was 19%. Shrubs covered 76% of the ground in the riparian zone, grasses covered 17 % . Conifers ranging in diameter from 15 to 30 cm were dominant, and 3 to 15 cm hardwoods were secondary tree growth (Table D-36).

Camp Creek Tributary Salmonid Density Estimates

Fish surveys were conducted from the mouth to the first tributary from the east, RM 0 to RM 0.4, on July 21, 1994. The maximum water temperature recorded was 11°C. A total of 24.92 % of the wetted area was sampled. No fish were captured or observed from 16 units sampled. The population was estimated at zero (Table E-22). Low flow and lack of water appeared to be the main reason for the absence of fish. The addition of cool water to the mainstem of Camp Creek from this tributary appears to be important for the habitat of rainbow/steelhead during the summer months.

Index Sites

Index site monitoring began in the spring of 1994. Trends in population structure, age classes, etc. will not be evident until additional years of information are collected. Therefore, results are brief and general.

The following species were captured: rainbow/steelhead, bull trout, chinook salmon, coho salmon, mountain whitefish, speckled dace, redside shiner, northern squawfish, chiselmouth chub, suckers, sculpin, smallmouth bass, carp, bluegill and mosquitofish (Table H-6). Observations indicate that salmonids are found throughout the Umatilla Basin but their distribution varies seasonally. Few salmonids were observed below RM 75 in the Umatilla River during the summer. These were observed near spring areas that apparently provide limited but important refuges from high water temperatures. Large numbers of non-salmonids were observed in 'all but the headwater sites. During August of 1994, crews enumerated over 50,000 dace, 28,000 redside shiners, 1500 chisel mouth, 4000 sculpin, and 500 northern squawfish. During the fall and spring, few salmonids were captured or observed higher in the drainage (i.e. Thomas Creek). No fry were observed below Three Mile Falls Dam during the spring and early summer where numerous fall chinook and coho salmon redds were observed the previous fall.

Presence/Absence Sites

Salmonids were captured during 30 of the 44 surveys (Table E-24). During the spring of 1994, juvenile salmonids were observed in higher numbers in some ephemeral tributaries than in the mainstem of the larger creek. By summer many of the sites sampled during the spring were puddled or completely dry. A 125 mm bull trout was captured in Coyote Creek, April 1994.

Seventeen passage barriers were found during the surveys. Twelve were classified as partial barriers and five as complete barriers (Table E-25). Modification of several of the barriers would likely increase available habitat for salmonids.

SPAWNING ESCAPEMENT SURVEYS

Major tributaries known to be utilized by spawning adult salmon and steelhead include Birch Creek, Squaw Creek, Meacham Creek and the North and South Forks of the Umatilla River (Figure A-2). Steelhead tend to use these and other tributaries, while spring chinook salmon use the upper reaches of the mainstem and lower reaches of the larger upper tributaries where water temperatures are sufficiently cool in late summer and early fall. Fall chinook and coho salmon generally spawn in the lower river. However, coho have been observed higher in the basin in tributaries such as Squaw Creek and Buckaroo Creek.

Steelhead

Flow levels and conditions for observation were mostly good during 1994. Survey conditions were not as good as those observed during the very low runoff year of the spring of 1992, but were much better than the high runoff encountered during the spring of 1993.

During summer steelhead escapement surveys, a total of 117 redds (2.0 redds/mile) were enumerated along 5 1.1 miles of lateral tributaries and six miles of the mainstem Umatilla River (Table F-l). Based on observations to date, it appears that only a small percentage of spawning summer steelhead utilize the mainstem for spawning and the remainder spawn in lateral tributaries. Since redd surveys begin in 1985, often over 50 percent of the observed redds in the Umatilla River Basin are enumerated in Meacham Creek and tributaries. Squaw Creek is the next most important spawning tributary, often with over 25% of the observed redds (Table F-4). Variability in areas surveyed and survey conditions make direct comparisons of redd data difficult in many years. Areas surveyed have been standardized, but gravel shifted during high flow periods has been observed to mask detection of redds marked during previous surveys. One-time surveys conducted after spawning are thus of minimal value in most years. In years with low snow pack, multiple surveys conducted every two or three weeks would yield the best and most comparable information. Because of the variability of survey conditions annually encountered during steelhead

surveys, intensive spawning ground surveys should only be conducted when the majority of the snow pack has melted and runoff before late March. Redd data is probably best utilized for relative spawning distribution information rather than an annual index of abundance. Because of the difficulties mentioned above, there is not a good correlation between steelhead adults released above Three Mile Falls Dam and redds observed per mile surveyed (Table F-S). Long term steelhead spawning population trends in a tributary can be determined by comparing redd data collected during multiple surveys of a tributary during low flow springs.

During the spring of 1994, at least 21 live steelhead were observed and five steelhead mortalities samples. An additional five steelhead were sampled moving downstream in the Squaw Creek pipe trap, one sampled from the Meacham Creek rotary trap and 17 sampled at the Westland adult trap. The Westland adult trap appears to be the best location to sample adult steelhead moving downstream after spawning.

ODFW conducted summer steelhead escapement surveys on Birch Creek, above the Forks and enumerated 118 redds and observed 27 summer steelhead in 18.5 miles of the system (Table F-2). These counts are higher than any previously recorded counts for this area.

The disposition of the 945 natural and 345 hatchery steelhead that returned to Three Mile Falls Dam was as follows: 135 were taken for broodstock, 50 hatchery adults were sacrificed to recover coded wire tags for research objectives. A total of 1,104 summer steelhead were available for harvest and natural spawning.

Spring Chinook Salmon

During spring chinook salmon escapement surveys, 74 redds (1.43 redds/mile) were enumerated and 113 carcasses sampled along 51.8 miles of the Umatilla River Basin between May 27, and September 26, 1994 (Table F-3, Figure F-l). Of the 240 spring chinook salmon released above Three Mile Falls Dam, 47.1% were recovered during escapement surveys. A total of 50 adipose clipped and coded wire tagged spring chinook salmon were recovered during spawning ground surveys to evaluate various juvenile release strategies. Other dispositions of spring chinook salmon enumerated at Three Mile Falls Dam from 1989 to 1994 are presented in Table F-8. Because of very intensive spawning ground surveys, it is felt that either a portion of the spring chinook salmon escapement remains below Pendleton, where conditions are very poor for observing the escapement, or poaching is

occurring. Radio telemetry studies conducted on spring chinook salmon during 1994 do not indicate that fall-back is a serious problem. Poaching remains a possibility, as remains of ten carcasses were observed in areas of the upper river, however, the handing out of subsistence spring chinook salmon from elsewhere and their subsequent possible dressing and disposal along the river bank clouds the situation. During past years, it has been reported that some individuals have caught very large numbers of spring chinook salmon during the closed season (and reportedly released same). Very heavy line and fishing lures were recovered during 1993, long after closer of the sport season, from a hole where spring chinook held for the summer in large numbers, below Meacham Creek Confluence. Because of multiple surveys of the area, it was known that the heavy fishing gear was lost well after the closure of the chinook sport fishery.

Spring chinook salmon survival above Pendleton through the successful completion of spawning, based on sampling of carcasses, averaged 82.3 % but varied greatly between areas (Table F-6). As has occurred during 1991 and 1993, survival to spawning was highest in the upper section of the drainage, where water temperatures were coolest, and survival decreased down river, as water temperatures increased. Survival to spawning was 100.0% in the North Fork Umatilla River, 90.7 % between RM 90-80, 78.6% from RM 80-79, 61.1% from RM 79-70, and 0.0% from RM 70-59.5. In Meacham Creek, survival through the completion of spawning, based on only 15 total spring chinook salmon sampled, was 57.1% from RM 12-6 and 66.7% from RM six to the mouth of Meacham Creek. The poor condition of most spring chinook salmon adults that do survive to spawn in the Umatilla River below the mouth of Meacham Creek and in Meacham Creek in most years makes determination of redds difficult. Redds in these marginal areas (high water temperatures) were often atypically small and thus it was sometimes difficult to determine, based on size of the redd, whether spawning had been successful. A good indicator of spawning success in these marginal areas was a comparison between redds enumerated and spawned out females sampled. In the Umatilla River during the last two years comparison of spawned out females sampled divided by redds enumerated were 84.0% and 75 .O% respectively.

Spawning distribution of returning adult spring chinook salmon in the Umatilla River (Table F-7) appears to be influenced by both the area where the hatchery reared juveniles were released and by where the returning adults were released, after being transported by tanker truck. In 1993 most of the

spring chinook salmon escapement should have returned to areas near Meacham Creek, based on their area of release as juveniles, yet 77.2% of the spawned out fish sampled in the Upper Umatilla River had been trucked above Pendleton as adults (most at RM 79.5), and only 30.4% of Meacham Creek successful spawners had been trucked above Pendleton as adults. In past years, many spring chinook salmon adults have returned to Meacham Creek or areas just below the mouth of Meacham Creek, because large numbers of juvenile spring chinook salmon had been released at or near Bonifer Pond. Survival of these returning adults has not been good in this area, as warm water has caused high prespawning mortality. To increase the survival of adults to spawning the returning fish should hold and spawn above the mouth of Meacham Creek, where water temperatures for holding and spawning are cooler.

The adult return during 1995 will be mostly from the 1990 and 1991 broods, many released above the mouth of Meacham Creek, and thus a higher percentage of the adults are expected to return to areas above the mouth of Meacham Creek, where survival should be highest in most years.

Fall Chinook and Coho Salmon

The total estimated return during the fall of 1993 to the Umatilla River (Three Mile Falls Dam escapement and fish sampled or observed and not sampled below Three Mile Falls Dam) was 1,653 coho and 482 fall chinook salmon adults (Table F-9).

A total of 44 coho salmon redds were enumerated and flagged during November and December of 1993 above Three Mile Falls Dam (Table F-10). Forty-one percent of the redds were observed from Cold Springs Diversion at RM 28.2 to Stanfield Bridge (RM 23.0) and 22.7% were observed from Stanfield Bridge to Simplot Bridge (RM 17.0). The area from Simplot Bridge to Three Mile Falls Dam was not surveyed because of extremely poor conditions for observation. Above Cold Springs Diversion to Fred Gray's Bridge, only an occasional redd was observed. Only 14 coho and 1 fall chinook salmon were sampled above Three Mile Falls Dam during redd enumeration.

Below Three Mile Falls Dam a total of 50 fall chinook and 122 coho salmon were sampled (Table F-l 1). Redds were not enumerated as minimal spawning gravel (mostly bedrock from Three Mile Falls Dam to Chinaman's Hole) and extremely poor conditions for observing redds make this a very difficult area to survey. Based on examination of carcasses, survival to

spawning of fall chinook salmon was 85.4% and coho survival to spawning was 74.6%. Based on coded wire tags recovered to date, it appears that most of the adult fish sampled below Three Mile Falls Dam were returns from smolts released in the Umatilla River. Length frequency histograms of adult fall chinook and coho salmon examined during the spawning ground surveys are presented in Figures F-2 and F-3.

Enumeration of redds and sampling of carcasses are not a good indicator of spawning success of fall chinook and coho salmon above Three Mile Falls Dam because of deep and dark water in much of the area during most years. Only a small percentage of the escapement is usually observed, and the percentage observed annually will vary greatly depending on where the fish are released and conditions for observing the escapement (conditions for observation are most variable in 'the mainstem during the Fall). A better indicator of successful spawning may be density of juveniles after emergence. Because coho salmon spend a year rearing after emergence, naturally produced fry in the lower river would have to migrate to the mainstem Columbia or find cold water refuges in the Umatilla River to survive, as extremely low flows and high water temperatures occur during parts of the year. The few naturally produced coho salmon juveniles sampled to date in the lower river were in extremely poor condition (completely covered with black spot, an external parasite). Coho salmon spawning distribution has been quite variable, because much of the coho salmon escapement is ripe or near ripe upon entry into the Umatilla River, and thus most adults have spawned in the immediate vicinity of their release area, and release areas have varied. Because of low flows and extremely high water temperatures below Pendleton during certain periods of the year, survival of juvenile coho salmon to emigration will be near zero unless refuges are available in the lower Umatilla or Columbia Rivers or adult fish are transported to the headwaters to spawn. Because of aggressive interactions with other salmonids, this may not be desirable.

JUVENILE SALMON-ID TRAPPING

Upriver Trapping

The rotary screw trap in the Umatilla River (RM 79.5) operated 245 out of 277 days from October 15, 1993 through June 18, 1994 and captured 2,413 juvenile rainbow/steelhead. Mean trap efficiency rate was 12% for juvenile steelhead (244 recaptured from 2,109 marked and released). A total

of 5,162 juvenile chinook salmon were captured. Mean trap efficiency rate was 36% for juvenile chinook (1,529 recaptured out of 4,240 marked and released; Tables G-l, G-2)

The rotary screw trap in Meacham Creek (RM 1.5) operated 183 out of 190 days from December 15 through June 22, 1994 and captured 4,959 juvenile rainbow/steelhead. Mean trap efficiency rate was 14% for juvenile steelhead (622 recaptured from 4,356 marked and released). A total of 832 juvenile chinook salmon were captured. Mean trap efficiency rate was 36% for juvenile chinook (273 recaptured out of 752 marked and released; Tables G-l, G-2).

The three pipe traps in Squaw Creek (RM 1) operated 185 out of 201 days from December 4 through June 22, 1994 and captured 1,903 juvenile rainbow/steelhead. Mean trap efficiency rate was 24% for juvenile steelhead (222 recaptured from 1,696 marked and released). A total of 46 juvenile chinook salmon were captured. Mean trap efficiency rate was 22% for juvenile chinook (7 recaptured out of 32 marked and released; Tables G-l, G-2).

Peak catches of juvenile rainbow/steelhead and chinook salmon occurred in October during the fall and in April and May in the spring. It appears that a number of juveniles move from the headwaters to the lower reaches of the basin during the fall and winter before emigrating in the spring.

Several uncertainties affect the evaluation of trap data regarding naturally produced smolts emigrating from the Squaw Creek, Meacham Creek, and the upper Umatilla River. These uncertainties include: wide day to day variation in trap catch rates; the winter mortality of fish moving past the trap in the fall before they leave the basin in the spring; the unknown number of salmonids passing the trap during the days the traps were not operated, and the unknown proportion of the rainbow/steelhead that were either presmolted emigrants or resident fish. It appears that many of the juvenile rainbow/steelhead captured at RM 79.5 were not emigrants as indicated by difference in the lengths of juvenile rainbow/steelhead captured in the lower river (Figures G-l, G-21).

Trapping was conducted in the Umatilla at RM 79.5 because most of the steelhead and adult chinook redds in past years have been found upstream of the site while hundreds of thousands of hatchery fish are annually released just below the site. Furthermore, the Meacham Creek and Squaw Creek sites are near the Umatilla site (Figure Map). In addition, water quality is

unsuitable for summer rearing of salmonids not far below the site. We postulated that by trapping juvenile salmonids at RM 79.5, naturally produced emigrants could be successfully estimated without subjecting recently released hatchery fish to the additional stress associated with trapping and handling. Trapping in the lower river would require continual monitoring during hatchery releases to prevent the trap from becoming inundated with fish and causing unnecessary stress to both hatchery and natural production smolts. However, fall emigration and the difference in size of juvenile rainbow/steelhead captured at RM 79.5 and at WEID canal suggest that trapping in both the mid and lower river will be required to effectively estimate the number of naturally produced smolts emigrating from the Umatilla River Basin (Figures G-6, G-21).

A total of 139 bull trout were captured in the Umatilla River trap. Two were captured in the Meacham Creek trap and one in the Squaw Creek trap (Table G-l). A summary of all our bull trout observations to date are summarized in Table I-l. Bull trout trapped in the fall averaged 264 mm (fork length; SD 46) in contrast to those trapped in the spring which averaged 152 mm (SD 46; Appendix I). Peak catches occurred in October during the fall and in April and May during the spring (Figure I-2). Traps were not operated in September. The age of a 390 mm bull trout was determined by scale and otolith analysis to be 4+. The first two years of growth were slow in contrast to faster growth of its last two years.

Downriver Trapping

During the five day evaluation period at the WEID capture facility, a total of 23 naturally produced spring chinook salmon averaging 112.2 mm, 369 hatchery released spring chinook salmon and 124 naturally produced rainbow/steelhead averaging 182.5 mm (Figure G-21) were enumerated (Table G-3). Overall minimum capture efficiency was between 22.0% and 65.5 % and averaging 37.8 % (Table G-4). Comparison of minimum capture efficiencies of natural spring chinook salmon with mean size of 112.2 mm with hatchery spring chinook salmon that were much larger (often over 200 mm) indicated that the natural spring chinook salmon were recaptured at a 34.7% higher rate during the short evaluation period.

Camera enumeration at the Three Mile Falls Dam East Bank viewing window indicated that large numbers of smolts were migrating downstream through the East Bank adult ladder. It is not possible to compare the percentage moving through the West vs. East Bank Facilities, as large

numbers of big hatchery smolts (hundreds) were holding in front of the five cfs orifice plate, when the area was dewatered, while closing the juvenile bypass. The recapture rate of naturally produced (small sized) chinook salmon may be higher than the big hatchery smolts because the larger fish may be better able to hold in front of the orifice plate.

The large variation in trapping efficiency between hatchery and natural salmonids suggests that separate, recapture rates should be determined to increase the accuracy of population estimates. Capture efficiencies were probably higher than would normally occur, as flow over the Dam was minimal during the feasibility study. Capture efficiency at the facility should vary greatly over short periods of time because of irrigation practices (variable flow caused by water withdrawal and/or release of McKay stored water) and the hydro operation at Boyd's Diversion.

Enumeration of the downstream migration appears feasible at Three Mile Falls Dam, but will be very labor intensive. Because of the ever changing flow levels discussed above, capture efficiencies will be extremely variable over short periods of time. Multiple efficiency tests should be conducted daily. Additionally, the variable flow levels necessitate that at least one person be on site at all times to maintain the proper flow into the trap.

HARVEST

Harvest monitors logged 128 survey hours during April, 1994. They conducted 20 angler interviews with 37 anglers and examined 0 adult steelhead. Several of the Tribal anglers were interviewed two and three times. Estimating total harvest was not possible without any catch observed during the surveys. Twenty-five of the anglers interviewed had logged 98.5 angling hours. The others were interviewed before they began fishing. Thirty adult steelhead were reported harvested during telephone interviews and other off-site contacts.

The post-season telephone survey was the only effective method of estimating harvest in 1994 because of the relatively few Tribal anglers, the localized area of their residence, and the reception of Tribal anglers to the non-intrusive techniques and questions of the telephone interviews.

AGE AND GROWTH

Based on analysis of scales, 49.2% of Umatilla River naturally produced summer steelhead returning to spawn in 1994 were from the 1989 brood year and 41.3% were from the 1990 brood (Tables H-l and H-2). Over 79% of the natural escapement had spent two years rearing in freshwater and 17.5% had reared for three years before emigration (Table H-3).

The most abundant juvenile salmonid in tributaries sampled during biological surveys were rainbow/steelhead. From 87.8 % -98.3 % of rainbow/steelhead present were age 0 or 1 (Tables H-4 and H-5). Population estimates and biological sampling were conducted during summer or fall, after steelhead smolts had emigrated, and only small numbers, ranging from 1.7%-12.2% of fish in various tributaries sampled, were age classes 2 and 3. Only one fish sampled during biological surveys and three fish sampled during index surveys were four years old and no older age classes were found. Mean size by age class, range, and standard deviation of juvenile rainbow/steelhead sampled by tributary are presented in Tables H-4 and H-5. Age data was utilized to expand the length samples by apportionment. Because of the large number of length samples, in most cases over 10% of the salmonids estimated to be in a tributary were measured, the age classes were fairly apparent without scale analysis, but independent scale interpretations were conducted. Little overlap occurred between length and age for age classes 0 and 1. More overlap occurred in the older age classes.

Age and length data from salmonids collected from the index sites are presented in Table H-6. This was the first year of data collection in many of the areas, and thus trends in population structure, age classes, etc. will not be evident until additional years of information are collected.

Based on coded wire tag return data, 66.6% of the spring chinook salmon adults in 1994 was from the 1990 brood and 33.3 % from the 1989 brood (Figure F-l).

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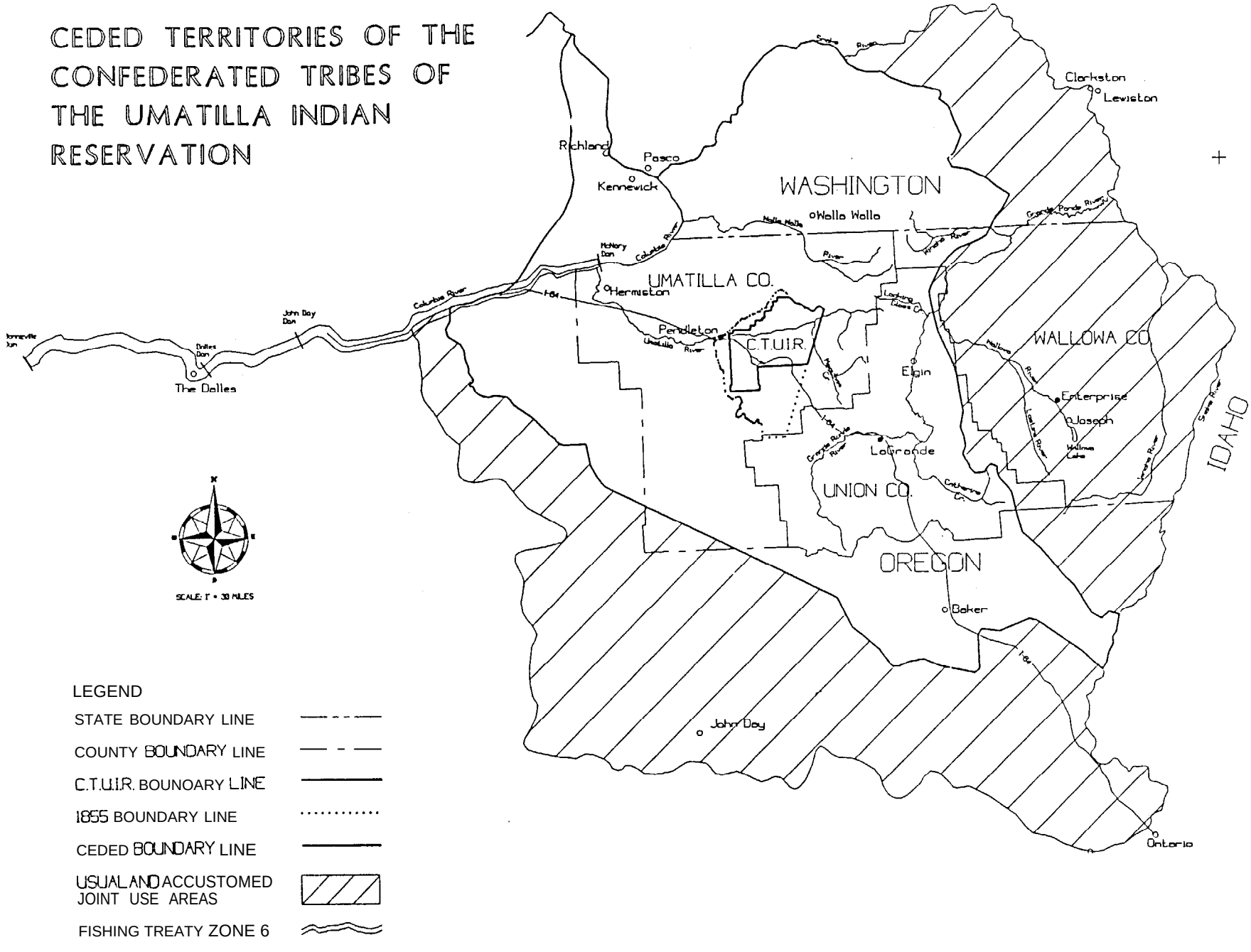
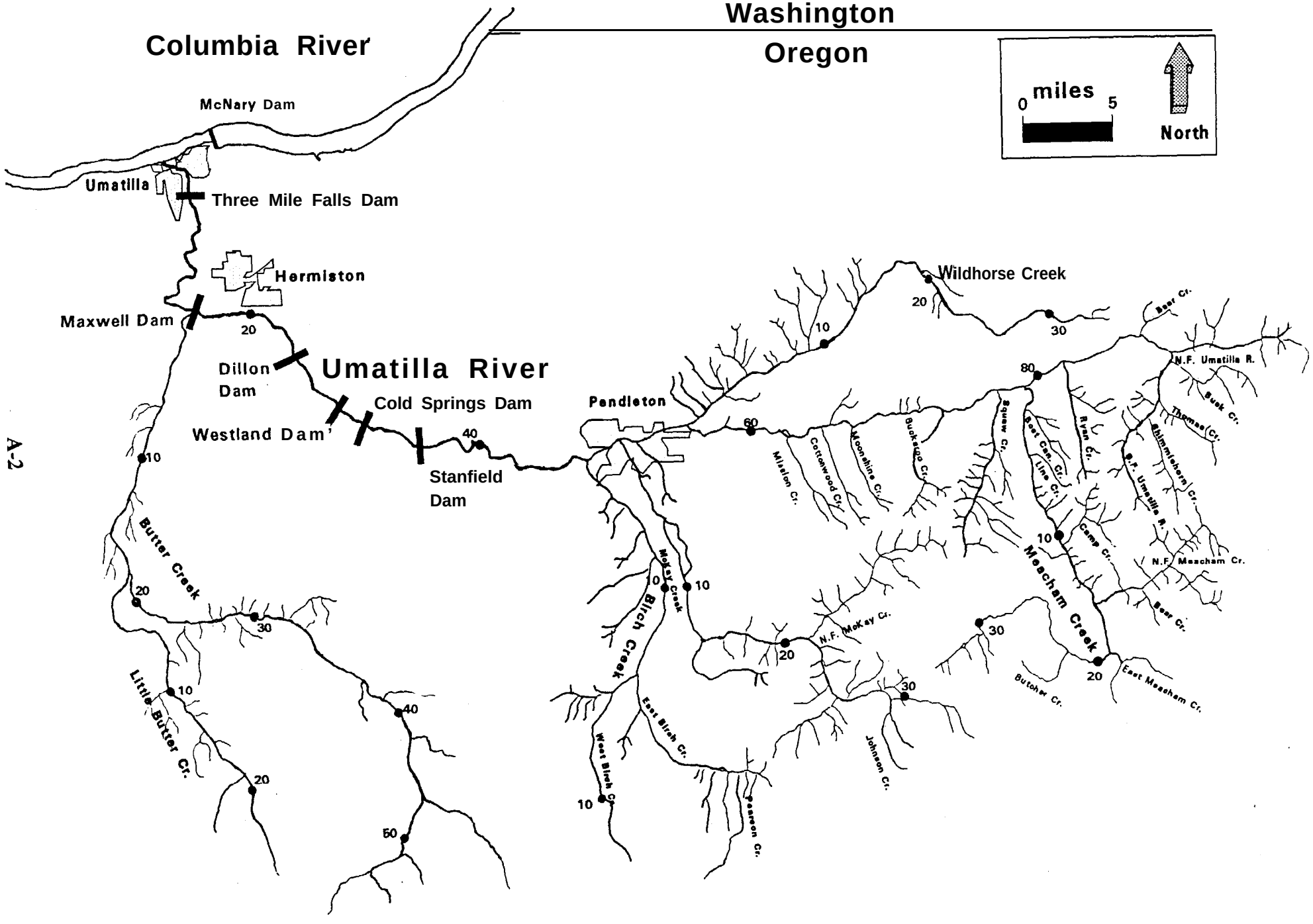


Figure A-l. Map of Reservation and Ceded Lands of the Umatilla Indian Reservation in Northeast Oregon and Southeast Washington.



A-2

Figure **A-2.** Map of the Umatilla River Basin with River Miles Denoted.

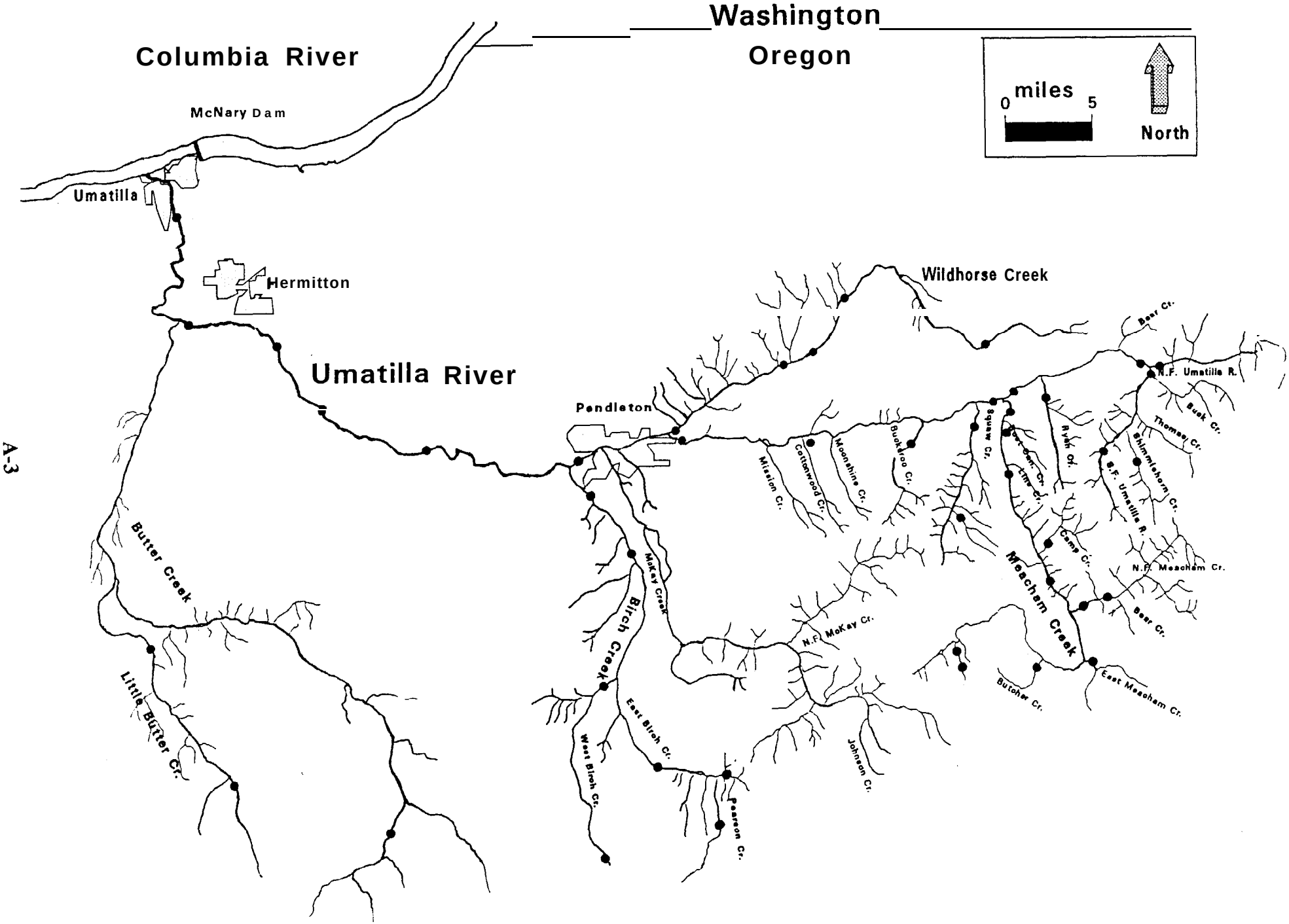


Figure A-3. Map of Thermograph Locations in the Umatilla River Basin.

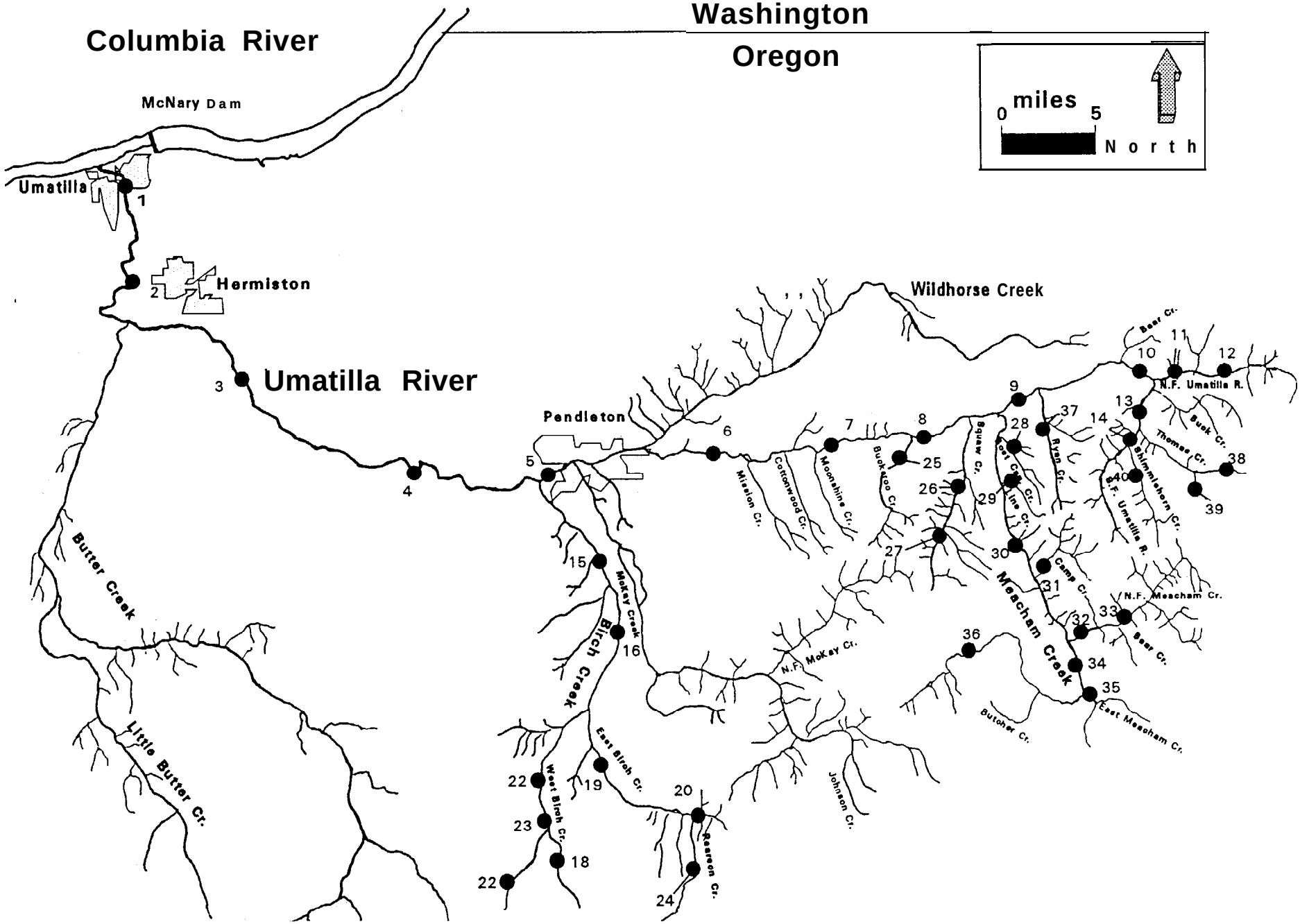


Figure A-4. Map of Index Site Locations in the Umatilla River Basin.

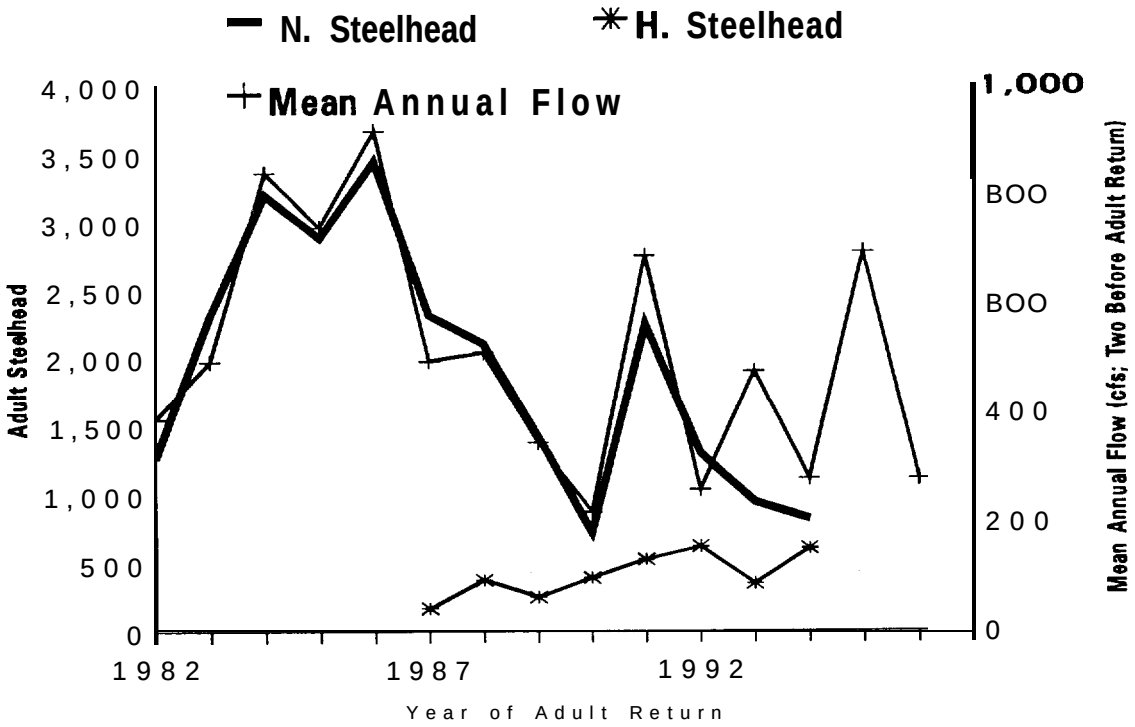


Figure B-l. Adult Steelhead Returns Compared to the Mean Annual Flows (cfs) at Umatilla Gage (RM 1.2) Two Years Prior to the Adult Return from 1982 to 1994, (1994 adult returns approximated; STSFLWB 1. CH3)

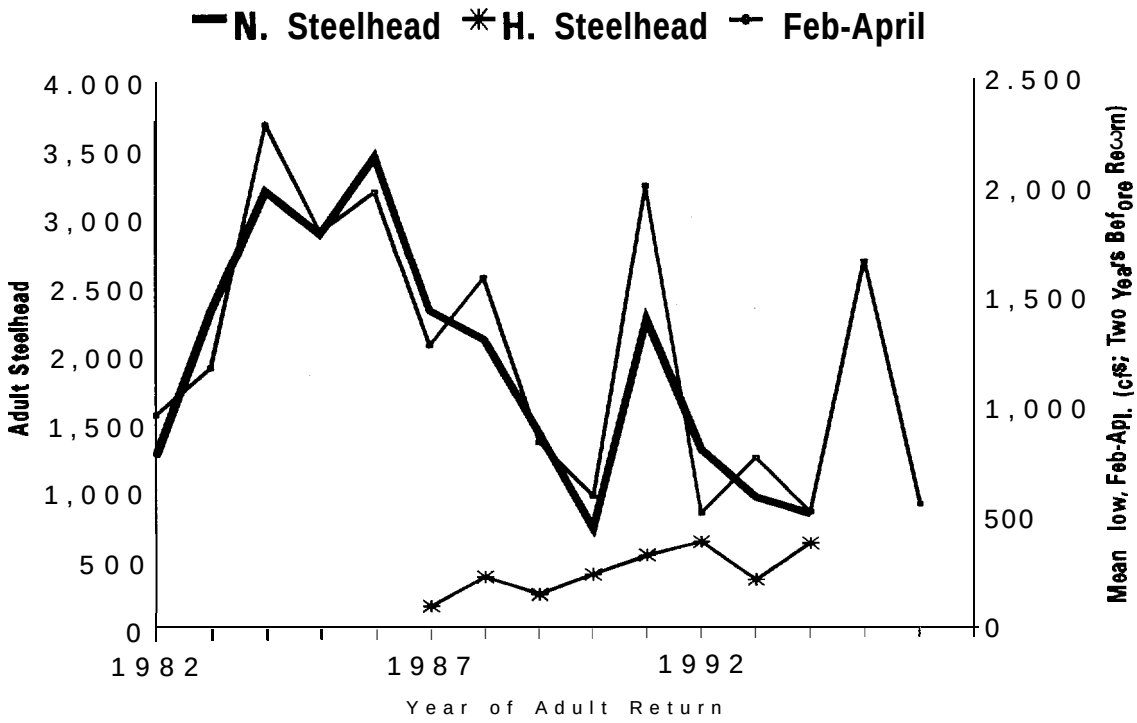


Figure B-2. Adult Steelhead Returns and the Average of February, March and April Mean Monthly Flows (cfs) at Umatilla Gage (RM 1.2) Two Years Prior to the Adult Return from 1982 to 1994 (1994 adult returns approximated: STSFLWB2.CH3).

APPENDIX C
Thermograph Locations and Recorded Temperatures

Table C-l. Thermographs in the Umatilla River.

LOCATION	AGENCY	RIVER MILE	DEPLOYMENT PERIOD	THERMOGRAPH TYPE
Umatilla River at Three Mile Falls Dam	CTUIR	3.1	All Year	Temp-Mentor
Umatilla River (at Three Mile Falls Dam)	USBR	3.7	Proposed	Hydromet
Umatilla River (at Maxwell Canal @ new gage)	USBR	15	All Year	Hydromet
Umatilla River (near Dillon Canal, at gage 03 10)	USBR	24	All Year	Hydromet
Umatilla River (near Feed Canal, at gage 0290)	USBR	28	All Year	Hydromet
Umatilla River (near Yoakum, at gage 0260)	USBR	37	All Year	Hydromet
Umatilla River (Near Rieth)	CTUJR	49	All Year	RTM2000
Umatilla River (Near Pendleton, at gage 0210)	USBR	55.2	Proposed	Hydromet
Umatilla River (Near ODFW Office)	CTUJR	56	All Year	Temp-Mentor
Umatilla River	CTUJR	78.5	All Year	Temp-Mentor
Umatilla River	CTUIR	79	All Year	Temp-Mentor
Umatilla River (at USGS Gage)	CTUJR	81.7	All Year	Temp-Mentor
Umatilla River (Below mouth of N. and S. Forks)	USFS	89.5	Feb.-Dec.	Temp-Mentor
Minthom Springs (Near Umatilla RM 65)	CTUIR	In Springs	All Year	Temp-Mentor
Buckaroo Creek	CTUJR	2	All Year	Temp-Mentor
Squaw Creek	CTUJR	2	All Year	Temp-Mentor
Little Squaw Creek	CTUJR	0.1	All Year	Temp-Mentor
Ryan Creek	CTUJR	1.3	All Year	RTM2000
N.Fork Umatilla River	USFS	0.1	June-Oct.	Temp-Mentor
S.Fork Umatilla River	USFS	0.1	Feb.-Dec.	Temp-Mentor
S.Fork Umatilla River	USFS	6	June-Oct.	Temp-Mentor
Shimmiehom	USFS	0.1	June-Oct	Temp-Mentor

Table C-2. Thermographs in Meacham **Creek** Drainage.

LOCATION	AGENCY	RIVER MILE	DEPLOYMEW PERIOD	THERMOGRAPH TYPE
Meacham Creek	CTUIR	2	All Year	Temp-Mentor
Meacham Creek	CTUIR	5.25	All Year	Temp-Mentor
Meacham Creek	CTUIR	13	All Year	RTM2000
Meacham Creek	ODFW	31.5	April-Oct.	Temp-Mentor
Meacham Creek	ODFW	32.5	April-Oct.	Temp-Mentor
Bonifer Pond (near Meacham C. RM 2.5)	CTUIR	In Pond	All Year	Temp-Mentor
Camp Creek	CTUIR	0.6	All Year	RTM2000
N.F. Meacham	ODFW	0.1	All Year (Began 5194)	Hobo
N.F. Meacham	USFS	2	June-Oct.	Temp-Mentor
East Meacham	CTUIR	0.1	All Year	RTM2000
Butcher Creek	CTUIR	1	All Year	RTM2000

Table C-3. Thermographs in Wildhorse Creek Drainage

LOCATION	AGENCY	RIVER MILE	DEPLOYMENT PERIOD	THERMOGRAPH TYPE
Wildhorse Creek (Mouth)	CTUIR	0	All Year	Temp-Mentor
Wildhorse Creek (Below new project)	CTUIR	9.5	Proposed, All Year	Temp-Mentor
Wildhorse Creek (Above new project)	CTUIR	11	Proposed, All Year	Temp-Mentor
Wildhorse Creek (Near Adams)	ODFW	13	All Year	Temp-Mentor
Wildhorse Creek (Headwaters)	CTUIR	26	All Year	Temp-Mentor

Table C-4. Thermographs in the Walla Walla River Basin

LOCATION	AGENCY	RIVER MILE	DEPLOYMENT PERIOD	THERMOGRAPH TYPE
Walla Walla River	CTUIR	8	All Year	Temp-Mentor
Walla Walla River	CTUIR	47	All Year	Temp-Mentor
II S.F. Walla Walla	CTUIR	0.5	All Year	RTM2000
S.F. Walla Walla	CTUIR	7.	All Year	Temp-Mentor
S.F. Walla Walla	CTUIR	20	All Year	RTM2000
Elbow ([redacted]F. Walla Walla) [redacted]	ODFW	0.1	New 5/94	HOBO
Burnt Cabin Creek (S.F. Walla Walla)	CTUIR	0.1	All Year	RTM2000
Reser Creek (S.F. Walla Walla)	CTUIR	0.1	All Year	RTM2000
N.F. Walla Walla	CTUIR	0.1	All Year	Temp-Mentor
N.F. Walla Walla	ODFW	6	New 5/94	H O B O
N.F. Walla Walla	ODFW	12	New 5/94	HOBO
Pine Creek	ODFW	20.5	New 5/94	Temp-Mentor
Pine Creek	ODFW	29	New 5/94	Temp-Mentor

Table C-5 Thermographs in Birch Creek, Butter Creek, and Willow Creek Drainages.

LOCATION	AGENCY	RIVERMILE	DEPLOYMENT PERIOD	THERMOGRAPH TYPE
Birch Creek	ODFW	3.5	April-Oct.	Temp-Mentor
Birch Creek (near Sparks)	ODFW	6.5	April-Oct.	Temp-Mentor
Fast Birch Creek	ODFW	8.5	April-Oct.	Temp-Mentor
Westgate Canyon (East Birch Creek)	ODFW	0.75	April-Oct.	Temp-Mentor
Pearson Creek	ODFW	4	New 5/94	Hobo
West Birch Creek	ODFW	2	New 4/94	Hobo
West Birch Creek	ODFW	15	New 4/94	Hobo
Butter Creek	ODFW	51	New 5/94	Hobo
Little Butter Creek (Near Gurdane)	ODFW	7	New 5/94	Hobo
Little Butter Creek (Near Lena)	ODFW	19.5	New 5/94	Hobo
Willow Creek	ODFW	61	New 5/94	Hobo
Willow Creek	ODFW	77.5	New 5/94	Hobo
Rhea Creek	ODFW	16.7	New 5/94	Hobo
Rhea Creek	ODFW	35	New 5/94	Hobo

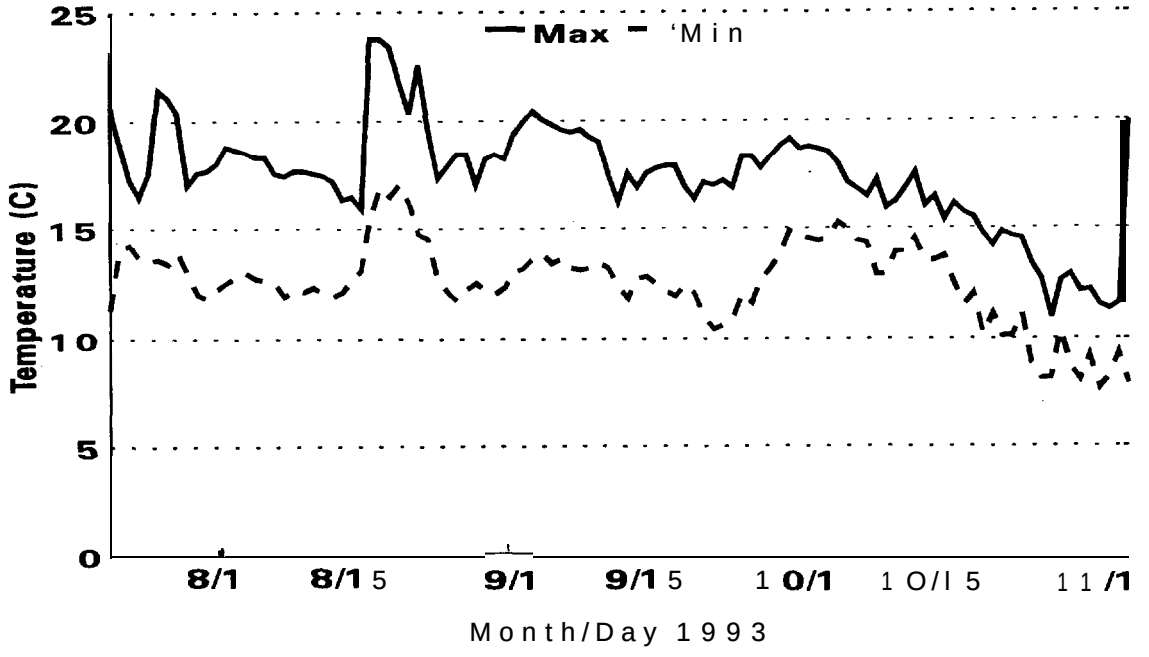


Figure C-1. Maximum and Minimum Temperatures Recorded in the Umatilla River, Near Rieth, RM 49.5, July through November 1993 (TGUR9307.CH3).

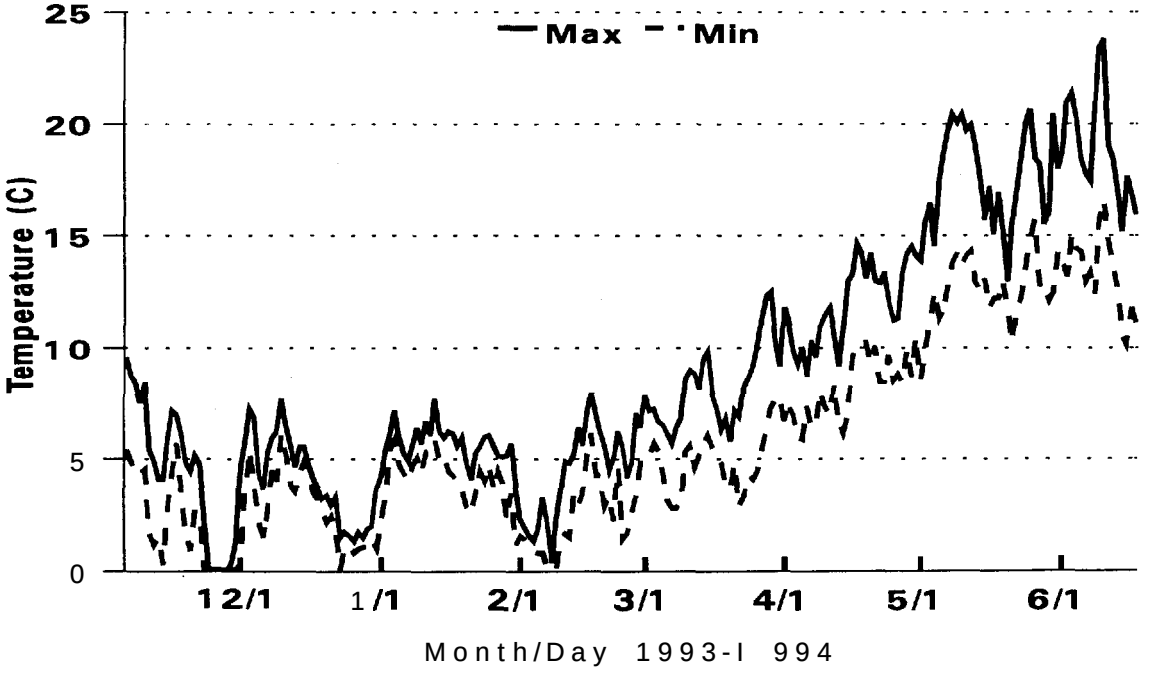


Figure C-2. Maximum and Minimum Temperatures Recorded in the Umatilla River, Near Rieth, RM 49.5, November, 1993 Through June, 1994 (TGUR9311.CH3).

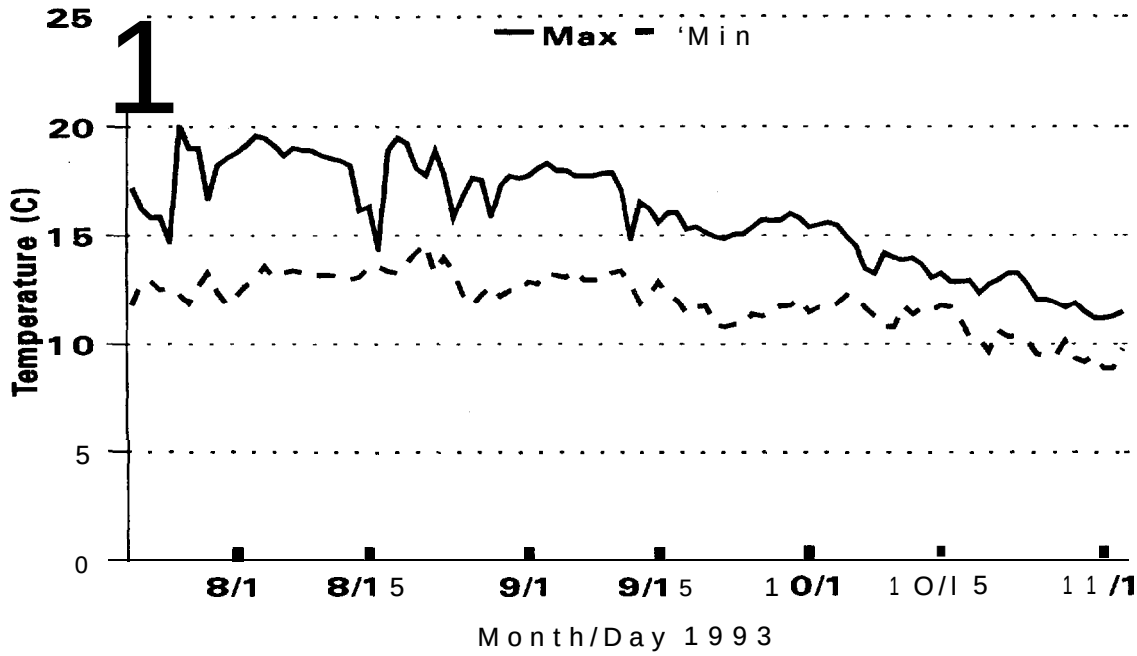


Figure C-3. The Maximum and Minimum Temperatures Recorded in Ryan Creek, RM 1.5, July into November, 1993 (TGRY9307.CH3).

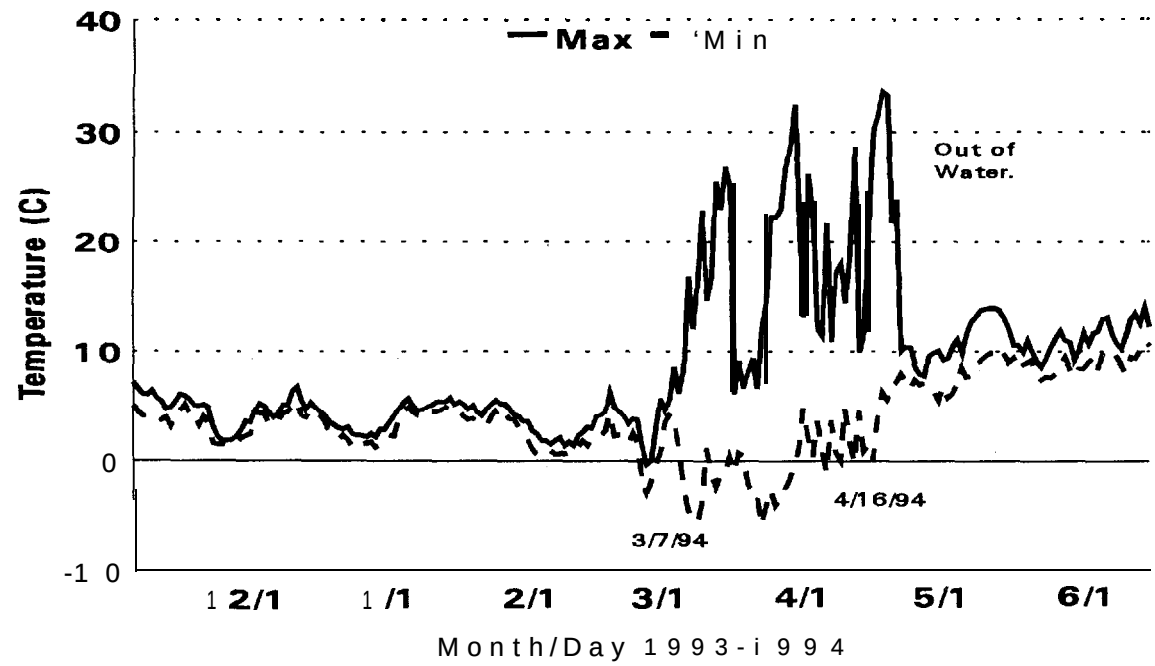


Figure C-4. Maximum and Minimum Temperatures Recorded in Ryan Creek, RM 1.5, November, 1993 to June, 1994 (TGRY9311.CH3).

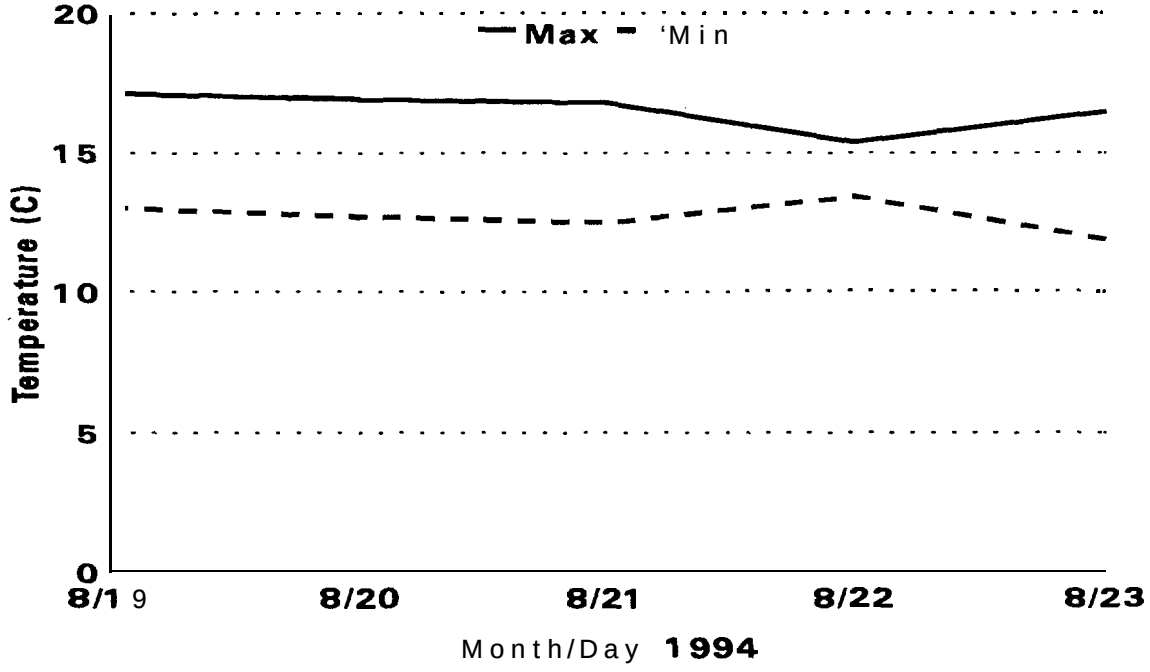


Figure C-S. Maximum and Minimum Temperatures Recorded in Ryan Creek, RM 1.5, August, 1994 (TGRY9408.CH3).

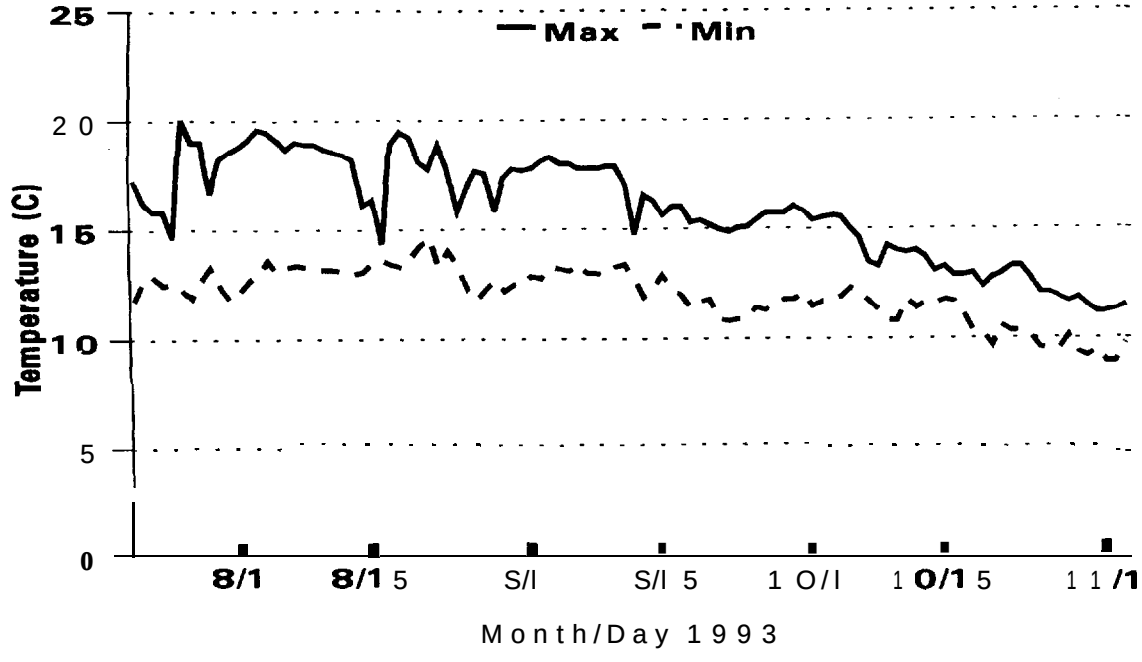


Figure C-6. Maximum and Minimum Temperatures Recorded in Meacham Creek, RM 13, July to November, 1993 (TGMM9307.CH3).

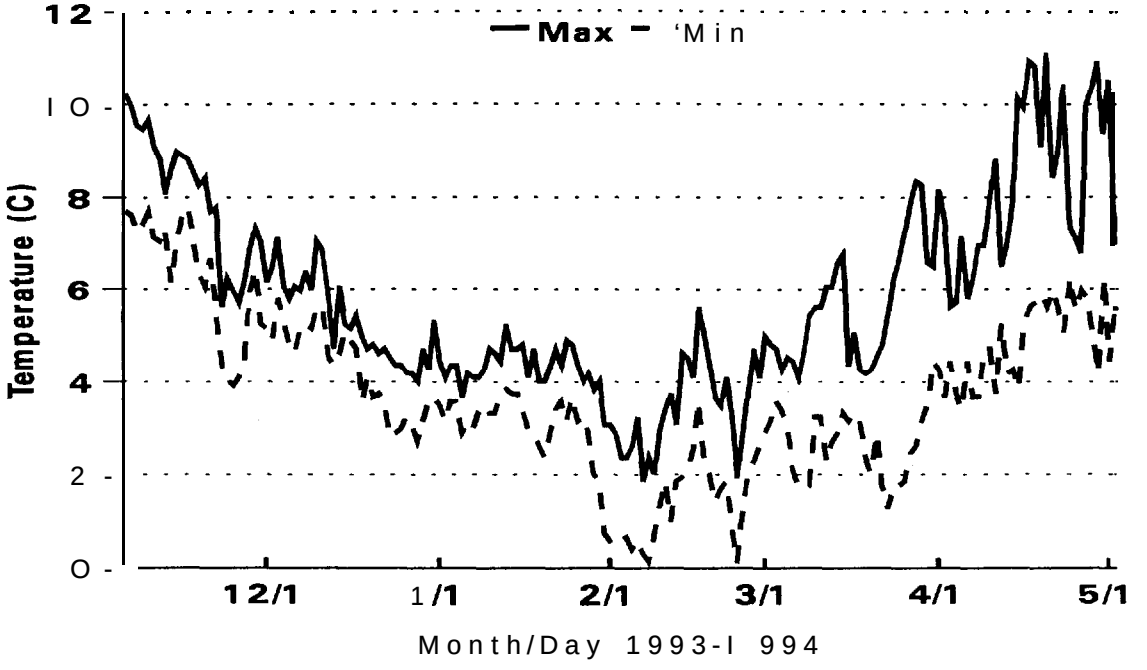


Figure C-7. Maximum and Minimum Temperatures Recorded in Meacham Creek, RM 13, November, 1993 to May, 1994 (TGMM9311.CH3).

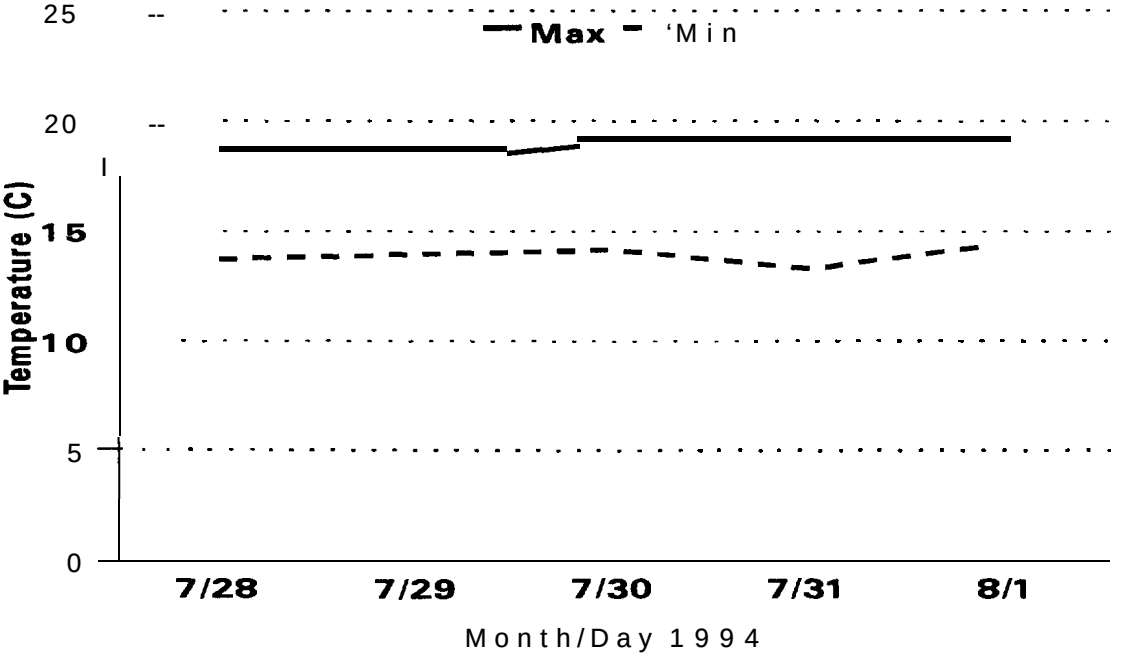


Figure C-8. Maximum and Minimum Temperatures Recorded in Meacham Creek, RM 13, July and August, 1994 (TGMM9407.CH3).

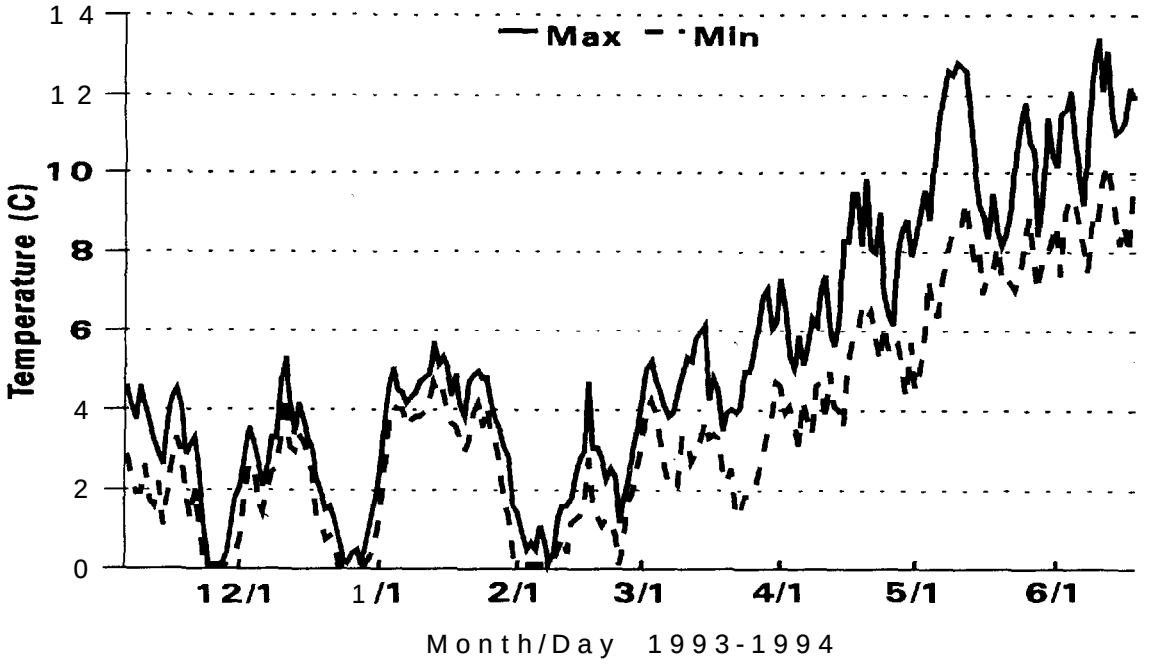


Figure C-9. Maximum and Minimum Temperatures Recorded in Camp Creek, RM 0.5, November, 1993 to June, 1994 (TGCP9311.CH3).

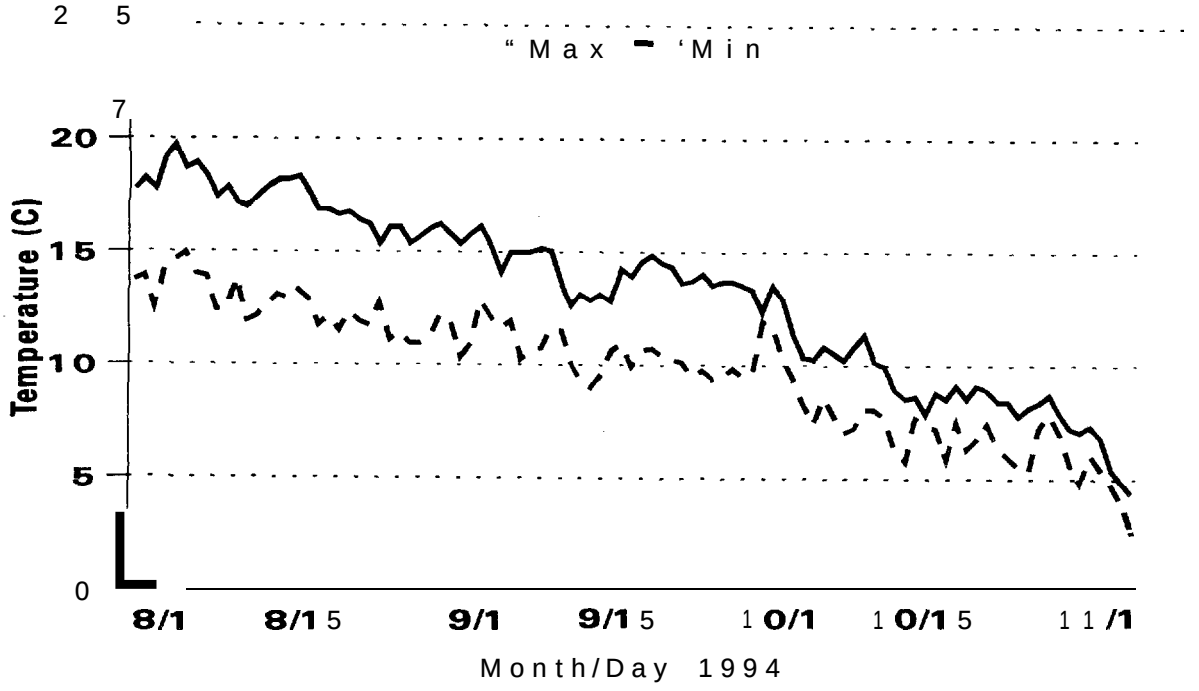


Figure C-IO. Maximum and Minimum Temperatures Recorded in Camp Creek, RM 0.5, July to November, 1994 (TGCP9407.CH3).

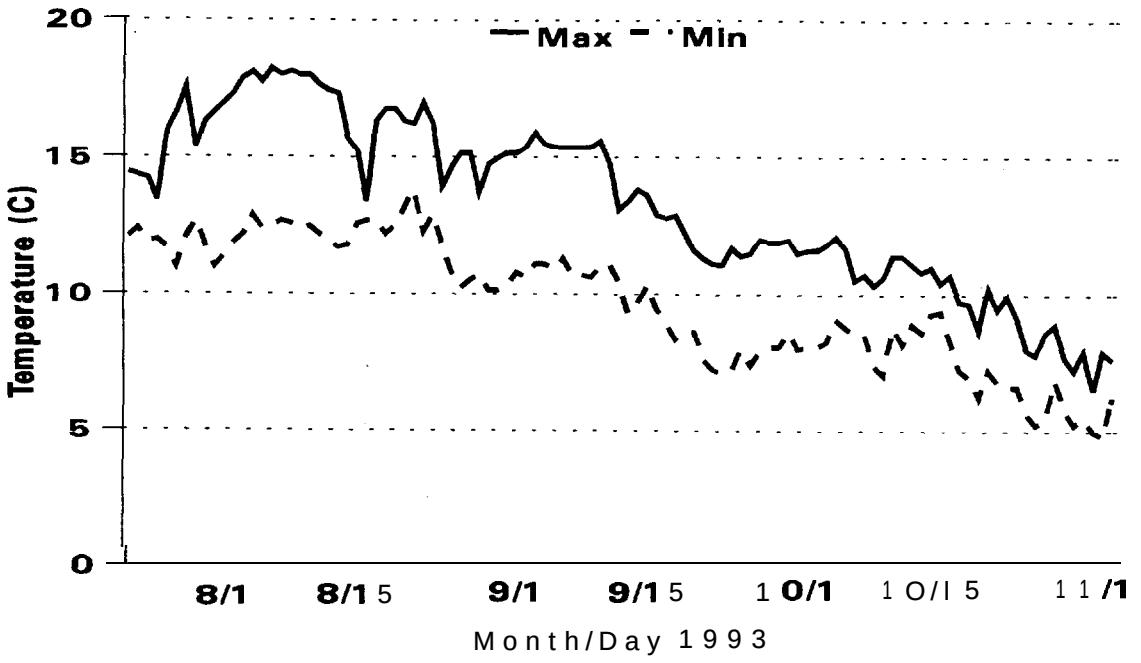


Figure C-l 1. Maximum and Minimum Temperatures Recorded in East Meacham Creek, RM 0.125, July to November, 1993 (TGEM9307.CH3).

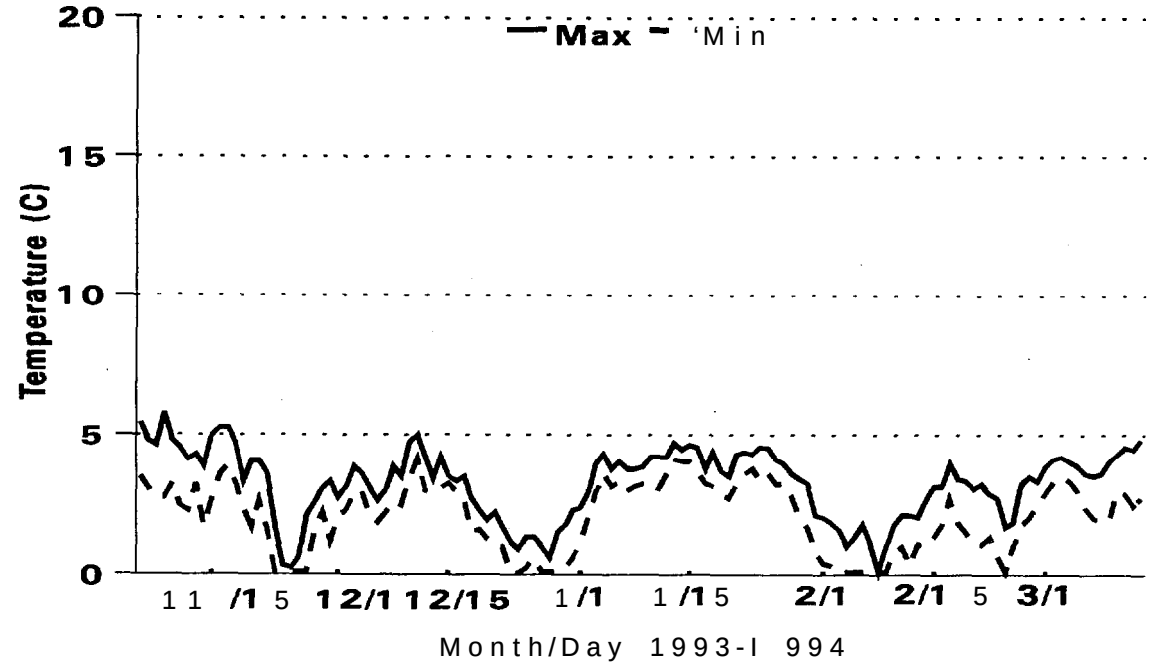


Figure C-12. Maximum and Minimum Temperatures Recorded in East Meacham Creek, RM 0.125, November, 1993 to March, 1994 (TGEM9311.CH3).

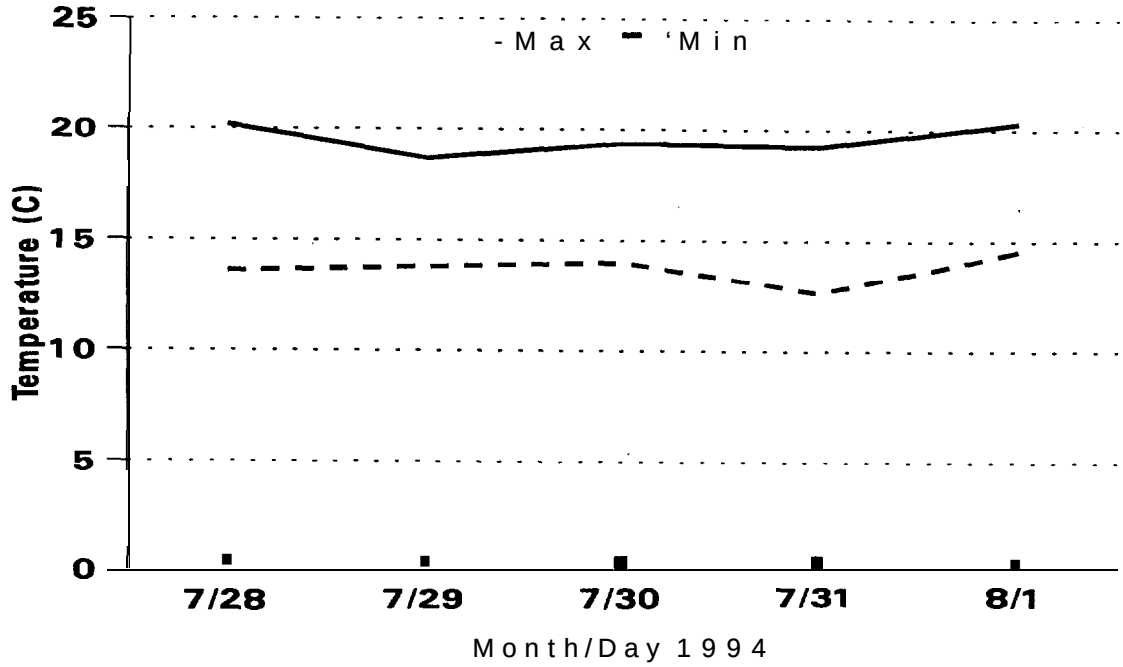


Figure C-13. Maximum and Minimum Temperatures Recorded in East Meacham Creek, RM 0.125, July and August, 1994 (TGEM9407.CH3).

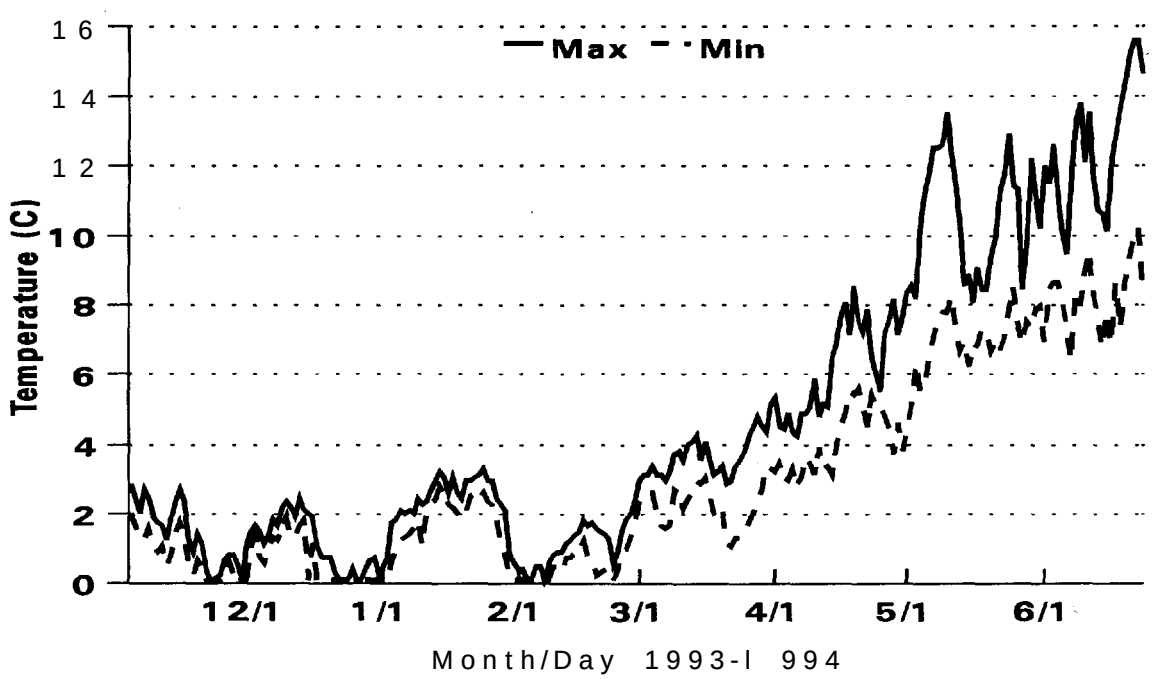


Figure C-14. Maximum and Minimum Temperatures Recorded in Butcher Creek, RM 0.125, November, 1993 to June, 1994 (TGBT9311.CH3).

APPENDIX D
Physical Habitat Survey Data Summary Tables.

Table D-l. The Number of Miles Surveyed, Total Area,and Number of Habitat Units Inventoried, 1994.

STREAM	NUMBER OF MILES SURVEYED	TOTAL AREA/m^2	TOTAL NUMBER OF UNITS
Umatilla River	25.7	858.776	2665
Squaw Creek	10.0	58.951	1443
Camp Creek	3.3	17,123	720
Camp Creek Tributary	0.4	671	too
TOTAL	**39.4**	**935.521**	**4928**

Table D-2. Summary of Habitat Quality Rankings from Habitat Survey Data. 1994.

MEASURED HABITAT FEATURE	HABITAT QUALITY RANKING CRITERIA			RANKING OF HABITAT FEATURE/n			
	Poor	Fair	Good	Umatilla River	Squaw Creek	Camp Creek	Camp Creek Tributary
Pool Area (%)	n<10	10<n<35	n>35	Fair/33.0	Fnir129.9	Fair/23.7	Fairi15.9
Dry Channel Area (%)	n>10	10>n>0	n=0	Fair/0.7	Poor/13.0	FairiO.9	Poor/59.8
Width/Depth (rimes)	n>30	30>n>10	n<10	Poor/52.8	Poor/*	Fairi22.4	Fair/25.1
Fines (%)	n>20	20>n>8	n<8	Fair/11	Good:2	Fair/8	Good'4
Open Sky (%)	n>50	50>n>20	w-20	Poor/69	Fair/40	Fair/27	Fair/27
Canopy Closure (%)	n<35		n>35	Poor/23	Good/44	Good/39	Good/46
Woody Debris (pieces, #/100m)	n<10	10<n<20	n>20	Poor/2.4	Poori3.4	Poor/8.7	Poor/6.3
Woody Debris (volume, m^3/100m)	n<20	20<n<30	n>30	Poor/4.0	Poor/2.2	Good/272	Poor/46

* numerical data unavailable

Table D-3. Habitat Inventory Summary for Umatilla River. units 1-378, RM 56.1 to 59.2, Valley, Channel, and Wood Summary, June 1994

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrou Valley Floor		Broad Valley Floor	
Steep V-shape	0	Constraining Terraces	100
Moderate V-shape	0	Multiple Terraces	0
Open V-shape	0	Wide Floodplain	0

Valley Width Index avg: 23.3 range: 3.0-25.0

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hi llslope	0	Single Channel	12
Bedrock	0	Multiple Channel	0
Terrace	88	Braided Channel	0
Alt. Terrace/Hill	0		
Landuse	0		

Channel Characteristics

Type	Length	Area	Dry Units
Primary	6,931	155,718	0
Secondary	4,370	36,093	2

Channel Dimensions

Wetted Surface		Active Channel		First Terrace	
Width	13.1	Width	24.1	Width	40.3
Depth	0.38	Height	0.5	Height	1.0
W:D	57.5				

Stream Flow Type: MF Water Temp: 18.0-26.0
Avg. Unit Gradient: 0.5 Habitat Units/100m: 3.3

Riparian, Bank, and Wood Summary

Land Use: LG.RR Riparian Veg.: D/30-50, S

Bank Stability

Bank Class	Percent Reach Length
Non-Erodible	3.5
Vegetation Stabilized	77.8
Boulder-cobble	6.6
Actively Eroding	12.2

Undercut Banks

Unit Average: 8.69%

Open Sky (% of 180)

Unit Average: 73
Range: 17-94

Large Woody Debris

Average Complexity Score: 1.2

Pieces	77	Volume(m^3)	61
Pieces/100m	1.1	Volume/100m	0.9

Table D-4. Habitat Inventory Summary for Umatilla River, units 1-378, RM 56.1 to 59.2, Habitat Unit Summary, June 1994.

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbbl	Bldr	Bdrk
DRY UNITS	2	50	6.3	0.00	398	1	0	0	50	40	10	0
GLIDE	62	2,470	14.4	0.43	46,277	419	13	4	34	15	9	26
POOL-ALCOVE	1	28	12.6	0.50	352	21	30	20	30	10	10	0
POOL-BACKWATER	46	660	4.6	0.32	4,527	55	24	6	39	10	5	15
POOL-BEAVER DAM		67	11.6	0.85	777	0	20	10	50	10	0	10
POOL-DAMMED	1	39	15.8	1.10	618	35	20	0	20	20	20	20
POOL-ISOLATED	3	574	2.5	0.23	1,234	44	20	3	33	10	7	27
POOL-LATERAL SCOUR	44	1,277	11.7	0.69	19,574	141	13	4	47	17	9	11
POOL-PLUNGE	3	29	11.2	0.78	347	43	7	0	17	13	13	50
POOL-STRAIGHT SCOUR	47	1,549	15.8	0.56	23,148	418	9	3	31	16	12	29
RAPID/BEDROCK	10	208	17.7	0.26	3,470	74	3	1	12	12	9	63
RAPID/BOULDERS	7	74	21.6	0.29	1,653	196	3	0	17	29	44	7
RIFFLE	122	3,007	12.0	0.21	50,343	679	9	2	47	17	10	15
RIFFLE W/ POCKETS	24	1,257	25.6	0.35	38,943	988	10	0	20	20	22	28
STEP/BEDROCK	3	7	11.2	0.22	74	9	10	D	7	10	10	63
STEP/STRUCTURE	2	6	22.6	0.10	75	0	15	5	60	10	5	5
Total:	378	11,301	13.1	0.38	191,810	3123	Avg:12	3	38	16	11	21

HABITAT SUMMARY

Habitat Group	No. Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Percent	Large Boulders Number	#/100m^2	Wood Class
Damned & BW Pools	52	1,368	5.0	0.34	7508	3.91	155	2.06	1.3
Scour Pools	94	2,855	13.8	0.62	43069	22.45	602	1.40	1.4
Glides	62	2,470	14.4	0.43	46277	24.13	419	0.91	1.1
Riffles	146	4,264	14.3	0.23	89286	46.55	1667	1.87	1.0
Rapids	17	281	19.3	0.27	5123	2.67	270	5.27	1.1
Cascades	0	0	.	.	0	0.00	0	0.00	.
Step/Falls	5	12	15.8	0.17	149	0.08	9	6.05	1.0
Small Streams (SS)	0	0	.	.	0	0.00	0	0.00	.
Dry	2	50	6.3	0.00	398	0.21	1	0.25	1.0

Table D-5. Habitat Inventory Summary for Umatilla River, units 1-378, RM 56.1 to 59.2, Stream Summary, June 1994.

STREAM SUMMARY — Umatilla River

Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Substrate Percent Wetted Area S/O	Sand	Grvl	Cbbl	Bldr	Bdrk	Total Large Boulder
378	11,301	13.1	0.38	191,810	12	3	38	16	11	21	3,123

Habitat Group	Wetted Area (m^2)	Percent
Scour Pool	43,069	22.5
Backwater Pools	7,508	3.9
Glide	46,277	24.1
Riffle	89,286	46.5
Rapid	5,123	2.7
Cascade	0	0.0
Step	149	0.1
Dry	398	0.2

Table D-6. Habitat Inventory Summary for Umatilla River, units 1-378, RM 56.1 to 59.2, Riparian Summary, June 1994

RIPARIAN ZONE VEGETATION SUMMARY

Reach 0 is represented by 13 transects

Predominant landform in each zone

	Zone 1 O-IO meters	Zone 2 10-20 meters	Zone 3 20-30 meters
Hillslope	4	4	4
High terrace	42	42	46
Lou terrace	35	38	35
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	19	15	15
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	17	3	3

Canopy closure and ground cover

	Zone 1 O-10 meters (%)	Zone 2 10-20 meters (%)	Zone 3 20-30 meters (%)
Canopy closure	26	5	4
Shrub cover	32	32	32
Grass/forb cover	21	21	27

Average number of trees in a 5-meter wide band

	Zone 1 O-10 meters		Zone 2 10-20 meters		Zone 3 20-30 meters		Zones 1-3 O-30 meters	
Diameter class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	4.3	0.0	0.2	0.0	0.5	0.0	4.9
15-30cm	0.0	1.4	0.0	0.0	0.0	0.5	0.0	1.9
30-50cm	0.0	0.4	0.0	0.2	0.0	0.0	0.0	0.5
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m^2	0.0	6.1	0.0	0.3	0.0	1.0	0.0	2.5

Table D-7. Habitat Inventory Summary for Umatilla River, units 379-543, RM 59.2 to 60.5, Valley, Channel, and Wood Summary, June 1994.

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0	Constraining Terraces	100
Moderate V-shape	0	Multiple Terraces	0
Open V-shape	0	Wide Floodplain	0

Valley Width Index avg: 25.0 range: 25.0-25.0

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0	Single Channel	0
Bedrock	0	Multiple Channel	0
Terrace	100	Braided Channel	0
Alt. Terrace/Hill	0		
Landuse	0		

Channel Characteristics

Type	Length	Area	Dry Units
Primary	1,730	43,525	0
Secondary	1,563	14,398	0

Channel Dimensions

Wetted Surface		Active Channel		First Terrace	
Width	13.6	Width	26.1	Width	41.1
Depth	0.37	Height	0.5	Height	1.0
W:D	79.0				

Stream Flow Type: MF Water Temp: 14.5-26.0
Avg. Unit Gradient: I.4 Habitat Units/100m: 5.0

Riparian, Bank, and Wood Summary

Land Use: LG.RR Riparian Veg.: D/30--50, S

Bank Stability

Bank Class	Percent Reach Length
Non-Erodible	7.6
Vegetation Stabilized	72.2
Boulder-cobble	1.9
Actively Eroding	17.0

Undercut Banks

Unit Average: 6.49%

Open Sky (% of 180)
Unit Average: 64
Range: 6-86

Large Woody Debris

Average Complexity Score: 1.1

Pieces	24	Volume(m^3)	34
Pieces/100m	1.4	Volume/100m	2.0

Table D-8. Habitat Inventory Summary for Umatilla River, units 379-543, RM 59.2 to 60.5, Habitat Unit Summary, June 1994.

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbbl	Bldr	Bdrk
GLIDE	25	650	14.8	0.45	12,567	45	10	2	32	13	5	38
POOL-BACKWATER	21	280	6.3	0.36	2,245	22	17	2	35	13	3	30
POOL-ISOLATED	5	79	5.4	0.25	412	12	30	6	22	8	0	34
POOL-LATERAL SCOUR	9	185	10.4	0.57	2,712	13	10	1	35	24	11	19
POOL-PLUNGE	4	69	13.7	1.23	913	15	10	8	15	10	8	50
POOL-STRAIGHT SCOUR	28	556	16.1	0.57	10,350	77	10	1	32	17	7	33
RAPID/BEDROCK	8	80	14.3	0.23	1,162	7	8	0	3	4		185
RAPID/BOULDERS	1	2	4.2	0.15	9	0	0	0	10	50	40	0
RIFFLE	59	1,345	15.5	0.20	26,593	170	10	1	35	18	8	29
RIFFLE W/ POCKETS	1	33	18.9	0.25	631	21	10	0	30	30	20	10
STEP/BEDROCK	4	13	18.1	0.23	329	0	5	0	8	5	3	80
Total:	165	3,293	13.6	0.37	57,923	382	Avg:11	1	31	16	6	35

HABITAT SUMMARY

Habitat Group	No. Units	Total Length (m)	Avg Uidth (m)	Avg Depth (m)	Wetted Area (m^2)	Percent	Large Boulders Number	#/100m^2	Uood Class
Damned & BW Pools	26	359	6.1	0.34	2657	4.59	34	1.28	1.3
Scour Pools	41	810	14.6	0.63	13975	24.13	105	0.75	1.1
Glides	25	650	14.8	0.45	12567	21.70	45	0.36	1.0
Riffles	60	1,378	15.5	0.20	27224	47.00	191	0.70	1.1
Rapids	9	82	13.2	0.22	1171	2.02	7	0.60	1.0
Cascades	0	0	.	.	0	0.00	0	0.00	.
Step/Falls	4	13	18.1	0.23	329	0.57	0	0.00	1.0
Small Streams (SS)	0	0	.	.	0	0.00	0	0.00	.
Dry	0	0	.	.	0	0.00	0	0.00	.

Table D-9. Habitat Inventory Summary for Umatilla River, units 379-543, RM 53.2 to 60.5, Stream Summary, June 1994

STREAM SUMMARY — Umatilla River

Number Units	Total Length (m)	Avg Uidth (m)	Avg Depth (m)	Total Area (m^2)	Substrate Percent Uetted Area S/O	Sand	Grvl	Cbbl	Bldr	Bdrk	Total Large Boulder
					-	-	-	-	-	-	
165	3,293	13.6	0.37	57,923	11	1	31	16	6	35	382

Wetted Area

Habitat Group	(m^2)	Percent
Scour Pool	13,975	24.1
Backwater Pools	2,657	4.6
Glide	12,567	21.7
Riffle	27,224	47.0
Rapid	1,171	2.0
Cascade	0	0.0
Step	329	0.6
Dry	0	0.0

Table D-10. Habitat Inventory Summary for Umatilla River, units 379-543, RM 59.2 to 60.5, Riparian Summary, June 1994

RIPARIAN ZONE VEGETATION SUMMARY

Reach 0 is represented by 7 transects

Predominant landform in each zone

	Zone 1 0-10 meters	Zone 2 10-20 meters	Zone 3 20-30 meters
Hillslope	0	0	0
High terrace	29	36	50
Lou terrace	50	43	36
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	21	21	14
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	11	5	4

Canopy closure and ground cover

	Zone 1 0-IO meters (%)	Zone 2 10-20 meters (%)	Zone 3 20-30 meters (%)
Canopy closure	42	34	20
Shrub cover	47	39	37
Grass/forb cover	28	37	42

Average number of trees in a 5-meter wide band

	Zone 1 0-10 meters		Zone 2 10-20 meters		Zone 3 20-30 meters		Zones 1-3 0-30 meters	
Diameter class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	1.9	0.0	1.6	0.0	0.7	0.0	4.1
15-30cm	0.0	1.9	0.0	0.4	0.0	0.9	0.0	3.1
30-50cm	0.0	0.4	0.0	0.4	0.0	0.0	0.0	0.9
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m^2	0 . 0	4.1	0.0	2.4	0.0	1.6	0.0	2.7

Table D-11. Habitat Inventory Summary for Umatilla River, units 544-2650, RM 60.5 to 81.8, Valley, Channel, and Wood Summary, June 1994.

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0	Constraining Terraces	100
Moderate V-shape	0	Multiple Terraces	0
Open V-shape	0	Wide Floodplain	0

Valley Width Index avg: 9.0 range: 3.0-25.0

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0	Single Channel	69
Bedrock	0	Multiple Channel	0
Terrace	20	Braided Channel	0
Alt. Terrace/Hill	11		
Landuse	0		

Channel Characteristics

Type	Length	Area	Dry Units
Primary	30,257	473,713	0
Secondary	21,463	123,667	37

Channel Dimensions

Wetted Surface		Active Channel		First Terrace	
Width	9.0	Width	20.8	Width	25.4
Depth	0.45	Height	0.4	Height	0.7
W:D	48.8				

Stream Flow Type: LF Water Temp: 7.5-23.5
Avg. Unit Gradient: 0.7 Habitat Units/100m: 4.1

Riparian, Bank, and Wood Sum-nary

Land Use: LG,AG Riparian Veg.: D/30-50,S

Bank Stability

Bank Class	Percent Reach Length
Non-Erodible	3.9
Vegetation Stabilized	76.9
Boulder-cobble	7.5
Actively Eroding	11.5

Undercut Banks
Unit Average: 7.43%

Open Sky (% of 180)
Unit Average: 68
Range: 3-94

Large Woody Debris

Average Complexity Score: 1.3

Pieces	819	Volume(m^3)	1,468
Pieces/100m	2.7	Volume/100m	4.9

Table D-12. Habitat Inventory Summary for Umatilla River, units 544-2650, RM 60.5 to 81.8, Habitat Unit Summary, June 1994.

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbbl	Bldr	Bdrk
CASCADE/BOULDERS	1	2	10.3	0.20	22	29	0	0	10	20	70	0
DRY UNITS	25	698	6.3	0.00	4,864	0	0	5	55	31	9	0
GLIDE	267	9,531	12.5	0.59	155,965	1467	12	12	38	28	10	1
POOL-ALCOVE	6	so4	6.2	0.73	2,986	0	22	42	18	13	5	0
POOL-BACKWATER	298	4,275	3.6	0.42	21,538	523	13	16	38	24	8	2
POOL-BEAVER DAM	1	15	3.1	0.55	46	0	10	50	30	10	0	0
POOL-DAMMED	5	67	8.2	0.58	571	9	16	14	40	22	8	0
POOL-ISOLATED	94	4,434	2.7	0.40	17,114	290	13	20	37	21	7	2
POOL-LATERAL SCOUR	298	7,495	9.9	0.85	93,441	1447	11	12	35	28	12	3
POOL-PLUNGE	3	23	4.1	0.70	79	15	7	7	43	33	10	0
POOL-STRAIGHT SCOUR	272	6,155	9.9	0.64	77,848	1266	10	11	35	29	12	3
POOL-TRENCH	1	14	2.1	0.70	29	0	10	10	20	20	10	30
PUDDLED CHANNEL	12	370	2.5	0.22	953	27	10	9	38	31	12	0
RAPID/BEDROCK	5	91	18.3	0.24	1,461	55	10	2	16	18	8	46
RAPID/BOULDERS	129	2,396	10.2	0.26	23,981	534	4	1	31	39	24	2
RIFFLE	655	14,292	9.8	0.21	174,336	1771	10	8	43	28	9	1
RIFFLE W/ POCKETS	29	1,321	15.2	0.34	21,958	864	10	8	26	30	22	5
STEP/BOULDERS	2	4	11.3	0.33	47	40	5	0	15	45	30	5
STEP/COBBLE	1	1	10.3	0.05	5	0	10	0	50	30	10	0
STEP/LOG	1	32	4.1	0.15	130	0	10	10	40	40	0	0
STEP/STRUCTURE	2	3	3.1	0.03	8	0	10	20	30	15	10	15
Total:	2107	51,720	9.0	0.45	597,381	8337	Avg:	10	11	38	28	11	2

HABITAT SUMMARY

Habitat Group	No. Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Percent	Large Boulders Number	#/100m^2	Wood Class
Damned & BW Pools	404	9,294	3.5	0.42	42255	7.07	822	1.95	1.4
Scour Pools	574	13,687	9.9	0.75	171396	28.69	2728	1.59	1.5
Glides	267	9,531	12.5	0.59	155965	26.11	1467	0.94	1.2
Riffles	684	15,613	10.0	0.22	196294	32.86	2635	1.34	1.1
Rapids	134	2,487	10.5	0.26	25442	4.26	589	2.32	1.0
Cascades	1	2	10.3	0.20	22	*** **	29	134.26	1.0
Step/Falls	6	39	7.2	0.15	191	0.03	40	20.94	1.0
Small Streams (SS)	0	0	.	.	0	0.00	0	0.00	
Dry	37	1,068	5.1	0.07	5816	0.97	27	0.46	1.1

Table D-13. Habitat Inventory Summary for Umatilla River, units 544-2650, RM 60.5 to 81.8, Stream Summary, June 1994.

STREAM SUMMARY — Umatilla River

Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Substrate Percent Wetted Area S/O	Sand	Grvl	Cbbl	Bldr	Bdrk	Total Large Boulder
2107	51,720	9.0	0.45	597,381	10	11	38	28	11	2	8,337

Habitat Group	Wetted Area (m^2)	Percent
Scour Pool	171,396	28.7
Backwater Pools	42,255	7.1
Glide	155,965	26.1
Riffle	196,294	32.9
Rapid	25,442	4.3
Cascade	22	**.*
Step	191	**.*
Dry	5,816	1.0

Table D-14. Habitat Inventory Summary for Umatilla River, units 544-2650, RM 60.5 to 81.8, Riparian Summary, June 1994.

RIPARIAN ZONE VEGETATION SUMMARY

Reach 0 is represented by 72 transects

Predominant landform in each zone

	Zone 1 O-10 meters	Zone 2 10-20 meters	Zone 3 20-30 meters
Hillslope	10	13	17
High terrace	51	51	54
Low terrace	24	21	20
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	14	14	7
Roadbed/Railroad	0	0	C
Riprap	0	0	0
Surface slope (%)	21	15	16

Canopy closure and ground cover

	Zone 1 O-10 meters (%)	Zone 2 10-20 meters (%)	Zone 3 20-30 meters (%)
Canopy closure	20	20	19
Shrub cover	36	36	40
Grass/forb cover	22	29	34

Average number of trees in a S-meter wide band

Diameter class	Zone 1 O-10 meters Conifer	Zone 1 O-10 meters Hardwood	Zone 2 10-20 meters Conifer	Zone 2 10-20 meters Hardwood	Zone 3 20-30 meters Conifer	Zone 3 20-30 meters Hardwood	Zones 1-3 O-30 meters Conifer	Zones 1-3 O-30 meters Hardwood
3-15cm	**.*	1.7	• ⊠ *	1.5	0.1	1.1	0.1	4.3
15-30cm	0.1	0.5	0.1	0.4	0.1	0.3	0.3	1.1
30-50cm	**.*	0.1	0.1	0.1	** *	** *	0.2	0.2
SO-90cm	0.0	**.*	0.0	0.0	0.0	0.0	□◪□	• ⊠◪⊠
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	□◪□	□◪□
Total/100m^2	0 . 2	2.3	0.2	2.0	0.2	1.4	0.2	1.9

Table D-15. Habitat Inventory Summary for Umatilla River, units 1-2650, RM 56.1 to 81.8, Valley, Channel, and Wood Summary, June 1994.

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0	Constraining Terraces	100
Moderate V-shape	0	Multiple Terraces	0
Open V-shape	0	Wide Floodplain	0

Valley Width Index avg: 12.1 range: 3.0-25.0

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0	Single Channel	56
Bedrock	0	Multiple Channel	0
Terrace	35	Braided Channel	0
Alt. Terrace/Hill	9		
Landuse	0		

Channel Characteristics

Type	Length	Area	Dry Units
Primary	39,113	482,422	0
Secondary	27,533	176,354	39

Channel Dimensions

Wetted Surface		Active Channel		First Terrace	
Width	10.0	Width	21.6	Width	28.5
Depth	0.43	Height	0.4	Height	0.7
W:D	52.8				

Stream Flow Type: LF Water Temp: 0.0-22.0
Avg. Unit Gradient: 0.7 Habitat Units/100m: 4.0

Riparian, Bank, and Wood Sum-nary

Land Use: LG,AG Riparian Veg.: D/30-50,S

Bank Stability

Bank Class	Percent Reach Length
Non-Erodible	4.0
Vegetation Stabilized	76.9
Boulder-cobble	7.0
Actively Eroding	11.9

Undercut Banks
Unit Average: 7.55%

Open Sky (% of 180)
Unit Average: 69
Range: 3-94

Large Woody Debris

Average Complexity Score: 1.3

Pieces	920	Volume(m^3)	1,564
Pieces/100m	2.4	Volume/100m	4.0

Table D-16. Habitat Inventory Summary for Umatilla River, units 1-2650, RM 56.1 to 81.8, Habitat Unit Summary, June 1994.

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbbl	Bldr	Bdrk
CASCADE/BOULDERS	1	2	10.5	0.20	22	29	0	0'	10	20	70	0
DRY UNITS	27	758	6.4	0.00	5,421	1	0	5	55	31	9	0
GLIDE	354	12,698	13.1	0.55	218,241	1931	12	10	37	24	9	a
POOL-ALCOVE	7	539	7.2	0.70	3,435	21	23	39	20	13	6	0
POOL-BACKWATER	365	5,249	3.9	0.40	28,746	600	15	14	38	22	7	5
POOL-BEAVER DAM	2	79	7.3	0.70	787	0	15	30	40	10	0	5
POOL-DAMMED	6	105	9.6	0.67	1,183	44	17	12	37	22	10	3
POOL-ISOLATED	102	5,137	2.8	0.39	19,292	346	14	19	36	20	7	4
POOL-LATERAL SCOUR	351	9,030	10.3	0.82	118,158	1601	11	11	37	26	11	4
POOL-PLUNGE	10	118	10.1	0.94	1,290	73	8	5	24	18	10	35
POOL-STRAIGHT SCOUR	347	8,286	11.4	0.62	112,849	1761	10	9	34	26	12	9
POOL-TRENCH	1	14	2.1	0.70	29	0	10	10	20	20	10	30
PUDDLED CHANNEL	12	376	2.5	0.22	978	27	10	9	38	31	12	0
RAPID/BEDROCK	23	369	16.7	0.24	5,964	136	6	1	10	10	6	67
RAPID/BOULDERS	137	2,510	10.9	0.26	26,421	730	4	1	31	38	25	2
RIFFLE	836	18,724	10.6	0.21	254,532	2620	10	6	43	26	9	5
RIFFLE W/ POCKETS	54	2,586	20.0	0.34	60,772	la73	10	4	23	26	22	15
STEP/BEDROCK	7	19	15.1	0.22	387	9	7	0	7	7	6	7	3
STEP/BOULDERS	2	4	11.6	0.33	49	40	5	0	15	45	30	5
STEP/COBBLE	1	1	10.5	0.05	5	0	10	0	50	30	10	0
STEP/LOG	1	32	4.2	0.15	135	0	10	10	40	40	0	0
STEP/STRUCTURE	4	a	12.8	0.06	81	0	13	13	45	13	8	10
Total:2650	66,645	10.0	0.43	858,776	11842	Avg:11	9	38	25	11	7

HABITAT SUMMARY

Habitat Group	No. Units	Total Length (m)	Avg Uidth (m)	Avg Depth (m)	Wetted Area (m^2)	Percent	Large Boulders Number	#/100m^2	Wood Class
Damned & BU Pools	482	11,110	3.8	0.41	53443	6.22	1011	1.89	1.4
Scour Pools	709	17,448	10.8	0.72	232325	27.05	3435	1.48	1.5
Glides	354	12,698	13.1	0.55	218241	25.41	1931	0.88	1.2
Riffles	890	21,310	11.2	0.22	315303	36.72	4493	1.42	1.1
Rapids	160	2,879	11.7	0.26	32385	3.77	866	2.67	1.0
Cascades	1	2	10.5	0.20	22	***.**	29	131.22	1.0
Step/Falls	15	64	13.0	0.18	657	0.08	49	7.45	1.0
Small Streams (SS)	0	0			0	0.00	0	0.00	
Dry	39	1,134	5.2	0.07	6399	0.75	28	0.44	1.1

Table D-17. Habitat Inventory Summary for Umatilla River, units 1-2650, RM 56.1 to 81.8, Stream Summary, June 1994.

STREAM SUMMARY — Umatilla River

Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Substrate Percent Wetted Area S/O	Sand	Grvl	Cbbl	Bldr	Bdrk	Total Large Boulder
2650	66,645	10.0	0.43	858,776	11	9	38	25	11	7	11,842

Uetted Area

Habitat Group	(m^2)	Percent
Scour Pool	232,325	27.1
Backwater Pools	53,443	6.2
Glide	218,241	25.4
Riffle	315,303	36.7
Rapid	32,385	3.8
Cascade	22	** *
Step	657	0.1
Dry	6,399	0.7

Table D-18. Habitat Inventory Summary for Umatilla River, units 1-2650, RM 56.1 to 81.8, Riparian Summary, June 1994.

RIPARIAN ZONE VEGETATION SUMMARY

Reach 0 is represented by 92 transects

Predominant landform in each zone

	Zone 1 0-10 meters	Zone 2 10-20 meters	Zone 3 20-30 meters
Hillslope	9	11	14
High terrace	48	49	53
Low terrace	27	25	23
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	15	14	9
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	20	12	13

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10-20 meters (%)	Zone 3 20-30 meters (%)
Canopy closure	23	19	17
Shrub cover	36	36	38
Grass/forb cover	23	28	34

Average number of trees in a 5-meter wide band

	Zone 1 0-10 meters		Zone 2 10-20 meters		Zone 3 20-30 meters		Zones 1-3 0-30 meters	
Diameter class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	**.*	2.1	** *	1.3	** *	1.0	0.1	4.4
15-30cm	0.1	0.7	0.1	0.4	0.1	0.3	0.2	1.4
30-50cm	**.*	0.2	0.1	0.1	** *	** *	0.1	0.3
50-90cm	0.0	**.*	0.0	0.0	0.0	0.0	0.0	**.*
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m^2	0.1	3.0	0.2	1.8	0.2	1.4	0.1	2.0

Table D-19. Consumptive Water Diversions from the Umatilla River, units I-2650, Survey Dates 07/14-09/28 1994.

UNIT NUMBER	RIVER MILE	DESIGNATED USE	TYPE	SIZE
37	56.9	Pasture	Screened	4"
142	57.5	Industrial	Screened Metal Pipe With Concrete	8"
146	57.5	Industrial	Screened Metal Pipe	4"
319	58.7	Pasture	Screened Galvanized Pioe	6"
474	59.8	Private	Screened PVC Pipe	4"
817	63.3	Private	Screened Pipe	4"
983	65.2	Pasture	Screened Pipe	4"
1088	65.8	Pasture	Screened Pioe	4"
1088	65.8	Pasture	Screened Pipe	3"
1140	66.2	Pasture	Screened Pipe	4"
1165	66.2	Pasture	Screened Pipe	4"
1254	67.2	Private	Screened Pump	2"
1261	67.2	Private	Screened Pump	2"
1324	68.5	Private	Screened Pump	6"
1600-1943	71-74	Private	5 Private Well Systems	1840 (gpm)
1740-2290	72-77.5	City of Pendleton Water Supply	7 Groundwater Infiltration Pipe Systems	6-8" 11.05 (cfs) 8594 (gpm)

Table D-20. Surface Springs associated with the Umatilla River, Rh4 56.1-81.8. Survey Date: 7-14 thru 11-8, 1994

RM	UNIT TYPE	SIDE	AREA (m^2)	RM	UNIT TYPE	SIDE	AREA (m^2)
57.0	RI	LEFT	500	64.8	IP	LEFT	7.5
57.4	BW	RIGHT	50	65.0	GL	RIGHT	20
58.0	IP	LEFT	1000	65.2	BW	RIGHT	1200
59.2	IP	LEFT	90	65.2	IP	RIGHT	45
59.3	IP	LEFT	30	65.2	IP	RIGHT	700
59.5	IP	LEFT	240	65.2	IP	RIGHT	12
60.2	RI	RIGHT	2090	65.6	LP	RIGHT	387
60.3	BW	RIGHT	16	65.6	IP	LEFT	3
60.5	SP	RIGHT	10	65.6	IP	RIGHT	12
60.5	BW	RIGHT	12	66.0	BW	RIGHT	78
60.6	RI	RIGHT	12	66.3	LP	RIGHT	225
60.8	RI	RIGHT	500	66.5	GL	LEFT	125
61.0	GL	LEFT	160	66.7	GL	RIGHT	18
61.4	BW	RIGHT	350	66.9	RI	LEFT	48
61.4	BW	LEFT	700	67.0	GL	LEFT	442
61.6	BW	RIGHT	18	67.2	IP	RIGHT	180
61.9	IP	RIGHT	750	68.0	BW	RIGHT	600
62.3	BW	RIGHT	140	68.1	RI	RIGHT	112
62.3	RI	RIGHT	40	68.3	BW	RIGHT	8
62.3	RI	LEFT	21	68.5	IP	RIGHT	12
62.6	BW	LEFT	28	68.6	IP	RIGHT	50
62.8	IP	LEFT	210	68.8	IP	RIGHT	400
62.8	RI	LEFT	60	69.2	SP	LEFT	240
63.1	IP	RIGHT	40	69.2	BW	RIGHT	150
63.2	BW	LEFT	12	69.4	RI	RIGHT	72
63.2	BW	RIGHT	375	69.5	BW	LEFT	336
63.3	IP	RIGHT	30	69.8	AL	RIGHT	500
63.3	IP	RIGHT	1750	70.4	BW	RIGHT	20
63.5	IP	RIGHT	750	70.6	IP	LEFT	10
63.6	AL	RIGHT	1750	70.6	PD	RIGHT	200
63.8	BW	RIGHT	65	71.0	GL	RIGHT	595
64.0	BW	LEFT	800	71.0	SP	LEFT	24
64.1	IP	LEFT	150	71.0	BW	LEFT	39
64.5	IP	RIGHT	52	71.0	BW	RIGHT	3

Table D-20. Continued

RM	UNIT TYPE	SIDE	AREA (m^2)	RM	UNIT TYPE	SIDE	AREA (m^2)
71.2	LP	RIGHT	26	76.0	IP	RIGHT	90
71.3	IP	LEFT	2500	76.2	IP	LEFT	480
71.3	BW	LEFT	4.4	76.4	IP	RIGHT	120
71.5	BW	LEFT	6	76.6	IP	LEFT	750
71.9	RB	RIGHT	32	76.8	IP	LEFT	114
72.0	IP	RIGHT	180	76.8	SP	RIGHT	260
72.0	IP	RIGHT	100	76.9	GL	RIGHT	22
72.0	BW	LEFT	35	76.9	GL	RIGHT	60
72.1	AL	RIGHT	160	77.0	IP	RIGHT	6
72.2	IP	RIGHT	320	77.0	IP	LEFT	600
72.4	IP	LEFT	240	77.0	IP	LEFT	360
72.5	IP	RIGHT	400	77.0	BW	LEFT	80
72.6	IP	RIGHT	60	78.5	AL	RIGHT	420
72.6	AL	RIGHT	900	78.7	IP	RIGHT	150
72.6	AL	RIGHT	300	78.7	IP	RIGHT	440
72.7	BW	LEFT	75	78.7	IP	RIGHT	100
73.0	IP	LEFT	200	78.9	IP	LEFT	58
73.9	BW	RIGHT	1350	78.9	IP	RIGHT	450
74.0	IP	RIGHT	244	79.2	BW	RIGHT	3
74.2	IP	RIGHT	750	79.3	IP	LEFT	28
74.2	SP	LEFT	800	79.3	IP	RIGHT	36
74.5	IP	LEFT	1250	79.3	BW	RIGHT	70
74.5	IP	LEFT	525	79.6	LP	LEFT	960
74.7	IP	RIGHT	120	79.9	AL	LEFT	60
74.9	AL	RIGHT	150	79.9	IP	RIGHT	25.5
74.9	AL	RIGHT	60	80.2	SP	RIGHT	495
75.0	IP	LEFT	120				
75.5	IP	LEFT	1200				
75.7	BW	RIGHT	10				
75.8	IP	RIGHT	280				
75.8	RI	RIGHT	36				
75.8	BW	RIGHT	66				
75.8	GL	RIGHT	100				
75.8	GL	RIGHT	63				

Table D-21. Habitat Inventory Summary for Squaw Creek, units 1- 1443, RM 0 to 10.0, Valley, Channel, and Wood Summary, June 1994.

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0	Constraining Terraces	0
Moderate V-shape	40	Multiple Terraces	0
Open V-shape	0	Wide Floodplain	60

Valley Width Index avg: 4.9 range: 1.0-25-O

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	40	Single Channel	22
Bedrock	0	Multiple Channel	38
Terrace	0	Braided Channel	0
Alt. Terrace/Hill	0		
Landuse	0		

Channel Characteristics

Type	Length	Area	Dry Units
Primary	15,662	51,010	51
Secondary	3,556	7,941	27

Channel Dimensions

Wetted Surface		Active Channel		First Terrace	
Width	2.7	Width	8.4	Width	13.2
Depth	0.23	Height	0.2	Height	0.8
W:D	***.*				

Stream Flow Type: LF Water Temp: 12.0-22.5
Avg. Unit Gradient: 1.7 Habitat Units/100m: 7.5

Riparian, Bank, and Wood Summary

Land Use: HG,RR Riparian Veg.: D 30-50, ST

Bank Stability

Bank Class	Percent Reach Length
Non-Erodible	6.4
Vegetation Stabilized	41.3
Boulder-cobble	34.3
Actively Eroding	17.8

Undercut Banks

Unit Average: 3.81%

Open Sky (% of 180)

Unit Average: 40
Range: o-95

Large Woody Debris

Average Complexity Score: 1.3

Pieces	540	Volume(m^3)	338
Pieces/100m	3 . 4	Volume/100m	2.2

Table D-22. Habitat Inventory Summary for Squaw Creek, units 1-1443, RM 0 to 10.0, Habitat Unit Summary, June 1994.

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Uidth (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbbl	Bldr	Bdrk
CASCADE/BEDROCK	1	5	4.4	0.15	22		0	0	0	0	0	100
DRY CHANNEL	5	207	2.5	0.00	525	9	0	4	38	48	lo	0
DRY UNITS	47	1,529	3.4	0.00	5,858	331	0	3	36	47	14	0
GLIDE	65	922	3.7	0.19	3,401	31	3	11	54	30	2	1
POOL-ALCOVE	3	37	5.6	0.28	209	0	70	23	7	0	0	0
POOL-BACKUATER	120	592	2.3	0.30	1,474	88	ii	15	48	22	1	3
POOL-DAMMED	1	9	5.5	0.35	50	0	10	10	40	40	0	0
POOL-ISOLATED	60	412	2.4	0.29	1,060	308	11	12	47	23	2	2
POOL-LATERAL SCOUR	318	3,026	2.9	0.42	9,939	138	1	10	54	31	2	2
POOL-PLUNGE	11	95	3.2	0.35	276	29	1	6	40	33	5	16
POOL-STRAIGHT SCOUR	163	1,387	2.9	0.31	4,558	162	1	10	53	32	3	1
POOL-TRENCH	5	28	2.3	0.39	64	2	0	2	18	22	2	56
PUDDLED CHANNEL	26	630	1.9	0.06	1,255	144	0	3	29	53	15	0
RAPID/BEDROCK	15	63	1.5	0.13	114	203	0	1	5	7	1	7 3
RAPID/BOULDERS	16	174	2.3	0.12	399	75	0	4	26	53	16	2
RIFFLE	495	7,661	2.6	0.10	21,985	546	1	9	53	32	3	2
RIFFLE W/ POCKETS	a3	2,434	3.0	0.12	7,743	545	0	4	29	50	15	1
STEP/BEDROCK	4	4	1.5	0.54	6	100	0	0	0	0	0	75
STEP/COBBLE	1	1	0.5	0.35	0	0	11	11	22	56	0	0
STEP/LOG	1	0	4.4	0.30	1	0	0	10	90	0	0	0
STEP/STRUCTURE	3	2	4.0	0.35	10	0	0	3	54	42	0	0
Total:	1443	19,217	2.7	0.23	58,951	2712	Avg: 2	9	49	33	4	3

HABITAT SUMMARY

Habitat Group	No. Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Percent	Large Boulders Number	#/100m^2	Wood Class
Damned & BW Pools	184	1,050	2.4	0.30	2795	4.74	396	14.17	1.7
Scour Pools	497	4,536	2.9	0.38	14836	25.17	331	2.23	1.5
Glides	65	922	3.7	0.19	3401	5.77	31	0.91	1.2
Riffles	578	10,094	2.7	0.11	29728	50.43	1091	3.67	1.1
Rapids	31	237	1.9	0.12	513	0.87	278	54.22	1.0
Cascades	1	5	4.4	0.15	22	0.04	1	*4.46*	0.0
Step/Falls	9	7	2.5	0.43	18	0.03	100	564.97	1.0
Small Streams (SS)	0	0	.	.	0	0.00	0	0.00	
Dry	78	2,365	2.8	0.02	7638	12.96	484	6.34	1.1

Table D-23. Habitat Inventory Summary for Squaw Creek, units 1-1443, RM 0 to 10.0, Stream Summary, June 1994.

STREAM SUMMARY — SQUAW CREEK

Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Substrate Percent Wetted Area S/O	Sand	Grvl	Cbbl	Bldr	Bdrk	Total Large Boulder
1443	19,217	2.7	0.23	58,951	2	9	49	33	4	3	2,712

Habitat Group	Wetted Area (m^2)	Percent
Scour Pool	14,836	25.2
Backwater Pools	2,795	4.7
Glide	3,401	5.8
Riffle	29,728	50.4
Rapid	513	0.9
Cascade	22	**.*
Step	18	** *
Dry	7,638	13.0

Table D-24. Habitat Inventory Summary for Squaw Creek, units 1-1443, RM 0 to 10.0, Riparian Summary, June 1994.

RIPARIAN ZONE VEGETATION SUMMARY

Reach 0 is represented by 47 transects

Predominant landform in each zone

	Zone 1 O-10 meters	Zone 2 10-20 meters	Zone 3 20-30 meters
Hillslope	16	23	34
High terrace	10	6	4
Low terrace	57	16	12
Floodplain	14	52	43
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	12	11	14

Canopy closure and ground cover

	Zone 1 O-10 meters (%)	Zone 2 10-20 meters (%)	Zone 3 20-30 meters (%)
Canopy closure	44	43	51
Shrub cover	44	47	52
Grass/forb cover	51	48	44

Average number of trees in a 5-meter wide band

	Zone 1 O-10 meters		Zone 2 10-20 meters		Zone 3 20-30 meters		Zones 1-3 O-30 meters	
Diameter class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	1.8	4.4	1.9	2.4	1.7	2.8	5.4	9.6
15-30cm	0.1	1.0	0.4	0.6	0.5	0.6	1.0	2.1
30-50cm	0.1	0.1	0.1	0.1	0.3	**.*	0.6	0.3
50-90cm	0.0	**.*	0.0	0.0	0.1	**.*	0.1	**.*
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	2.1	5.5	2.4	3.2	2.6	3.4	2.4	4.0

Table D-25. Habitat Inventory Summary for Camp Creek downstream of Passage Barrier, units 1-659, RM 0 to 3.1, Valley, Channel, and Wood Summary, June 1994.

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	3	Constraining Terraces	91
Moderate V-shape	6	Multiple Terraces	0
Open V-shape	0	Wide Floodplain	0

Valley Width Index avg: 5.3 range: 1.0-13.0

Channel Morphology (Percent Reach Length)'

Constrained		Unconstrained	
Hillslope	6	Single Channel	91
Bedrock	3	Multiple Channel	0
Terrace	0	Braided Channel	0
Alt. Terrace/Hill	0		
Landuse	0		

Channel Characteristics

Type	Length	Area	Dry Units
Primary	3,998	15,189	0
Secondary	950	1,613	10

Channel Dimensions

Wetted Surface		Active Channel		First Terrace	
Width	3.0	Width	7.2	Width	11.3
Depth	0.26	Height	0.5	Height	0.8
W:D	21.8				

Stream Flow Type: MF Water Temp: 10.0-15.0
Avg. Unit Gradient:, 2.9 Habitat Units/100m: 13.3

Riparian, Bank, and Wood Summary

Land Use: RR,ST Riparian Veg.: C 15-30,S

Bank Stability

Bank Class	Percent Reach Length
Non-Erodible	8.1
Vegetation Stabilized	64.5
Boulder-cobble	18.4
Actively Eroding	a.7

Undercut Banks
Unit Average: 8.99%

Open Sky (% of 180)
Unit Average: 27
Range: O-87

Large Woody Debris

Average Complexity Score: 1.7

Pieces	317	Volume(m^3)	10,907
Pieces/100m	7 . 9	Volume/100m	272.8

Table D-26. Habitat Inventory Summary for Camp Creek downstream of Passage Barrier, units 1-659, RM 0 to 3.1, Habitat Unit Summary, June 1994.

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbbl	Bldr	Bdrk
CASCADE/BEDROCK	2	7	2.0	0.15	15	0	0	0	0	0	0	100
CASCADE/BOULDERS	1	3	3.3	0.20	11	3	0	0	20	40	40	0
DRY UNITS	5	43	1.8	0.00	86	15	20	2	22	32	24	0
G L I D E	10	51	3.3	0.20	191	18	12	10	45	19	12	2
POOL-BACKWATER	39	98	1.5	0.25	154	55	22	18	32	17	10	1
POOL-DAMMED	4	22	2.4	0.36	64	0	45	18	10	10	5	13
POOL-ISOLATED	3	4	1.0	0.17	4	0	7	53	30	7	3	0
POOL-LATERAL SCOUR	a4	532	2.6	0.42	1,469	152	11	11	34	24	14	5
POOL-PLUNGE	29	106	3.6	0.59	439	72	9	8	29	26	19	9
POOL-STRAIGHT SCOUR	109	528	2.9	0.37	1,652	320	12	11	34	25	14	3
POOL-TRENCH	5	39	2.3	0.53	98	9	4	4	14	14	10	53
PUDDLED CHANNEL	5	64	1.1	0.07	74	22	18	6	22	28	26	0
RAPID/BEDROCK	13	50	1.8	0.14	110	a	4	2	7	8	10	70
RAPID/BOULDERS	121	851	3.3	0.18	2,979	759	3	4	28	34	30	2
RIFFLE	96	796	2.7	0.13	2,602	244	a	11	44	24	13	1
RIFFLE W/ POCKETS	106	1,735	3.7	0.20	6,794	1133	4	6	31	33	26	0
STEP/BEDROCK	1	2	1.1	0.15	2	0	0	0	0	0	0	100
STEP/BOULDERS	13	10	2.9	0.12	29	34	4	4	19	28	29	17
STEP/COBBLE	2	2	3.3	0.25	6	1	10	5	20	40	25	D
STEP/LOG	10	4	4.2	0.07	17	7	13	8	43	21	15	0
STEP/STRUCTURE	1	1	8.8	0.15	4	0	10	10	40	20	10	10
Total:	659	4,948	3.0	0.26	16,802	2852	Avg: 9	9	32	26	19	5

HABITAT SUMMARY

Habitat Group	No. Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Percent	Large Boulders Number	#/100m^2	Wood Class
Damned & BU Pools	46	124	1.5	0.25	223	1.32	55	24.72	2.1
Scour Pools	227	1,205	2.8	0.42	3658	21.77	553	15.12	2.0
Glides	10	51	3.3	0.20	191	1.14	18	9.41	1.2
Riffles	202	2,531	3.3	0.16	9396	55.92	1377	14.66	1.5
Rapids	134	901	3.2	0.18	3088	18.38	767	24.84	1.4
Cascades	3	11	2.4	0.17	26	0.15	3	11.58	1.0
Step/Falls	27	18	3.6	0.11	59	0.35	42	70.71	1.8
Small Streams (SS)	0	0	.		0	0.00	0	0.00	
Dry	10	107	1.4	0.04	161	0.96	37	23.05	1.3

Table D-27. Habitat Inventory Summary for Camp Creek downstream of Passage Barrier, units 1-659, RM 0 to 3.1, Stream Summary, June 1994.

STREAM SUMMARY — CAMP CREEK

Number Units	Total Length (m)	Avg Uidth (m)	Avg Depth (m)	Total Area (m^2)	Substrate Percent Wetted Area S/O	Sand	Grvl	Cbbl	Bldr	Bdrk	Total Large Boulder
659	4,948	3.0	0.26	16,802	9	9	32	26	19	5	2,852

Habitat Group	Wetted Area (m^2)	Percent
Scour Pool	3,658	21.8
Backwater Pools	223	1.3
Glide	191	1.1
Riffle	9,396	55.9
Rapid	3,088	18.4
Cascade	26	0.2
Step	59	0.4
Dry	161	1.0

Table D-28. Habitat Inventory Summary for Camp Creek downstream of Passage Barrier, units 1-659, RM 0 to 3.1, Riparian Summary, June 1994.

RIPARIAN ZONE VEGETATION SUMMARY

Reach 0 is represented by 20 transects

Predominant landform in each zone

	Zone 1 0-10 meters	Zone 2 10-20 meters	Zone 3 20-30 meters
Hillslope	22	33	37
High terrace	43	39	30
Low terrace	24	26	24
Floodplain	0	2	2
Wetland/meadow	0	0	0
Stream channel	11	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	37	30	30

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10-20 meters (%)	Zone 3 20-30 meters (%)
Canopy closure	39	37	38
Shrub cover	66	68	66
Grass/forb cover	21	24	25

Average number of trees in a 5-meter wide band

	Zone 1 0-10 meters		Zone 2 10-20 meters		Zone 3 20-30 meters		Zones 1-3 0-30 meters	
Diameter class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.7	3.5	1.5	0.7	1.4	0.9	3.5	5.1
15-30cm	0.7	1.3	1.0	0.2	1.8	0.1	3.4	1.6
30-50cm	0.4	0.1	0.4	0.0	0.6	0.1	1.4	0.2
50-90cm	0.2	0.0	0.1	0.0	0.1	0.0	0.3	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m^2	1.9	4.9	2.9	0.9	3.7	1.1	2.8	2.3

Table D-29. Habitat Inventory Summary for Camp Creek uptream of Passage Barrier, units 660-720, RM 3.1 to 3.3, Valley, Channel, and Wood Summary, June 1994.

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	2	Constraining Terraces	98
Moderate V-shape	0	Multiple Terraces	0
Open V-shape	0	Wide Floodplain	0

Valley Width Index avg: 4.0 range: 1.0-8.0

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0	Single Channel	0
Bedrock	2	Multiple Channel	0
Terrace	0	Braided Channel	0
Alt. Terrace/Hill	98		
Landuse	0		

Channel Characteristics

Type	Length	Area	Dry Units
Primary	353	1,063	0
Secondary	9	7	0

Channel Dimensions

Uetted Surface		Active Channel		First Terrace	
Width	2.8	Width	6.3	Width	11.6
Depth	0.27	Height	1.3	Height	2.0
W:D	18.5				

Stream Flow Type: MF Water Temp: 9.0-15.0
Avg. Unit Gradient: 5.1 Habitat Units/100m: 16.9

Riparian, Bank, and Wood Summary

Land Use: MT,LT Riparian Veg.: C50-90,C30-

Bank Stability

Bank Class	Percent Reach Length
Non-Erodible	11.0
Vegetation Stabilized	86.1
Boulder-cobble	1.8
Actively Eroding	1.1

Undercut Banks
Unit Average: 6.15%

Open Sky (% of 180)
Unit Average: 25
Range: 11-39

Large Woody Debris

Average Complexity Score: 1.1

Pieces	32	Volume(m3)	28
Pieces/100m	9.1	Volume/100m	8.0

Table D-30. Habitat Inventory Summary for Camp Creek upstream of Passage Barrier, units 660-720, RM 3.1 to 3.3, Habitat Unit Summary, June 1994.

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m2)	Large Boulders (#>0.5m)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbbl	Bldr	Bdrk
POOL-BACKWATER	5	9	1.0	0.22	9	11	16	18	30	18	12	6
POOL-ISOLATED	1	1	0.5	0.15	1	3	20	30	10	20	20	0
POOL-LATERAL SCOUR	9	54	3.3	0.47	177	25	9	11	28	21	14	17
POOL-PLUNGE	4	18	3.0	0.59	52	30	8	10	30	28	25	0
POOL-STRAIGHT SCOUR	11	40	3.1	0.40	127	57	6	9	32	25	20	8
RAPID/BEDROCK	5	22	2.1	0.10	44	7	6	4	6	4	2	78
RAPID/BOULDERS	17	185	3.2	0.15	575	202	2	6	27	30	33	2
RIFFLE	4	29	2.9	0.16	76	12	10	10	35	28	15	3
STEP/BEDROCK	1	2	1.1	0.15	2	0	0	0	0	0	0	100
STEP/BOULDERS	2	1	2.3	0.13	2	6	0	5	25	30	40	0
STEP/LOG	2	1	3.4	0.13	4	a	10	10	30	20	30	0
Total:	61	362	2.8	0.27	1,070	361	Avg: 6	9	27	23	21	13

HABITAT SUMMARY

Habitat Group	No. Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m2)	Percent	Large Boulders Number	#/100m2	Wood Class
Damned & BW Pools	6	11	0.9	0.21	10	0.92	14	142.86	1.2
Scour Pools	24	111	3.2	0.45	357	33.34	112	31.39	1.2
Glides	0	0	.	.	0	0.00	0	0.00	.
Riffles	4	29	2.9	0.16	76	7.06	12	15.89	1.0
Rapids	22	207	2.9	0.14	619	57.86	209	33.75	1.1
Cascades	0	0	.	.	0	0.00	0	0.00	.
Step/Falls	5	4	2.5	0.13	9	0.82	14	159.09	1.4
Small Streams (SS)	0	0	.	.	0	0.00	0	0.00	.
Dry	0	0	.	.	0	0.00	0	0.00	.

Table D-31. Habitat Inventory Summary for Camp Creek upstream of Passage Barrier, units 660-720, RM 3.1 to 3.3, Stream Summary, June 1994.

STREAM SUMMARY — CAMP CREEK

Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m2)	Substrate Percent Wetted Area S/O	Sand	Grvl	Cbbl	Bldr	Bdrk	Total Large Boulder
61	362	2.8	0.27	1,070	6	9	27	23	21	13	361

Habitat Group	Wetted Area (m2)	Percent
Scour Pool	357	33.3
Backwater Pools	10	0.9
Glide	0	0.0
Riffle	76	7.1
Rapid	619	57.9
Cascade	0	0.0
Step	9	0.8
Dry	0	0.0

Table D-32. Habitat Inventory Summary for Camp Creek upstream of Passage Barrier, units 660-720. RM 3.1 to 3.3, Riparian Summary. June 1994.

RIPARIAN ZONE VEGETATION SUMMARY

Reach 0 is represented by 4 transects

Predominant landform in each zone

	Zone 1 O-10 meters	Zone 2 10-20 meters	Zone 3 20-30 meters
Hillslope	38	63	75
High terrace	63	38	25
Lou terrace	0	0	0
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	33	43	52

Canopy closure and ground cover

	Zone 1 O-10 meters (%)	Zone 2 10-20 meters (%)	Zone 3 20-30 meters (%)
Canopy closure	38	44	36
Shrub cover	61	81	84
Grass/forb cover	20	19	16

Average number of trees in a S-meter wide band

	Zone 1 O-IO meters		Zone 2 10-20 meters		Zone 3 20-30 meters		Zones 1-3 O-30 meters	
Diameter class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	1.5	1.3	2.3	0.0	2.3	0.0	6.0	1.3
15-30cm	1.0	0.8	2.3	0.0	3.3	0.0	6.5	0.8
30-50cm	0.5	0.0	0.5	0.0	0.0	0.0	1.0	0.0
SO-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m^2	3.0	2.0	5.0	0.0	5.5	0.0	4.5	0.7

Table D-33. Habitat Inventory Summary for Camp Creek Tributary, units 1-100, RM 0 to 0.4, Valley, Channel, and Wood Summary, June 1994.

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0	Constraining Terraces	100
Moderate V-shape	0	Multiple Terraces	0
Open V-shape	0	Wide Floodplain	0

Valley Width Index avg: 10.5 range: 10.0-16.0

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0	Single Channel	100
Bedrock	0	Multiple Channel	0
Terrace	0	Braided Channel	0
Alt. Terrace/Hill	0		
Landuse	0		

Channel Characteristics

Type	Length	Area	Dry Units
Primary	367	670	15
Secondary	2	1	0

Channel Dimensions

Wetted Surface		Active Channel		First Terrace	
Width	1.4	Uidth	3.8	Width	10.1
Depth	0.10	Height	0.5	Height	1.5
W:D	25.1				

Stream Flou Type: LF Water Temp: 9.0-I 1.0
Avg. Unit Gradient: 5.9 Habitat Units/100m: 27.1

Riparian, Bank, and Wood Sum-nary

Land Use: LT,ST Riparian Veg.: C30-50 C15-

Bank Stability

Bank Class	Percent Reach Length
Non-Erodible	0.6
Vegetation Stabilized	95.6
Boulder-cobble	0.5
Actively Eroding	0.2

Undercut Banks
Unit Average: 1.80%

Open Sky (% of 180)
Unit Average: 27
Range: 3-56

Large Woody Debris

Average Complexity Score: 1.0

Pieces	23	Volume(m^3)	17
Pieces/100m	6 . 3	Volume/100m	4.6

Table D-34. Habitat Inventory Summary for Camp Creek Tributary, units 1-100, RM 0 to 0.4, Habitat Unit Summary, June 1994.

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Uidth (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbbl	Bldr	Bdrk
DRY UNITS	8	113	3.0	0.00	374	36	1	6	34	29	26	4
POOL-BACKUATER	2	2	0.6	0.20	1	7	10	10	20	2s	3s	0
POOL-LATERAL SCOUR	S	14	0.9	0.20	14	IO	6	10	32	28	18	6
POOL-PLUNGE	3	6	1.2	0.27	7	18	7	7	30	30	27	0
POOL-STRAIGHT SCOUR	30	62	1.4	0.18	85	111	5	9	40	27	19	0
PUDDLED CHANNEL	7	34	0.9	0.06	27	25	1	7	so	21	20	0
RAPID/BOULDERS	30	96	1.4	0.05	102	130	3	4	39	30	24	0
RIFFLE	7	27	1.3	0.05	43	24	7	7	39	27	20	0
RIFFLE W/ POCKETS	3	13	0.9	0.05	16	20	3	3	30	33	30	0
STEP/BOULDERS	5	1	0.9	0.05	1	14	0	2	31	33	34	0
Total:	100	368	1.4	0.10	671	395	Avg: 4	7	38	28	23	1

HABITAT SUMMARY

Habitat Group	No. Units	Total Length (m)	Avg Uidth (m)	Avg Depth (m)	Uetted Area (m^2)	Percent	Large Boulders Number	#/100m^2	Uood Class
Damned & BU Pools	2	2	0.6	0.20	1	0.13	7	777.78	1.0
Scour Pools	38	82	1.3	0.19	106	15.83	139	130.89	1.0
Glides	0	0	.	.	0	0.00	0	0.00	.
Riffles	10	40	1.2	0.05	59	8.77	44	74.83	1.0
Rapids	30	96	1.4	0.05	102	15.26	130	126.95	1.0
Cascades	0	0	.	.	0	0.00	0	0.00	.
Step/Falls	5	1	0.9	0.05	1	0.21	14	972.22	1.0
Small Streams (SS)	0	0	.	.	0	0.00	0	0.00	.
Dry	1s	147	2.0	0.03	401	59.79	61	15.21	1.0

Table D-35. Habitat Inventory Summary for Camp Creek Tributary, units 1-100, RM 0 to 0.4, Stream Summary, June 1994.

STREAM SUMMARY **CAMP CREEK TRIBUTARY (NO NAME)**

Number Units	Total Length (m)	Avg Uidth (m)	Avg Depth (m)	Total Area (m^2)	Substrate Percent Uetted Area S/O	Sand	Grvl	Cbbl	Bldr	Bdrk	Total Large Boulder
100	368	1.4	0.10	671	4	7	38	28	23	1	395

Wetted Area

Habitat Group	(m^2)	Percent
Scour Pool	106	15.8
Backwater Pools	1	0.1
Glide	0	0.0
Riffle	59	a.8
Rapid	102	15.3
Cascade	0	0.0
Step	1	0.2
Dry	401	59.8

Table D-36. Habitat Inventory Summary for Camp Creek Tributary, units 1-100, RM 0 to 0.4, Riparian Summary, June 1994

RIPARIAN ZONE VEGETATION SUMMARY

Reach 0 is represented by 4 transects

Predominant landform in each zone

	Zone 1 0-10 meters	Zone 2 10-20 meters	Zone 3 20-30 meters
Hillslope	13	13	0
High terrace	75	88	88
Low terrace	0	0	0
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	13	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	19	19	18

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10-20 meters (%)	Zone 3 20-30 meters (%)
Canopy closure	46	34	30
Shrub cover	75	79	74
Grass/forb cover	14	21	16

Average number of trees in a S-meter wide band

	Zone 1 0-10 meters		Zone 2 10-20 meters		Zone 3 20-30 meters		Zones 1-3 0-30 meters	
Diameter class	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	1.3	4.3	0.8	2.3	1.3	0.3	3.3	6.8
15-30cm	1.3	1.8	0.8	0.3	2.0	0.0	4.0	2.0
30-50cm	0.8	0.0	0.0	0.0	0.3	0.0	1.0	0.0
SO-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m^2	3.3	6.0	1.5	2.5	3.5	0.3	2.8	2.9

APPENDIX E
Biological Survey Data Summary Tables and Figures

Table E-l. Population Density Estimate of Rainbow and Bull Trout, Chinook and Coho Salmon, Umatilla River, RM 56.1 to 59.2, Survey Dates: 8/22 through 8/25 1994.

HABITAT TYPE	# UNITS EACH HABITAT TYPE	# UNITS SAMPLED EACH HABITAT TYPE	% OF TOTAL # HABITAT UNITS SAMPLED	SURFACE AREA OF EACH HABITAT TYPE /M²	SURFACE AREA SAMPLED /M²	% OF SURFACE AREA SAMPLED	EST. MEAN DENSITY RBT-N, SALMON /M²	EST. # RBT-N, SALMON EACH HABITAT TYPE
POOLS								
Plunge Pool	3	1	33.33	347	99	28.53	.0000	0
scour Pool	47	4	8.51	23148	3050	13.18	.0000	0
Lateral Pool	44	8	18.18	19574	4582	23.41	.oooo	0
Dammed Pool	1	0	0.00	618	0	0.00	.0000	0
Beaver Dam Pool	1	0	0.00	777	0	0.00	.0000	0
SUBUNIT POOLS								
Alcove	1	0	0.00	352	0	0.00	.0000	0
Back Wate Pool	45	3	6.67	4477	568	12.69	.0000	0
Back Water Pool With spring		0	0.00	50	0	0.00	.0000	0
Isolated Pool (IP)	2	0	0.00	234	0	0.00	.0000	0
Isolated Pool w/ Spring	1	0	0.00	1000	0	0.00	.0000	0
GLIDES								
Glide 1	62	3	4.84	46277	1130	2.44	.oooo	0
RIFFLES								
Riffle	121	3	2.48	49843	1213	2.43	.0000	0
Riffle With spring	1	0	‘0.00	500	0	0.00	.0000	0
Riffle With Pockets	24	3	12.50	38943	1844	4.74	.oooo	0
RAPIDS								
Rapid-Boulder	7	2	25.87	1653	393	23.77	.oooo	0
Rapid-Bedrock	10	1	10.00	3470	1080	31.12	.0000	0
SPECIAL CASES								
Steps	5	0^	0.00	149	0	0.00	.oooo	0
Dry	2	0^	0.00	398	0	0.00	.oooo	0
TOTALS	378	28	7.41	191810	13959	7.28	.0000	0

The physical properties of Steps (5), and Dry Units (2) prevented sampling.

Table E-2. Population Density Estimate of Rainbow/steelhead and Bull Trout, Chinook and Coho Salmon, Umatilla River, RM 59.2 to 60.6, Survey Dates: 8125 through 8/30 1994.

HABITAT TYPE	# UNITS EACH HABITAT TYPE	# UNITS SAMPLED EACH HABITAT TYPE	% OF TOTAL # HABITAT UNITS SAMPLED	SURFACE AREA OF EACH HABITAT TYPE /M²	SURFACE AREA SAMPLED /M²	% OF SURFACE AREA SAMPLED	EST. MEAN DENSITY RBT-N, SALMON /M²	EST. # RBT-N, SALMON EACH HABITAT TYPE
POOLS								
Plunge Pool	4	3	75.00	913	538	58.93	.0000	0
scour Pool	27	4	14.81	10340	723	6.99	.0000	0
Scour Pool With Spring	1	1	100.00	10	10	100.00	.2000	2
Lateral Pool	9	2	22.22	2712	225	8.30	.0000	0
SUBUNIT POOLS								
Back Water Pool	19	2	10.53	2217	180	8.12	.0000	0
Back Water Pool With spring	2	2	100.00	28	28	100.00	.2857	8
Isolated Pool (IP)	4	0	0.00	322	0	0.00	.oooo	0
Isolated Pool w/ Spring	1	1	100.00	90	90	100.00	.0889	8
Un-ID. Isolated Pool With Spring	2	1	50.00	270	30	11.11	.0667	18
GLIDES								
Glide	25	1	4.00	12567	850	6.76	.oooo	0
RIFFLES								
Riffle	58							0
Riffle With Spring	1							0
Riffle With Pockets	1							0
RAPIDS								
Rapid-Boulder	1	0	0.00	9	0	0.00	.oooo	0
Ra id-Be s rock	8	1	12.50	1162	80	6.88	.oooo	0
SPECIAL CASES								
Steps	4	0^	0.00	329	0	0.00	.0000	0
TOTALS	**167**	**18**	**10.78**	**58193**	**2754**	**4.73**	**.0006**	**36**

^ The physical properties of steps (4) prevented sampling.

Table E-3. Population Estimate of Rainbow/steelhead and Bull Trout, Chinook and Coho Salmon, Umatilla River, RM 60.6 to 81.8, Survey Dates: 8-30 through 1 l-8, 1994.

HABITAT TYPE	# UNITS EACH HABITAT TYPE	# UNITS SAMPLED EACH HABITAT TYPE	% OF TOTAL # HABITAT UNITS SAMPLED	SURFACE AREA OF EACH HABITAT TYPE /M²	SURFACE AREA SAMPLED /M²	% OF SURFACE AREA SAMPLED	EST. MEW DENSITY RBT-N, SALMON /M²	EST. # RBT-N, SALMON EACH HABITAT TYPE
POOLS								
Plunge Pool	3	1	33.33	79	12	15.19	.0000	0
Scour Pool	267	25	9.36	76029	4252	5.59	.0487	3703
Scour Pool w/ss	5	0	0.00	1819	0	0.00	--	--
Lateral Pool	294	23	7.82	91870	4601	5.01	.0522	4796
Lateral Pool w/ss	4	2	50.00	1 5 9 8	251	15.71	.0279	45
Trench Pool	1	1	100.00	29	29	100.00	.1724	5
Dammed Pool	5	2	40.00	573	231	40.31	.1126	65
Beaver Dam Pool	1	1	100.00	46	46	100.00	0000	0
SUBUNIT POOLS								
Alcove	2	0	0.00	526	0	0.00	0000	0
Alcove w/ss	4	4	100.00	2460	2460	100.00	.0016	4
Non-ID Alcove w/ss	5	0	0.00	1840	0	0.00	--	--
Back Water Pool	369	16	4.34	14946.6	1315.5	8.80	0243	363
Back Water Pool w/ss	29	11	37.93	6591.4	3900	59.17	.0395	260
Isolated Pool (IP)	52	4	7.70	3799	74	1.95	.0946	359
Isolated Pool w/ss	42	31	73.81	13.315	12.131.5	91.11	.1975	2630
Non-ID Isolated Pool w/ss	8	8	100.00	2632	2632	100.00	.1090	287
Puddled	11	0	0.00	754	0	0.00	--	--
Puddled w/ss	1	1	100.00	200	200	100.00	.4350	87
GLIDES								
Glide	257	21	8.17	154,360	5583	3.62	.0489	7548
Glide w/ss	10	5	50.00	1605	893	55.64	.0526	84
RIFFLES								
Riffle	646	33	5.11	173,585	7258.5	4.18	.0430	7464
Riffle w/ss	9	3	33.33	751	168	22.37	.1548	116
Riffle w/ Pockets	29	8	27.59	21,981	2598	11.82	.0693	1523
RAPIDS								
Rapid-Boulders	128	7	5.47	23,972	1038	4.33	.0559	1340
Rapid-Boulders w/ss	1	0	0.00	32	0	0.00	--	_
Rapid-Bedrock	5	0	0.00	1464	0	0.00	_	--
CASCADES								
Cascade-Boulder	1	0	0.00	*22*	*0*	*0.00*	_	_
SPECIAL CASES								
Steps	6	0^	0.00	190	0	0.00	.0000	0
Dry	25	0^	0.00	4873	0	0.00	.0000	0
TOTALS	**2120**	**207**	**9.76**	**601,853**	**49,673.5**	**8.25**	**.0510**	**30,679**

^ The physical features of Steps and Dry units prevented sampling.
* SS indicates surface springs.

Table E-4. Actual, Estimated Number and Percentage of Juvenile Rainbow/steelhead and Salmon in the Urnatilla River. RM 56.1 to 81.8, Units l-2650 and 15 Unidentified Units, Sampled 8-22 through 11-8, 1994.

UMATILLA RIVER	% SPECIES COMPOSITION	ACTUAL # OF EACH SPECIES SAMPLED	EXPANDED ESTIMATED # OF EACH SPECIES
Rainbow/steelhead - Natural	54.95	207 1	16878
Steelhead - Hatchery	1.09	41	335
Chinook Salmon - Natural	41.71	1572	12811
Coho Salmon - Natural	2.23	84	685
Bull Trout - Natural	.02	1	6
Total	**100.00**	**3769**	**30.715**

Table E-5. Actual, Estimated Number and Percentage of Juvenile Rainbow/steelhead and Salmon in Squaw Creek, RM 0 to 10, Sampled 6-28 through 8-4, 1994.

SQUAW CREEK	% SPECIES COMPOSITION	ACTUAL # OF EACH SPECIES SAMPLED	EXPANDED ESTIMATED # OF EACH SPECIES
Rainbow/steelhead - Natural	96.92	3464	36,45:
Chinook Salmon - Natural	2.94	105	1105
Coho salmon - Natural	.14	5	53
Total	**100.00**	**3574**	**37,611**

Table E-6. Actual, Estimated Number and Percentage of Juvenile Rainbow/steelhead in Camp Creek, RM 0 to 3.3, Sampled 6/20 through 7/21 1994.

CAMP CREEK	% SPECIES COMPOSITION	ACTUAL # OF EACH SPECIES SAMPLED	EXPANDED ESTIMATED # OF EACH SPECIES
Rainbow/steelhead - Natural	100.00	865	6646
Total	**100.00**	**865**	**6646**

Table E-7. Maximum, Minimum, and Average Lengths of Juvenile Salmonids in the Umatilla River, RM 56.1 to 81.8, units l-26.50 and 15 Unidentified units, Sampled 8-22 through 11-8, 1994.

SPECIES	MAXIMUM LENGTH	MINIMUM LENGTH	AVERAGE LENGTH	TOTAL SAMPLED
Rainbowlsteelhead - Natural	351	39	88.89	207 1
Steelhead - Hatchery	297	67	196.56	41
Chinook Salmon - Natural	119	49	84.35	1572
Coho Salmon - Natural	124	62	78.88	84
Bull Trout - Natural	218	218	218	1

Table E-8. Maximum, Minimum, and Average Lengths of Juvenile Salmonids in Squaw Creek, RM 0 to 10, Sampled 6-28 through 8-4, 1994.

SPECIES	MAXIMUM LENGTH	MINIMUM LENGTH	AVERAGE LENGTH	TOTAL SAMPLED
Rainbow/steelhead - Natural	320	27	79.87	3464
Chinook Salmon - Natural	116	56	77.99	105
Coho Salmon - Natural	87	57	74.00	5

Table E-9. Maximum, Minimum, and Average Lengths of Juvenile Rainbow/steelhead in Camp Creek, RM 0 to 3.3, Sampled 6-20 through 7-21, 1994.

SPECIES	MAXIMUM LENGTH	MINIMUM LENGTH	AVERAGE LENGTH	TOTAL SAMPLED
Rainbowlsteelhead - Natural	240	20	65.14	865

Table E-10. Number of Scales Sampled, Percent of Scales Sampled, and Total Number of Mountain Whitefish, Umatilla River, RM 56.1 to 81.8, 8-22 through 11-8, 1994.

SPECIES	# OF SCALES SAMPLED	% OF SCALES SAMPLED	TOTAL # OF WHITEFISH SAMPLED	EXPANDED DENSITY POPULATION
Mountain Whitefish	20	2 0 . 8 3	96	1249*

* Conservative estimate, see methods section for expansion methodology.

Table E-l 1. Maximum, Minimum, and Mean of Mountain Whitefish in the Umatilla River, RM 56.1 to 81.8, Sampled 8-22 through 11-8 1994.

SPECIES	MAXIMUM LENGTH	MINIMUM LENGTH	MEAN
Mountain Whitefish	350	71	184.79

Table E-12. Habitat Preference of Mountain Whitefish, Umatilla River, RM 57.1 to 81.7, Units 1 through 2650 + 15 Non-Identified Units, Sampled 8-22 through 11-8, 1994.

HABITAT TYPE	NUMBER OF WHITEFISH CAPTURED	% OF TOTAL	DENSITY*	UNIT RANGE	RM RANGE	MEAN UNIT	MEAN RM
FAST H_2O HABITAT TYPE							
Riffle With Pockets	36	37.50	.0183	942-1665	64.9-71.3	1106	66.0
Riffle	20	20.83	.0062	566-l 824	60.8-72.5	1087	65.9
Rapid With Boulders	16	16.67	0082	852-1941	64.0-74.0	1597	71.0
Subtotal	72	75.00	.0121*	566-1941	60.8-74.0	1210	67.1
SLOW H_2O HABITAT TYPE							
Lateral Scour Pool	9	9.38	.0054	810-1474	63.2-69.8	1167	66.3
Straight Scour Pool	9	9.38	.0038	654-1273	61.9-67.9	1024	65.6
Isolated Pool With Spring	6	6.24	.0034	817	63.5	817	63.5
Subtotal	24	25.00	.0042*	654-1474	61.9-69.8	1026	65.3
TOTAL	**96**	**100.00**	**.0082***	**566-1941**	**60.8-74.0**	1188	46.6

* Conservative estimate, see methods section for expansion methodology.

Table E-13. Salmonid Mortalities due to Electrofishing in the Umatilla River, Squaw Creek, and Camp Creak, 1994, (delayed mortalities unknown).

STREAM	NUMBER FISH CAPTURED	NUMBER OF MORTS.	MORT. %	SIZE RANGE (mm)	MEAN SIZE (mm)
UMATILLA RIVER Surveyed 8-22 through 11-8 1994					
Chinook Salmon - Natural	1572	40	2.54	69-113	85
Rainbow/s&Ahead - Natural	2071	19	.92	56-100	73
Coho Salmon - Natural	84	1	1.20	70	70
Mountain Whitefish	96	1	1.04	112	112
SQUAW CREEK Surveyed 6-28 through 8-3 1994					
Rainbow/steelhead - Natural	3464	101	2.92	30-168	61
Chinook Salmon - Natural	105	1	.95	80	80
CAMP CREEK Surveyed 6-20 through 7-211994					
Rainbow/steelhead - Natural	865	29	3.35	27-168	47
TOTAL	**8257**	**192**	**2.33**	**27-168**	**75**

Table E-14. Bird Bites Observed on Fish Captured During Electrofishing, Umatilla River, Sampled 8-22 through 11-8 1994.

SPECIES	NUMBER CAPTURED	# FISH WITH BIRD BITES	% OF # CAPTURED	SIZE RANGE (mm)	MEAN SUE (mm)	UNIT RANGE	M E A N UNIT	R M
Northern Squawfish	1317	10	.76	155-375	234	49-1584	1106	66
Rainbow/ Steelhead- Natural	207 1	9	.43	152-235	190	654-2023	1170	66.3
Rainbow/ Steelhead- Hatchery	41	3	7.32*	180-284	233	817-931	877	64.4
Mountain Whitefish	96	3	3.13	134-224	192	654-1941	1205	66.7
Chinook Salmon- Natural	*1572*	2	.13	87-93	90	1522-1929	1726	72
TOTAL	5097	27	.52	87-375	204	49-2023	1159	67.1

* The percent of bird bites that occurred in artificial environments was unknown.

Table E-15. Number of Non-Salmonids Visually Estimated or Captured* from 253 of 2665 Units, Umatilla River, RM 56.1 to 81.8, 8-22 through 11-8 1994.

SPECIES	NUMBER VISUALLY ESTIMATED	% OF NUMBER VISUALLY ESTIMATED	EXPANDED NON-SALMONID ESTIMATE	NON-SALMONID TO SALMONID RATIO
Speckled Dace	33,380	40.96	434,188	14.14 : 1
Redside Shiner	28.737	35.26	373,795	12.20 : 1
Chiselmouth Chub	8276	10.15	107,650	3.5 : 1
Sucker	4941	6.06	64,270	2.09 : 1
Sculpin	4858	5.96	63,190	2.06 : 1
Northern Squawfish	1317	1.61	17,131	0.56 : 1
Brown Bullhead	4	0.005	52	0.01 : 1
TOTAL	81,504	100.00	1,060,276*	34.52 : 1^

* Conservative estimate, see methods section for expansion methodology.
^ Northern Squawfish were the only non-salmonid captured.

Table E-16. Number of Non-Salmonids Visually Estimated from 189 of 1443 Units Sampled, Squaw Creek, RM 0 to 10, 6-28 through 8-3 1994.

SPECIES	NUMBER VISUALLY ESTIMATED	% OF NUMBER VISUALLY ESTIMATED	EXPANDED NON-SALMOMD ESTIMATE	NON-SALMONID TO SALMONID RATIO
Sculpin	11,093	50.46	108,708	2.89 : 1
Speckled Dace	10,879	49.49	106,611	2.83 : 1
Sucker	8	.04	78	0.01 : 1
TOTAL	21,980	100.00	215,397	5.73 : 1

Table E-17. Number of Non-Salmonid Visually Estimated from 100 of 659 Units Sampled, Camp Creek, RM 0 to 3.1, 6-20 through 7-21 1994.

SPECIES	NUMBER VISUALLY ESTIMATED	% OF NUMBER VISUALLY ESTIMATED	EXPANDED SCULPIN ESTIMATE	SCULPIN TO. SALMONID RATIO
Sculpin	908	100.00	6,934	1.04: 1
TOTAL	908	100.00	6,934*	1.04 :1*

* Conservative estimate, see methods section for expansion methodology.

Table E-18. Stomach Contents Sampled from 1317 Northern **Squawfish** Captured During Electrofishing on the Umatilla River, RM 56.1 to 81.8, Units l-2650 and 15 Non-Identified Units, Sampled 8-22 through 11-8 1994.

CONTENTS	NUMBER SAMPLED	% O F TOTAL CAPTURED	SIZE RANGE FORK LENGTH (MM)	MEAN SIZE (MM)	UNIT RANGE	MEAN UNIT	MEAN RM	RATIO OF # ESTIMATED vs # EATEN
Insects	157	11.92	60-441	122	594-2597	1631	71	_
Crayfish	77	5.84	118-444	320	9-1732	659	61.9	--
Sculpin	50	3.80	95-285	176	804-1975	1438	69.4	97:1
Speckled Dace	50	3.80	86-385	161	4 12-2273	1083	65.9	668:1
Snails	26	1.97	74-373	170	327-@857	677	62.3	_
Shiner	9	.68	108-271	184	49-1584	842	63.8	3193:1
Plant	8	.61	81-l 10	91	771-2605	1611	71	_
Sucker	5	.38	235-475	314	396-1584	1125	66.2	988:1
Northern Squawfish	3	.23	154-470	313	482-594	534	60.5	439:1
Rainbow Trout - Natural	l	.08	135	135	817	817	63.3	2071:1
Subtotal	**386**	**29.31**	60-475	**182**	**9-2605**	**1241**	**67.4**	**638:1**
Empty or Un-Id Remains	931	70.69	29-460	148	i -2605	**1516**	**70.4**	_
TOTAL	**1317**	**100.00**	29-475	**159**	**1-2605**	**1431**	**69.3**	**638:1**

Table E-19. Population Density Estimate of Natural Rainbow/steelhead, Chinook and Coho Salmon, Squaw Creek, RM 0 to 10, 6/28 through 8/3 1994.

HABITAT TYPE	# UNITS EACH HABITAT TYPE	# UNITS SAMPLED EACH HABITAT TYPE	% OF TOTAL # HABITAT UNITS SAMPLED	SURFACE AREA OF EACH HABITAT TYPE /M²	SURFACE AREA SAMPLED /M²	%OF SURFACE AREA SAMPLED	EST. MEAN DENSITY RBT-N, SALMON /M²	EST. # RBT-N, SALMON EACH HABITAT TYPE
POOLS								
Plunge Pool	11	4	36.36	216.0	125.0	45.29	.4960	137
Scou Pool	163	23	14.11	4558.0	687.25	15.08	1.0447	4762
Lateral Pool	318	24	7.55	9939.0	726.0	7.30	1.1446	11376
Trench Pool	5	5	100.00	64.0	64.0	100.00	1.0156	65
Dammed Pool	1	1	100.00	50.0	50.0	100.00	.1400	7
SUBUNIT POOLS								
Alcove	3	0	0.00	209.0	0.0	0.00	.oooo	0
Back Water Pool	120	20	16.67	1476.0	243 .O	16.46	.9383	1385
Isolated Pool	60	22	36.67	1060.0	439.25	41.44	.6238	661
Puddled	26	4	15.38	1255.0	262.0	20.88	1.1494	1442
GLIDES								
Glide	65	24	36.92	3401 .o	1043.5	33.62	.5098	1734
RIFFLES								
Riffle	495	31	6.26	21985.0	1165.85	5.30	.4821	10599
Riffle With Pockets	83	17	20.48	7743.0	845.75	10.92	.6633	5136
RAPIDS								
Rapid-Boulder	16	9	56.25	399.0	274.0	68.67	.5730	229
Rapid-Bedrock	15	4	26.67	114.0	68.0	59.65	.4412	50
CASCADES								
Cascade-Boulders	0	0	0.00	0.0	0.0	0.00	.oooo	0
Cascade-Bedrock	1	1	100.00	22.0	22.0	100.00	1.2727	28
SPECIAL CASES								
Steps	9	0	0.00	17.0	0.0	0.00	.oooo	0
Dry	52	0	0.00	6383 .O	0.0	0.00	.oooo	0
TOTALS	1443*	189	13.10	58951.0	6015.6	10.20	.6380	37611^

52 units were unable to be sampled because they were steps (52) or dry units (9).

*An estimated 31481 were RBT/N, 951 were CHN, 43 were COHOIN.

Table E-20. Population Density Estimate of Natural Rainbow/steelhead (RBT-N), Camp Creek Downstream of Natural Passage Barrier, RM 0 to 3.1, Survey dates 6/20 through 7/21, 1994.

HABITAT TYPE	# UNITS EACH HABITAT TYPE	# UNITS SAMPLED EACH HABITAT TYPE	%OF TOTAL # HABITAT UNITS SAMPLED	SURFACE AREA OF EACH HABITAT TYPE /M²	SURFACE AREA SAMPLED D/M²	% OF SURFACE AREA SAMPLED	MEAN DENSITY RBT-N /M²	EST. # RBT-N IN EACH HABITAT TYPE
POOLS								
Plunge Pool	29	10	34.48	409.0	122.5	29.95	.5306	217
scour Pool	109	13	11.93	1600.5	231.8	14.48	.6946	1112
Lateral Pool	84	12	14.29	1440.5	252.0	17.49	.5119	737
Trench Pool	5	4	80.00	94.0	62.0	65.96	.4839	45
Dammed Pool	4	3	75.00	61.0	51.0	83.61	.7254	44
SUBUNIT *POOLS*								
Back Water Pool	39	10	25.64	148.65	38.3	25.77	1.044	155
Isolated Pool	3	2	66.67	3.35	2.85	85.07	.3509	1
Puddled	5	1	20.00	69.0	10.0	14.49	.8000	55
GLIDES								
Glide	10	6	60.00	184.0	123.0	66.85	.4797	88
RIFFLES								
Riffle	96	14	14.58	2507.0	454.9	18.15	.3957	992
Riffle With Pockets	106	11	10.38	6543.0	472	7.21	.3729	2440
RAPIDS								
Rapid - Boulder	121	10	8.26	2917.0	317.0	10.87	.2366	690
Rapid-Bedrock	13	2	15.38	110.0	44.0	40.00	.6364	70
CASCADES								
Cascade-Boulders	1	1	100.00	10.0	9.0	90.00	.oooo	0
Cascade-Bedrock	2	1	50.00	15.0	10.0	66.67	.oooo	0
SPECIAL CASES								
Steps	27	0*	0	------	0	0	.0000	0
Dry	5	0*	0	------	0	0	.oooo	0
TOTALS	659	100	15.95	16802	2200.35	13.10	.3955	6646

*The physical properties of steps (27) and dry units (5) prevented sampling.

Table E-21. Population Density Estimate of Salmonids, Camp Creek Upstream of Natural Passage Barrier, RM 3.1 to 3.3, Surveyed 7-20 through 7-21, 1994.

HABITAT TYPE	# UNITS EACH HABITAT TYPE	# UNITS SAMPLED EACH HABITAT TYPE	% OF TOTAL # HABITAT UNITS SAMPLED	AREA OF EACH HABITAT TYPE /M²	% OF TOTAL AREA IN HABITAT SURVEY	AREA SAMPLED /M²	% OF AREA SAMPLED	MEAN DENSITY /M²
POOLS								
Plunge Pool	4	1	25.00	52	4.86	15.00	60.00	.0000
scour Pool	11	1	9.09	127	11.87	7.00	5.51	.0000
Lateral Pool	9	1	11.11	177	16.54	1.00	.56	.0000
SUBUNIT POOLS								
Back Water Pool	5	1	20.00	9	0.84	2.00	22.22	.0000
Isolated Pool	1	0	0.00	1	0.09	0.00	0.00	.0000
RIFFLES								
Riffle	4	1	25.00	76	7.10	16.00	64.00	.0000
RAPIDS								
Rapid-Boulders	17	1	5.88	575	53.74	10.00	1.73	.oooo
Rapid-Bedrock	5	1	20.00	44	4.11	5.00	11.36	.oooo
SPECIAL CASES								
steps	5*	0	0.00	8	0.75	0.00	0.00	.0000
TOTALS	**61**	**7**	**11.48**	**1070**	**100.00**	56.00	5.23	.0000

The physical properties of steps prevented sampling.

^ Additional sampling was done from RM 3.3 to 3.8. No fish were captured or observed. Aquatic insects were abundant, and two crayfish were sighted. Sampling was done most frequently in the areas that had the greatest potential to hold fish.

Table E-22. Population Density Estimate of Salmonids in an Un-named Tributary of Camp Creek, RM 0 to 0.4, Surveyed 7-21, 1994.

HABITAT TWE	# UNITS EACH HABITAT TYPE	# UNITS SAMPLED EACH HABITAT TYPE	% OF TOTAL # HABITAT UNITS SAMPLED	AREA OF EACH HABITAT TYPE /M²	% OF TOTAL AREA IN HABITAT SURVEY	AREA SAMPLED /M²	% OF AREA SAMPLED	MEAN DENSITY/ M²
POOLS								
Plunge Pool	3	1	33.33	7	1.04	1.50	21.43	.oooo
Scour Pool	30	4	13.33	85	12.67	15.25	17.94	.oooo
Lateral Pool	5	3	60.00	14	2.09	8.30	13.83	.0000
SUBUNIT POOLS								
Back Water Pool	2	1	50.00	1	.15	SO	.50	.oooo
Puddled	7	2	28.57	27	4.02	11.25	41.67	.oooo
RIFFLES								
Riffle	7	2	28.57	43	6.41	18.75	43.60	.oooo
Riffle With Pockets	3	1	50.00	16	2.38	1.20	7.50	.oooo
RAPIDS								
Rapid-Boulders	30	2	6.67	102	15.20	17.00	16.67	.oooo
SPECIAL CASES								
Steps	5	0^	0.00	1	.15	.oo	.oo	.0000
Dry	8	0^	0.00	374	55.74	.00	.oo	.oooo
TOTALS	100	16	16.00	671	100.00	73.75	10.99	.oooo

The physical properties of steps and dry units prevented sampling.

Table E-23. Locations of Index Sites in the Umatilla River Basin, 1994.

SITE #	SYSTEM	RM	SITE #	SYSTEM	RM
01	Umatilla River	1.5	21	Bear Creek	0.5
02	Umatilla River	9.0	22	Bear Creek	4.5
03	Umatilla River	25.0	23	Bridge Creek	1.0
04	Umatilla River	38.0	24	Pearson Creek	2.0
05	Umatilla River	50.0	25	Buckaroo Creek	1.0
06	Umatilla River	60.3	26	Squaw Creek	2.5
07	Umatilla River	67.5	27	Squaw Creek	7.0
08	Umatilla River	74.0	28	Boston Canyon Creek	0.6
09	Umatilla River	80.5	29	Line Creek	0.3
10	Umatilla River	88.5	30	Meacham Creek	9.0
11	North Fork Umatilla River	1.0	31	Camp Creek	0.6
12	North Fork Umatilla River	2.7	32	North Fork Meacham Creek	0.5
13	South Fork Umatilla River	1.0	33	North Fork Meacham Creek	3.0
14	South Fork Umatilla River	4.0	34	Meacham Creek	17.0
15	Birch Creek	5.5	35	East Fork Meacham Creek	0.3
16	Birch Creek	10.0	36	Meacham Creek	28.5
17	West Birch Creek	2.0	37	Ryan Creek	1.0
18	West Birch Creek	10.5	38	Thomas Creek	2.5
19	East Birch Creek	4.5	39	Spring Creek	0.2
20	East Birch Creek	13.0	40	Shimmiehom Creek	0.5

Table E-24. Streams Sampled for Presence/Absence of Salmonids in the Umatilla River Basin, 1994.

SYSTEM	RIVER MILE	DATE	SALMONIDS?
Dark Canyon Creek	0 to 0.1	3-17-94	yes
Klondike Springs Creek	0 to 0.1	3-17-94	yes
Little Pearson Creek	0 to 0.2	3-18-94	yes
Johnson Creek	0 to 0.2	3-18-94	yes
California Gulch Creek	1.0 to 1.1	3-18-94	yes
Jungle/Windy Springs Creek	0 to 0.1	3-21-94	no
South Canyon Creek	0.5 to 0.6	3-21-94	yes
South Canyon Springs	0 to 0.1	3-21-94	yes
Bachelor Canyon Creek	0.1 to 0.3	3-22-94	yes
Un-named TJ of Bachelor Canyon Creek @ RM 1.0	0 to 0.1	3-22-94	no
Stanley Creek	1.0 to 1.1	3-28-94	yes
Wegner Creek	1.8 to 1.9	3-29-94	no
Stewart Creek	4.0 to 4.1	3-29-94	yes
Cambell Canyon Creek	0 to 0.1	3-30-94	no
Buck Creek	0 to 0.1	4-4-94	no
Little Squaw Creek	0 to 0.7	4-6-94	yes
Un-named TJ of Squaw @ RM 5.8	0 to 0.3	4-6-94	yes
Coyote Creek	0 to 0.5	4-8-94	yes
Un-named TJ of North Fork Umatilla River @ RM 1.5	0 to 0.1	4-11-94	yes
Un-named TJ of South Fork Umatilla River @ RM 1.4	0 to 0.1	4-14-94	yes
TJ of South Fork Umatilla River @ RM 1.7	0 to 0.1	4-14-94	no
Un-named TJ of South Fork Umatilla River @ RM 2.0	0 to 0.1	4-14-94	no
George Canyon Creek	0 to 0.1	4-15-94	no
Wildhorse Creek	0 to 0.1	4-18-94	yes
Un-named TJ of Thomas Creek @ RM 4.0	0 to 0.1	4-18-94	no
Whitman Springs Creek	0 to 0.1	4-18-94	yes
Un-named TJ of Ryan Creek @ RM 1.0	0 to 0.1	4-20-94	yes
Un-named TJ of Umatilla River @ RM 81.8	0 to 0.1	4-20-94	yes
Owsley Creek	0 to 0.1	5-2-94	yes

Table E-24. Continued.

SYSTEM	RIVER MILE	DATE	SALMONIDS?
Chinamans' Slough	0 to 0.1	5-7-94	no
Sheep Creek	0 to 0.1	8-3-94	yes
Chinamans' Slough	0 to 0.1	8-15-94	no
Coyote Creek	0 to 0.3	11-10-94	yes
Bear Creek	0 to 0.6	11-15-94	yes
Cottonwood Creek	0.6 to 0.7	11-30-94	yes
Moonshine Creek	0 to 0.1	11-30-94	yes
Mission Creek	3.0 to 3.1	11-30-94	yes
Patawa Creek	8 to 8.1	12-1-94	no
South Patawa Creek	4 to 4.1	12-1-94	yes
North Coyote Creek	4.7 to 4.8	12-1-94	no
Thomhollow Creek	0 to 0.1	12-1-94	yes
Chinamans' Slough	0 to 0.1	12-5-94	no
Un-named TJ of North Fork Umatilla River @ RM 1.5	0 to 0.2	3-24-95	yes
Coyote Creek	0 to 0.5	3-24-95	yes

Table E-25. Fish Passage Barriers in the Umatilla River Basin, Surveyed 3-16 through 1 l-8, 1994.

STREAM	RIVER MILE	BARRIER TYPE	COMPOSITION	STEP HEIGHT (m)	DEGREE	RECOMMENDED ACTION
Umatilla River	1.5	Channel Modification	Concrete	0.7	Partial	Modify
Umatilla River	2.4	Irrigation Dam	Concrete	1.0	Partial	Modify
Umatilla River	49.0	Vacated Irrigation Dam	Concrete	1.2	Partial	Remove
Umatilla River	60.3	Falls	Natural Bedrock	1.2	Partial	Leave
West Birch Creek	16.3	Falls	Natural Bedrock	10.0	Complete	Leave
Jungle/Windy Springs Creek	0.1	Culvert	Steel	0.15	Partial	Modify
McKay Creek	6.0	Earthen Dam	Earth/Concrete	4 0	Complete	Leave
Wildhorse Creek	0.1	Vacated Irrigation Dam	Concrete	0.7	Partial	Remove
Greasewood Creek	0.4	Irrigated Dam	Concrete	0.6	Partial	Modify
Mission Creek	3.2	Falls	Possible Bedrock	1.6	Partial	Modify
Moonshine Creek	1.0	Road Bridge	Concrete	1.2	Partial	Modify
Moonshine Creek	0.25	Falls	Natural Bedrock	0.5	Partial	Leave
Coonskin Creek	.30	Road Bridge Culvert	Steel	0.5	Partial	Modify
Camp Creek	.25	Vacated Irrigation Dam	Concrete	1.3	Partial	Remove
Camp Creek	3.1	Falls	Natural Bedrock	12	Complete	Leave
Un-named Tributary at RM 1.5 of SF Umatilla River	0.1	Culvert	[redacted]	0.5	Complete	Modify
Whitman Springs	0.1	Culvert	[redacted]	0.5	Complete	Modify

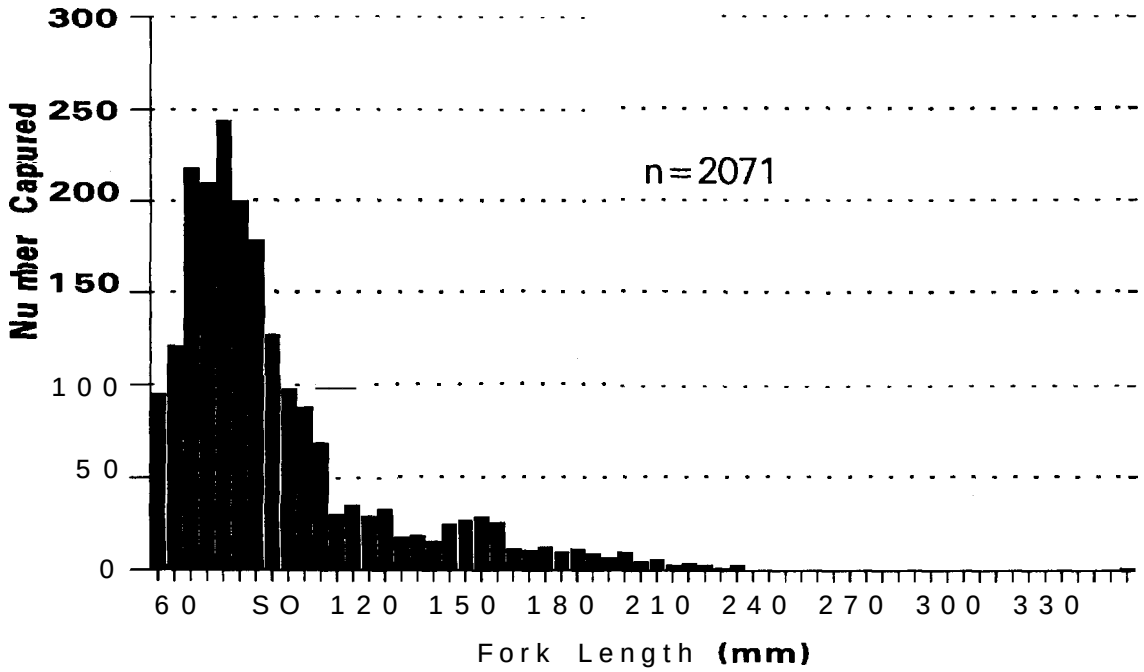


Figure E-l. Length Frequency Histogram of Natural Rainbow/steelhead Sampled in the Umatilla River, 1994 (94B-UMA5.CH3)

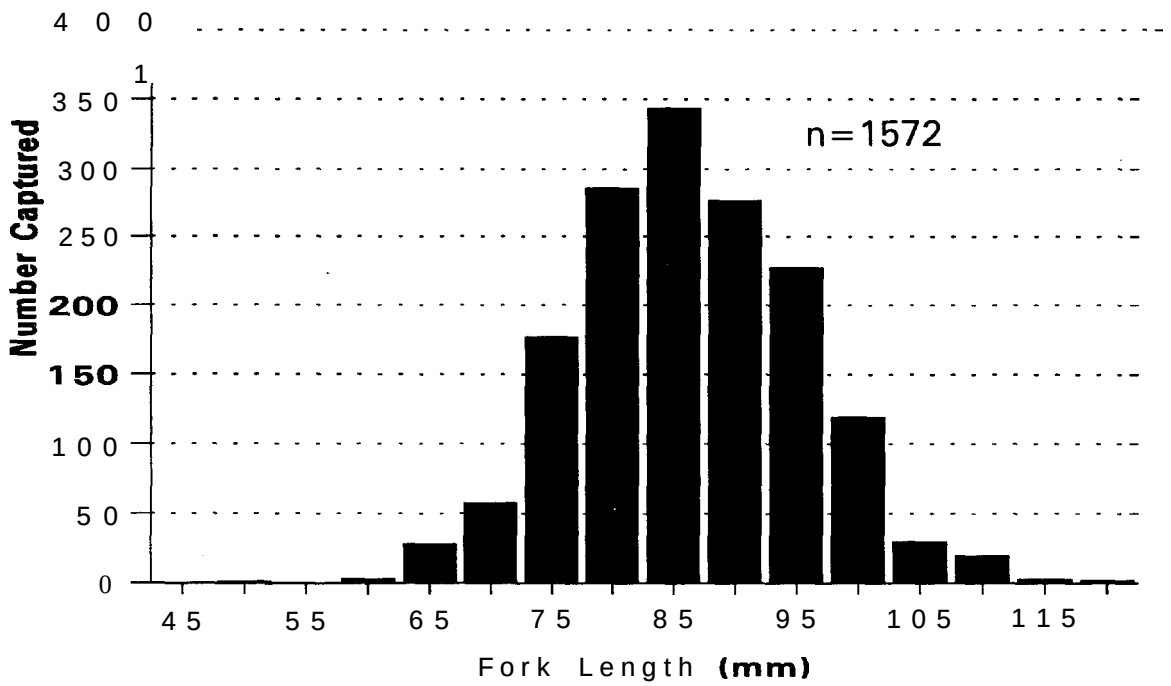


Figure E-2. Length Frequency Histogram of Natural Chinook Salmon Sampled in the Umatilla River, 1994 (94B-UMA2.CH3)

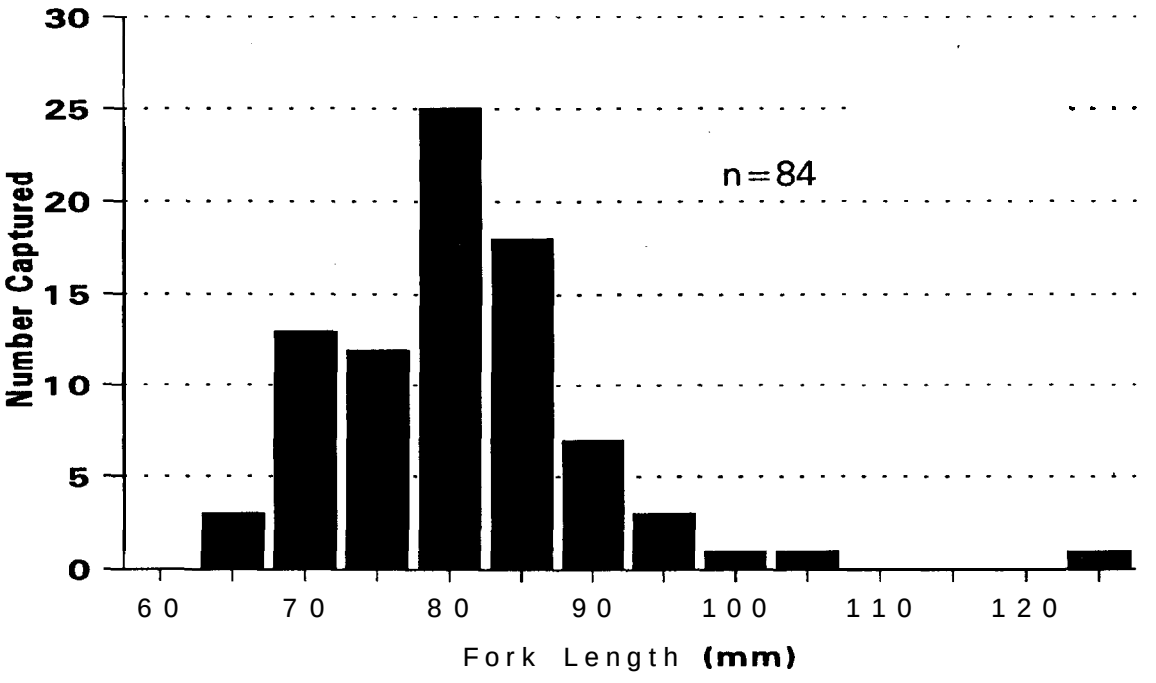


Figure E-3. Length Frequency Histogram of Natural Coho Salmon Sampled in the Umatilla River, 1994 (94B-UMA3.CH3)

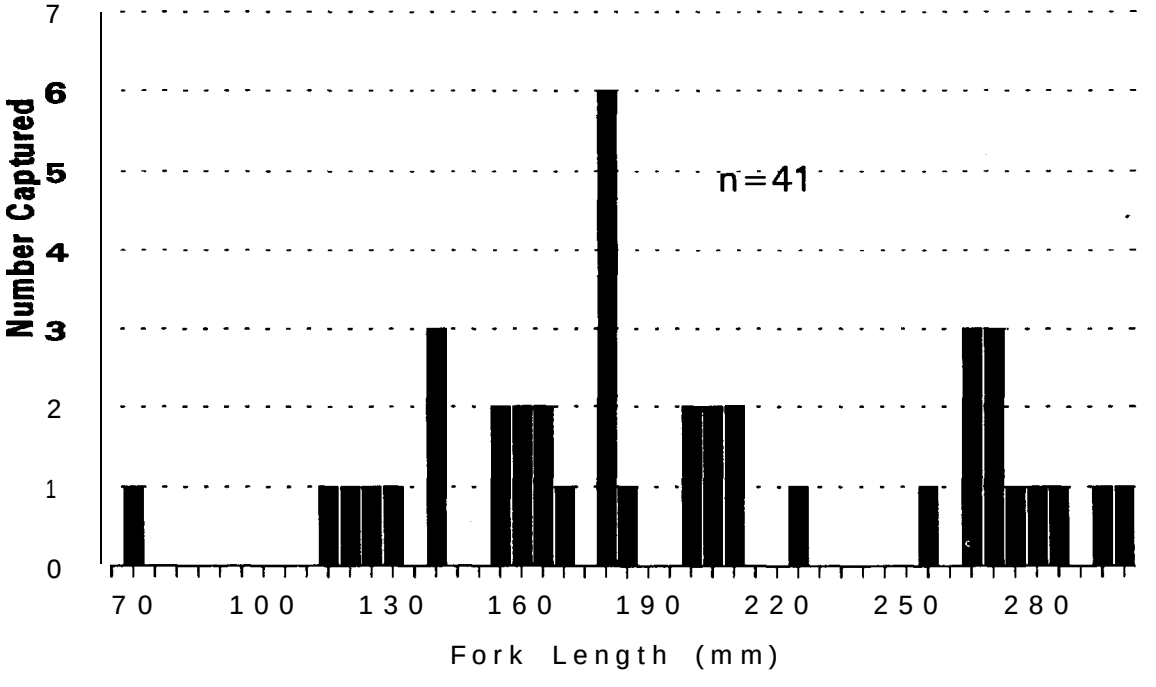


Figure E-4. Length Frequency Histogram of Hatchery Rainbow Trout/steelhead Sampled in the Umatilla River, 1994 (94B-UMA4.CH3)

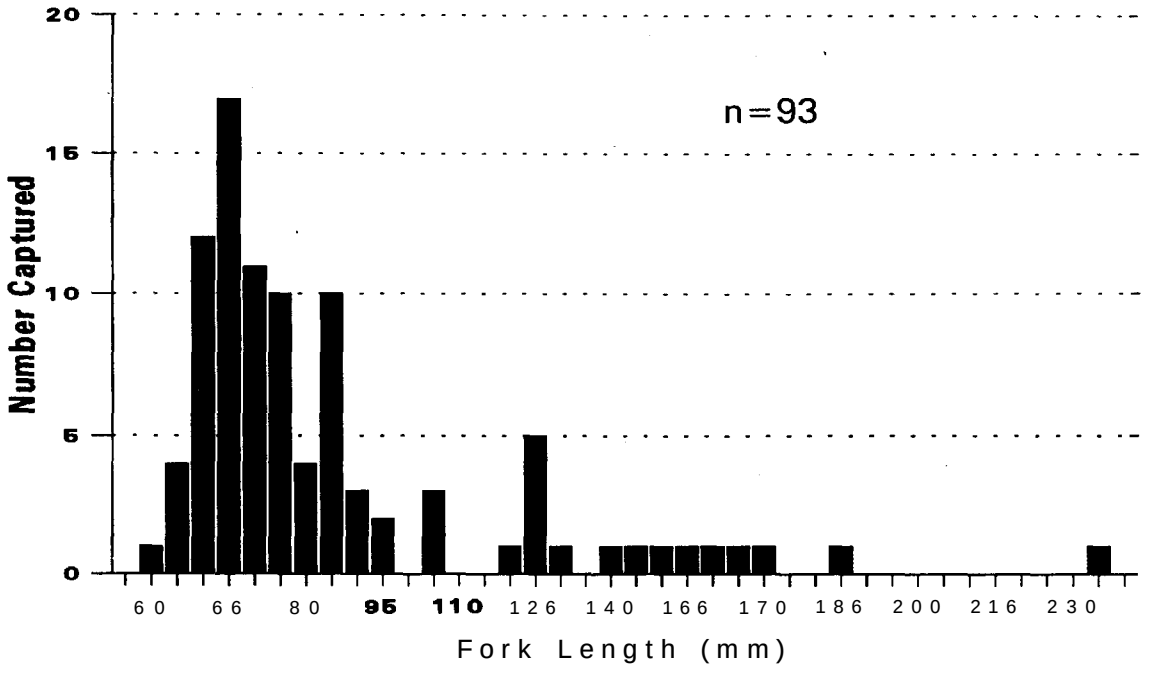


Figure E-5. Length Frequency Histogram of Natural Rainbow/s&Ahead with Black Spot Condition Sampled in the Umatilla River, 1994 (URNBLKST.CH3)

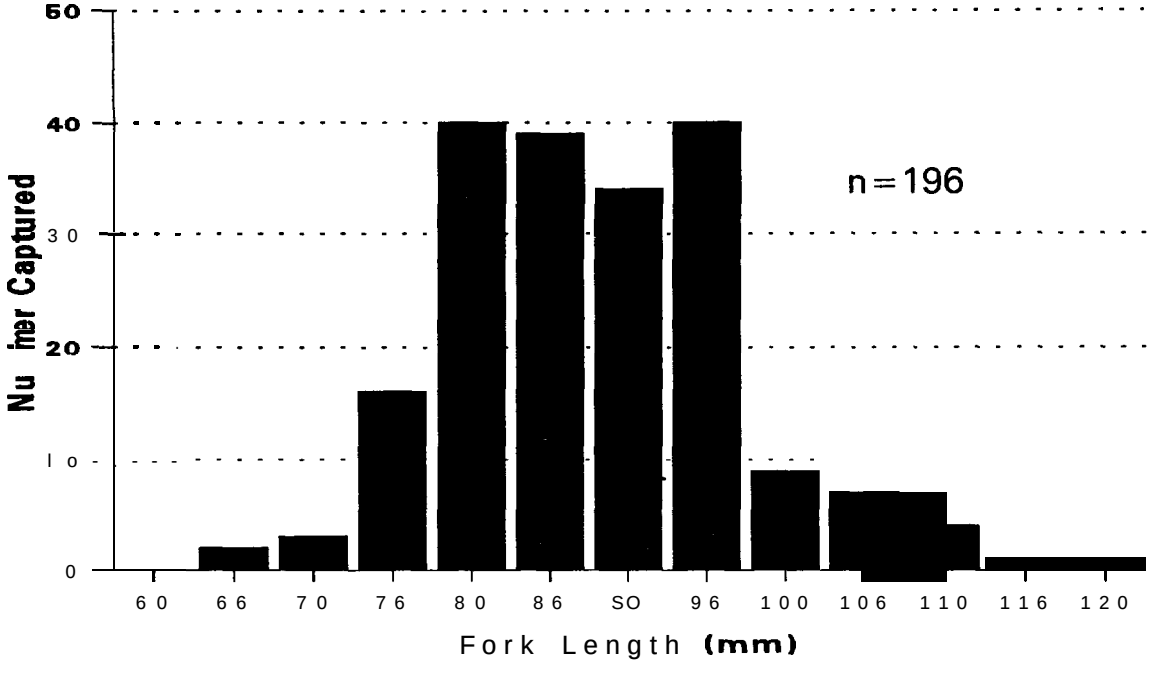


Figure E-6. Length Frequency Histogram of Natural Chinook with Black Spot Condition Sampled in the Umatilla River, 1994 (UCHNBLKS.CH3)

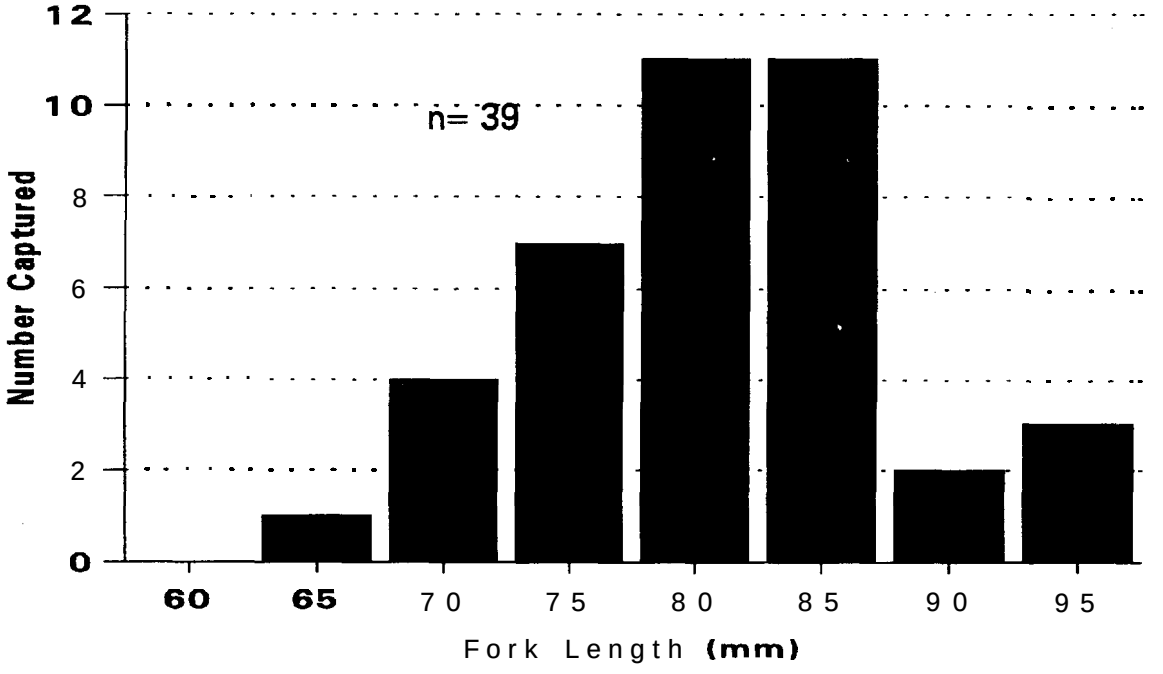


Figure E-7. Length Frequency Histogram of Natural Coho with Black Spot Condition Sampled in the Umatilla River,. 1994 (UCOBLKST.CH3)

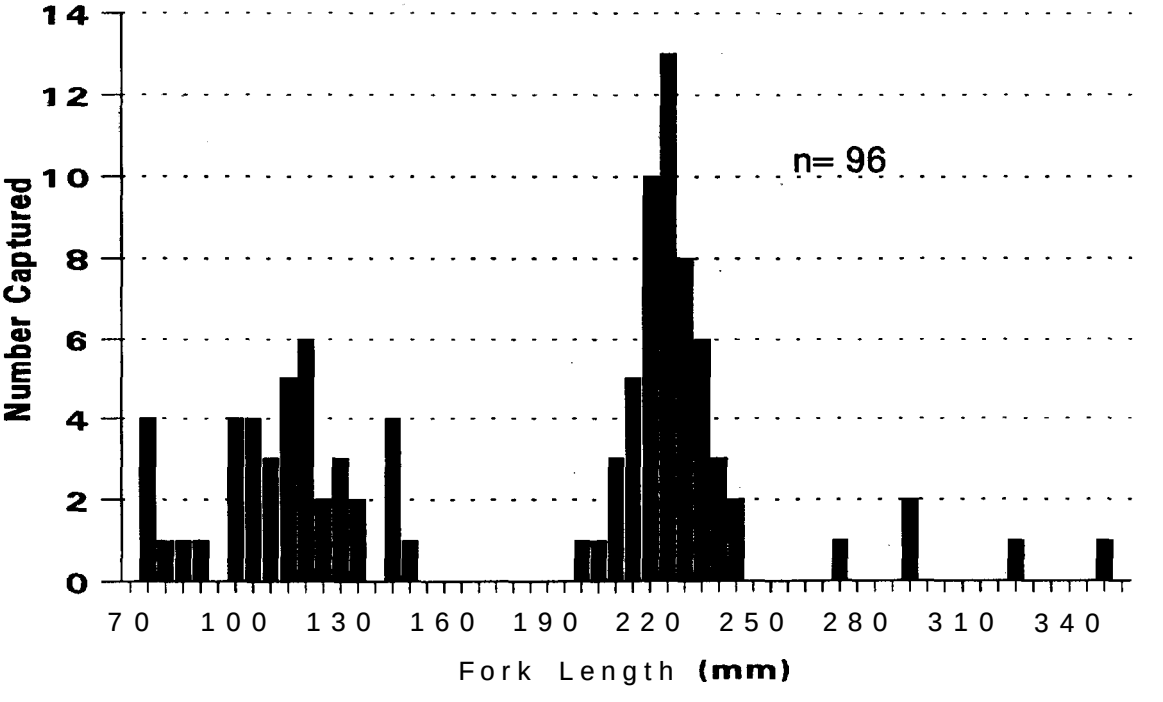


Figure E-8. Length Frequency Histogram of Mountain Whitefish Sampled in the Umatilla River, 1994 (94MWHTF.CH3)

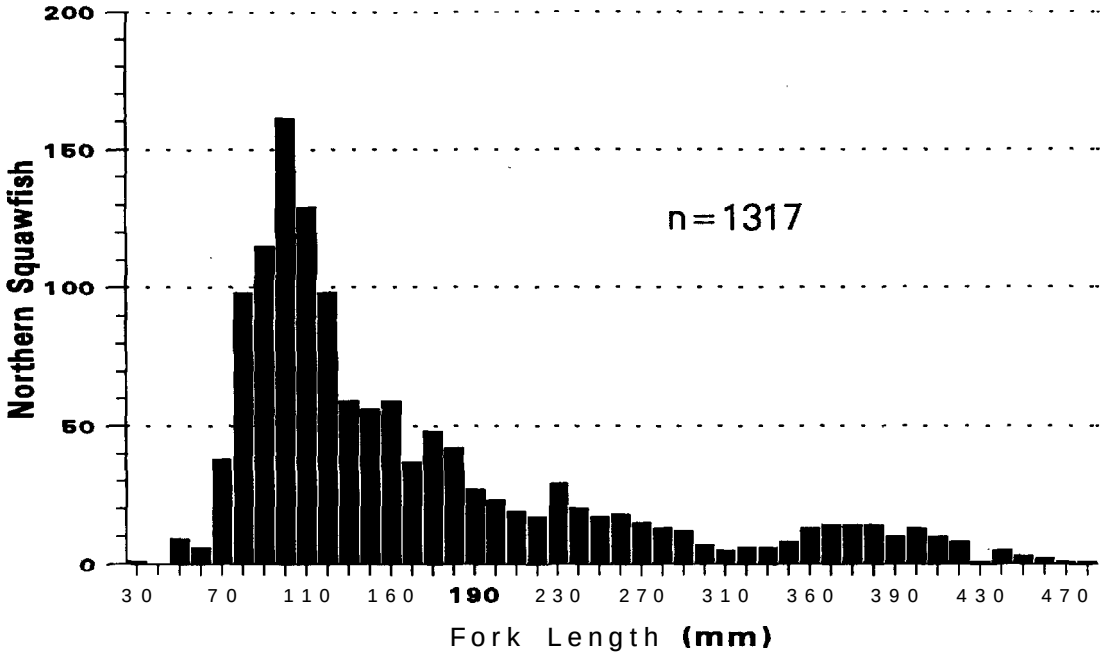


Figure E-9. Length Frequency Histogram of Northern Squawfish Sampled in the Umatilla River, 1994 (94B-UMA6. CH3)

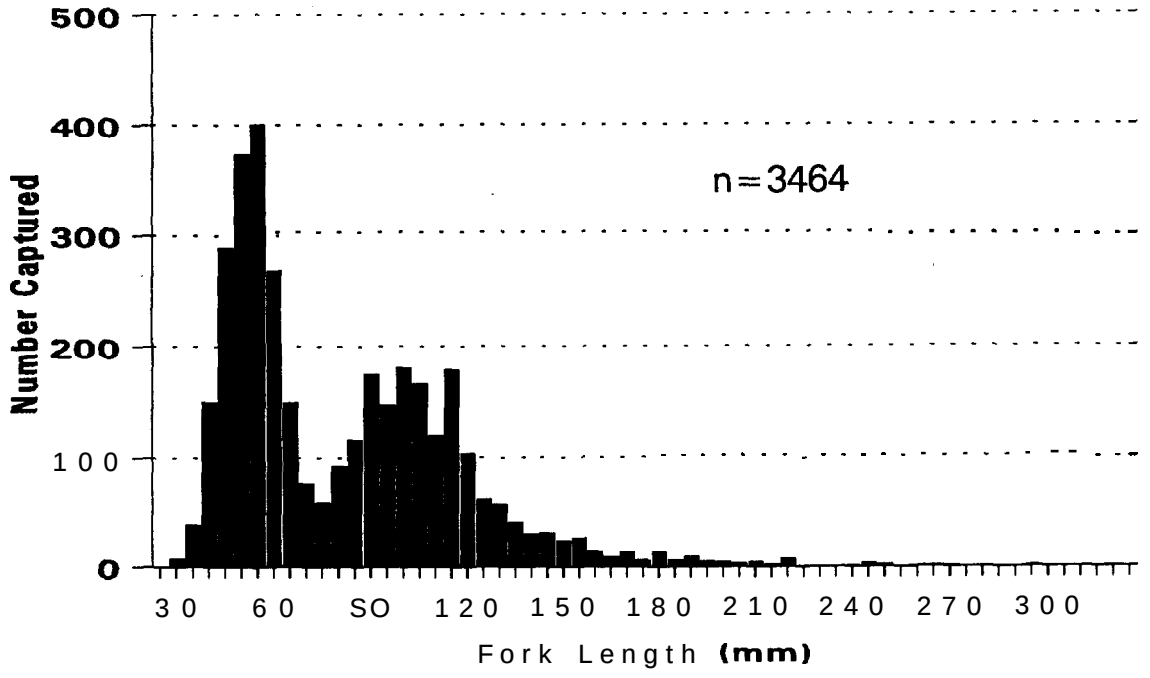


Figure E-10. Length Frequency Histogram of Rainbow/steelhead Sampled in Squaw Creek, 1994 (94B-SQUA2. CH3)

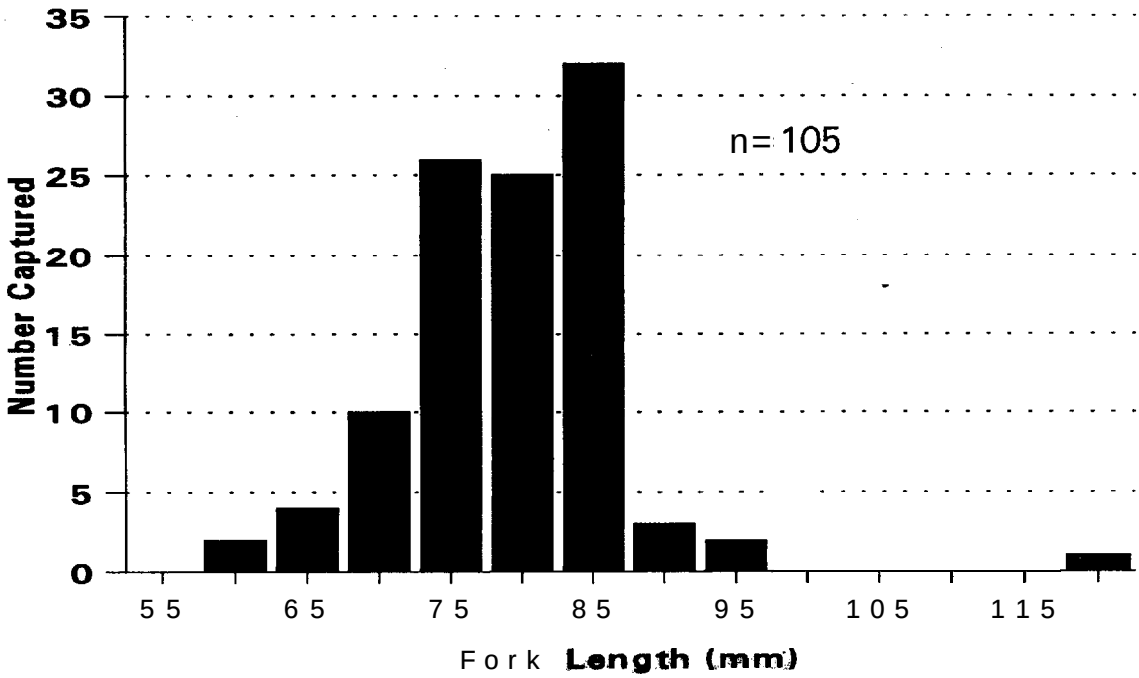


Figure E-11. Length Frequency Histogram of Natural Chinook Sampled in Squaw Creek, 1994 (94BSQUA1.CH3)

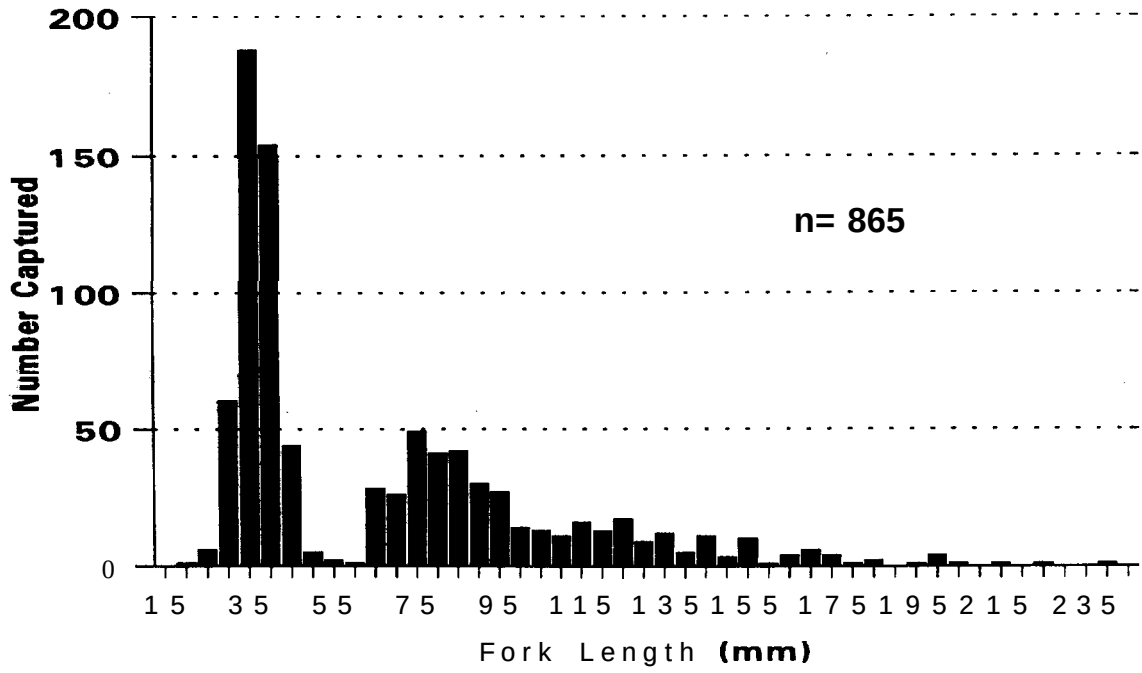


Figure E-12. Length Frequency Histogram of Rainbow/steelhead Sampled in Camp Creek, 1994 (94B-CAMP. CH3)

APPENDIX F
Spawning Survey Data for 1993-1994

Table F-l. Summary of Summer Steelhead Escapement Data, Umatilla River Basin, 1994.

REDD #	RIVER MILE	AREA DESCRIPTION SPECIFICS	DATE 1994	STEELHEAD OBSERVED	STEELHEAD SAMPLED
NORTH FORK OF THE UMATILLA [redacted] SURVEYED ON 4/12, 5/2, 5/18					
1	0.1	Across from t[redacted]	4/12		
2	0.27		5/2		
3	0.3		5/2		
4	2.7	[redacted]	4/12		
SOUTH FORK OF THE UMATILLA RIVER, MOUTH TO RIVER MILE 5.3, SURVEYED ON 5/9					
1	0.0	At the mouth	5/9		
2	0.6	Buck Creek Confluence	5/9		
3	1.0	2.0 miles below the mouth of Thomas Creek (TCC)	5/9		
4	3.0	450 yards below TCC	5/9		
5	3.1	300 yards below TCC	519		
6	3.2	210 yards below TCC	5/9		
7	3.3	150 yards below TCC	5/9		
8	4.3	200 yards below the mouth of Shimmiehorn	5/9		
MAINSTEM OF THE UMATILLA RIVER, RIVER MILES 84 TO 89.5, SURVEYED ON 5/17					
1	88.5	Corporation Hole	5/17		
2	97.6	1.0 mile Below Forks (BF)	5/17	0	1
3	97.1	1.5 BF	5/17		
4	96.1	2.5 BF	5/17		
5	95.6	3.0 BF	5/17		
RYAN CREEK, MOUTH TO RIVER MILE 3.0, SURVEYED ON 5/4					
1	0.125	275 yards above mouth	5/4		
2	0.2	300 yards above mouth	5/4		
3	1.7		5/4		

REDD #	RIVER MILE	AREA DESCRIPTION SPECIFICS	DATE 1994	STEELHEAD OBSERVED	STEELHEAD SAMPLED
MEACHAM	REEK, MO	TH TO RIVER MILE 18.2, SURVEYED ON 5110, 5/11, AND 5/12			
1	2.2		5/10		
2	2.2		5/10		
3	2.2		5/10		
4	2.2		5/10		
5	2.4		5/10		
5	2.6		5/10		
7	2.6		5/10		
8	2.75		5/10		
9	3.0		5/10		
10		Just Below Upper Habitat Structure	5/10		
11	4.7	0.3 miles below the mouth of Line Creek	5/10		
12	4.7	0.3 miles below the mouth of Line Creek	5/10		
13	5	just below the mouth of Line Creek	5/10		
14	5	mouth of Line Creek	5/10		
15	3.5		5/10		
16	4.8		5/10		
17	5.5		5/10		
18	5.7		5/10		
19	6.1		5/11	3	2
20	7.0		5/11		
21		0.6 of a mile below the A-Frame	5/11		
22		0.6 of a mile below the A-Frame	5/11		
23	a.5		5111		
24	11.5	loo yards below Duncan Bridge	5/11		
25	11.5	Duncan Bridge	5/11		
26	11.4		5/11		
27	11.4		5/11		
28	11.7		5/11		
29	11.8		5/11		
30	12.2		5/11		
31	12.2		5/11		
32	12.8		5/11		
33	12.9		5/11		
34	15.6-18.2		5/12		
35	·		5/12		
36	·		5/12		
37	·		5/12		
38	·		5/12		
39	14.7	0.6 mile below the North Fork of Meacham Creek Bridge	5/12		
40	15.3	30 yards below the North Fork of Meacham Creek Bridge	4/28	2	0
BOSTON C	WON CREEK, MOUTH TO RIVER MILE 1.0, SURVEYED ON 3/30 AND 4/26				
1	0.1	20 yards above first pool	3/30	4	
2	0.1	second pool	3/30		
3	0.6	100 yards above forks (Index Area)	3/30		
CAMP CR	K, MOUTH	O RIVER MILE 3.1. SURVEYED ON 4/14 AND 4329			
1	0.0	Mouth at railroad bridge	4/29		
2	0.26	50 feet above dam	4/29		
3	0.7	240 yards above red cabin	4/29		
4	2.4	200 yards below forks	4/29		
5	2.4	150 yards below forks	4/29		
6	2.4	100 yards below forks	4/14	2	

Table F-l. Continued

REDD#	RIVER MILE	AREA DESCRIPTION SPECIFICS	DATE 1994	STEELHEAD OBSERVED	STEELHEAD SAMPLED
NORTH F(.K MEACHAM CREEK, MOUTH TO RIVER MILE 5.5, SURVEYED ON 4/1			4/28 AND	5	
1	0.1		4/28		
2	0.3		4/28		
3	0.7		4/28		
4	1.6		4/13		
5	3.0	Mouth of Bear Creek	4/13	3	
6	3.23	400 yards above the Mouth of Beer Creek	4/13		
7	3.37	650 yards above the Mouth of Bear Creek	4/28	6	
8	4.0		5/5		
9	4.1		5/5		
10	4.5		5/5		
11	4.6		5/5		
SQUAW CREEK, MOUTH TO LITTLE SQUAW CREEK (RM 6.8), SURVEYED 2/15, 4/4			I/5, 4/11, 4/25, 4/26 AND 5/3		
1	0.6	305 yards above highway bridge	4/11		
2	0.7	330 yards above highway bridge	4/11		
3	0.9	100 yards below Walt Farrow's House (WFH)	4/11		
4	1.2	300 yards above WFH	4/11		
5	1.2	325 yards above WFH	4/5		
6	1.2	400 yards shove WFH	4/26		
7	1.3	500 yards above WFH	4/5	2	
8	1.5	0.5 miles above WFH	5/3		
9	1.9	Just below Little Celilo #2	4/26		
10	2.2	150 yards below Clif's old house	4/11		
11	2.2	100 yards below Clif's old house	4/5		
12	2.2	100 yards below Clif's old house	4/11		
13	2.2	100 yards below Clif's old house	4/11	4	
14	2.3	Across from Clif's old house	4/11		
15	2.8	160 yards below new log house	5/3		
1b	2.8	150 yards below new log house	4/11		
17	2.8	100 yards below new log house	5/3		
18	3.2	Just below Bachelor Canyon	5/3		
19	3.2	Just below Bachelor Canyon	5/3	1	
20	3.3	100 yards above Bachelor Canyon	4/11		
21	3.4	400 yards above Bachelor Canyon	414	1	
22	3.5	450 yards above Bachelor Canyon	4/26		
23	3.5	525 yards above Bachelor Canyon	4/11		
24	3.6	625 yards above Bachelor Canyon	414		
25	4.1	100 yards above first road crossing	414		
26	4.1	250 yards above first road crossing	414		
27	4.1	250 yards above first road crossing	4/11	2	2
28	4.2	400 yards above first road crossing	4/25		
29	4.6	Red Cabin Hole	4/11		
30	5.4	275 yards above third road crossing	4/25		
31	5.4	400 yards above third road crossing	4/25		
32	5.5	550 yards above third road crossing	4/11		
33	5.5	560 yards above third road crossing	4/25		
34	5.6	7 10 yards above third road crossing	4/4		
35	5.7	9 10 yards above third road crossing	4/25		
36	6.8	150 yards above little Squaw Creek	4/11		
MINTHORN SPRINGS CREEK, MOUTH TO RIVER MILE 0.2, SURVEYED 4/21					
1	0.2	20 yards below hatchery outlet	4/21	2	
BUCKAROO CREEK, MOUTH TO RIVER MILE 3.0, SURVEYED 4/1					
		No redds observed	4/1		
TOTAL REDDS				TOTAL OBSERVED	TOTAL SAMPLED
117				32	5

Table F-2. Summer Steelhead Spawning Ground Surveys, Umatilla River Basin, ODFW, 1994

STREAM	DATE	FISH	REDDS	MILES	REDDS/MILE
East Birch	4/28/94	9	61	7.0	8.7
Westgate Canyon	4/28/94	4	6	0.5	12.0
Pearson Creek	4/29/94	9	31	5.0	6.2
West Birch	4/28/94	5	20	6.0	3.3
TOTALS		27	118	18.5	6.4

Table F-3. **Summary** of Spring Chinook Salmon Escapement Survey Data, Umatilla River Basin, 1994.

REDD#	RIVER MILE	AREA DESCRIPTION SPECIFICS	HABITAT TYPE	DATE 1994	PRESPAWNING MORTALITY		SPAWNED OUT	
NORTH FORK OF THE UMATILLA RIVER, MOUTH TO RIVER MILE 3.0 SURVEYED ON 8/2, 8/9 8/15, 8/22, 8/31, 9/6, 9/12 AND 9/19					FEMALES	MALES	FEMALES	MALES
1	2.0		Riffle	8/31	0	0		
2	2.0		Riffle	8/31				
3	2.0		Riffle	8131				
4	2.0		Riffle	9/6				
5	1.8		Riffle	8/31				
6	1.7		Riffle	8/9				
7	1.7		Plunge Pool Tailout	8/15				
8	1.7		Plunge Pool Tailout	9/12				
9	1.5		Riffle	8/31				
10	1.0		Riffle	8/31				
11	1.0		Riffle	9/19				
12	0.7		Tailout	8/15				
13	0.7		Tailout	9/6				
14	0.6		Tailout	9/6				
15	0.5		Tailout	9/6				
16	0.3		Riffle	9/6				
MAINSTEM UMATILLA RIVER MILE 86.6 TO 89.6 SURVEYED ON 6/29, 8/ 8/15, 8/22, 8/26, 8/31, 9/6, 9/12 AND 9/19								
1	89.5	0.1 Miles Below the Forks (MBF)		8/31	1	0		
2	89.4	0.2 MBF		8/31				
3	89.2	0.4 MBF		9/6				
4	89.1	0.5 MBF		8/31				
5	89.1	0.5 MBF		8/31				
6	87.6	2.0 MBF		8/31				
7	87.3	2.3 MBF		9/12				
8	87.2	2.4 MBF		9/12				
9	87.2	2.4 MBF		9/6				
10	86.8	2.8 MBF		8131				
11	86.8	2.8 MBF		8131				
12	86.7	2.9 MBF		9/6				
13	86.7	2.9 MBF		9/6				

Table F-3. Continued

REDD#	RIVER MILE	AREA DESCRIPTION	HABITAT TYPE	DATE 1994	PRESPAWNING MORTALITY		SPAWNED OUT	
					FEMALES	MALES	FEMALES	MALES
MAINSTEM UMATILLA, RIVER **MILE** 83.6 TO 86.6 SURVEYED ON **6/29, 8/8, 8/18, 8/31, 9/7, 9/13** AND **9/20**								
1	86.6	3.0 MBF		9/7	**1**	0	5	10
2	86.5	3.1 MBF		9/7				
3	86.3	3.3 MBF		813 I				
4	86.3	3.3 MBF		917				
5	85.9	3.7 MBF		9/7				
6	84.1	5.5 MBF		9/7				
MAINSTEM UMATJLLA, RIVER **MILE** 80.0 TO 83.6 **SURVEYED** ON **6/9*, 7/12, 8/12, 8/18, 9/1, 9/7, 9/13** AND **9/20**								
1	82.7	100 yards below Pig Head Bridge	Riffle	9/7	**1**	1	7	3
2	83.1	17 yards below Gage/SGS	Tailout	9/7				
3		7 yards downstream	Tailout	9/1				
4		50 yards below dam	Riffle	9/13				
5		33 yards above hole	Riffle	9/7				
6		3 yard downstream	Riffle	9/20				
7		17 yards above hole	Riffle	9/1				
8	80.2	0.2 miles above bridge	Riffle	9/13				
9	80.2	0.2 miles above bridge	Riffle	9/1				
MAINSTEM UMATILLA, RIVER **MILE** 76.7 TO 80.0 **SURVEYED** ON **5/27, 5/31*, 6/7*, 6/23, 7/12, 8/4, 8/16, 8/26, 9/1, 9/8, 9/14** AND **9/21**								
1	79.9	200 yards below bridge	Tailout	9/21	4	3	11	6
2	79.8	300 yards below bridge	Riffle	9/14	**2** unknown			
3	79.8	350 yards below bridge	Riffle	9/14	sex			
4	79.8	350 yards below bridge	Riffle	9/14				
5	79.8	350 yards below bridge	Riffle	9/21				
6	79.5	26 yards above trap site	Riffle	9/14				
7	79.5	rotary screw trap site	Tailout	9/14				
8	79.4	250 yards below trap site	Tailout	9/14				
9	79.0	150 yards Meacham Creek	Riffle	9/8				
10	78.0	250 byards Meacham Creek	Riffle	9/14				
11	77.9	200 yards below Gibbon RR yard	Riffle	9/1				
12	77.9	200 yards below Gibbon RR yard	Rime	9/8				
13	77.9	250 yards below Gibbon yardRR	Riffle	9/14				
14	76.9	300 yards aSquaw Creek	Riffle	9/14				
MAINSTEM UMATJLLA, **RIVER MILE** 73.5 TO 76.7 **SURVEYED** ON **6/8, 6/28, 8/4, 8/16, 9/1, 9/8, 9/14** AND 9121								
1	76.5	13.1 miles BF		9/14	1	0	2	3
2	76.2	13.4 miles BF		9/21				
MAINSTEM UMATILLA, **RIVER MILE** 70.0 TO 73.5 **SURVEYED** ON **6/8, 6/28** AND **8/10**								
none	70.0-73.5	Thornhollow Bridge to Louie Dick's Fence						
MAJNSTEM **UMATILLA, RIVER** MILE 67.5 TO 70.0 **SURVEYED** ON **6/30** AND **8/10**								
none	67.5-70.0	Louie Dick's Fence to Cayuse Railroad Bridge						
MAINSTEM UMATILLA, RIVER MILE 63.8 TO 67.5 SURVEYED ON **6/30** AND **8/10**								
none	63.8-67.5	Cayuse Railroad Bridge to Minthorn Springs						

REDD#	RIVER MILE	AREA DESCRIPTION	HABITAT TYPE	DATE 1994	PRESPAWNING MORTALITY		SPAWNED OUT	
MAINSTEM UMATILLA, RIVER MILE 63.8 TO 67.5, **SURVEYED** ON **6/30**					FEMALES	MALES	FEMALES	MALES
none	63.8-67.5	Minthorn Springs to Mission Bridge						
MEACHAM CREEK, MOUTH TO **RIVER** MILE 3.0 **SURVEYED** ON **6/20, 7/1, 7/20, 8/1, 8/11, 8/23, 9/2, 9/9, 9/15** AND **9/22**								
1	2.4			9/15	1	1	3	0
2	2.3			9/15				
3	1.9			9/22				
MEACHAM CREEK, RIVER MILE 3.0 to 6.0 SURVEYED ON **6/20, 7/1, 7/20, 8/1, 8/11, 8/23, 9/2, 9/9, 9/15** *AND* **9/22**								
1								
2	53 4.8	300 yards below Line Creek	Tailout Rime	9/9	1	0	3	0
4	4.8	300 yards below Line Creek	Rime	9/15				
	4.8	300 yards below Line Creek	Riffle	9/22				
5	4.8	300 yards below Line Creek	Riffle	9/22				
6	3.9	250 feet below project fence	Tailout	9/15				
MEACHAM CREEK, **RIVER MILE** 6.0 to 12.8 **SURVEYED** ON **6/22, 7/11, 8/3*, 8/17, 9/2, 9/9** AND **9/26**								
1	6.4			9/22	3	0	3	1
2	6.2			9/22				
3	6.2			9/22				
4	6.1			9/22				
5	8.5		Riffle	9/26				
MEACHAM CREEK, **RIVER MILE** 12.8 TO 15.2 **AND THE** NORTH **FORK** OF **MEACHAM CREEK RIVER MILE** 0.0 TO 3.75 **SURVEYED 8/5**								
none					PRESPAWNING MORTALITY		SPAWNED OUT	
TOTAL REDDS					TOTAL FEMALES	TOTAL MALES	MTN. FEMALES	TOTAL MALES
74					13	5	56	37

• Partial survey

Table F-4. Summary of Steelhead Redds Observed in the Umatilla Basin by Tributary 1995 - 1994.

Year	Squaw Creek	Buckaroo Creek	Meacham Creek	NF Meacham Creek	Camp Creek	Boston Canyon Creek	NF Umatilla	SF Umatilla	Ryan Creek	Minthorn Springs	Pearson Creek	west Birch	East Bill
1985	14	2		1	4	10			2				
1986	25	3	46	27	8	8			13				
1987	25	0	49	7	12		6	3	10		22		11
1988	95	20	51	10	6	2	1	5	9		15	2	39
1989	46	10	24	4	1	9	3	7	16				
1990	SURVEYS WERE NOT CONDUCTED - HIGH WATER DURING SPRING												
1991	SURVEYS WERE NOT CONDUCTED - HIGH WATER DURING SPRING												
1992	77	5	120	30	8	0	17	15	3	5	1	0	4
1993	10	6	6	3	7	6	high water	8			3	3	11
1994	36	0	40	11	6	3	4	8	3	1	31	20	61

ote: Variability in areas surveyed and survey conditions make direct comparison of redd data difficult.

Table F-5. Comparisons of Umatilla River Adult Summer Steelhead Released above Three Mile Falls Dam, Redds and Redds per Mile surveyed, 1985 - 1994 (* estimated, **=Birch Creek ODWF survey).

YEAR	ADULT STEELHEAD ABOVE 3MFD	REDDS OBSERVED	MILES SURVEYED	REDDS PER MILE SURVEYED
1985	3197*	33	23.5	1.4
1986	2885*	134	20.9	6.4
1987	3444*	156	52.5	3.0
1988	2304	275	61	4.5
1989	2287	128	50.2	2.5
1990	1393	High Water	High Water	High Water
1991	857	High Water	High Water	High Water
1992	2322	300	67.2	4.4
1993	1621	51 - High Water	46.6	High Water
1994	1104	117	57.1	2.0
1994		118**	18.5**	6.4**

Table F-6. Summary of Successful Spawning by Reach of Spring Chinook Salmon Based on Examination of Carcasses, 1994.

RIVER REACH	SUCCESSFUL SPAWNERS		PRESPAWNING MORTALITIES			PERCENT SUCCESSFUL SPAWNING
	FEMALES	MALES	FEMALES	MALES	SEX UNKNOWN	
North Fork (0-3)	13	9	0	0	0	100.0
RM 86.3 to 89.5	9	5	1	0	0	93.3
RM 83.6 to 86.3	5	10	1	0	0	93.8
RM 80 to 83.6	7	3	1	1	0	83.8
RM 78.9 to 80	7	4	1	2	0	78.6
RM 76.7 to 78.9	4	2	3	1	5	50.0
RM 73.5 to 76.7	2	3	1	0	0	83.0
RM 70 to 73.5	0	0	0	0	0	0
RM 59.5 to 70	0	0	0	0	0	0
Meacham 0-3	3	0	1	1	0	60.0
Meacham 3-6	3	0	1	0	0	75.0
Meacham 6-9.8	3	1	3	0	0	57.1
Meacham 9.8-15	Dry	Dry	Dry	Dry	Dry	0.0
TOTAL	56	37	13	5	2	82.3

'able F-7. Umatilla River Spring Chinook Salmon Redd Distributions, 1989-1993.

YEAR	1989	1990	1991	1992	1993	1994
Total Number of Redds Observed	14	289	144	59	224	74
RIVER SECTION	NUMBER OF REDDS OBSERVED / PERCENT BY REACH					
North Fork Umatilla River	0 / 0	68 / 23.5	13 / 9.0	10 / 16.9	27 / 12.1	16 / 21.6
RM 86 to 89.5	14 / 100	174 / 60.3	21 / 14.6	13 / 22.0	25 / 11.2	13 / 17.6
RM 83-86			29 / 20.1	15 / 25.4	14 / 6.5	6 / 8.1
RM 80 to 83	0 / 0		26 / 18.1	13 / 22.0	31 I 13.8	9 / 12.2
RM 78.9 to 80	0 / 0					
RM 76.7 to 78.9	0 / 0		20 / 13.9	6 I 10.2	39 / 17.4	14 I 18.9
RM 73.6 to 76.7	0 / 0	36 / 12.5	0 / 0	0 / 0	25 / 11.1	2 / 2.7
RM 70.0 to 73.6	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RM 67.5 to 70.0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
RM 63.8 to 67.5	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 1 0
RM 63.8 to 59.5	01 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
Meacham Creek (RM 1-15)	0 / 0	11 / 3.7	35 124.3	1 I 1.7	63 128.1	14 / 18.9

ible F-S. Disposition of Umatilla Ri r Spring Chinoo Salmon love Tl ce Mile alls D: (TMD), 1989-1993.

	1989	1990	1991	1992	1993	1994
Total Observed at TMD	164	2190	1330	464	1221	277
Chinook Sacrificed/Mort. at TMD	36	26	234	200	165	31
Chinook Taken For Brood Stock	0	200	0	0	0	0
Number Released above TMD	128	1965	1096	264	1056	234
Number Released at TMD	—	—			9	6
Number of Adipose Clipped Fish Released Above TMD	3	685	479	135	603	133
Estimated Harvest Above TMD	?	?	?	0*	191	o*
Number of Chinook Sampled on Spawning Grounds	6	272	264	79	474	113
Percent Recovered (all chinook)	4.7	13.8	24.1	29.9	44.9	47.1
Number of add. clipped chinook recovered	0	83	136	39	356	50
Percent Recovered (ad. clipped)	0	12.1	28.4	28.9	59.3	37.6
Prespawning Mortalities Examined	0	0	88	22	125	20
Spawned Out Carcasses Examined	0	0	130	48	338	93
Spawned Out Females Examined	—	—	81	37	205	56
Redds Observed	14	287	144	59	244	74

Table F-9. Minimum Estimate of Fall Chinook Salmon and Coho Salmon Adult Returns to the Umatilla River, 1989-1993.

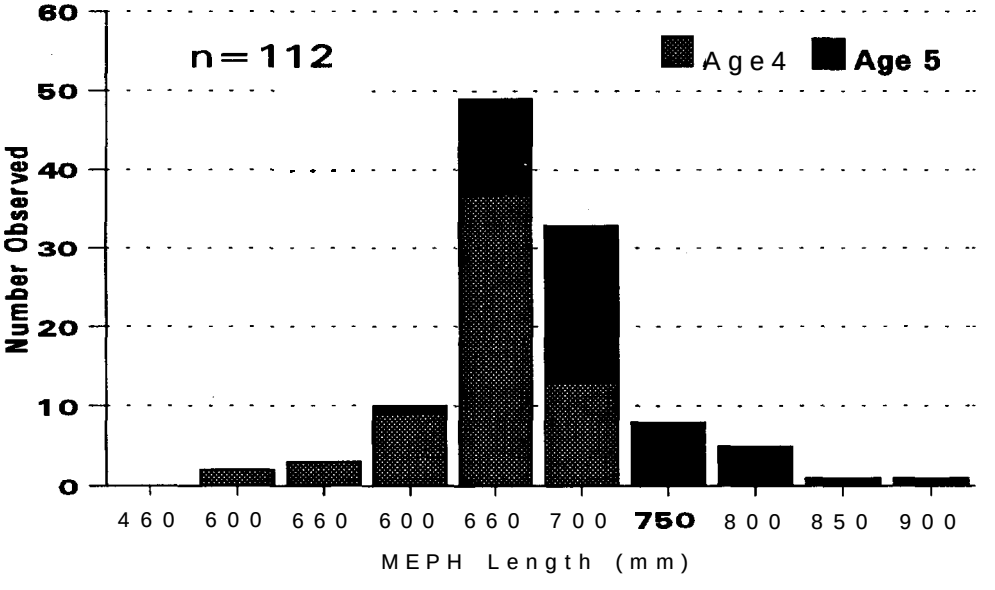
YEAR	ADULTS ENUMERATED AT THREE MILE DAM	ADULTS BELOW THREE MILE DAM	TOTAL	PERCENT BELOW THREE MILE DAM
COHO				
1989	4154	2	4198	1.0%
1990	409	107	411	0.5%
1991	1732		1839	5.8%
1992	356	22	378	5.8%
1993	1531	122	1653	7.4%
CHINOOK				
1989	271	89	360	27.2%
1990	329	110	439	25.1%
1991	522	85	538	3.0%
1992	225	70	310	27.4%
1993	412		482	14.5%

ble F-10. Sumu ry of Umatill oho Salmon Adult Escapement Surveys, 1993.

REDD#	RIVER MILES	AREA DESCRIPTION	DATE 1994	PRESPAWNING MORTALITY		SPAWNED OUT	
MAINSTEM STANFIELD	MATILLA RIVER, RIVER MILES 17 TO 23, SIMPLOT BRIDGE TO RIDGE, SUBVEYED 11/16			FEMALES	MALES	FEMALES	MALES
1	22.3	0.75 miles below Stanfield Bridge	11116				
2	22.2	150 yards below redd number 1	11116				
3	22.1	75 yards below redd number 2	11116				
4	21.8	0.33 miles below redd number 3	11116				
5	21.8	0.33 miles below redd number 3	11116				
6	21.6	0.25 miles below redds 4 and 5	11116				
7	17.1	across form tower in railroad yard	11116				
8	17.1	across from tower in railroad yard	11116				
9	17	Simplot corner	11116				
10	17	Simplot corner	11116				
MAINSTEM TO ONE MI	MATILLA R ABOVE CC	ER, RIVER MILES 23 to 29.1, STANFIELD BRIDGE NSPRINGS DAM, SURVEYED 11/18					
1	29.1	200 yards below Coldsprings Dam	11118		2	2	2
2	29.1	200 yards below Coldsprings Dam	11/18				
3	29.1	200 yards below Coldsprings Dam	11/18				
4	29.0	400 yards below Coldsprings Dam	11/18				
5	27.3	200 yards above Westland Dam	11/18				
6	27.3	200 yards above Westland Dam	11/18				
7	27.28	160 yards above Westland Dam	11/18				
8	27.28	150 vards above Westland Dam	11/18				
9	27.26	100 yards above Westland Dam	11118				
10	27.25	100 yards above Westland Dam	11/18				
11	27.25	30 yards above Westland Dam	11118				
12	27.21	Echo Bridge to Stanfield Bridge	11/18				
13	23-26.3	Echo Bridge to Stanfield Bridge	11118				
14	23-26.3	Echo Bridge to Stanfield Bridge	11118				
15	23-26.3	Echo Bridge to Stanfield Bridge	11/18				
16	23-26.3	Echo Bridge to Stanfield Bridge	11/18				
17	23-26.3	Echo Bridge to Stanfield Bridge	11/18				
18	23-26.3	Echo Bridge to Stanfield Bridge	11118				
MAINSTEM COLDSPRIN	MATILLA RIVER, RIVER MILES 29.2 to 33.2, ONE MILE ABOVE S DAM, TO NOLIN, SURVEYED 11119						
1	32.15	0.25 miles below Stanfield Dam	11/19		2		
		200 yards below irrigation return channel	11/19				
3	31-33.2	upper two miles of this reach	11/19				
MAINSTEM SURVEYED	MATILLA RIVER, RIVER MILES 33.2 to 37.2, NOLIN TO YOKUM, /23						
1	36.9	150 yards below Yokum Bridge	11/23				1
MAINSTEM MILE ABOV	MATILLA RIVER, RIVER MILES 59.5 to 64.8, MISSION TO ONE MINTHORN SPRINGS, SURVEYED 12/13						
1	64.8	one mile above Minthorn Springs	12/13				
2	64.3	0.5 miles above Minthorn Springs	12/13				
3	63.55	0.25 miles below Minthorn Springs	12/13				
4	63.3	0.5 miles below Minthorn Springs	12/13				
MAINSTEM BRIDGE TO	MATILLA RIVER, RIVER MILES 67.5 to 80, CAYUSE RAILROAD RED GRAY'S BRIDGE, SURVEYED 12/13						
1	76.7-80	Fred Grey's to the mouth of Squaw Creek	12/21				
2	76.7-80	Fred Grey's to the mouth of Squaw Creek	12/21				
3	70.0-73.5	Thornhollow to Louie Dick's fence	12/21				
4	70.073.5	Thornhollow to Louie Dick's fence	12/21				
5	70.0-73.5	Thornhollow to Louie Dick's fence	12/21				
6	70.0-73.5	Thornhollow to Louie Dick's fence	12/21				
7	67.5-70.0	Louie Dick's fence to Cayuse RR Bridge	12/21				
8	67.5-70.0	Louie Dick's fence to Cayuse RR Bridge	12/21				
TOTAL REDDS				TOTAL FEMALES	TOTAL MALES	TOTAL FEMALES	TOTAL MALES
44				0	2	2	3

Table F-11. Fall Chinook and Coho Salmon Escapement Surveys, 1989-1993

YEAR	MILES SURVEYED	REDDS	OBSERVED LIVE FISH				RECOVERED CARCASSES			
			CHF	COHO	UNKNOWN	TOTAL	CHF	COHO	UNKNOWN	SUM
ABOVE THREE MILE FALLS DAM										
1989	32.5	92	5	30	0	35	20	37	10	67
1990	42.8	50	19	3	11	33	12	6	1	19
1991	29.0	18	12	15	1	28	5	11	1	17
1992	9.0	12	0	11	3	14	2	8	1	11
1993	42.0	44	0	12	0	12	1	14	0	15
BELOW THREE MILE FALLS DAM										
1989	2.5		8	4	IS	27	92	52	17	161
1990	2.5		15	9	11	35	120	5	8	133
1991	2.5		16	68	0	84	16	107	1	124
1992	2.5		50	19	0	69	88	22	0	110
1993	2.5		6	23	0	29	50	122	0	172



Figures F-l. Length Frequency Histogram of Adult Spring Chinook Salmon Examined During Escapement Surveys, 1994, ages **are** based on coded wire tag recoveries and expanded from 4.5 fish, 30 at age four and 15 at age five, (CHS93LG.CH3).

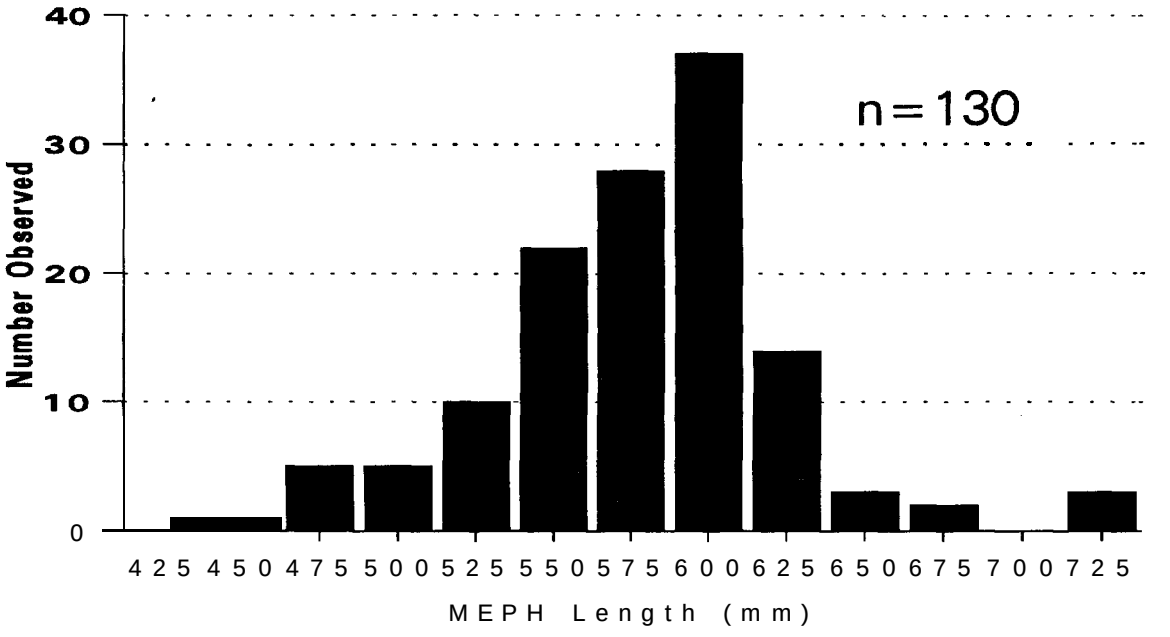


Figure F-2. Length Frequency Histogram of Adult Coho Salmon Examined During Escapement Surveys, Fall of 1993 (the lengths of 5 coho examined could not be obtained due to decomposition; COHO93LG.CH3).

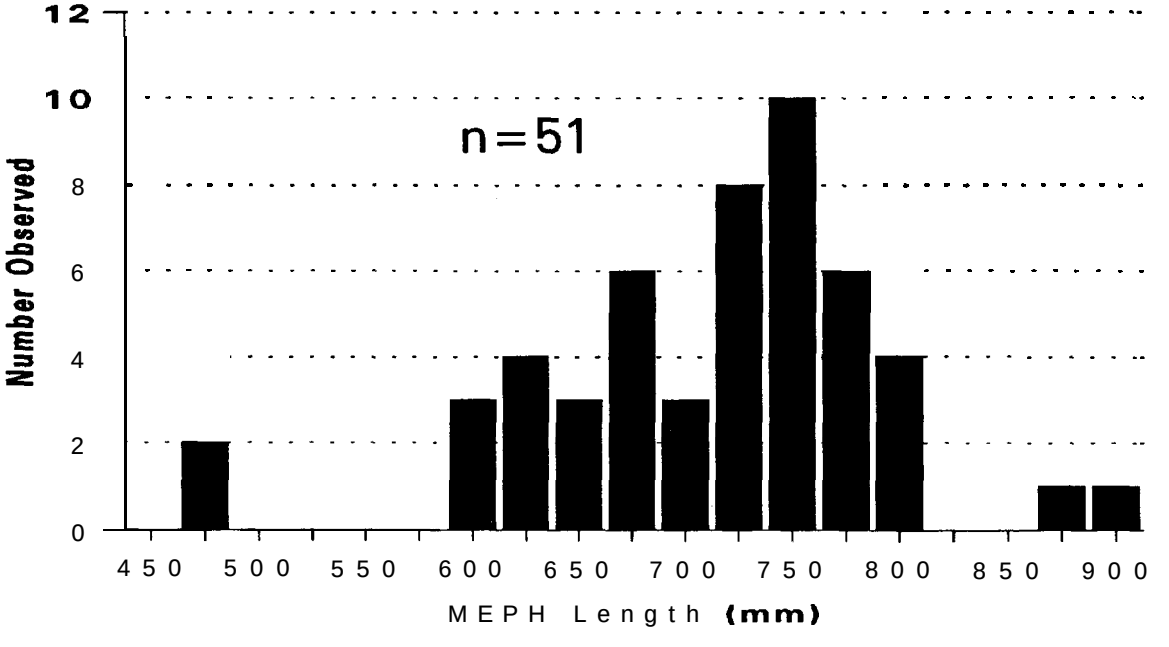


Figure F-3. Length Frequency Histogram of Adult Fall Chinook Salmon Examined During Escapement Surveys, Fall of 1993 (CHF93LG.CH3).

APPENDIX G
Emigrant Trapping Tables and Figures

Table G-l. Summary of Trap Catch Data from the Umatilla, Meacham Creek and Squaw Creek Traps, 1993/94; Expanded Catch Estimate Does Not Account for Days the Traps were not Operated.

	TRAPS		
	UMATILLA	**MEACHAM**	**SQUAW**
Trapping Dates	10/15/93 to 07/19/94	12/15/93 to 06/22/94	12/04/94 to 06/22/94
Trapping days over total days	245 / 277	183 f 190	185 / 201
CHINOOK			
Number Captured	5162	832	46
Number Marked and Released Upstream	4240	752	32
Expanded Catch Estimate	14,315	2291	210
Total Number Recaptured	1529	273	7
Average % Recaptured	36%	36%	22%
# Recaptured 0 - 24 hours	1374	238	2
# Recaptured 25 - 48 hours	85	21	2
# Recaptured 49 - 72 hours	37	8	1
# Recaptured 73+ hours	33	6	2
Average % Containment	72%	72%	100%
Number of containment trials	10	17	2
RAINBOW f STEELHEAD			
Number Captured	2413	4959	1903
Number Marked and Released Upstream	2109	4356	1696
Expanded Catch Estimate	20,857	34,752	9219
Total Number Recaptured	244	622	412
Average % Recaptured	12%	14%	24%
# Recaptured 0 - 24 hours	175	468	222
# Recaptured 25 - 48 hours	32	74	75
# Recaptured 49 - 72 hours	11	40	38
# Recaptured 73 + hours	26	40	77
Average % Containment	54%	87%	92%
Number of containment trials	15	17	11
Bull Trout	139	2	1
Whitefish	51	11	2
Redside Shiner	477	6825	167
Sucker	198	321	201
Dace	16,931	5264	3715
Sculpin	558	95	549
Squawfish	304	476	14

Table G-2. Basic Statistics for Juvenile Rainbow/steelhead and Chinook Salmon Captured in the Upriver Traps During the 199311994 Contract Year.

	JUVENILE CHINOOK SALMON			JUVENILE RAINBOW/STEELHEAD		
UMATILLA ROTARY TRAP	**MEAN FORK LENGTH (mm)**	**n**	**STANDARD DEVIATION**	**MEAN FORK LENGTH (mm)**	**n**	**STANDARD DEVIATION**
October - December 1993	103.9	843	11.48	140.5	609	32.16
January - March 1994	60.6	686	44.10	129.7	376	25.19
April - June 1994	73.1	1066	20.78	121.5	917	37.84
July 1994	82.0	283	8.63	99.3	195	44.03
MEACHAM CREEK ROTARY TRAP						
December 1993	67.7	1.5	34.03	135.6	36	30.32
January - March 1994	80.6	116	30.01	54.8	1972	23.70
April - June 1994	81.1	697	7.85	139.4	1883	30.36
SQUAW CREEK PIPE TRAPS						
December 1993	98.6	44	10.02	116.6	114	23.11
January - March 1994	100.2	11	7.61	125.6	216	29.66
April - June 1994	80.0	24	18.30	121.62	1468	31.17

Table G-3. Salmonids Enumerated at West Extension Irrigation District Canal Capture Facility, Three Mile Falls Dam, West Bank, March 21 through 25, 1994; (CHS= Spring Chinook Salmon; AD = adipose fin clip, LV = left ventral fin clip, Hatchery Fish).

DATE	NATURAL CHS	AD CHS	LV or ADLV CHS	NATURAL STEELHEAD
3/21	0	0	0	7
3/22	9	15	0	46
3/23	8	5	5	29
3/24	6	0	344	42
3/25	0	0	0	0
Total	23	20	349	124

Table G-4. Mark Recapture of Juvenile Salmonids at Three Mile Falls Dam, West Bank, 1994 (CHS = spring chinook salmon; RB/STS = rainbow/summer steelhead; UC = upper caudle fin clipped; LC = lower caudle fin clipped; BC = both caudle fins clipped).

DATE	RELEASED			RECAPTURED		REMARKS
	CHS	RB/STS	CLIP	CHS	RB/STS	
3/21						Trap Fishing - 12:30 pm
3/22	23	50	UC	1UC	9UC	Trap Fishing
3/23	17	29	LC	2UC	1UC, 7LC	Water Overflowed livebox
3/24	59	23	BC	6UC, 6LC, 3BC	1UC, 12LC, 7BC	Trap on bypass - 6:30 pm
3/25				0	0	Trap Fishing 6:30 am-9:30 am

TOTAL CHS RELEASED	TOTALCHS RECAPTURED	% CHS RECAPTURED	TOTAL RB/STS RELEASED	TOTAL RB/STS RECAPTURED	RB/STS % RECAPTURED
23	9	39.1	50	11	22.0
17	6	35.3	29	19	65.5
59	3		23	7	

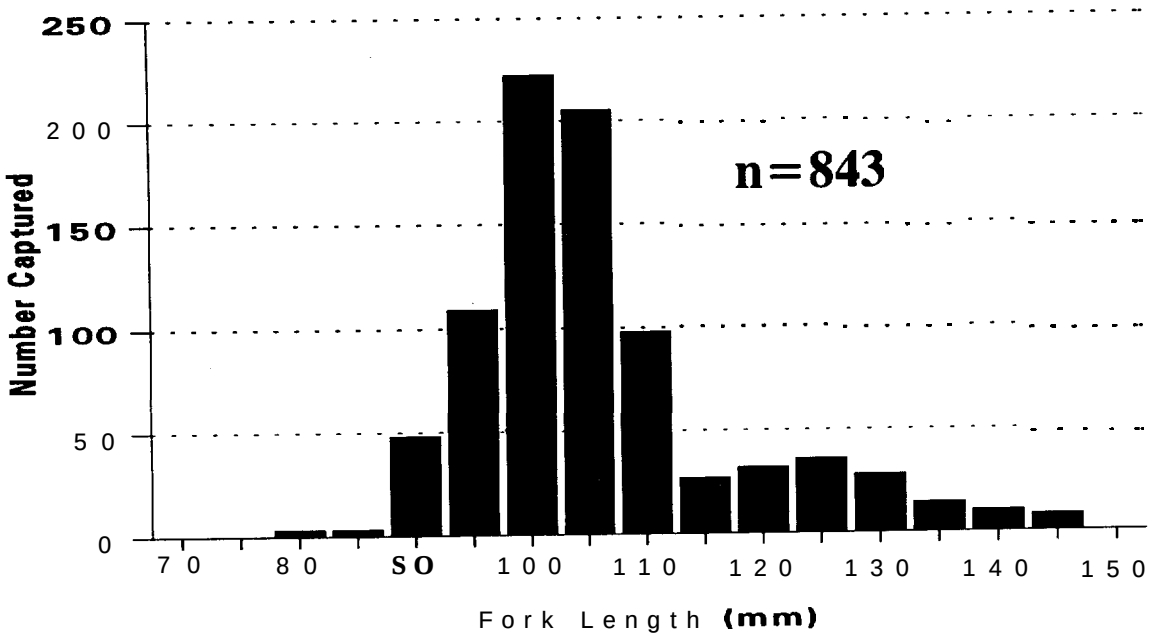


Figure G-l. Length Frequency of Juvenile Chinook Salmon Captured by the Rotary Screw Trap in the Umatilla River (RM 79.5) from October through December, 1993. (Q1LFCHNU.CH3)

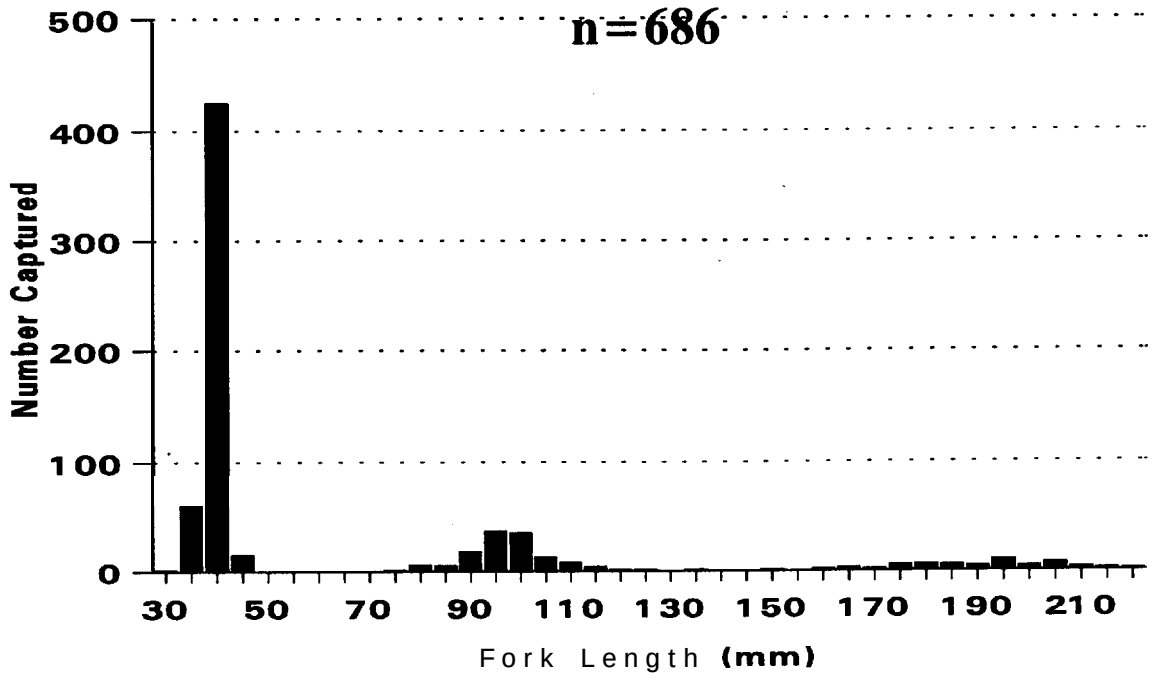


Figure G-2. Length Frequency of Juvenile Chinook Salmon Captured by the Rotary Screw Trap in the Umatilla River (RM 79.5) from January through March, 1994. (Q2LFCHNU.CH3)

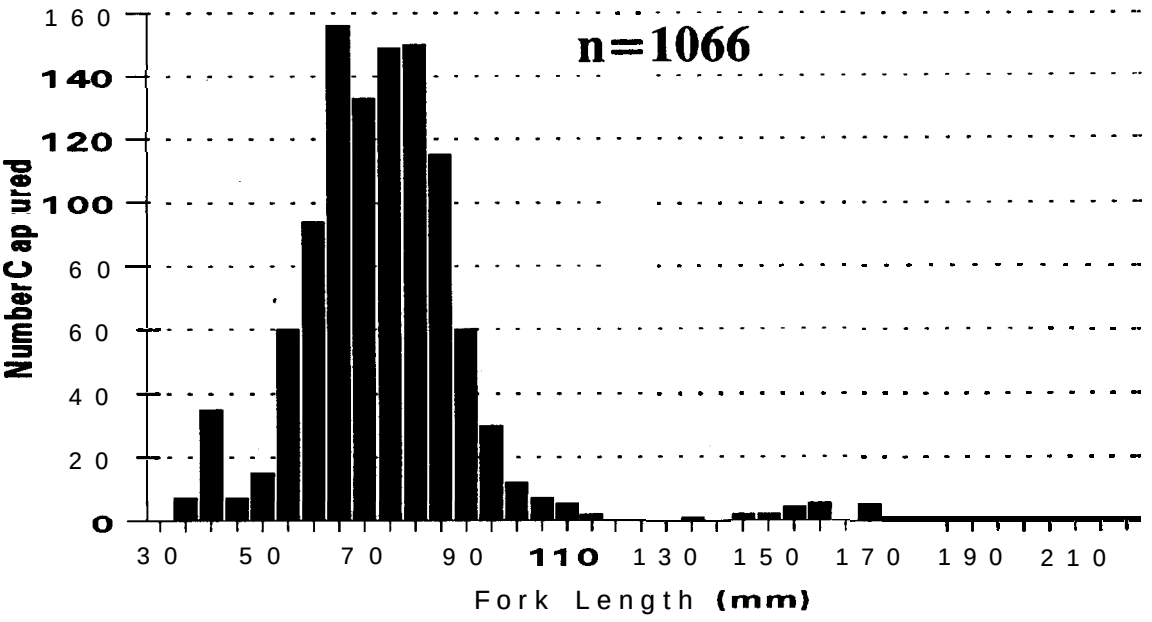


Figure G-3. Length Frequency of Juvenile Chinook Salmon Captured by the Rotary Screw Trap in the Umatilla River (RM 79.5) from April through June, 1994. (Q3LFCHNU.CH3)

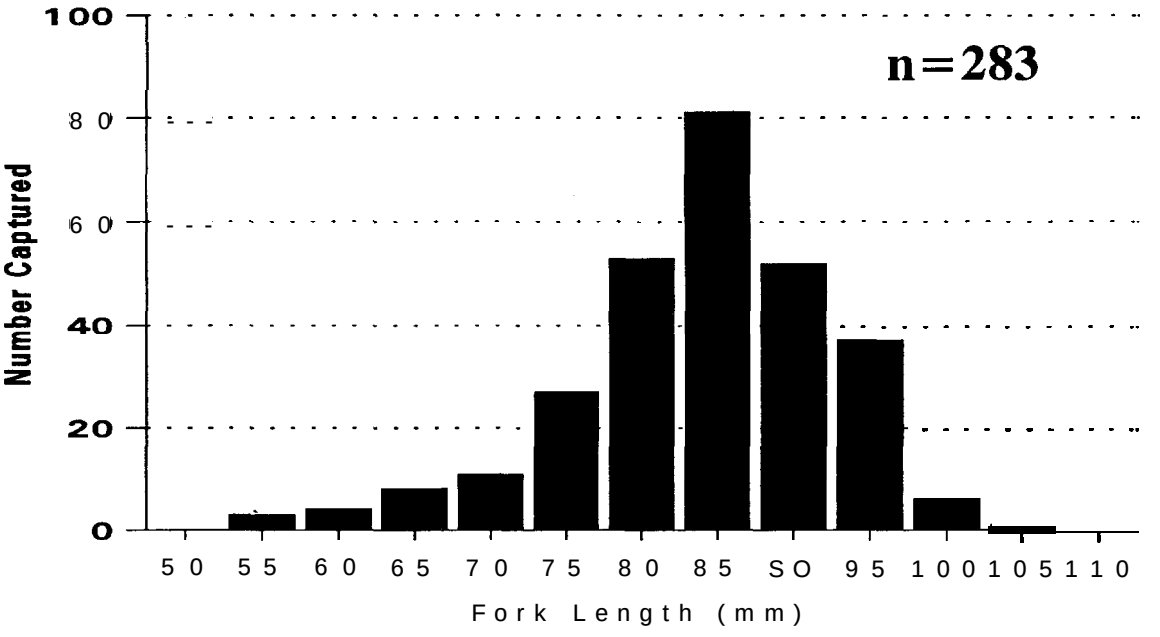


Figure G-4. Length Frequency of Juvenile Chinook Salmon Captured by the Rotary Screw Trap in the Umatilla River (RM 79.5), July, 1994. (Q4LFCHNU.CH3)

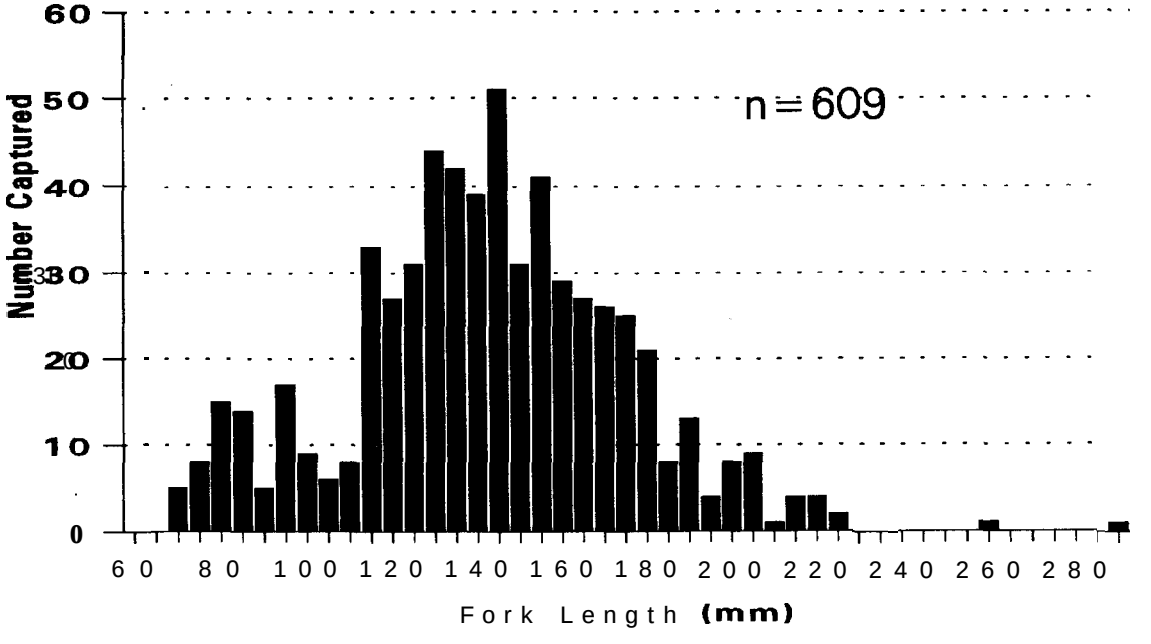


Figure G-5. Length Frequency of Juvenile Rainbow/Steelhead Captured by the Rotary Screw Trap in the Umatilla River (RM 79.5) from October through December, 1993. (Q1LFSTSU.CH3)

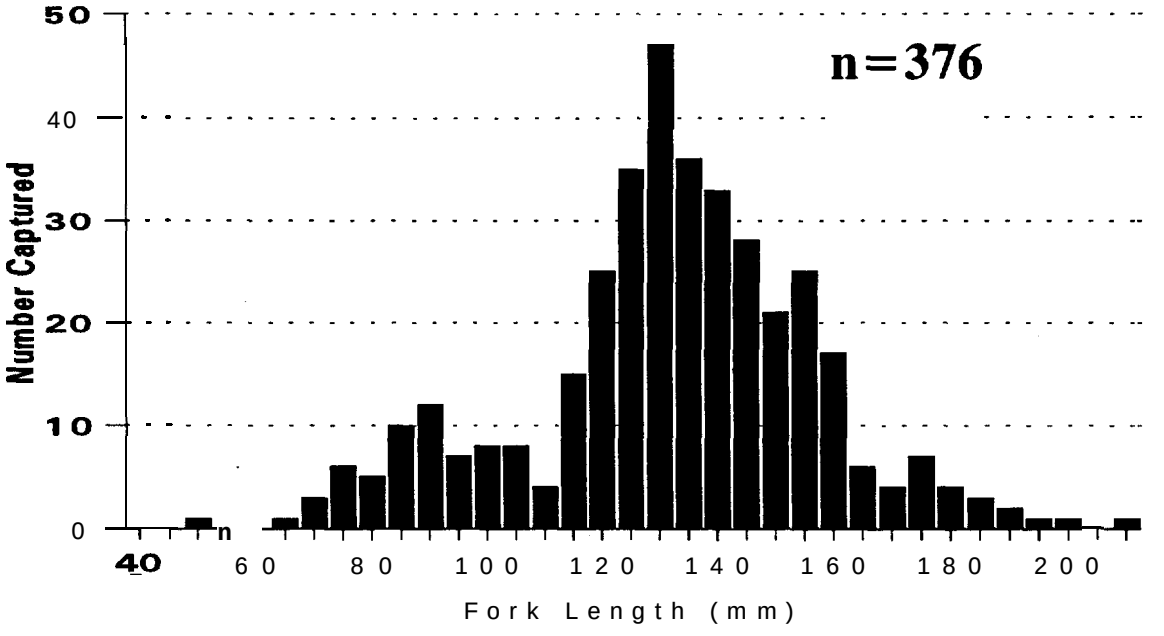


Figure G-6. Length Frequency of **Rainbow/Steelhead** Captured by the Rotary Screw Trap in the Umatilla River (RM 79.5) from January through March, 1994. **(Q2LFSTSU.CH3)**

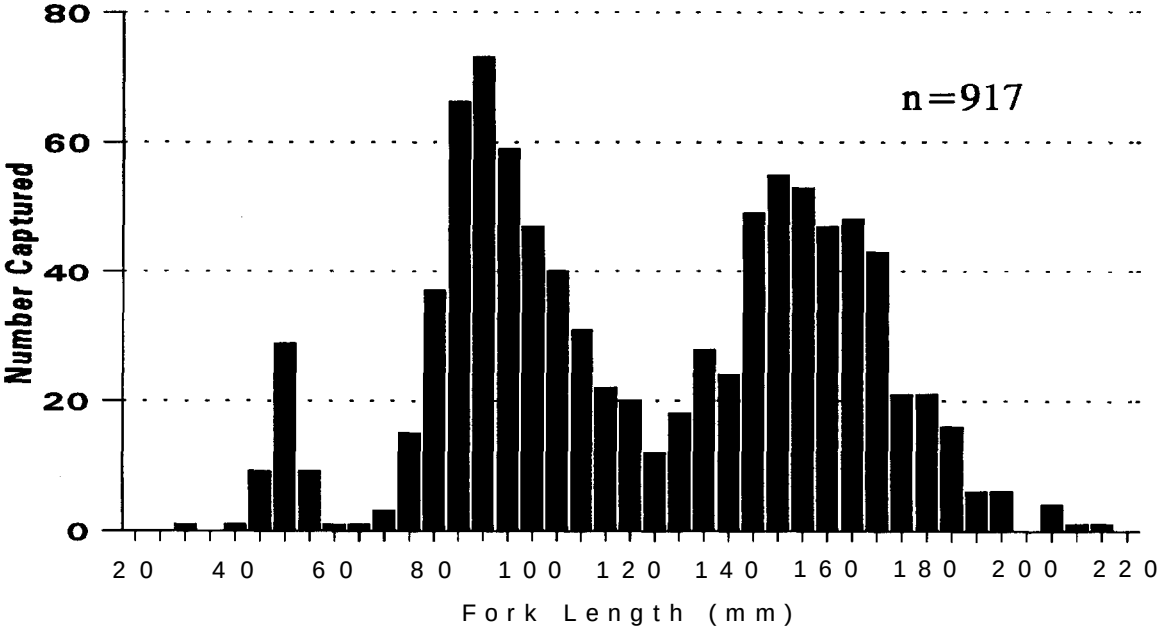


Figure G-7. Length Frequency of **Rainbow/Steelhead** Captured by the Rotary Screw Trap in the Umatilla River (RM 79.5) from April through June, 1994. **(Q3LFSTSU.CH3)**

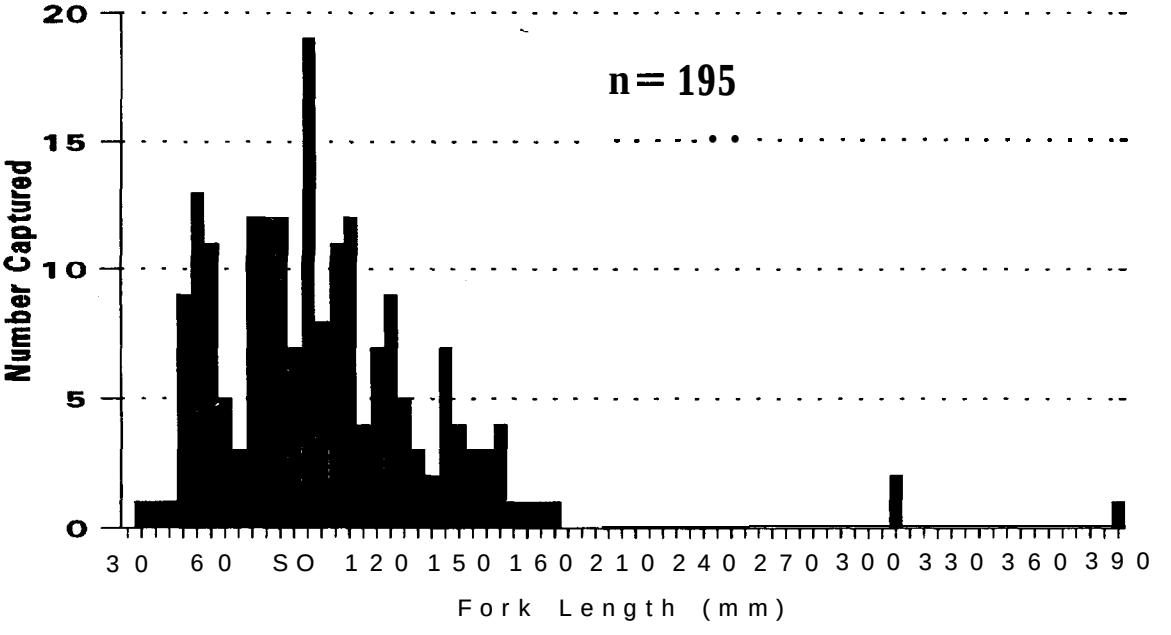


Figure G-8. Length Frequency of Rainbow/Steelhead Captured by the Rotary Screw Trap in the Umatilla River (RM 79.5), July, 1994. (Q4LFSTSU.CH3)

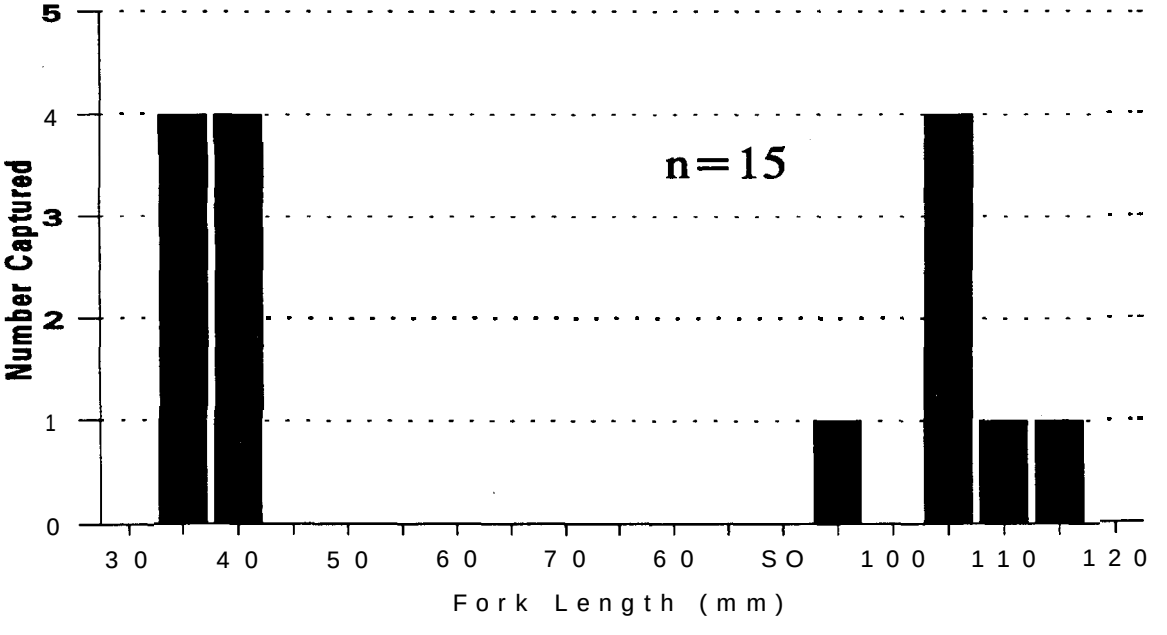


Figure G-9. Length Frequency of Juvenile Chinook Salmon Captured by the Rotary Screw Trap in the Meacham Creek (RM 1.5) from October through December, 1993. (Q1LFCHNM.CH3)

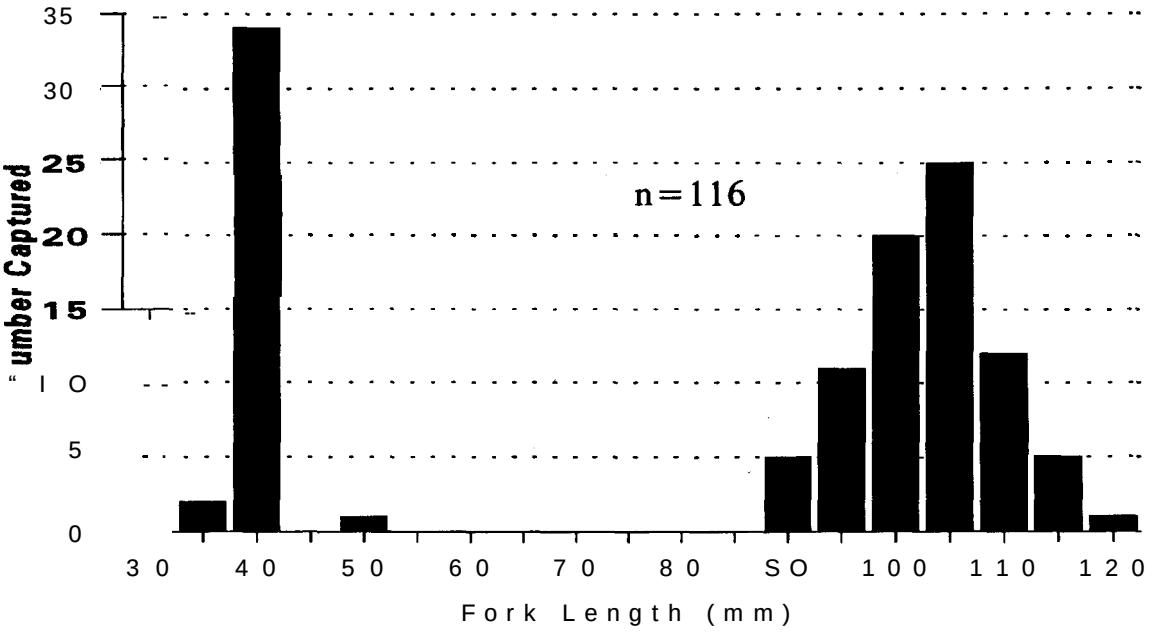


Figure G-10. Length Frequency of Juvenile Chinook Salmon Captured by the Rotary Screw Trap in the Meacham Creek (RM 1.5) from January through March, 1994. (Q2LFCHNM.CH3)

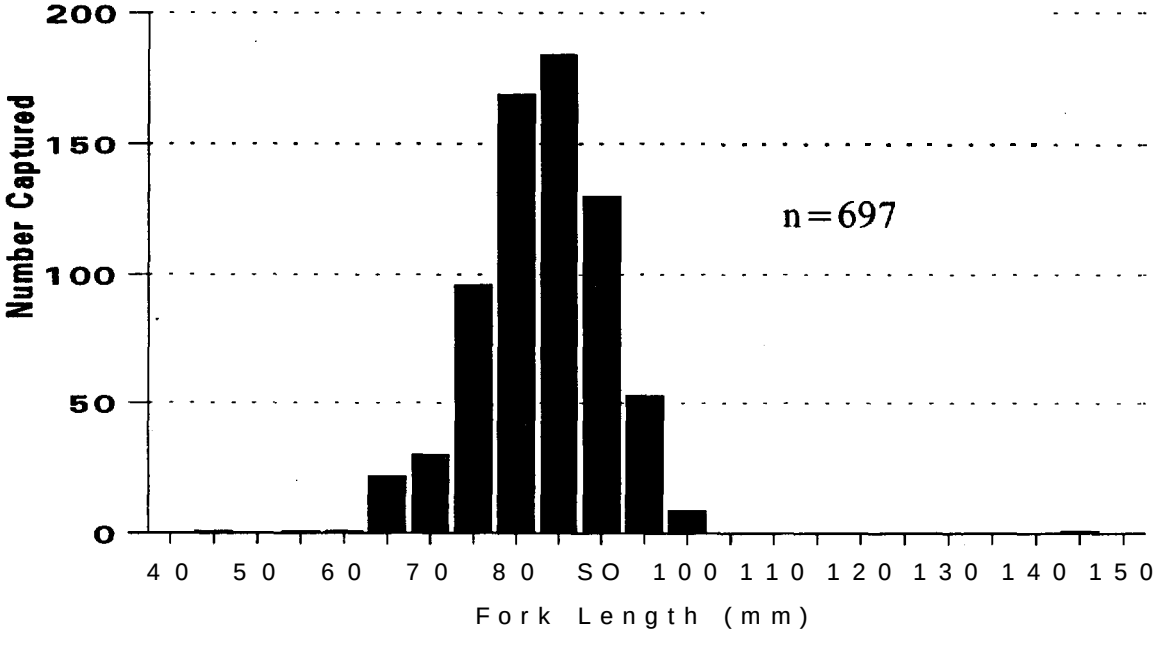


Figure G-l 1. Length Frequency of Juvenile Chinook Salmon Captured by the Rotary Screw Trap in the Meacham Creek (RM 1.5) from April through June, 1994. (Q3LFCHNM.CH3)

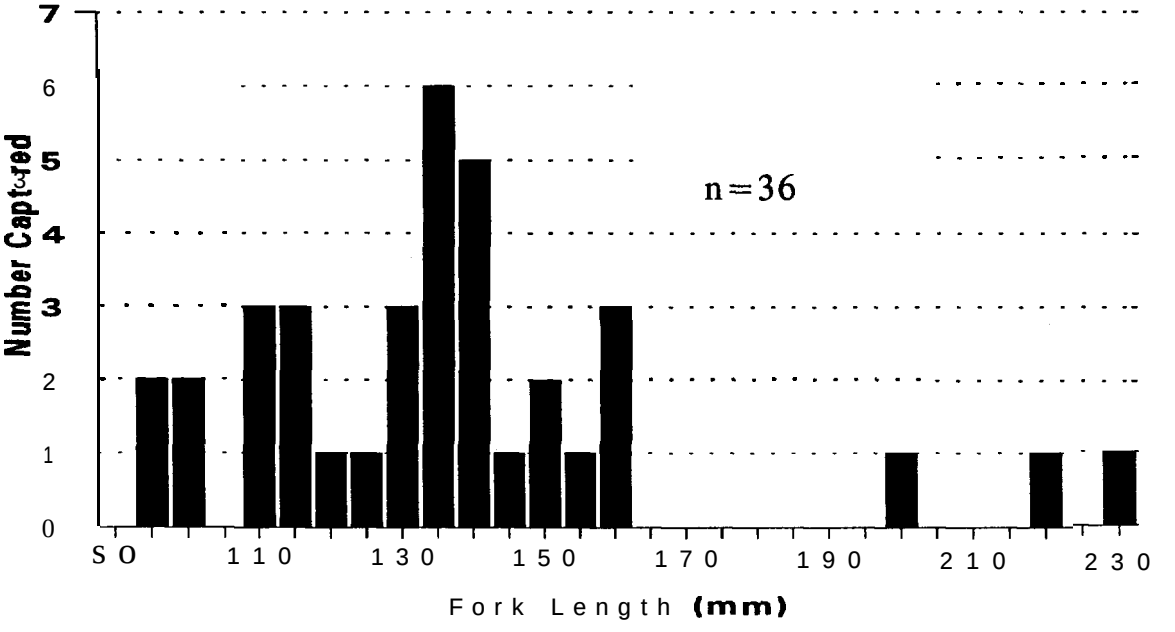


Figure G-12. Length Frequency of Rainbow/Steelhead Captured by the Rotary Screw Trap in the Meacham Creek (RM 1.5), December, 1993. (Q1LFSTSM.CH3)

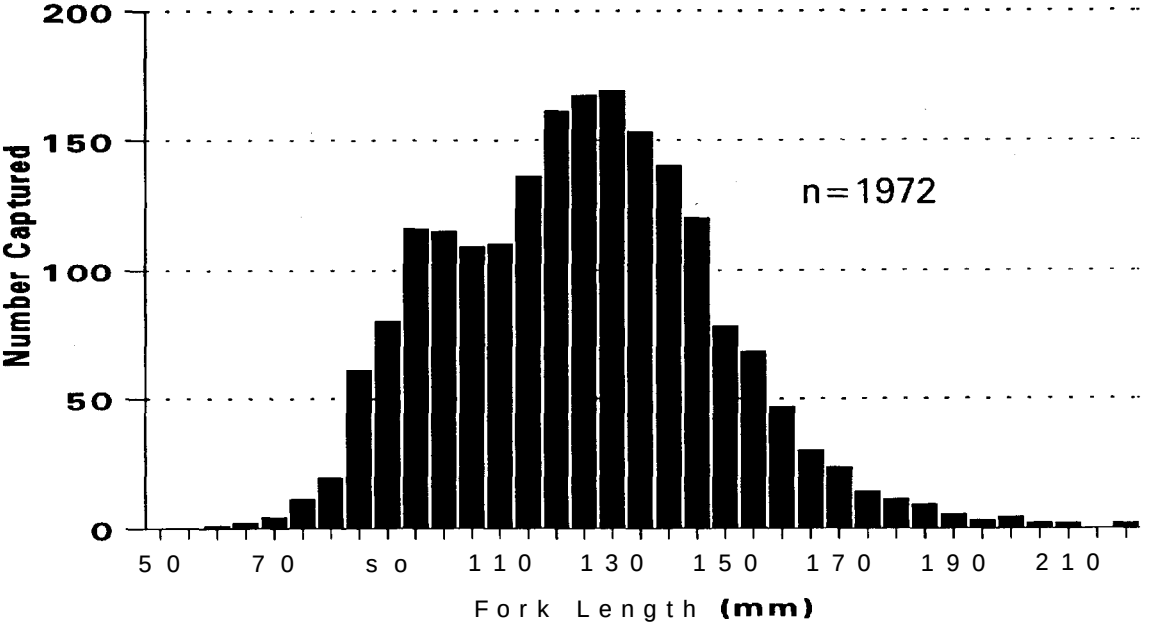


Figure G-13. Length Frequency Rainbow/Steelhead Captured by the Rotary Screw Trap in the Meacham Creek (RM 1.5) from January through March, 1994. (Q2LFSTSM.CH3)

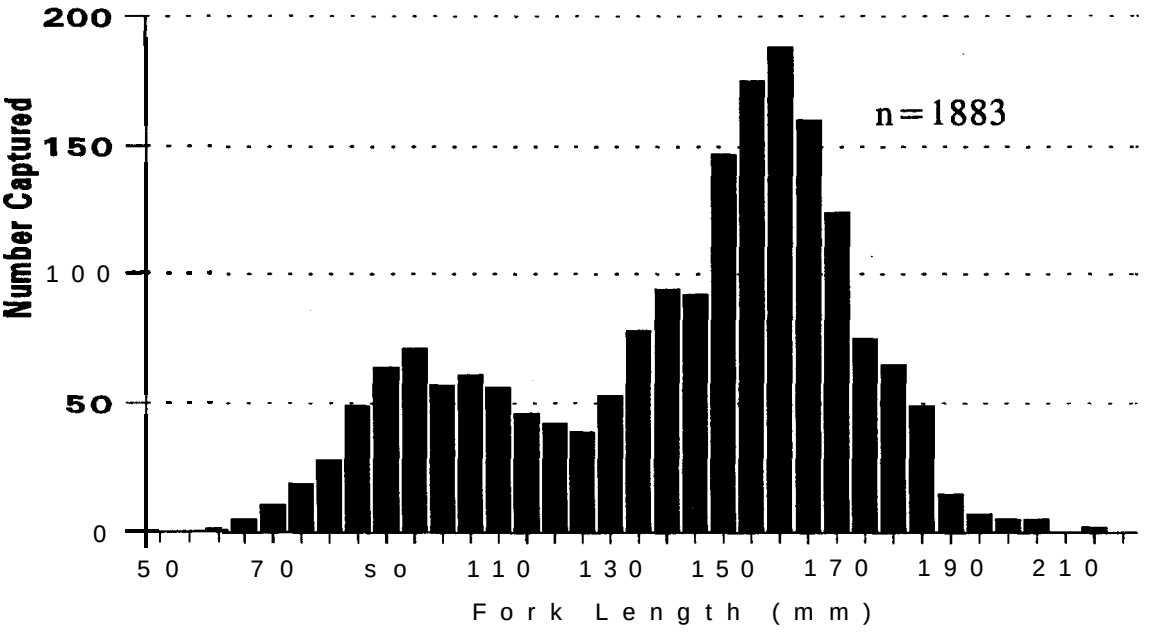


Figure G-14. Length Frequency of Rainbow/Steelhead Captured by the Rotary Screw Trap in the Meacham Creek (RM 1.5) from April through June, 1994. (Q3LFSTSM.CH3)

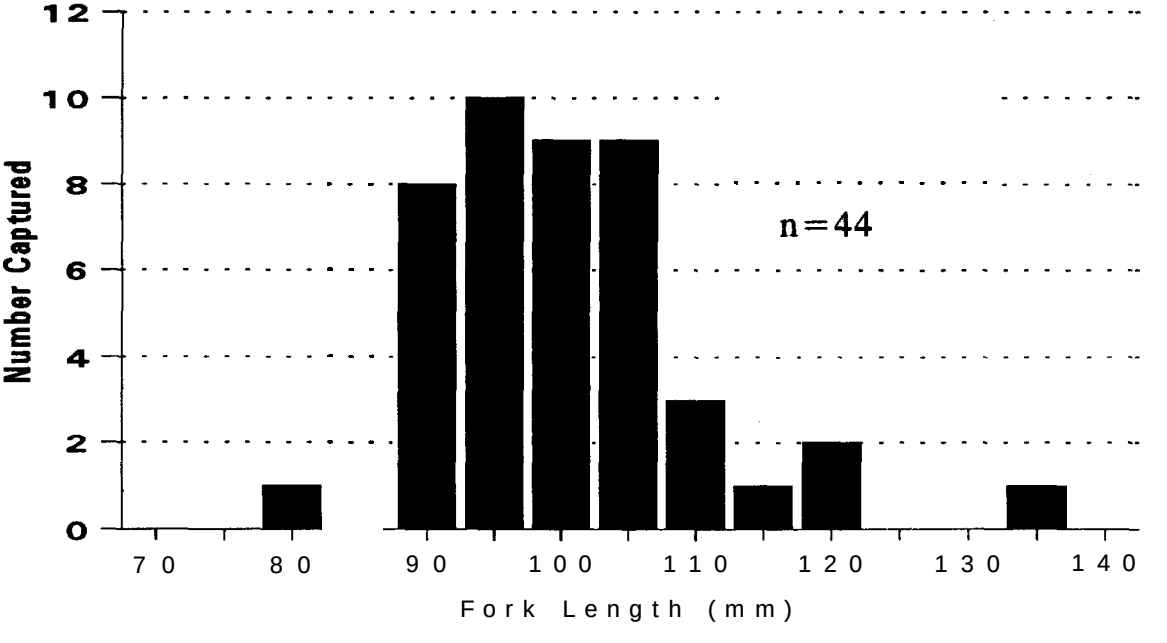


Figure G-15. Length Frequency of Juvenile Chinook Salmon Captured by the Pipe Traps in the Squaw Creek (RM OS), December, 1993. (Q1LFCHNS.CH3)

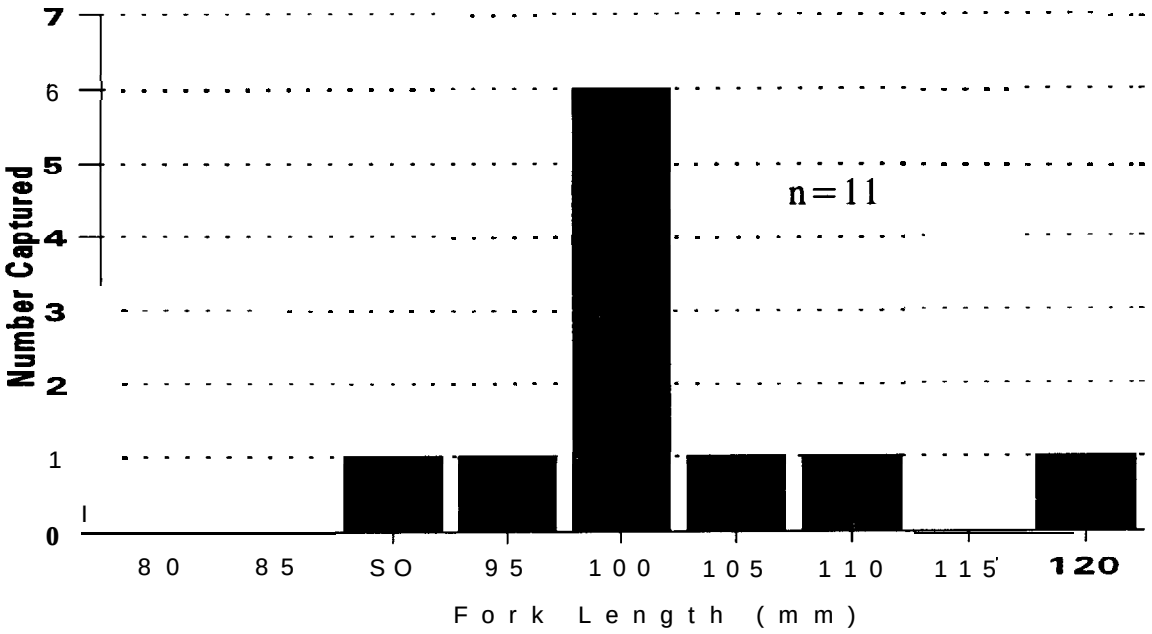


Figure G-16. Length Frequency of Juvenile Chinook Salmon Captured by fhe Pipe Traps in the Squaw Creek (RM 0.5) from January through March, 1994. (Q2LFCHNS.CH3)

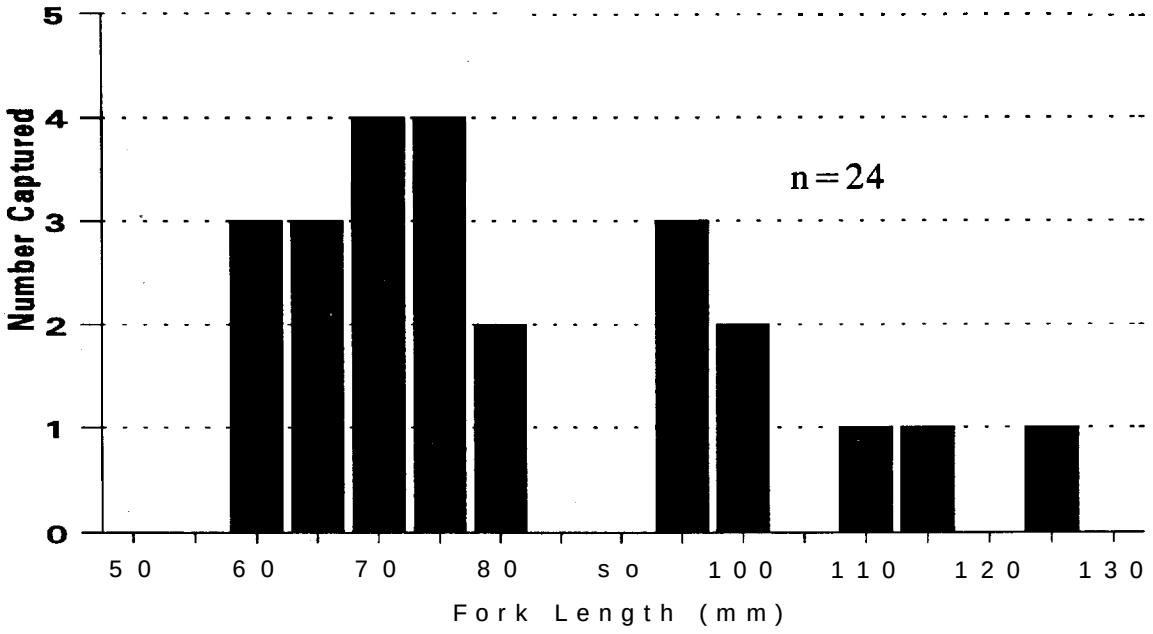


Figure G-17. Length Frequency of Juvenile Chinook Salmon Captured by the Pipe Traps in the Squaw Creek (RM 0.5) from April through June, 1994. (Q3LFCHNS.CH3)

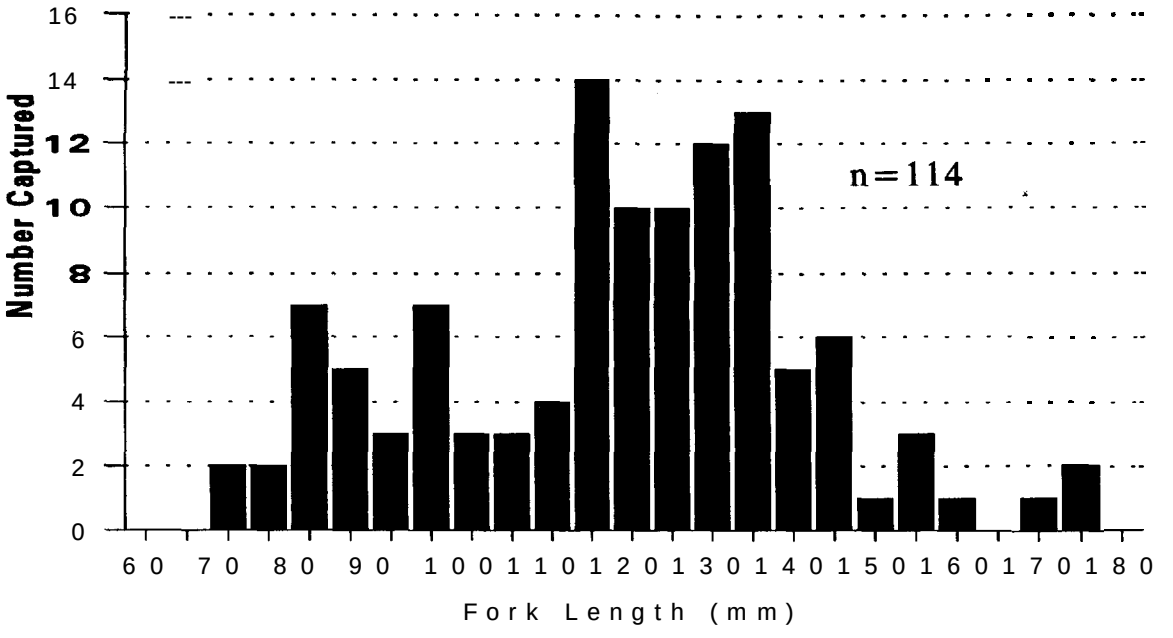


Figure G-18. Length Frequency of **Rainbow/Steelhead** Captured by the Pipe Traps in the Squaw Creek (RM OS), December, 1993. **(Q1LFSTSS.CH3)**

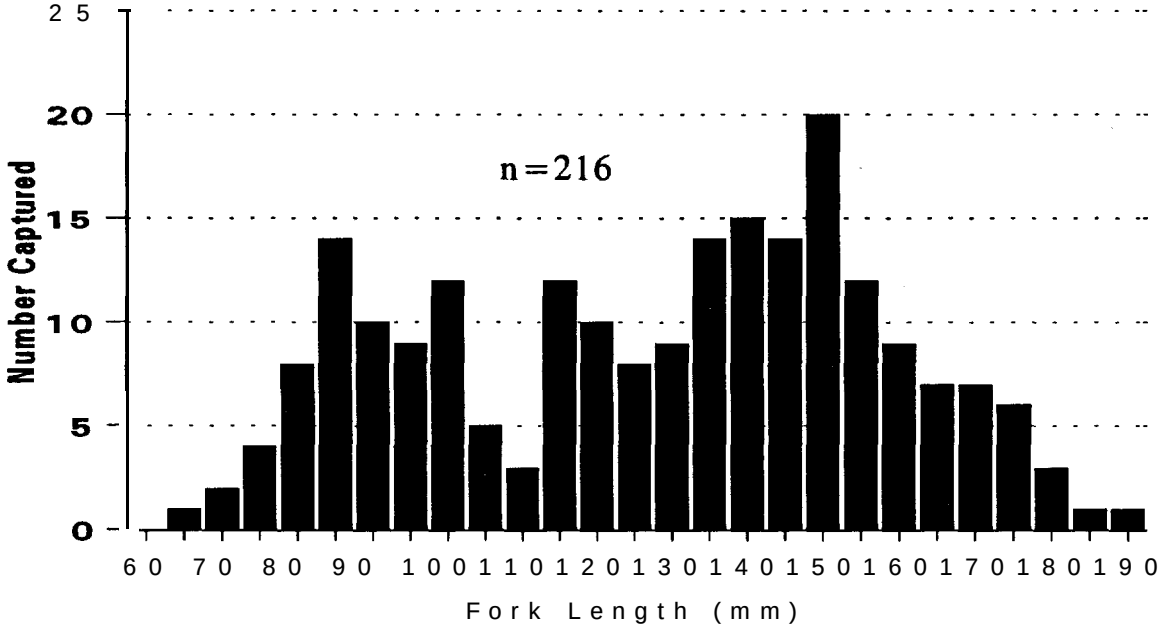


Figure G-19. Length Frequency of **Rainbow/Steelhead** Captured by the Pipe Traps in the Squaw Creek (RM 0.5) from January through March, 1994. **(Q2LFSTSS.CH3)**

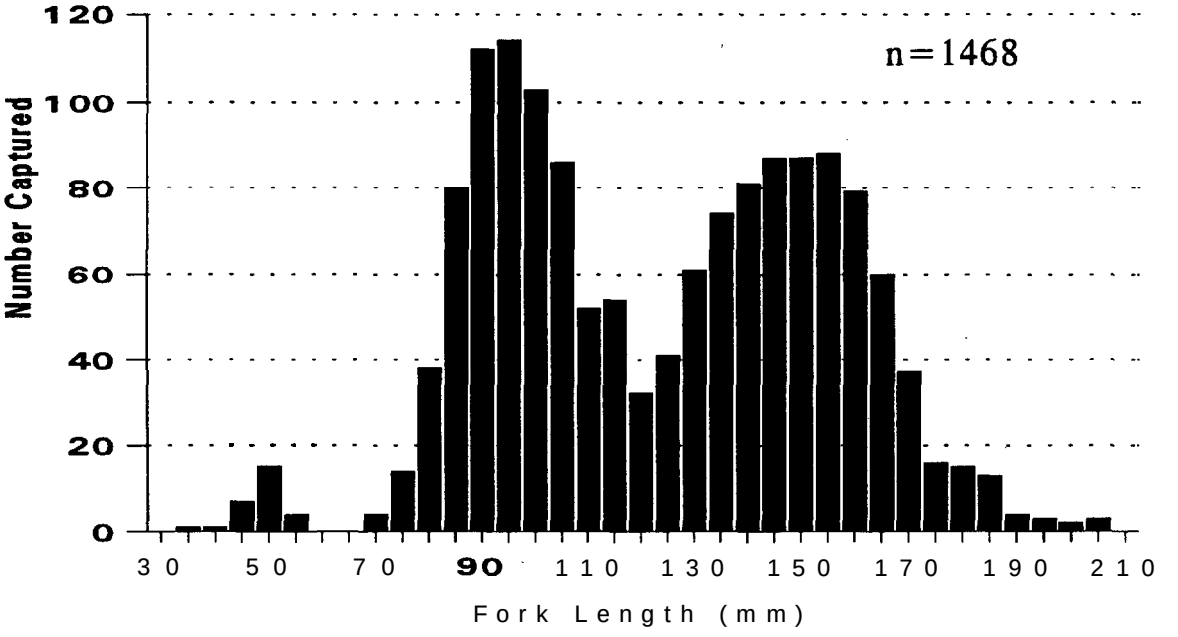


Figure G-20. Length Frequency of **Rainbow/Steelhead** Captured by the Pipe Traps in the Squaw Creek (RM 0.5) from April through June, 1994. **(Q3LFSTSS.CH3)**

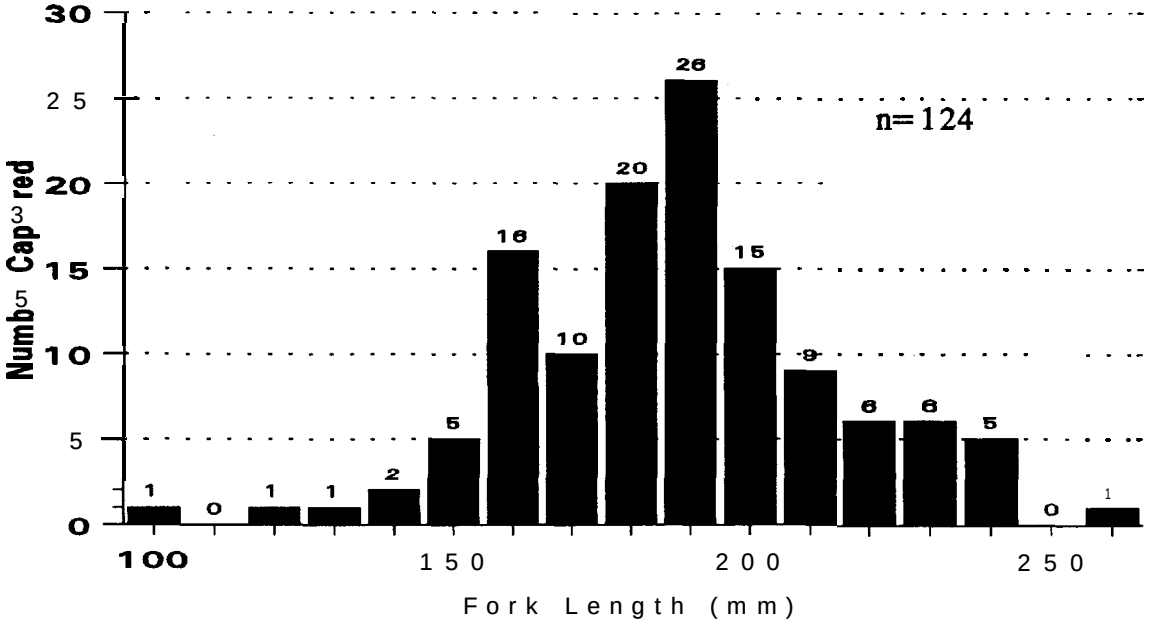


Figure G-21. Length Frequency of Juvenile **Rainbow/Steelhead** Captured at Three Mile Falls Dam, March 21, 1994, **n**= 124 **(PAUL3MD.CH3).**

APPENDIX H

Age and Growth Tables

Table H-l. Age Summary of the Umatilla River Natural Summer Steelhead Escapement in the Umatilla River, by sex, 1994.

Sex		AGE						
		1.1	1.2	2.1	2.2	3.1	3.2	Total
Female	n=	0	2	14	13	2	3	34
	%=	0	5.9	41.2	38.2	5.9	8.8	100.0
Male	n=	0	0	10	13	3	3	29
	%=	0	0	34.5	44.8	10.3	10.3	100.0
Total	n=	0	2	24	26	5	6	63
	%=	0	3.2	38.1	41.3	7.9	9.5	100.0

Table H-2. Brood Year Data of the 1994 Umatilla River Natural Summer Steelhead Escapement.

Sex		1990 Brood	1989 Brood	1988 Brood	Total
Female	n=	16	15	3	34
	%=	47.1	44.1	8.8	100.0
Male	n=	10	16	3	29
	%=	34.5	55.1	10.3	100.0
Total	n=	26	31	6	63
	%=	41.3	49.2	9.5	100.0

Table H-3. Freshwater Age Data of the 1994 Wild Summer Steelhead Escapement in the Umatilla River.

Sex		Age 1	Age 2	Age 3	Total
Female	n=	2	27	5	34
	%=	5.9	79.4	14.7	100
Male	n=	0	23	6	29
	%=	0	79.3	20.7	100
Total	n=	2	50	11	63
	%=	3.2	79.3	17.5	100.0

Table H-4. Ages Based on Scale Analysis and Expansions Based on Comparisons of Age vs. Fork Length of Juvenile Rainbow/Steelhead Sampled in Various Tributaries on the Umatilla River, 1993.

Boston Canyon Creek **August 31, - September 08, 1993**

Age	n=	Range (mm)	Mean (mm)	S.D.	L/F - Age Expansion	Percent
0	1	74	74		444	85.2
1	16	101-180	137.1	21.2	34	6.5
2	18	129-189	160.5	18.5	39	7.5
3	1	205	205		4	0.8

Line Creek **September 09, - September 20, 1993**

Age	n=	Range (mm)	Mean (mm)	S.D.	L/F - Age Expansion	Percent
0	7	62-76	67.7	5.8	245	64.1
1	34	82-149	111.6	17.3	110	28.8
2	13	127-195	157.3	22.0	25	6.5
3	1	186	186		2	0.5

Buckaroo Creek **September 20, - October 01, 1993**

Age	n=	Range (mm)	Mean (mm)	S.D.	L/F - Age Expansion	Percent
0	17	56-101	73.3	14.1	243	55.5
1	34	88-188	138.1	24.1	164	37.4
2	5	142-200	170.4	21.7	26	5.9
3	1	236	236		5	1.1

Meacham Creek **October 14, - November 09, 1993**

Age	n=	Range(mm)	Mean (mm)	S.D.	L/F - Age Expansion	Percent
0	8	81-112	92.9	10.3	1662	59.3
1	46	105-195	147.5	26.1	1093	39.0
2	10	195-282	233.9	26.8	36	1.3
3	6	262-400	298	51.2	11	0.4
4	1	257	257		1	0.0

Table H-5. Ages Based on Scale Analysis and Expansions Based on Comparisons of Age vs. Fork Length of Juvenile Rainbow/Steelhead Sampled in Various Tributaries of the Umatilla River, 1994.

Camp Creek June 20 - July **20, 1994**

Age	n=	Range (mm)	Mean (mm)	S.D.	L/F - Age Expansion	Percent
0		20-57			460	53.2
1	47	61-129	90.4	17.1	299	34.6
2	34	114-198	148.5	24.2	97	11.2
3	7	152-240	204	27.8	9	1.0

Squaw Creek **June 28 - August 03, 1994**

Age	n=	Range (mm)	Mean (mm)	S.D.	L/F - Age Expansion	Percent
0	40	32-88	55	13.1	1926	55.3
1	71	79-190	108.7	19.7	1285	36.9
2	26	112-208	150.2	25.5	247	7.1
3	5	180-267	223.2	34.4	26	.7

Umatilla River **August 30, - November 08, 1994**

Age	n=	Range (mm)	Mean (mm)	S.D.	L/F - Age Expansion	Percent
0	85	46-113	79.3	15.3	1640	79.3
1	66	97-208	150.4	27.6	378	18.3
2	17	133-235	187.4	31.8	42	2.0
3	6	194-294	235.2	42.2	9	0.4

Table H-6. Index Sites, Age and **Length** data, Umatilla River Basin, 1994.

SPECIES	DATE	LENGTH	INDEX LOCATION	Site #	Age
Rbt-n	03/29/94	098	Birch Creek	15	1
Rbt-n	03/29/94	132	Birch Creek	15	2
Rbt-n	03/29/94	136	Birch Creek	15	2
Rbt-n	03/29/94	140	Birch Creek	15	2
Rbt-n	03/29/94	141	Birch Creek	15	2
Rbt-n	04/15/04	147	Birch Creek	16	2
Rbt-n	04/15/94	150	Birch Creek	11	2
Rbt-n	04/15/94	155	Birch Creek	16	2
Rbt-n	04/15/94	174	Birch Creek	16	2
Rbt-n	04/15/94	175	Birch Creek	16	1
Rbt-n	04/15/94	204	Birch Creek	16	3
Rbt-n	04/15/94	220	Birch Creek	16	2
Rbt-n	03/21/94	075	Birch E.	20	1
Rbt-n	08/11/94	080	Birch E.	20	0
Rbt-n	11/18/94	084	Birch E.	20	1
Rbt-n	03/17/94	092	Birch E.	19	1
Rbt-n	03/21/94	092	Birch E.	20	2
Rbt-n	08/11/94	100	Birch E.	20	1
Rbt-n	03/21/94	101	Birch E.	20	2
Rbt-n	08/11/94	105	Birch E.	19	1
Rbt-n	03/21/94	107	Birch E.	20	2
Rbt-n	08/11/94	110	Birch E.	19	1
Rbt-n	08/11/94	115	Birch E.	20	1
Rbt-n	11/18/94	115	Birch E.	19	1
Rbt-n	11/18/94	115	Birch E.	20	-
Rbt-n	08/11/94	115	Birch E.	19	1
Fib-n	08/11/94	120	Birch E.		1
Rbt-n	03/21/94	123	Birch E.	20	2
Rbt-n	11/18/94	125	Birch E.	19	1
Rbt-n	08/11/94	125	Birch E.	19	1
Rbt-n	03/17/94	125	Birch E.	19	2
Rbt-n	11/18/94	126	Birch E.	20	1
Rbt-n	08/11/94	130	Birch E.	19	-
Rbt-n	11/18/94	130	Birch E.	19	1
Rbt-n	03/21/94	134	Birch E.	20	2
Rbt-n	08/11/94	14.0	Birch E.	19	1
Rbt-n	03/17/94	142	Birch E.	19	2
Rbt-n	08/11/94	143	Birch E.		1
Rbt-n	03/17/94	145	Birch E.	20	2
Rbt-n	11/18/94	146	Birch E.	19	1
Rbt-n	03/21/94	150	Birch E.	20	3
Rbt-n	08/11/94	152	Birch E.	19	1
Rbt-n	08/11/94	152	Birch E.	20	-
Rbt-n	11/18/94	153	Birch E.	20	-
Rbt-n	08/11/94	155	Birch E.	19	1
Rbt-n	08/11/94	160	Birch E.	19	1
Rbt-n	11/18/94	178.	Birch E.	19	2
Rbt-n	08/11/94	205	Birch E.	19	-
Rbt-n	08/11/94	220	Birch E.	19	3
Rbt-n	11/18/94	235	Birch E.	19	3
Rbt-n	03/17/94	245	Birch E.	19	3
Rbt-n	08/1 1/94	275	Birch E.	19	3
Rbt-n	03/18/94	064	Birch E. (Cali Gulch)	P-A	1
Rbt-n	03/18/94	089	Birch E. (Cali Gulch)	P-A	1
Rbt-n	03/18/94	110	Birch E. (Cali Gulch)	P-A	1
Rbt-n	03/18/94	115	Birch E. (Cali Gulch)	P-A	1
Rbt-n	03/18/94	155	Birch E. (Cali Gulch)	P-A	2
Rbt-n	03/18/94	174	Birch E. (Cali Gulch)	P-A	-
Rbt-n	03/18/94	183	Birch E. (Cali Gulch)	P-A	2
Rbt-n	03/18/94	247	Birch E. (Cali Gulch)	P-A	-
Rbt-n	03/18/94	061	Birch E. (Johnson Cr.)	P-A	1
Rbt-n	03/18/94	072	Birch E. (Johnson Cr.)	P-A	1
Rbt-n	03/18/94	060	Birch E. (Johnson Cr.)	P-A	1
Rbt-n	03/18/94	100	Birch E. (Johnson Cr.)	P-A	1
Rbt-n	03/18/94	110	Birch E. (Johnson Cr.)	P-A	1
Rbt-n	03/18/94	120	Birch E. (Johnson Cr.)	P-A	1
Rbt-n	03/18/94	138	Birch E. (Johnson Cr.)	P-A	-
Rbt-n	03/18/94	178	Birch E. (Johnson Cr.)		2
Rbt-n	03/18/94	183	Birch E. (Johnson Cr.)	P-A	2
Rbt-n	03/18/94	225	Birch E. (Johnson Cr.)	P-A	3
Rbt-n	03/21/94	066	Birch E. (South Canyon Spring)	P-A	1
Rbt-n	03/21/94	085	Birch E. (South Canyon Spring)		1
Rbt-n	03/21/94	110	Birch E. (South Canyon Spring)	P-A	2
Rbt-n	03/21/94	095	Birch E. (S. Canyon Cr.)	P-A	2
Rbt-n	03/21/94	115	Birch E. (S. Canyon Cr.)	P-A	2
Rbt-n	03/21/94	136	Birch E. (S. Canyon Cr.)	P-A	2
Rbt-n	03/21/94	139	Birch E. (S. Canyon Cr.)	P-A	2
Rbt-n	03/21/94	169	Birch E. (S. Canyon Cr.)	P-A	3
Rbt-n	03/28/94	084	Birch W.	18	1
Rbt-n	08/09/94	093	Birch W.	18	1
Rbt-n	03/28/94	096	Birch W.	18	1
Rbt-n	11118194	105	Birch W.	16	1
Rbt-n	11/18/94	115	Birch W.	18	1
Rbt-n	08/09/94	118	Birch W.	18	1
Rbt-n	11/18/94	125	Birch W.	18	1
Rbt-n	11/18/94	135	Birch W.	18	1
Rbt-n	03/28/94	140	Birch W.	18	2
Rbt-n	11/18/94	143	Birch W.	17	1
Rbt-n	03/28/94	147	Birch W.	18	2
Rbt-n	08/09/94	155	Birch W.	18	1
Rbt-n	11/18/94	158	Birch W.	17	2
Rbt-n	03/28/94	182	Birch W.	18	2
Rbt-n	03/16/94	185	Birch W.	17	2
Rbt-n	11/18/94	166	Birch W.	17	2
Rbt-n	03/28/94	167	Birch W.	18	2
Rbt-n	03/16/94	189	Birch W.	17	2
Rbt-n	08/09/94	170	Birch W.	17	1
Rbt-n	11/18/94	182	Birch W.	17	1
Rbt-n	03/28/94	197	Birch W.	18	2
Rbt-n	03/28/94	253	Birch W.	18	4
Rbt-n	03/28/94	280	Birch W.	18	2
Rbt-n	03/28/94	270	Birch W.	18	3
Rbt-n	03/28/94	085	Birch W. (Stanley Cr)	P-A	1
Rbt-n	03/28/94	099	Birch W. (Stanley Cr)	P-A	1
Rbt-n	03/28/94	117	Birch W. (Stanley Cr)	P-A	1
Rbt-n	03/28/94	154	Birch W. (Stanley Cr)	P-A	2
Rbt-n	03/28/94	182	Birch W. (Stanley Cr)	P-A	2
Rbt-n	03/29/94	075	Birch W. (Bear Creek)	P-A	1
Rbt-n	03/29/94	080	Birch W. (Bear Creek)	P-A	1
Rbt-n	03/30/94	097	Birch W. (Bear Creek)	P-A	1
Rbt-n	03/30/94	101	Birch W. (Bear Creek)	P-A	1
Rbt-n	08/16/94	115	Birch W. (Bear Creek)	22	1
Rbt-n	03/30/94	115	Birch W. (Bear Creek)	P-A	1
Rbt-n	03/30/94	120	Birch W (Bear Creek)	P-A	1
Rbt-n	08/16/94	123	Birch W. (Bear Creek)	22	1
Rbt-n	03/30/94	125	Birch W. (Bear Creek)	P-A	2
Rbt-n	08/16/94	128	Birch W. (Bear Creek)	22	1
Rbt-n	03/29/94	128	Birch W. (Bear Creek)	P-A	2
Rbt-n	03/30/94	134	Birch W. (Bear Creek)	P-A	2
Rbt-n	03/30/94	134	Birch W. (Bear Creek)	P-A	2
Rbt-n	08/16/94	140	Birch W. (Bear Creek)	22	1
Rbt-n	03/29/94	140	Birch W. (Bear Creek)	P-A	2
Rbt-n	03/29/94	141	Birch W. (Bear Creek)	P-A	2
Rbt-n	03/29/94	144	Birch W. (Bear Creek)	P-A	2
Rbt-n	03/30/94	146	Birch W. (Bear Creek)	P-A	2
Rbt-n	0at16/94	150	Birch W. (Bear Creek)	22	1
Rbt-n	08/16/94	155	Birch W. (Bear Creek)	22	1
Rbt-n	03/30/94	159	Birch W. (Bear Creek)	P-A	2
Rbt-n	03/29/94	180	Birch W. (Bear Creek)	P-A	2
Rbt-n	08/16/94	165	Birch W. (Bear Creek)	22	-
Rbt-n	08/16/94	173	Birch W. (Bear Creek)	22	2
Rbt-n	08/16/94	175	Birch W. (Bear Creek)	22	2
Rbt-n	08/16/94	180	Birch W. (Bear Creek)	22	2
Rbt-n	03/29/94	181	Birch W. (Bear Creek)	P-A	2
Rbt-n	0811 6/94	193	Birch W. (Bear Creek)	22	2
Rbt-n	03/29/94	198	Birch W. (Bear Creek)	P-A	3
Rbt-n	08/16/94	200	Birch W. (Bear Creek)	22	3
Rbt-n	03/30/94	201	Birch W. (Bear Creek)	P-A	3
Rbt-n	08/16/94	203	Birch W. (Bear Creek)	22	3
Rbt-n	03/29/94	207	Birch W. (Bear Creek)	P-A	3
Rbt-n	08/16/94	214	Birch W. (Bear Creek)	22	3
Rbt-n	08/16/94	215	Birch W. (Bear Creek)	22	3
Rbt-n	03/30/94	218	Birch W. (Bear Creek)	P-A	3
Rbt-n	03/30/94	233	Birch W. (Bear Creek)	P-A	4
Rbt-n	03/30/94	258	Birch W. (Bear Creek)	P-A	-
Rbt-n	03/28/94	093	Birch W. (Bridge Cr.)	P-A	1
Rbt-n	03/28/94	108	Birch W. (Bridge Cr.)	P-A	1
Rbt-n	11/18/94	131	Birch W. (Bridge Cr.)	23	1
Rbt-n	11/18/94	149	Birch W. (Bridge Cr.)	23	1
Rbt-n	11/18/94	180	Birch W. (Bridge Cr.)	23	1
Rbt-n	03/28/94	183	Birch W. (Bridge Cr.)	P-A	2
Rbt-n	08/09/94	202	Birch W. (Bridge Cr.)	23	-
Rbt-n	08/09/94	205	Birch W. (Bridge Cr.)	23	2
Rbt-n	11/18/94	207	Birch W. (Bridge Cr.)	23	2
Rbt-n	08/09/94	235	Birch W. (Bridge Cr.)	23	2
Rbt-n	03/18/94	080	Birch (Little Pearson Cr.)	P-A	1
Rbt-n	03/18/94	095	Birch (Little Pearson Cr.)	P-A	1
Rbt-n	03/18/94	125	Birch (Little Pearson Cr.)	P-A	2
Rbt-n	03/18/94	137	Birch (Little Pearson Cr.)	P-A	2
Rbt-n	03/18/94	178	Birch (Little Pearson Cr.)	P-A	3
Rbt-n	12/08/94	194	Birch (Lower Bear Creek)	21	2
Rbt-n	03/17/94	084	Birch (Pearson Cr)	24	1
Rbt-n	03/17/94	079	Birch (Pearson Cr)	24	1
Rbt-n	11/23/94	081	Birch (Pearson Cr)	24	1
Rbt-n	03/17/94	084	Birch (Pearson Cr)	24	1
Rbt-n	08/11/94	090	Birch (Pearson Cr)	24	1

Table H-6. Continued

SPECIES	DATE	LENGTH	INDEX LOCATION	Site #	Age
Rbt-n	08/11/94	105	Biih (Pearson Cr)	24	1
Rbt-n	08/11/94	110	Birch (Pearson Cr)	24	1
Rbt-n	11/23/94	110	Birch (Pearson Cr)	24	1
Rbt-n	11/23/94	118	Birch (Pearson Cr)	24	1
Rbt-n	08/11/94	125	Birch (Pearson Cr)	24	1
Rbt-n	03/17/94	125	Birch (Pearson Cr)	24	2
Rbt-n	11/23/94	128	Birch (Pearson Cr)	24	1
Rbt-n	08/11/94	132	Birch (Pearson Cr)	24	1
Rbt-n	11/23/94	142	Birch (Pearson Cr)	24	1
Rbt-n	08/11/94	145	Birch (Pearson Cr)	24	1
Rbt-n	08/11/94	159	Birch (Pearson Cr)	24	2
Rbt-n'	03/17/94	180	Birch (Pearson Cr)	24	3
Rbt-n	11/23/94	185	Birch (Pearson Cr)	24	3
Rbt-n	11/23/94	190	Birch (Pearson Cr)	24	3
Rbt-n	11/23/94	196	Birch (Pearson Cr)	24	
Rbt-n	08/1 1/94	197	Birch (Pearson Cr)	24	3
Rbt-n	03/17/94	127	Birch (Pearson Trib RM6)	P-A	2
Rbt-n	03/17/94	138	Birch (Pearson Trib RM6)	P-A	2
Rbt-n	03/17/94	164	Birch (Pearson Trib RM6)	P-A	2
Rbt-n	03/18/94	165	Birch (Pearson TribRM4.8)	P-A	3
Rbt-n	03/18/94	69	Birch (Pearson TribRM4.6)	P-A	1
Rbt-n	03/29/94	125	Birch (Stewart Cr.)	P-A	1
Rbt-n	03/29/94	135	Birch (Stewart Cr.)	P-A	1
Rbt-n	08/04/94	068	Buckaroo Creek	25	0
Rbt-n	08/04/94	132	Buckaroo Creek	25	1
Rbt-n	08/04/94	149	Buckaroo Creek	25	2
Rbt-n	08/04/94	153	Buckaroo Creek	25	1
Rbt-n	11/30/94	095	Cottonwood Cr.	P-A	1
Rbt-n	11/30/94	118	Cottonwood Cr.	P-A	1
Rbt-n	11/30/94	122	Cottonwood Cr.	P-A	
Rbt-n	11/30/94	129	Cottonwood Cr.	P-A	1
Rbt-n	05/03/94	057	Meacham Creek	33	1
Rbt-n	05/03/94	068	Meacham Creek	33	1
Rbt-n	05/03/94	070	Meacham Creek	33	1
Rbt-n	05/03/94	071	Meacham Creek	34	1
Rbt-n	04/22/94	072	Meacham Creek	30	1
Rbt-n	05/03/94	074	Meacham Creek	36	1
Rbt-n	05/03/94	075	Mmchem Creek	33	1
Rbt-n	05/03/94	075	Meacham Creek	33	1
Rbt-n	05/03/94	075	Mmcham creek	32	1
Rbt-n	08/02/94	076	Mmcham Creek	36	0
Rbt-n	04/22/94	077	Mmcham Creek	30	1
Rbt-n	05/03/94	077	Meacham Creek	33	1
Rbt-n	08/03/94	077	Mmchem Creek	34	1
Rbt-n	05/03/94	081	Meacham Creek	33	1
Rbt-n	05/03/94	083	Meacham Creek	34	1
Rbt-n	05/03/94	084	Meacham Creek	36	1
Rbt-n	05/03/94	085	Meacham Creek	34	1
Rbt-n	05/03/94	087	Meacham Creek	32	1
Rbt-n	08/02/94	087	Meacham Creek	36	1
Rbt-n	04/22/94	089	Meacham Creek	30	1
Rbt-n	05/03/94	090	Meacham Creek	33	1
Rbt-n	08/03/94	090	Meacham Creek	34	1
Rbt-n	08/17/94	090	Meacham Creek	30	0
Rbt-n	05/03/94	091	Meacham Creek	33	1
Rbt-n	04/22/94	092	Meacham Creek	30	1
Rbt-n	04/22/94	094	Meacham Creek	30	1
Rbt-n	05/03/94	094	Meacham Creek	36	1
Rbt-n	04/22/94	095	Meacham Creek	30	1
Rbt-n	08/03/94	095	Mmcham Creek	34	1
Rbt-n	08/03/94	100	Mmcham Creek	34	1
Rbt-n	08/02/94	100	Mmcham creek	36	1
Rbt-n	08/03/94	102	Meacham Creek	34	1
Rbt-n	08/02/94	104	Meacham Creek	36	1
Rbt-n	08/02/94	104	Meacham Creek	36	1
Rbt-n	08/03/94	105	Meacham Creek	34	1
Rbt-n	08/17/94	105	Meacham Creek	30	1
Rbt-n	04/22/94	105	Meacham Creek	30	1
Rbt-n	05/03/94	106	Meacham Creek	33	2
Rbt-n	05/03/94	106	Meacham Creek	-36	1
Rbt-n	11/21/94	109	Mmcham Creek	34	1
Rbt-n	08/02/94	112	Meacham Creek	36	1
Rbt-n	08/02/94	112	Meacham Creek	36	1
Rbt-n	08/03/94	113	Meacham Creek	34	1
Rbt-n	08/17/94	115	Meacham Creek	30	1
Rbt-n	04/22/94	115	Meacham Creek	34	2
Rbt-n	05/03/94	118	Meacham Creek	33	2
Rbt-n	08/17/94	120	Meacham Creek	30	1
Rbt-n	08/03/94	121	Meacham Creek	34	1
Rbt-n	05/03/94	123	Meacham Creek	33	2
Rbt-n	08/02/94	125	Mmcham Creek	36	1
Rbt-n	05/03/94	128	Mmcham Creak	36	2
Rbt-n	11/21/94	129	Mmcham Creek	34	1
Rbt-n	05/03/94	130	Meacham Creek	36	2

SPECIES	DATE	LENGTH	INDEX LOCATION	Site #	Age
Rbt-n	08/02/94	135	Meacham Creek	36	1
Rbt-n	04/22/94	142	Meacham Creek	30	2
Rbt-n	08/03/94	144	Meacham Creek	34	1
Rbt-n	05/03/94	145	Meacham Creek	36	2
Rbt-n	08/03/94	152	Meacham Creek	34	2
Rbt-n	08/02/94	155	Meacham Creek	36	2
Rbt-n	08/17/94	155	Meacham Creek	30	1
Rbt-n	08/02/94	164	Meacham Creek	36	2
Rbt-n	11/21/94	164	Meacham Creek	34	
Rbt-n	11/21/94	170	Meacham Creek	34	1
Rbt-n	11/21/94	172	Meacham Creek	34	2
Rbt-n	08/02/94	182	Meacham Creek	36	3
Rbt-n	08/03/94	185	Meacham Creek	34	2
Rbt-n	08/03/94	192	Meacham Creek	34	2
Rbt-n	08/02/94	193	Meacham Creek	36	2
Rbt-n	11/21/94	198	Meacham Creek	34	
Rbt-n	08/02/94	203	Meacham Creek	36	-
Rbt-n	08/03/94	213	Meacham Creek	34	2
Rbt-n	05/03/94	218	Meacham Creek	36	3
Rbt-n	08/17/94	231	Meacham Creek	30	2
Rbt-n	08/03/94	257	Meacham Creek	34	
Rbt-n	11/21/94	260	Meacham Creek	34	
Rbt-n	08/15/94	053	Mmchem (Boston Canyon)	28	0
Rbt-n	08/15/94	032	Meacham (Boston Canyon)	28	1
Rbt-n	11/17/94	084	Meacham (Boston Canyon)	28	1
Rbt-n	08/15/94	085	Meacham (Boston Canyon)	28	1
Rbt-n	11/17/94	097	Meacham (Boston Canyon)	26	1
Rbt-n	08/15/94	104	Mmcham (Boston Canyon)	28	1
Rbt-n	08/15/94	155	Meacham (Boston Canyon)	28	
Rbt-n	08/15/94	185	Meacham (Boston Canyon)	28	2
Rbt-n	08/15/94	189	Meacham (Boston Canyon)	28	2
Rbt-n	08/15/94	190	Meacham (Boston Canyon)	20	3
Rbt-n	03/29/94	201	Mmcham (Boston Canyon)	28	2
Rbt-n	08/15/94	215	Meacham (Boston Canyon)	28	3
Rbt-n	03/29/94	217	Meacham (Boston Canyon)	28	3
Rbt-n	11/17/94	068	Meacham (Camp Cr.)	31	0
Rbt-n	08/15/94	078	Meacham (Camp Cr.)	31	1
Rbt-n	03/23/94	085	Meacham (Camp Cr.)	31	2
Rbt-n	08/15/94	087	Mmcham (Camp Cr.)	31	1
Rbt-n	03/23/94	100	Meacham (Camp Cr.)	31	2
Rbt-n	08/15/94	107	Meacham (Camp Cr.)	31	1
Rbt-n	08/15/94	115	Meacham (Camp Cr.)	31	1
Rbt-n	03/23/94	121	Meacham (Camp Cr.)	31	2
Rbt-n	08/15/94	128	Meacham (Can-p Cr.)	31	1
Rbt-n	08/15/94	129	Meacham (Camp Cr.)	31	1
Rbt-n	08/15/94	145	Meacham (Camp Cr.)	31	2
Rbt-n	03/23/94	148	Mmchem (Camp Cr.)	31	2
Rbt-n	11/17/94	166	Mmchem (Camp Cr.)	31	
Rbt-n	08/15/94	170	Meacham (Camp Cr.)	31	
Rbt-n	08/15/94	176	Meacham (Camp Cr.)	31	2
Rbt-n	08/15/94	209	Meacham (Camp Cr.)	31	3
Rbt-n	11/17/94	211	Meacham (Camp Cr.)	31	
Rbt-n	08/15/94	214	Meacham (Camp Cr.)	31	-
Rbt-n	08/15/94	220	Meacham (Camp Cr.)	31	3
Rbt-n	03/23/94	225	Meacham (Camp Cr.)	31	4
Rbt-n	08/02/94	040	Meacham (East)	35	0
Rbt-n	08/02/94	043	Meacham (East)	35	0
Rbt-n	08/02/94	045	Meacham (East)	35	0
Rbt-n	05/02/94	052	Mmcham (East)	35	1
Rbt-n	11/21/94	060	Meacham (East)	35	0
Rbt-n	11/21/94	062	Meacham (East)	35	0
Rbt-n	05/02/94	066	Meacham (East)	35	1
Rbt-n	05/02/94	067	Meacham (East)	35	1
Rbt-n	08/02/94	075	Mmchem (East)	35	1
Rbt-n	11/21/94	078	Meacham (East)	35	1
Rbt-n	05/02/94	081	Meacham (East)	35	1
Rbt-n	08/02/94	083	Meacham (East)	35	1
Rbt-n	11/21/94	085	Meacham (East)	35	1
Rbt-n	08/02/94	093	Mmcham (East)	35	0
Rbt-n	11/21/94	093	Mmcham (East)	35	1
Rbt-n	05/02/94	094	Meacham (East)	35	2
Rbt-n	11/21/94	100	Meacham (East)	35	1
Rbt-n	05/02/94	100	Meacham (East)	35	1
Rbt-n	08/02/94	105	Meacham (East)	35	1
Rbt-n	08/02/94	115	Mmcham (East)	35	1
Rbt-n	11121194	117	Mmcham (East)	35	1
Rbt-n	08/02/94	125	Mmcham (East)	35	1
Rbt-n	05/02/94	131	Mmcham (East)	35	2
Rbt-n	05/02/94	131	Meacham (East)	35	2
Rbt-n	11/21/94	141	Meacham (East)	35	2
Rbt-n	08/02/94	141	Meacham (East)	35	2
Rbt-n	08/02/94	152	Meacham (East)	35	2

Table H-6. Continued

SPECIES	DATE	LENGTH	INDEX LOCATION	Site #	Age
Rbt-n	03/22/94	074	Meacham (Line Cr)	29	1
Rbt-n	03/22/94	095	Meacham (Line Cr)	29	1
Rbt-n	03/22/94	105	Meacham (Line Cr)	29	1
Rbt-n	08/03/94	110	Meacham (Line Cr)	29	1
Rbt-n	11/17/94	127	Meacham (Line Cr)	29	1
Rbt-n	08/03/94	054	Meacham (North Fork)	32	0
Rbt-n	08/10/94	083	Meacham (North Fork)	33	1
Rbt-n	05/03/94	085	Maacham (North Fork)	32	1
Rbt-n	08/03/94	088	Meacham (North Fork)	32	1
Rbt-n	08/03/94	090	Maacham (North Fork)	32	1
Rbt-n	08/10/94	090	Maacham (North Fork)	33	1
Rbt-n	08/10/94	096	Maacham (North Fork)	33	1
Rbt-n	08/03/94	100	Meacham (North Fork)	32	1
Rbt-n	12/06/94	100	Meacham (North Fork)	33	1
Rbt-n	05/03/94	100	Meacham (North Fork)	32	1
Rbt-n	08/03/94	100	Maacham (North Fork)	32	1
Ftbt-n	08/10/94	101	Maacham (North Fork)	33	1
Rbt-n	08/03/94	106	Maacham (North Fork)	32	1
Rbt-n	08/03/94	108	Maacham (North Fork)	32	1
Rbt-n	12/06/94	110	Maacham (North Fork)	33	1
Rbt-n	08/10/94	110	Maacham (North Fork)	33	1
Rbt-n	08/10/94	110	Meacham (North Fork)	33	1
Rbt-n	05/03/94	113	Meacham (North Fork)	32	2
Rbt-n	08/10/94	114	Meacham (North Fork)	33	1
Rbt-n	05/03/94	115	Meacham (North Fork)	32	2
Rbt-n	08/03/94	117	Maacham (North Fork)	32	1
Rbt-n	12/06/94	119	Maacham (North Fork)	33	1
Rbt-n	12/06/94	120	Meacham (North Fork)	33	1
Rbt-n	12/06/94	130	Meacham (North Fork)	32	1
Rbt-n	08/03/94	132	Meacham (North Fork)	32	1
Rbt-n	08/03/94	135	Meacham (North Fork)	32	1
Rbt-n	08/10/94	137	Meacham (North Fork)	33	
Rbt-n	08/10/94	145	Meacham (North Fork)	33	2
Rbt-n	12/06/94	155	Maacham (North Fork)	33	2
Rbt-n	08/10/94	156	Maacham (North Fork)	33	2
Rbt-n	08/03/94	174	Maacham (North Fork)	32	2
Rbt-n	08/03/94	177	Maacham (North Fork)	32	2
Rbt-n	08/10/94	176	Maacham (North Fork)	33	2
Rbt-n	08/03/94	162	Meacham (North Fork)	32	2
Rbt-n	08/03/94	196	Maacham (North Fork)	32	2
Rbt-n	08/03/94	206	Maacham (North Fork)	32	2
Rbt-n	08/10/94	210	Maacham (North Fork)	33	3
Rbt-n	08/10/94	217	Meacham (North Fork)	33	–
Rbt-n	08/03/94	236	Meacham (North Fork)	32	3
Rbt-n	08/03/94	257	Meacham (North Fork)	32	3
Rbt-n	08/10/94	300	Meacham (North Fork)	33	3
Rbt-n	08/10/94	305	Maacham (North Fork)	33	–
Rbt-n	08/10/94	310	Meacham (North Fork)	33	–
Rbt-n	08/03/94	340	Meacham (North Fork)	32	–
Rbt-n	08/10/94	370	Maacham (North Fork)	33	–
Rbt-n	05/02/94	066	Meacham (Owsley Cr.)	P-A	1
Rbt-n	05/02/94	061	Maacham (Owslay Cr.)	P-A	1
Rbt- n	05/02/94	102	Meacham (Owsley Cr.)	P-A	1
Rbt-n	05/02/94	110	Meacham (Owsley Cr.)	P-A	2
Rbt-n	05/02/94	115	Maacham (Owsley Cr.)	P-A	2
Rbt-n	05/02/94	162	Maacham (Owsley Cr.)	P-A	2
Rbt-n	08/02/94	096	Meacham (Sheep Cr.)	RM.3	1
Rbt-n	11/30/94	097	Mission Craak	P-A	0
Rbt-n	11/30/94	118	Mission Creek	P-A	1
Rbt-n	11/30/94	136	Mission Creek	P-A	1
Rbt-n	11/30/94	144	Mission Craak	P-A	
Rbt-n	11/30/94	156	Mission Creek	P-A	
Rbt-n	11/30/94	168	Mission Creek	P-A	2
Rbt-n	11/30/94	178	MissionCreek	P-A	2
Rbt-n	11/30/94	Ia5	Mission Creek	P-A	
CHS	11/30/94	086	Moonshine Cr.	P-A	0
Rbt-n	11/30/94	094	Moonshine Cr.	P-A	0
Rbt-n	11/30/94	142	Moonshine Cr.	P-A	1
Rbt-n	11/30/94	144	Moonshine Cr.	P-A	1
Rbt-n	11/30/94	146	Moonshine Cr.	P-A	1
Rbt-n	11/30/94	156	Moonshine Cr.	P-A	1
Rbt-n	11/30/94	196	Moonshine Cr.	P-A	
Rbt-n	12/01/94	114	Patawa Craak	P-A	1
Rbt-n	12/01/94	136	Patawa Creek	P-A	1
Rbt-n	12/01/94	142	Patawa Creek	P-A	2
Rbt-n	04/20/94	072	Ryan Creek	37	1
Rbt-n	04/20/94	095	Ryan Craak	37	2
Rbt-n	08/16/94	096	Ryan Creek	37	1
Rbt-n	04/20/94	104	Ryan Creek	37	2
Rbt-n	08/16/94	110	Ryan Creak	37	1
Rbt-n	04/20/94	110	Ryan Creek	37	2
Rbt-n	04/20/94	124	Ryan Creek	37	2
Rbt-n	08/16/94	130	Ryan Creek	37	2
Rbt-n	08/16/94	135	Ryan Creak	37	2
Rbt-n	08/16/94	142	Ryan Creek	37	2
Rbt-n	08/16/94	150	Ryan Creek	37	2
Ftbt-n	04/20/94	152	Ryan Creek	37	2
Rbt-n	04/20/94	168	Ryan Creek	37	2
Rbt-n	08/16/94	180	Ryan Creek	37	2
Rbt-n	04/20/94	111	Ryan Creek (UnTri)	P-A	2
Rbt-n	08/01/94	a47	Squaw Creek	26	0
Rbt-n	08/01/94	056	Squaw Creek	26	0
Rbt-n	08/01/94	057	Squaw Creak	26	0
Rbt-n	04/01/94	066	squaw creek		1
Rbt-n	11/22/94	075	Squaw Creek	26	0
Rbt-n	03/22/94	085	Squaw Creek	26	1
Rbt-n	08/10/94	085	Squaw Creek	27	1
Rbt-n	08/01/94	089	Squaw Creek	26	0
Rbt-n	08/10/94	a92	Squaw creek	27	1
Rbt-n	8/01/94	094	Squaw creek	26	1
Rbt-n	08/10/94	100	Squaw creek	27	1
Rbt-n	08/01/94	100	squaw creek	26	1
Rbt-n	03/22/94	101	squaw Creek	26	1
Rbt-n	08/01/94	112	squaw creek	26	1
Rbt-n	08/01/94	120	squaw creek	26	1
Rbt-n	8/01/94	124	Squaw Creek	26	1
Rbt-n	08/10/94	127	Squaw Creek	27	1
Rbt-n	11/22/94	135	Squaw Creek	27	2
Rbt-n	08/01/94	135	squaw creek	26	1
Rbt-n	08/01/94	147	Squaw Creek	26	1
Rbt-n	08/10/94	147	squaw creek	27	1
Rbt-n	08/01/94	146	squaw creek	26	2
Rbt-n	11/22/94	148	Squaw Creek	27	2
Rbt-n	04/06/94	171	Squaw Creek	27	2
Rbt-n	08/01/94	176	Squaw Creek	26	2
Rbt-n	08/10/94	180	Squaw Creek	27	2
Rbt-n	11/22/94	163	Squaw Creek	26	1
Rbt-n	11/22/94	210	Squaw Creek	27	
Rbt-n	04/06/94	054	Squaw Cr. (UnTrRM5)	P-A	1
Rbt-n	04/06/94	070	Squaw Cr. (UnTrRM5)	P-A	1
Rbt-n	04/06/94	076	Squaw Cr. (UnTrRM5)	P-A	1
Rbt-n	04/06/94	112	Squaw Cr. (UnTrRM5)	P-A	2
Rbt-n	04/06/94	132	Squaw Cr. (UnTrRM5)	P-A	2
Rbt-n	04/06/94	145	Squaw Cr. (UnTrRM5)	P-A	2
Rbt-n	04/06/94	167	Squaw Cr. (UnTrRM5)	P-A	2
Rbt-n	03/22/94	065	Squaw (Bachlor Canyon Cr.)	P-A	1
Rbt-n	03/22/94	005	Squaw (Bachlor Canyon Cr.)	P-A	1
Rbt-n	03/22/94	095	Squaw (Bachlor Canyon Cr.)	P-A	2
Rbt-n	03/22/94	113	Squaw (Sachlor Canyon Cr.)	P-A	2
Rbt-n	03/22/94	134	Squaw (Sachlor Canyon Cr.)	P-A	2
Rbt-n	04/06/94	073	Squaw (Little Squaw Cr.RM.5)	P-A	1
Rbt-n	04/06/94	073	Squaw (Little Squaw Cr.RM.7)	P-A	1
Rbt-n	04/06/94	084	Squaw (Little Squaw Cr.RM.7)	P-A	1
Rbt-n	04/06/94	133	Squaw (Little Squaw Cr.RM.7)	P-A	2
Rbt-n	04/06/94	137	Squaw (Little Squaw Cr.RM.7)	P-A	2
Rbt-n	04/06/94	072	Squaw (Little Squaw Cr.)	P-A	1
Rbt-n	04/06/94	094	Squaw (Little Squaw Cr.)	P-A	1
Rbt-n	04/06/94	115	Squaw (Little Squaw Cr.)	P-A	2
Rbt-n	04/06/94	123	Squaw (Little Squaw Cr.)	P-A	2
Rbt-n	04/06/94	134	Squaw (little Squaw Cr.)	P-A	2
Rbt-n	04/06/94	207	Squaw (Little Squaw Cr.)	P-A	4
Rbt-n	04/06/94	070(?)	Squaw (Un Trib RM5)	P-A	2
Rbt-n	04/06/94	100	Squaw (Un Trib RM5)	P-A	2
Rbt-n	04/20/94	073	Trib.2miaboveRYAN	P-A	1
Rbt-n	04/11/94	073	Umatilh N. F.	11	1
CHS	08/09/94	080	Umatilh N.F.	11	0
Rbt-n	08/09/94	080	Umatilia N.F.	11	1
Rbt-n	11/10/94	061	Umatilh N.F.	12	0
Rbt-n	08/09/94	085	Umatilla N.F.	12	1
Rbt-n	08/09/94	085	Umatilla N.F.	11	1
Rbt-n	04/08/94	094	Umatilla N.F.	12	2
CHS	08/09/94	094	Umatilla N.F.	11	0
Rbt-n	08/09/94	095	Umatilla N. F.	11	1
Rbt-n	04/11/94	099	Umatilia N.F.	11	2
Rbt-n	08/09/94	100	Umatilh N.F.	12	2
Rbt-n	11/10/94	100	Umatilia N. F.	12	1
Rbt-n	04/08/94	100	Umatilla N.F.	12	1
Rbt-n	08/09/94	101	Umatilla N.F.	11	1
Rbt-n	08/09/94	110	Umatilla N.F.	11	
Rbt-n	04/08/94	113	Umatilk N.F.	12	2
Rbt-n	08/09/94	115	Umatilla N.F.	12	2
Rbt-n	08/09/94	125	Umatilla N.F.	11	2
Rbt-n	08/09/94	125	Urnatilla N.F.	12	2
Rbt-n	04/08/94	126	Umatilla N.F.	12	2
Ftbt-n	08/09/94	135	Umatilla N.F.	10	2
Rbt-n	08/09/94	135	Umatilla N.F.	10	1
Rbt-n	08/09/94	140	Umatilla N.F.	10	1
Rbt-n	08/09/94	150	Umatilla N.F.	11	2
Rbt-n	08/09/94	150	Umatilh N.F.	12	2
Rbt-n	04/11/94	151	Umatilla N.F.	11	3

Table H-6. Continued

SPECIES	DATE	LENGTH	INDEX LOCATION	Site #	Age
Rbt-n	08/09/94	155	Umatilla N.F.	11	2
Rbt-n	04/11/94	159	Umatilh N.F.	11	2
Rbt-n	11/10/94	166	Umatilla N. F.	12	2
Rbt-n	04/08/94	168	Umatilla N.F.	12	3
Rbt-n	08/09/94	170	Umatilla N. F.	11	3
Rbt-n	08/09/94	174	Umatilla N.F.	10	2
Rbt-n	08/09/94	177	Umatilla N.F.	10	2
Rbt-n	08/09/94	180	Umatilla N. F.	12	
Rbt-n	08/09/94	185	Umatilta N.F.	12	2
Rbt-n	08/09/94	Ia9	Umatilla N.F.	11	3
Rbt-n	08/09/94	200	Umatilla N.F.	10	2
Rbt-n	08/09/94	222	Umatilla N.F.	12	3
Rbt-n	04/11/94	077	Umatilla N.F. (Un Trib RM1.5)	P-A	1
Rbt-n	04/11/94	094	Umatilla N.F. (Un Trib RM1.5)	P-A	2
Rbt-n	04/11/94	098	Umatilla N.F. (Un Trib RMI.5)	P-A	2
Rbt-n	04/11/94	113	Umatilla N.F. (Un Trib RM1.5)	P-A	2
Rbt-n	04/11/94	122	Umatilta N.F. (Un Trib RM1.5)	P-A	2
Rbt-n	04/11/94	175	Umatilta N.F. (Un Trib RMI.5)	P-A	3
Rbt-n	04/11/94	200	Umatilla N.F. (Un Trib RM1.5)	P-A	3
Rbt-n	04/08/94	061	Umatilla N.F. (Coyote Cr.)	P-A	1
Rbt-n	04/08/94	061	Umatilta N.F. (Coyote Cr.)	P-A	1
Rbt-n	04/08/94	104	Umatilla N. F. (Coyote Cr.)	P-A	2
Rbt-n	04/08/94	126	Umatilta N.F. (Coyote Cr.)	P-A	2
Rbt-n	04/08/94	127	Umatilla N.F. (Coyote Cr.)	P-A	3
Rbt-n	04/08/94	132	Umatilla N.F. (Coyote Cr.)	P-A	3
Rbt-n	04/08/94	144	Umatilla N.F. (Coyote Cr.)	P-A	
Rbt-n	04/08/94	154	Umatilla N.F. (Coyote Cr.)	P-A	2
Rbt-n	04/08/94	159	Umatilla N.F. (Coyote Cr.)	P-A	3
Rbt-n	08/11/94	052	Umatilh River	07	0
Rbt-n	08/11/94	060	Umatilh River	07	0
CHS	08/15/94	062	Umatilb River	08	0
Rbt-n	04/29/94	065	Umatilh River	10	1
Rbt-n	04/29/94	065	Umatilh River	09	1
Rbt-n	04/29/94	074	Umatilla River	09	1
Rbt-n	04/29/94	074	Umatilh River	09	1
CHS	08/10/94	074	Umatilla River	09	0
Coho	11/28/94	075	Umatilh River	04	0
Rbt-n	04/29/94	076	UmatillaRiver	IO	1
Rbt-n	04/29/94	077	Umatilh River	10	1
Rbt-n	04/22/94	077	Umatilh River	08	1
CHS	08/15/94	077	UmatillaRiver	08	0
Fibt-n	04/29/94	079	Umatilla River	10	1
CHS	11/24/94	081	UmatillaRiver	07	0
Rbt-n	04/29/94	081	Umatilla River	09	1
Rbt-n	04/29/94	081	UmatillaRiver	09	1
Rbt-n	11/29/94	082	UmatillaRiver	07	0
Rbt-n	04/22/94	082	UmatiltaRiver	08	1
Rbt-n	04/29/94	083	Umatilla River	10	1
Rbt-n	08/15/94	084	Umatilla River	08	0
CHS	08/15/94	084	Umatilla River	08	0
Coho	11/28/94	085	Umatilla River	04	
MWTF	08/10/94	085	Umatilb River	09	8
Rbt-n	04/22/94	085	Umatilh River	08	1
Rbt-n	11/29/94	087	Umatilh River	07	0
Rbt-n	04/22/94	088	Umatilla River	08	1
Rbt-n	04/29/94	088	UmatillaRiver	10	1
Rbt-n	04/29/94	090	Umatilh River	09	1
CHS	08/10/94	090	UmatillaRiver	09	0
CHS	11/28/94	091	Umatilb River	05	0
Rbt-n	04/29/94	092	Umatilh River	IO	1
Rbt-n	04/29/94	092	Umatilh River	IO	1
Rbt-n	08/11/94	093	Umatilh River	07	0
Rbt-n	04/29/94	095	Umatilla River	09	1
Rbt-n	05/05/94	096	Umatilla River	07	1
Rbt-n	04/29/94	096	UmatillaRiver	09	1
CHS	11/24/94	097	UmatillaRiver	07	0
Rbt-n	04/29/94	097	Umatilla River	IO	1
Rbt-n	04/29/94	105	Umatilla River	09	1
Coho	04/25/94	107	UmatiliaRiver	04	1
Rbt-n	08/15/94	107	UmatillaRiver	01	0
Rbt-n	04/29/94	108	UmatillaRiver	10	2
Rbt-n	08/15/94	112	UmatillaRiver	01	0
Rbt-n	04/29/94	114	Umatilh River	09	2
Rbt-n	08/15/94	115	Umatilla River	08	1
Coho	04/25/94	115	UmatillaRiver	04	1
Rbt-n	08/10/94	115	UmatillaRiver	09	1
Rbt-n	05/05/94	118	Umatilb River	07	1
Rbt-n	08/15/94	119	Umatilla River	08	1
Coho	04/28/94	121	UmatillaRiver	06	H
Coho	04/25/94	130	Umatilla River	04	1
Rbt-n	08/15/94	130	Umatilla River	08	1
Rbt-n	08/15/94	138	UmatillaRiver	08	1
Rbt-n	08/11/94	142	UmatillaRiver	07	1
Rbt-n	04/29/94	142	UmatillaRiver	09	2
Rbt-n	04/29/94	143	UmatillaRiver	IO	2
Rbt-n	04/29/94	145	UmatillaRiver	09	2
Rbt-n	08/10/94	145	UmatillaRiver	09	1
Rbt-n	08/11/94	150	Umatilla River	07	1
Rbt-n	05/05/94	153	UmatillaRiver	07	2
Rbt-n	08/15/94	153	Umatilb River	08	1
Rbt-n	05/05/94	160	Umatilh River	07	2
Rbt-n	04/29/94	163	UmatillaRiver	09	3
CHS-adu	11/28/94	166	Umatilla River	05	H
Rbt-n	08/15/94	173	UmatillaRiver	01	2
Rbt-n	08/10/94	179	UmatiltaRiver	09	1
Rbt-n	08/15/94	180	UmatillaRiver	08	1
Rbt-n	08/10/94	210	Umatilla River	09	2
Rbt-n	08/15/94	210	UmatillaRiver	08	2
Rbt-n	08/10/94	210	UmatillaRiver	09	2
Rbt-n	08/15/94	222	Umatilb River	08	3
Rbt-adh	11/29/94	250	Umatilb River	07	H
Rbt-n	08/11/94	312	UmatillaRiver	07	3
Rbt-n	04/29/94	64	Umatilh River	10	1
Rbt-n	08/10/94	058	Umatilla S.F.	13	0
Rbt-n	08/10/94	082	Umatilh SF.	13	0
Rbt-n	08/10/94	070	Umatilla S.F.	14	0
Rbt-n	08/10/94	073	Umatilla S.F.	14	1
Rbt-n	04/11/94	078	Umatilla S.F.	13	1
CHS	11/14/94	080	UmatillaS.F.	13	0
Rbt-n	11/22/94	081	Umatilh S.F.	14	0
Rbt-n	08/10/94	092	Umatilh S. F.	14	1
Rbt-n	11/22/94	108	Umatilla S. F.	14	1
Rbt-n	08/10/94	110	Umatilh S. F.	14	1
Rbt-n	08/10/94	110	Umatilh S.F.	13	1
Rbt-n	08/10/94	110	Umatilb S.F.	13	1
Rbt-n	08/10/94	115	Umatilh S.F.	13	1
Rbt-n	08/10/94	115	Umatilh SF.	13	
Rbt-n	11/22/94	115	Umatilh S.F.	14	1
Rbt-n	08/10/94	115	Umatilla S.F.	14	1
Rbt-n	08/10/94	120	Umatilla S. F.	13	2
Rbt-n	08/10/94	122	Umatilla S.F.	13	2
Rbt-n	08/10/94	125	Umatilh S.F.	14	1
Rbt-n	08/10/94	135	Umatilh S.F.	14	
Rbt-n	11/22/94	137	Umatilh S.F.	14	2
Rbt-n	08/10/94	140	UmatillaS.F.	13	2
Rbt-n	08/10/94	144	UmatillaS.F.	14	2
Rbt-n	08/10/94	145	Umatilh S.F.	13	
Rbt-n	08/10/94	150	UmatillaS.F.	14	2
Rbt-n	08/10/94	160	UmatillaS.F.	14	2
Rbt-n	08/10/94	165	Umatilla S. F.	14	2
Rbt-n	08/10/94	181	Umatilla S. F.	13	2
Rbt-n	11/14/94	200	Umatilla S.F.	13	3
Rbt-n	05/05/94	054	Umatilla S.F. (Shimmehom)	40	1
Rbt-n	05/05/94	061	Umatilla S. F. (Shimmehom)	40	1
Rbt-n	08/10/94	075	Umatilla S.F. (Shimmehom)	40	0
Rbt-n	08/10/94	085	Umatilla S.F. (Shimmehom)	40	1
Rbt-n	08/10/94	090	Umatilla S.F. (Shimmehom)	40	1
Rbt-n	08/10/94	092	Umatilla SF. (Shimmehom)	40	1
Rbt-n	05/05/94	102	Umatilla S.F. (Shimmehom)	40	2
Rbt-n	08/10/94	105	Umatilh S.F. (Shimmehom)	40	1
Rbt-n	08/10/94	114	Umatilla S.F. (Shimmehom)	40	1
Rbt-n	08/10/94	120	Umatilla SF. (Shimmehom)	40	
Rbt-n	08/10/94	125	Umatilia S.F. (Shimmehom)	40	1
Rbt-n	08/10/94	130	Umatilla S.F. (Shimmehom)	40	1
Rbt-n	08/10/94	131	Umatilla S.F. (Shimmehom)	40	2
Rbt-n	05/05/94	132	Umatilh S.F. (Shimmehom)	40	2
Rbt-n	08/10/94	141	Umatilla S.F. (Shimmehom)	40	2
Rbt-n	08/10/94	156	Umatilia SF. (Shimmehom)	40	
Rbt-n	08/10/94	176	Umatilla S.F. (Shimmehom)	40	2
Rbt-n	04/14/94	061	Umatilh S.F. (Spring Creek)	39	1
Rbt-n	08/04/94	070	Umatilla S.F. (Spring Creek)	39	1
Wt-n	04/14/94	072	Umatilh S.F. (Spring Creek)	39	1
Rbt-n	08/04/94	079	Umatilla S.F. (Spring Creek)	39	1
Rbt-n	08/04/94	068	Umatilh S.F. (Spring Creek)	39	1
Rbt-n	03/14/94	090	Umatilla S.F. (Spring Creek)	39	2
Rbt-n	08/04/94	094	Umatilta S.F. (Spring Creek)	39	1
Rbt-n	08/04/94	105	Umatilla S.F. (Spring Creek)	39	1
Rbt-n	08/04/94	118	Umatilh S.F. (Spring Creek)	39	2
Rbt-n	08/04/94	122	Umatilh S.F. (Spring Creek)	39	1
Rbt-n	08/04/94	137	Umatilla S.F. (Spring Creek)	39	2
Rbt-n	08/04/94	155	Umatilh S.F. (Spring Creek)	39	3
Rbt-n	04/14/94	174	Umatilla S.F. (Spring Creek)	39	3
Rbt-n	08/04/94	166	Umatilia SF. (Spring Creek)	39	2
Rbt-n	08/04/94	211	Umatilla SF. (Spring Creek)	39	
Rbt-n	11/14/94	39	Umatilh SF. (Spring Creek)	39	0
Rbt-n	04/14/94	080	Umatilh S.F. (Un Trib RM2)	P-A	1
Rbt-n	04/14/94	083	Umatilla S.F. (Un Trib RM2)	P-A	1
Rbt-n	04/14/94	083	Umatilla S.F. (Un Trib RM2)	P-A	1
Rbt-n	04/14/94	094	Umatilla S.F. (Un Trib RM2)	P-A	1

APPENDIX I

Bull Trout Observations

Table I-1. Summary of Bull Trout Observations in the Umatilla River Basin, 1992 through 1994.

STREAM / LOCATION	DATE(s)	NUMBER	LENGTH	METHOD
Meacham Creek (RM 1.5)	December '93 to June '94	2	148, 210	Rotary Trap
Umatilla Trap (RM 79.5)	April '93 to June '94	139	120 to 390	Rotary Trap
Squaw Creek Trap	January '94 to June '94	1	211	Pipe Trap
Coyote Creek, North Fork Umatilla Tributary	April '94	1	125	Electro.
N.F. Umatilla (RM .75)	November '92	1	265	Electro.
N.F. Umatilla (RM 3)	August '93	1	140	Mort.
Buck Creek, South Fork Umatilla Tributary	May '92	1	160	Electro.
Umatilla (RM 80)	June '94	1	390	Mort. *
Umatilla (RM 78.5)	June ,93	1	150	Electro.
Squaw Creek (RM 1)	October '92	1	210	Electro.
Squaw Creek (RM 7)	July '94	1	~150	Observ.
Meacham Creek (RM 1-9)	August '92	1	270	Mort.

* Angling related mortality; hooks in gills.

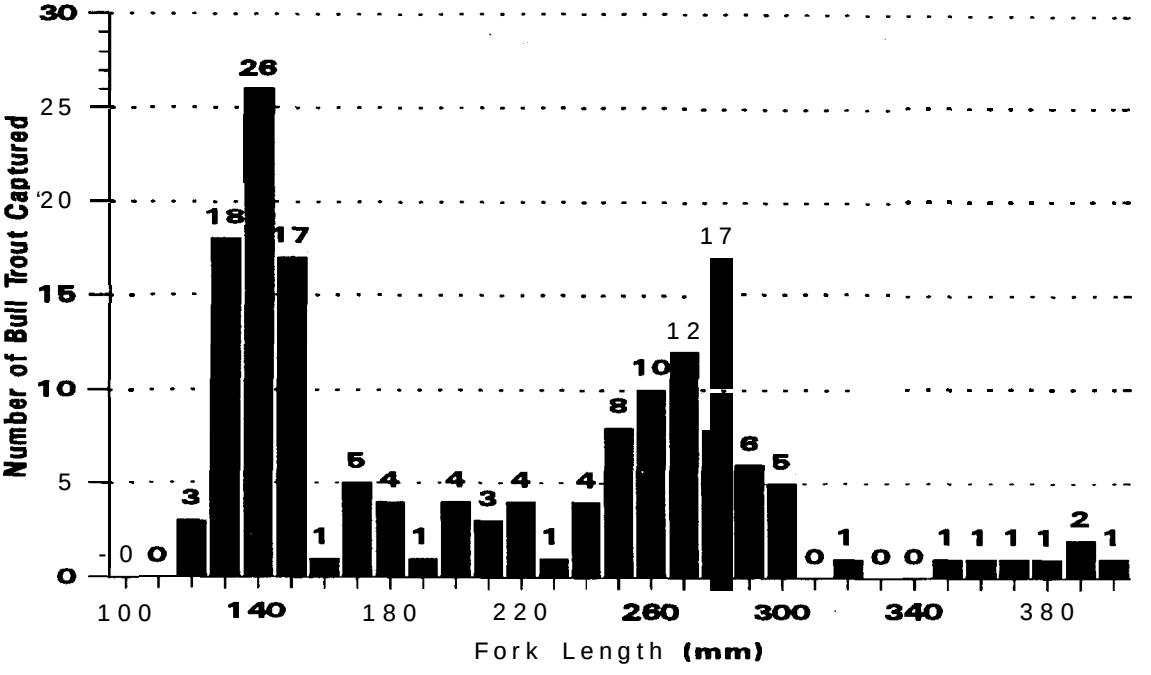


Figure I-l. Length Frequency Histogram of Bull Trout Captured by Electrofishing or Trapping From May 1992 to October 1994, n = 145, (BULTROU2.CH3).

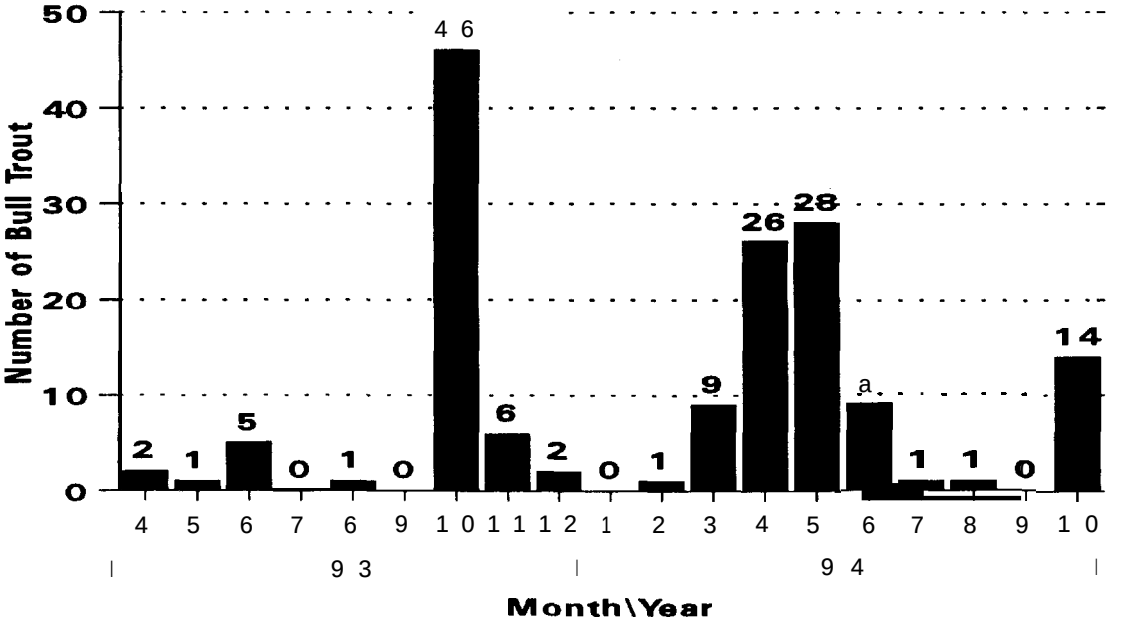


Figure I-2. Time Frequency Histogram of Bull Trout Captured by Electrofishing and/or Trapping from April 1993 through October 1994, n = 145, (BULLTIME.CH3)

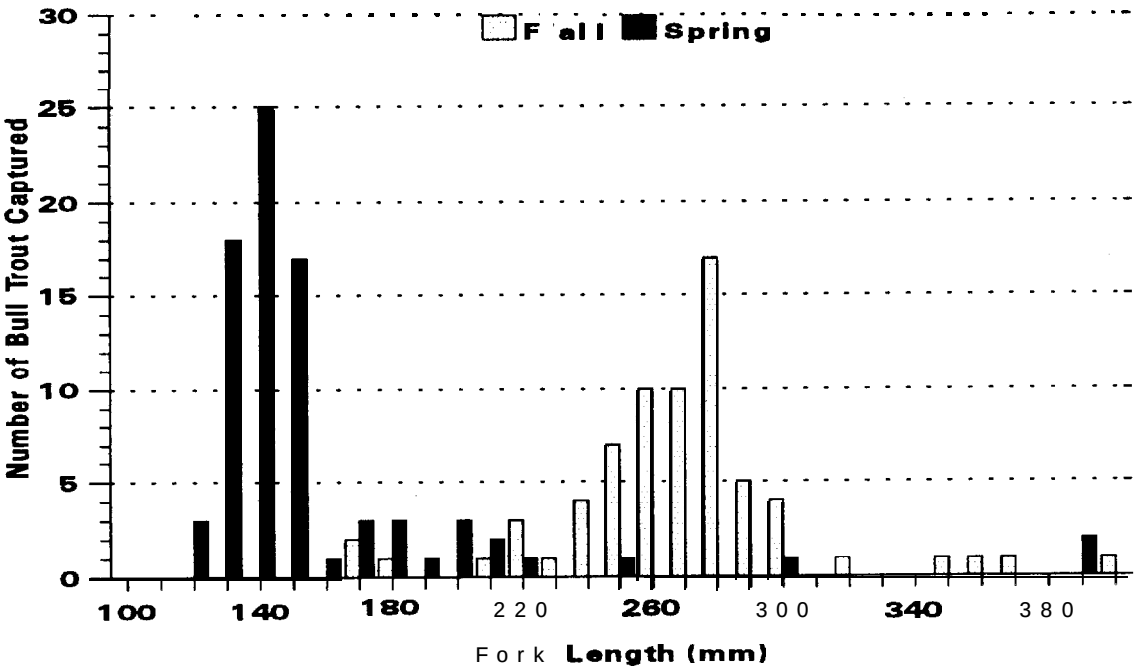


Figure I-3. Length Frequency Histogram of Bull Trout Captured by Trapping and Electrofishing in the Spring and Fall Months, 1993-1994, (BULTROUT.CH3).

APPENDIX J

Table J-l. Summary of Landmarks and their Associated River Miles, Umatilla River Basin.

Location / Landmark	RM	Location / Landmark	RM
Three Mile Falls Dam	3.7	Gibbon Railroad Yard	78.4
Horse Ranch	5	Mouth Of Meacham Creek	79.0
Tree Farm	5.5	Imeques C-mem-ini-kern	79.5
House on Bluff	7.4	Fred Gray's Bridge	80.0
South Park Bridge	8.8	Emmit Williams Place	81.1
Boyd's Return	9	London Bridge	81.4
Boyd's Dam	10.2	Reservation Boundary--Ryan Creek	81.8
Lookinglass Road	11.3	Larson's Driveway	83.1
Maxwell Dam	15.2	Stage Coach Stop House	84.8
Simplot	1 7	Bar M Driveway	85.9
Stanfield Bridge	23	Bear Creek	86.8
I-84 Bridge	24.2	Old Silver Building	87.1
Dillon Dam	24.6	Corporation Hole	88.5
Echo Bridge	26.3	Umatilla Mainstem Forks	89.5
Westland Dam	27.2	North Fork Umatilla River	O-10
Coldsprings Dam	28.2	Coyote Creek	2.5
Stanfield Dam	32.4	Woodward Creek	5.7
Yoakum	37	South Fork Umatilla River	O-10
Barnhart Bridge	42.2	Buck Creek	0.5
Forth's Diversion	46.9	Thomas Creek	3.3
Mouth of Birch Creek	48.3	Shimmiehom Creek	4.6
PGG Building	51	Meacham Creek	O-36
ODFW, Receiver Site #4	56	Boston Canyon Creek	2.2
Pendleton Ready Mix	57	Bonifer Acclimation Site	2.3
Mission Bridge	59.5	Line Creek	5.0
Minthom Springs	64.5	Camp Creek	10.9
Cayuse Railroad Bridge	67.0	Duncan	12.0
Cayuse Highway Bridge	67.5	East Meacham Creek	18.5
Louie Dick's Fence	70.0	Butcher Creek	21.5
Thornhollow Railroad Bridge	71.0	Meacham	30.0
Badger Comer	71.8	North Fork Meacham Creek	o-9.5
Thomhollow Highway Bridge	73.5	Bear Creek	18.0
Weathers's Place	74.5	Pot Creek	21.0
Mouth of Squaw Creek	76.7		

APPENDIX K

RECORD OF OBJECTIVE AND TASK COMPLETION FOR THE 1993-1994 STATEMENT OF WORK, UMATILLA NATURAL PRODUCTION MONITORING AND EVALUATION PROJECT

(September 30, 1993 to September 29, 1994).

OBJECTIVE AND TASK	STATUS	PAGE NUMBER IN ANNUAL PROGRESS REPORT WHERE COMPLETION OF TASK IS DISCUSSED. AND COMMENTS.
OBJECTIVE 1. Estimate salmonid habitat		
Task 1 .l Survey habitat	Completed, ongoing	Work done in 93/94 is discussed on pages 5 to 11 and 18 to 31; Appendix D
Task 1.2 Obtain habitat surveys from other agencies	Completed, ongoing	Habitat surveys are in progress, therefore only some of the summaries are available.
Task 1.3 Digitize habitat data collected	Completed, ongoing	Appendix D
Task 1.4 Estimate usable habitat in the Umatilla Basin	Completed, ongoing	Habitat surveys are in progress, this will be completed when all surveys are finished
OBJECTIVE 2. Biological sampling		
Task 2.1 Collect Existing Data	Completed	Data collected prior to 1994 is not repotted in the 93/94 progress report
Task 2.2 Determine survey needs	Completed	Not in annual progress report
Task 2.3 Conduct Presence/absence surveys	Completed, ongoing	Pages 9 and 30 in report
Task 2.4 Conduct intensive biological surveys	Completed, ongoing	Pages 6 to 9 and 21 to 30 Appendix E in report
Task 2.5 Conduct index site monitoring	Completed: ongoing	Pages 9 and 30, in the report
Task 2.6 Evaluate snorkel techniques	Not Initiated	Time did not allow in 1994, to be done in 1995
Task 2.7 Examine age/size relationships	Completed? ongoing	Appendix H, pages I7 and 30, in report
Task 2.8 Estimate salmonid abundance in the Basin	Initiated, ongoing	this task can not be completed until all the habitat and fish inventory work is completed

OBJECTIVE AND TASK	STATUS	PAGE NUMBER IN ANNUAL PROGRESS REPORT WHERE COMPLETION OF TASK IS DISCUSSED, AND COMMENTS.
OBJECTIVE 3. Estimate **salmonid** reproduction		
Task 3.1 Estimate adult escapement above Three Mile Dam	Completed, ongoing	Appendix F, pages 11 to 13 and 3 1 to 34
Task 3.2 Conduct spawning surveys	Completed, ongoing	Appendix F, pages 11 to 13 and 31 to 34
Task 3.3 Estimate spawning statistics	Completed, ongoing	Appendix F, pages 11 to 13 and 3 1 to 34
Task 3.4 Estimate total egg deposition	Initiated, ongoing	
Task 3.5 Compare findings in the Umatilla Basin to adjacent basins	Initiated, ongoing	
OBJECTIVE 4. Estimate **smolt** production		
Task 4.1 Install rotary screw traps	Completed	Pages 13 to 15 and 35 to 37
Task 4.2 Construct and install pipe traps	Completed	Pages 13 to 15 and 35 to 37
Task 4.3 Operate rotary traps	Completed, ongoing	Pages 13 to 15 and 35 to 37 Appendix G
Task 4.4 Operate pipe traps	Completed, ongoing	Pages 13 to 15 and 35 to 37 Appendix G
Task 4.5 Operate pipe traps	Completed	Pages 13 to 15 and 35 to 37 Appendix G
ask 4.6 Estimate Trap Efficiencies	Completed, ongoing	Pages 13 to 15 and 35 to 37 Appendix G
Task 4.7 Determine differences in trapping rates between hatchery and natural **smolts**	Initiated, ongoing	Lack of juvenile hatchery salmonids captured prevented the completion of this task
Task 4.8 Estimate total smolt production	Initiated, ongoing	Critical uncertainties prevented the development of a reasonable estimate of smolt production.
Task 4.9 Calculate egg to smolt survival rates	Initiated, ongoing	
Task 4.10 Determine smolt survival rates	Initiated, ongoing	Requited the completion of task 4.9, and downstream trapping
Task 4.11 Examine PIT tags as a tool in the Umatilla River	Completed	PIT tags were determined not to be effective until detection rates in the **mainstem** Columbia River are increased above current levels

OBJECTIVE AND TASK	STATUS	PAGE NUMBER IN ANNUAL PROGRESS REPORT WHERE COMPLETION OF TASK IS DISCUSSED. AND COMMENTS.
OBJECTIVE 5. Determine salmonid life history characteristics		
Task 5.1 Examine relationships between habitat and salmonid abundance	Completed, ongoing	Appendix D and E
Task 5.2 Determine migration patterns	Completed, ongoing	pages 35 and 36
Task 5.3 Determine age and growth information through scale analysis	Completed, ongoing	Appendix H, pages 17 to 39
Task 5.4 Compare life history patterns with salmonids outside of the Umatilla Basin	Initiated, ongoing	
OBJECTIVE 6. Determine the genetic and ecological risks of hatchery programs	Initiated, ongoing	This objective was not directly addressed in 1994
OBJECTIVE 7. Determine if hatchery supplementation enhances production of natural steelhead	Initiated, ongoing	This objective was not directly addressed in 1994
OBJECTIVE 8. Estimate tribal harvest of adult salmonids		
Task 8.1 Develop creel survey design	Completed, ongoing	Pages 15 to 16 and 38
Task 8.2 Train creel survey design	Completed, ongoing	Pages 15 to 16 and 38
Task 8.3 Finalize creel design when seasons are set	Completed, ongoing	Pages 15 to 16 and 38
Task 8.4 Conduct creel surveys	Completed? ongoing	Pages 15 to 16 and 38
Task 8.5 Summarize and Report data	Completed, ongoing	Pages 15 to 16 and 38
ADDITIONAL TASKS COMPLETED IN 1993/1994	Completed, ongoing	Quarterly and annual progress reports: develop 1994/1995 Statement of work; purchase equipment and materials. hire and train seasonal workers.

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