ANNUAL PROGRESS REPORT

FISH RESEARCH PROJECT
OREGON

PROJECT TITLE: Evaluation of the Effects of Elk Creek Dam on Migratory Salmonids

PROJECT PERIOD: 1 October 1994 to 30 September 1995

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SUMMARY

Objectives for 1995

Objectives in the first year of the project were to (1) transport adult salmonids around Elk Creek Dam; (2) determine production rates of wild juvenile salmonids in the Elk Creek Basin and in a nearby basin to be used as a reference area; (3) determine recruitment rates of wild salmonids in Elk Creek; and (4) identify sampling areas, develop sampling methods, and estimate sample sizes needed to meet project objectives.

Accomplishments in 1995

All objectives were accomplished.

Findings in 1995

Catches of wild adult salmonids at the collection facility in Elk Creek during the 1994-95 return year included 201 steelhead (*Oncorhynchus mykiss*) and 232 coho salmon (*O. kisutch*). These returns represented 1.6% of the wild steelhead and 7.1% of the wild coho salmon that passed the counting station at Gold Ray Dam. We estimated that the Elk Creek Basin accounts for 9.5% of the area accessible to anadromous salmonids that pass Gold Ray Dam.

We trapped 18 adult fish twice because they moved downstream after transport. This finding suggests that adult fish are likely stressed by factors associated with trap, transport, and handling of fish. The number of transported fish that moved downstream past Elk Creek Dam and failed to return to the trap is unknown.

We concluded that a comparison of production rates of juvenile salmonids in tributaries of Trail Creek and Elk Creek is an effective method to determine if transportation of adult salmonids around Elk Creek Dam restores natural production to levels appropriate for the Elk Creek Basin. We identified areas accessible to migrating adult salmonids in the Trail Creek and Elk Creek basins and determined that population estimates derived by electrofishing were not biased by the small size of subyearling salmonids.

Large tributaries of Trail Creek produced 14 times more subyearling trout (7,630 fish/km) than large tributaries of Elk Creek (529 fish/km). Most fry were progeny of steelhead and migratory cutthroat trout (*O. clarki*). Production rates of subyearling trout averaged 2,660 fish/km in small tributaries of Trail Creek and 2,828 fish/km in small tributaries of Elk Creek. Sensitivity analysis suggested that average production rates in small streams may have to differ by 1,500 fish/km to be detected by more sampling.

Small tributaries in the Trail Creek and Elk Creek basins produced few subyearling coho salmon. Production rates of coho salmon in large streams could not be effectively compared because production rates varied greatly within basins. Production rates in large streams ranged between 0 and 4,000 fish/km. Densities of subyearling coho salmon that reared in three large tributaries of Elk Creek during late summer suggested that seeding rates varied between 0 and 85% of carrying capacity.

INTRODUCTION

Elk Creek Dam is one of three dams authorized by the United States Congress and constructed by the United States Army Corps of Engineers (USACE) in the Rogue River Basin of southwestern Oregon. The other dams, Lost Creek and Applegate, are fully operational. A court order halted construction of Elk Creek Dam in 1987 after dam height reached 83 feet.

Elk Creek enters the Rogue River at river kilometer (RK) 244. Elk Creek Dam is located 2.7 km upstream from the creek mouth (Figure 1). The basin covers about 351 sq km, of which 343 sq km are upstream of Elk Creek Dam. Monthly flow in Elk Creek usually averages less than 10 cfs in late summer and 400-600 cfs in winter and early spring (Moffatt et al. 1990). Mean monthly flow in winter peaks between 1,000 and 1,800 cfs (Moffatt et al. 1990).

Blockage of spawning areas used by anadromous fish in the Elk Creek Basin was to be mitigated by the production of coho salmon and steelhead at Cole M. Rivers Hatchery. Mitigation was to begin when the dam was fully constructed. During construction of the dam, the USACE built a diversion tunnel through the dam that was designed to pass juvenile and adult salmonids.

Spawning surveys and trap catches of juveniles suggested that few adult coho salmon or steelhead passed the dam during the 1991-92 run year even though staff with the Oregon Department of Fish and Wildlife (ODFW) observed hundreds of adult salmonids in the pool immediately downstream of the dam. These observations increased concern that adult salmonids were unable to pass Elk Creek Dam.

In response to that concern, ODFW began a trap-and-haul operation at Elk Creek Dam in autumn of 1992. Adult salmonids were trapped below the dam and were trucked and released upstream of the dam during the 1992-93 and 1993-94 run years. Trap catches totaled 38 coho salmon and 119 steelhead in 1992-93, and 86 coho salmon and 120 steelhead in 1993-94.

Returns to the trap below Elk Creek Dam accounted for only 2.0% of the wild adult steelhead that passed the counting station at Gold Ray Dam in 1992-93 and only 1.3% of the wild adult steelhead that passed Gold Ray Dam in 1993-94. The Elk Creek Basin accounts for about 9.5% of the area accessible to anadromous salmonids that pass Gold Ray Dam on the Rogue River. It seems likely that Elk Creek Dam was at least partially responsible for the low returns of adult steelhead to Elk Creek in 1992-93 and 1993-94 because steelhead spawn primarily in tributaries of the Rogue River (Rivers 1964; Everest 1973).

Elk Creek Dam also may have affected other migratory salmonids. Coho salmon, spring chinook salmon (*O. tshawytscha*), fall chinook salmon, and cutthroat trout also spawn in the Elk Creek Basin. Coho salmon and steelhead in southern Oregon and northern California have been provisionally proposed by the National Marine Fisheries Service as threatened under the Endangered Species Act. Small numbers of spring chinook salmon (<200) and fall chinook salmon (<50) spawn in Elk Creek when flow increases enough in autumn to permit upstream migration. Adult cutthroat trout also migrate into Elk Creek, although these fish do not appear to be anadromous.

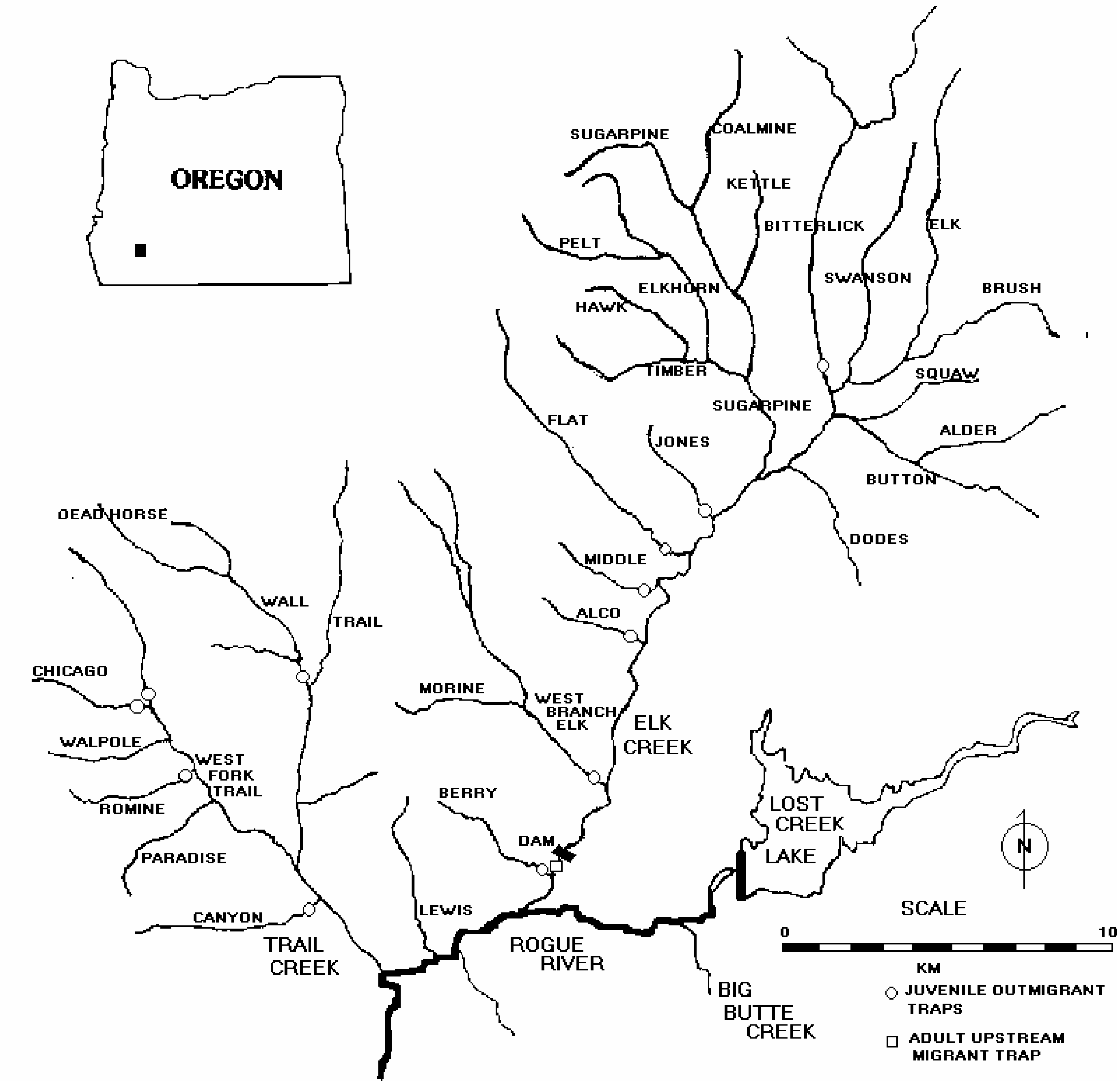

Figure 1. Map of the Elk Creek and Trail Creek basins with locations of juvenile fish traps. Creeks that were sampled in 1995 or will be sampled in 1996 are labeled with names.

The project goal is to develop strategies to restore the natural production of self-sustaining migratory salmonids to a level appropriate for the habitat available in the Elk Creek Basin. Work in the first year of the project consisted primarily of (1) identification of sampling sites, (2) development of sampling methods, and (3) estimation of sample sizes needed to meet project objectives. Sampling was primarily directed toward coho salmon, steelhead, and cutthroat trout.

PROJECT DESIGN

We developed four integrated objectives to attain the project goal: (1) collect and transport adult salmonids that attempt to migrate upstream and downstream of Elk Creek Dam, (2) determine production rates of naturally produced juvenile coho salmon and juvenile steelhead in the Elk Creek Basin and in a nearby basin, (3) determine recruitment rates of naturally produced coho salmon and steelhead in Elk Creek, and (4) determine the impact on juvenile salmonids that attempt to migrate upstream of Elk Creek Dam. A project proposal was submitted in October 1994 and is summarized below.

Objective 1

Migratory adult salmonids need to be trapped and transported around Elk Creek Dam to reach upstream spawning areas. Prior to transport, fish will be sampled to obtain life history data to estimate recruitment rates needed to complete Objective 3. In addition, steelhead and cutthroat trout that migrate downstream after spawning need to be passed around the weir.

Objective 2

Comparisons of rates of fish production in tributaries of Elk Creek and in reference streams in nearby areas should indicate whether salmonid populations in the Elk Creek Basin are depressed. If populations are depressed and transportation of migrating adults is an effective method of restoring production, rates of fish production in the Elk Creek Basin should increase through time and reach levels similar to those found in comparable types of habitat in the reference streams. We will test the following hypothesis to complete Objective 2.

Ho: There are no differences in the production rates of subyearling salmonids inhabiting comparable types of habitat in tributaries of Elk Creek and in nearby reference streams.

Production rates will be defined as the sum of migrant and resident salmonids (Task 2.3) divided by some measure of habitat quantity (Task 2.2) within areas used by anadromous salmonids (Task 2.1). Analysis of variance will be used to test for differences in production rates of subyearling salmonids within Elk Creek tributaries and reference streams. We identified three tasks needed to complete Objective 2:

Task 2.1 Determine the areas capable of producing juvenile coho salmon and juvenile steelhead.

Task 2.2 Determine the amount of habitat present for juvenile coho salmon and juvenile steelhead.

Task 2.3 Determine the number of subyearling coho salmon and subyearling steelhead produced in streams.

Assumptions associated with this approach are (1) Elk Creek tributaries and reference streams do not differ in water quality, (2) migration patterns do not differ between juvenile salmonids produced in Elk Creek tributaries and reference streams, and (3) juvenile steelhead can be distinguished from juvenile cutthroat trout and juvenile rainbow trout (if present).

Objective 3

Estimation of recruitment through the juvenile phase of salmonid life history circumvents the problems associated with estimates derived from mature fish. It is not possible to estimate the number of smolts that originated from parents that spawned in the Elk Creek Basin because many juvenile salmonids migrate to the Rogue River as fry (Everest 1973). Consequently, we define recruitment rates as the number of fry produced per spawning parent. If transportation of returning adults is an effective method of restoring production, recruitment rates for fish produced in the Elk Creek Basin should decrease through time. Recruitment estimates should also provide some guidance as to the number of adult fish needed to seed the available habitat in the Elk Creek Basin. We will use regression analysis to test the following hypothesis associated with Objective 3.

Ho: Recruitment rates of anadromous salmonids produced in the Elk Creek Basin do not change during five years of trap and transport.

We identified two tasks needed to complete Objective 3:

Task 3.1. Estimate egg-to-subyearling survival rates for naturally produced coho salmon and steelhead.

Task 3.2. Estimate the fry-parent relationship for naturally produced coho salmon and steelhead that return to Elk Creek.

Objective 4

Juvenile salmonids in the Rogue River Basin migrate into tributary streams during freshets in autumn and winter (Everest 1973). Juvenile salmonids that enter the trap below Elk Creek Dam in winter and spring may be upstream migrants because they must swim upstream to enter the trap. An upstream migration may be a mechanism to avoid mortality or injury during high flow events. Mortality rates may have increased if the tunnel beneath Elk Creek Dam blocks upstream migration of juvenile salmonids. Estimation of survival rates of juveniles released above and below the dam will directly address this question. We will test the following hypothesis to complete Objective 4.

Ho: There is no difference in the survival rate of juvenile salmonids released upstream and downstream of Elk Creek Dam during winter.

METHODS

Analytical procedures followed those described by Zar (1984). We selected $P \leq 0.05$ as the criterion for statistical significance.

Collection and Transport of Salmonids

We operated the fish collection facility in Elk Creek from 6 October 1994 through 16 May 1995. The trap was checked a minimum of once daily. We recorded the species, sex, and fork length to the nearest 0.5 cm, and looked for marks or tags on each fish. Fish longer than 30 cm received a left opercle punch. We collected scale samples from steelhead and cutthroat trout. About 20 scales were taken immediately above the lateral line and immediately posterior to the dorsal fin. We transported and released fish in Elk Creek about 2 km upstream from the dam. We checked the diversion weir daily for carcasses and recorded data as for trapped fish. The weir operated continuously except for the night of 1 December 1994.

Juvenile Production in Treatment and Reference Areas

Selection of Sampling Areas

We used inventories of fish habitat and geological formations to develop a list of candidate streams that could represent treatment and reference areas. We investigated only those basins that were major tributaries of the Rogue River and were within 30 miles of Elk Creek.

We surveyed candidate streams to obtain information that could be used to characterize basic habitat features. We initially surveyed streams in the Elk Creek Basin and later surveyed streams in other basins. Data collected included (1) distance from the Rogue River, (2) length of stream judged to be available to migratory adult salmonids, (3) elevation at the mouth, (4) access for sampling with traps and electrofishing equipment, (5) gradient, and (6) mean width of the active channel.

We electrofished six tributaries of Elk Creek in February and March to determine the presence and spatial distribution of mature resident trout. Creeks sampled included Berry, Alco, Middle, Jones, Flat, and West Branch. We divided each stream into 4-6 sections and made one pass with an electrofisher in 10 pools at the most convenient access point within each section. Fish were identified to the lowest possible taxon and fork lengths were measured to the nearest 0.1 cm.

We snorkeled portions of Sugarpine Creek and other creeks upstream of Bitterlick Creek to determine the distribution limits for juvenile coho salmon in the Elk Creek Basin. Snorkelers recorded sampling location, distance snorkeled, and numbers of juvenile coho salmon and trout. Snorkelers recorded trout as Age-0+ or older and did not attempt to distinguish trout by species.

Estimation of Migrant Salmonids

We enumerated the minimum number of juvenile salmonids that migrated from streams with six weir traps in the Elk Creek Basin and five weir traps in the Trail Creek Basin (Table 1). We constructed *V*-shaped weirs composed of panels with 1/8-inch mesh screen to direct fish into trap boxes. Baffles were installed in trap boxes to reduce predation on fry. Traps were checked daily when catches exceeded 20 fish per day. Trapping continued at least until

Table 1. Description of weir traps constructed and operated in 1995.

Stream	Trap location	Operation period	Distance from the Rogue River
ELK CREEK BASIN			
Berry Creek	RK 0.0	04/09-07/30	2 km
West Branch	RK 0.2	05/18-11/13	5 km
Alco Creek	RK 0.1	03/30-07/27	10 km
Middle Creek	RK 0.0	03/30-07/27	12 km
Flat Creek	RK 0.8	05/24-08/24	14 km
Jones Creek	RK 0.1	04/09-06/29	15 km
Bitterlick Creek	RK 0.5	05/26-09/25	21 km
TRAIL CREEK BASIN			
Canyon Creek	RK 0.2	04/07-07/31	3 km
Romine Creek	RK 0.1	04/06-07/28	9 km
Wall Creek	RK 0.1	05/25-08/29	10 km
Chicago Creek	RK 0.1	04/01-08/30	12 km
West Fork	RK 12.1	05/19-08/30	12 km

catches of juvenile salmonids on successive weeks totaled no more than 5% of the annual catch or until flow almost ceased. We assumed that traps were 100% efficient when the entire flow passed through the screens and trap boxes.

We identified fish to the lowest possible taxon. Fry smaller than 3.2 cm were classified as unknown salmonids because we were not certain that coho salmon could be differentiated from trout. We used the characteristics described by Hartman and Gill (1968) to differentiate cutthroat trout and steelhead that were yearlings or older. We did not attempt to differentiate subyearling trout. We measured the fork length of a maximum of 150 juveniles from each taxon during each week and used length-frequency distributions to segregate subyearling salmonids from older salmonids.

Estimation of Resident Salmonids

We electrofished 13 streams to estimate the number of juvenile salmonids resident in areas judged to be accessible to anadromous salmonids. We electrofished all of the streams with weir traps (Table 1). In addition, we electrofished RK 3.5-8.5 of Sugarpine Creek in the Elk Creek Basin because snorkel surveys revealed the presence of juvenile coho salmon.

We divided streams into sampling units of equal length that were systematically sampled. Sampling rates varied between every third unit (33% sampling rate) and every eighth unit (12% sampling rate). We chose larger sampling rates when trap catches indicated that coho salmon were present or when less than 3 km of the stream was available to anadromous fish. We chose smaller sampling rates when coho salmon were absent and more than

3 km of the stream was available to anadromous fish. Sampling units were 50 m long in the smaller streams and 100 m long in the larger streams.

Electrofishing began in the second unit upstream from traps. We installed block nets with 3/16-inch mesh at each end of the unit to be electrofished, except when we judged that a barrier prevented upstream movement from the unit. Fish were identified to the lowest possible taxon and subyearlings were be differentiated from older fish with length frequency distributions. We measured the fork length of all fish to the nearest 0.1 cm except when we subsampled because catches of a single taxa exceeded 100 fish.

We used the two-pass removal method to estimate the number of fish in a sampling unit. When the catch of subyearling trout or coho salmon on the second pass was greater than 50% of the catch of cohorts on the first pass, we made two more passes. We rarely needed to make four passes.

We terminated electrofishing upon reaching the upstream limit of coho salmon and subyearling trout we believed to be the progeny of migratory adults. We used four criteria to define the upstream limits of fish distribution: absence of fish, presence of a barrier, change in the species composition of juvenile salmonids, or when trout populations were dominated by fish older than subyearlings.

Structures greater than 2 m in height were judged to be barriers. We electrofished at least one unit upstream of barriers to determine if there were changes in population structure or species composition of juvenile salmonids. When cutthroat trout older than subyearlings dominated the catch above structures, we assumed those structures were barriers to the upstream migration of adult trout. When we also observed dominance by older cutthroat trout in streams without definitive barriers, we assumed that point represented the upstream limit of the spawning distribution of migratory trout.

We used the methods of Bohlin (1981) as adapted by ODFW staff (J. Dambacher, ODFW, Corvallis, 20 March 1995, personal communication) to estimate the number and density of fish in the length of a stream and the confidence intervals associated with the estimates. We used the model of Nickelson et al. (1992) to predict summer densities of juvenile coho salmon in three streams where ODFW previously estimated the amount of summer habitat.

Physical Factors

We measured water temperature at weir traps hourly to the nearest 0.1^{o}C with automated recorders. We estimated flow to the nearest 0.1 cfs during electrofishing surveys for juvenile fish. In small streams, we recorded the time taken for the streamflow to fill a 5-gallon bucket. In larger streams, we estimated flow by measuring the cross section of the stream and used an electronic meter to estimate water velocity. We also measured stream conductivity to the nearest 1 *u*ohm with an electronic meter.

We used a measuring tape to estimate the length of each stream that we electrofished. Measurements began at the traps used to catch juvenile fish. We also measured the length of each pool and riffle within each electrofishing unit. We used the definition of Bisson et al. (1981) to classify pools and classified all other habitat units as riffles.

Estimation of Recruitment Rates

We renovated and installed an 8-foot rotary trap 500 m downstream of Elk Creek Dam. We estimated trap efficiency with mark-recapture experiments conducted for each taxon of fish captured in the trap. We marked fish with a partial clip of either lobe of the caudal fin. Marks were changed weekly and fish were marked only in the first five days of each week. We marked fish in the morning and released them in the late afternoon about 200 m upstream from the rotary trap. We held fry separately from older fish to negate predation and recorded any moralities prior to release.

We measured the fork length, to the nearest 0.1 cm, of all marked fish released and all marked fish recaptured in the rotary trap. We compared lengths of released and recaptured fish from individual mark groups to evaluate whether the rotary trap captured fish in a size-selective manner.

We used the methods of Thedinga et al. (1994) to estimate the number of fish that passed the rotary trap and the confidence interval associated with the estimate.

RESULTS AND DISCUSSION

Collection and Transport of Salmonids

Trap catches of mature salmonids in the 1994-95 return year totaled 232 wild and 52 hatchery coho salmon, 204 wild and 7 hatchery steelhead, 31 unmarked and 4 marked chinook salmon, and 39 wild cutthroat trout. Trap catches of adult salmonids are summarized in Appendix Tables A-1 and A-2. We assumed that all coho salmon and steelhead of hatchery origin would have been marked with fin clips because adult fish that matured in 1994-95 were all marked prior to release as juveniles from Cole M. Rivers Hatchery. We did not attempt to estimate the number of hatchery fish among the unmarked chinook salmon collected in the trap because only a portion of the juvenile spring chinook salmon released at Cole M. Rivers Hatchery are marked with fin clips. No cutthroat trout of hatchery origin are released in the Rogue River basin.

We observed three mature chinook salmon spawning upstream of the weir on 20 October. These fish passed upstream prior to installation of the weir. We recovered one spawned chinook salmon on the weir that had not been transported upstream of Elk Creek Dam. We also recovered 15 carcasses of spawned coho salmon and two carcasses of spawned steelhead on the weir. All had been transported around the dam prior to spawning.

We did not observe any immediate mortality among transported adults. However, some transported fish migrated downstream through the dam and over the weir prior to spawning. One coho salmon and 17 steelhead migrated downstream after transport above Elk Creek Dam and were subsequently trapped a second time. This finding suggests that adult fish are likely stressed by factors associated with trapping, transport, and handling of fish during collection of life history data. The number of transported fish that migrated downstream prior to spawning and failed to return to the trap is not known.

Trap catches of juvenile salmonids at the collection facility totaled one wild coho salmon, 85 wild and one hatchery steelhead, and two wild cutthroat trout. Juvenile salmonids were captured from late October through early February with peak catches in November (Appendix Table A-3). These fish may have been attempting to migrate upstream. Cutthroat trout were 24-27 cm in length and may have matured in early 1995. Wild steelhead were 15-25 cm long and averaged 17.7 cm in length (95% confidence interval = $\pm$ 1.3 cm).

Juvenile Production in Treatment and Reference Areas

Selection of Sampling Areas

We surveyed 14 streams in the Elk Creek Basin, eight streams in the Big Butte Creek Basin, five streams in the Little Butte Creek Basin, 10 streams in the Evans Creek Basin, and seven streams in the Trail Creek Basin (Appendix Table A-4). We concluded that streams in the Trail Creek Basin were most comparable to streams in the Elk Creek Basin because adjoining basins are most likely to share similar geological, hydrological, and biological features. We found that streams in the Big Butte Creek Basin tended to have higher gradients, were less accessible, and most had irrigation diversions. Streams in the Little Butte Creek Basin also had water diversions and were too few to meet the experimental design of the project. Streams in the Evans Creek Basin tended to have greater sediment loads, possibly because they were in a different geological province, and were farther from the Rogue River as compared to other basins (Appendix Table A-4).

We found evidence that migratory adult salmonids spawned in most of the streams in the Trail Creek Basin. Large redds in Wall Creek and the West Fork of Trail Creek indicated that coho salmon or winter steelhead spawned in each creek during 1994-95. In March, we observed adult salmonids, comparable in size to summer steelhead or migratory cutthroat trout, spawning in Canyon Creek and Chicago Creek.

We noted that some features differed between streams in the Trail Creek and Elk Creek basins. The lower portions of the West Fork of Trail Creek and Trail Creek stop flowing in most summers (J. Budziak, ODFW, Central Point, 3 March 1995, personal communication) while Elk Creek is perennial (Moffatt et al. 1990). If juvenile salmonids fail to migrate before flow ceased, then fry-to-adult survival rates would probably be lower for salmonids produced in the Trail Creek Basin as compared to counterparts produced in the Elk Creek Basin. If low flows subsequently result in lower densities of spawners in the Trail Creek Basin, production rates of salmonid fry in the Trail Creek Basin may be naturally lower than those in the Elk Creek Basin, regardless of any effect by Elk Creek Dam.

Only two streams in the Trail Creek Basin appeared to meet our criteria for classification as large streams, though we planned on sampling three, rather than two, large streams (*see* **Objective 2**, page 4). In addition, barriers likely to block upstream passage of adult salmonids were closer to potential trap sites on large streams in the Trail Creek Basin as compared to large streams in the Elk Creek Basin. If barriers result in greater densities of spawners in the Trail Creek Basin, production rates of salmonid fry in the Trail Creek Basin may be naturally greater than those in the Elk Creek Basin.

In contrast to large streams, we judged that small streams in the Trail Creek and Elk Creek basins exhibited sufficient similarity to meet the criteria for reference and treatment streams as outlined in the experimental design of the project. We also concluded that tributaries of Trail Creek afforded better choices for reference streams as compared to other candidate streams that we examined.

Estimation of Migrant Salmonids

Juvenile trout were captured in all of the tributaries trapped in the Elk Creek and Trail Creek basins. Juvenile coho salmon were captured in four of five streams trapped in the Trail Creek Basin, but were captured in only three of seven streams trapped in the Elk Creek Basin. No juvenile chinook salmon were captured in weir traps installed on tributaries of Elk Creek or Trail Creek. The total number of juvenile salmonids captured in the weir traps are in Table 2. Weekly catches of juvenile fish in the weir traps are in Appendix Tables A-5 through A-16. Mean lengths of juvenile fish caught weekly in the weir traps are in Appendix Tables A-17 through A-28.

Table 2. Number of juvenile salmonids caught in weir traps fished in 1995. Unknown salmonids represent fry less than 3.2 cm and may have all been trout.

Stream	Unknown salmonids Age 0+	Trout Age 0+	Coho salmon Age 0+	Coho salmon Age 1+	Cutthroat trout Age ≥ 1+	Steelhead[a] trout Age ≥ 1+
TRAIL CREEK BASIN						
Canyon Creek	10,164	2,172	9,158	3	46	7
Romine Creek	53	1,582	7	1	16	1
Chicago Creek	657	858	0	0	77	4
West Fork	3,045	6,890	2,566	2	37	25
Wall Creek	332	10,615	54	0	20	12
ELK CREEK BASIN						
Berry Creek	872	18,089	11	0	17	59
Alco Creek	23	2,896	4	0	49	10
Middle Creek	171	990	0	0	34	8
Jones Creek	307	3,360	0	0	51	18
West Branch	2,130	695	904	32	82	55
Flat Creek	0	922	0	0	36	15
Bitterlick Creek	89	33	0	0	85	38

[a] *May include some rainbow trout.*

Catch and length data indicated that few subyearling salmonids migrated from small streams prior to the installation of traps in early April. In small tributaries of Elk Creek, subyearling salmonids were first captured two weeks after we installed traps in Middle Creek and in Alco Creek. Salmonid fry were captured immediately after we installed the trap in Jones Creek, but catches in the first week of trapping averaged only eight fry per day. These fish averaged less than 3 cm long, indicative of fry newly emergent from the gravel. In small tributaries of Trail Creek, subyearling salmonids were first captured one week after installation of the trap in Romine Creek and two weeks after installation of the trap in Chicago Creek.

In contrast to small streams, more subyearling salmonids migrated from large streams prior to installation of weir traps. In large tributaries of Elk Creek, subyearling salmonids were captured immediately after we installed traps in Flat Creek and West Branch. While catches in the first week of trapping in Flat Creek averaged less than one trout fry daily, the mean length of those fish was 4.6 cm. It may be that a large number of trout fry migrated from Flat Creek prior to installation of the weir trap because data from other creeks indicated that trout fry are less than 3 cm at time of emergence from the gravel. In West Branch, we caught only one trout fry and four coho salmon fry in the first week of trapping. In Bitterlick Creek, no subyearling salmonids were caught until two weeks after we installed the trap.

Greater numbers of salmonid fry probably migrated from large tributaries of Trail Creek as compared to large tributaries of Elk Creek. In West Fork and Wall Creek, we captured trout and coho salmon immediately after installation of the traps. In both creeks, mean lengths of trout fry averaged less than 3.0 cm during the first week of trapping. This indicates that trout fry were emerging as traps were installed. However, subyearling coho salmon in both creeks averaged more than 4.4 cm long when first caught. Large numbers of coho salmon fry may have migrated from large tributaries of Trail Creek prior to installation of traps because data from other creeks indicated that newly emergent coho salmon fry were less than 3.5 cm long.

High flows delayed the installation of weir traps in large streams until the middle of May. Weir traps in large streams will likely catch all migrants only in years of relatively low flows during spring. However, partial counts of migrants will not bias comparisons of production rates in the Trail Creek and Elk Creek basins provided that traps are installed at the same time in both basins and there are no differences between basins in the migration timing of salmonid fry. Our data suggested that salmonid fry were more likely to migrate earlier from streams in the Trail Creek Basin rather than streams in the Elk Creek Basin. Such a difference will make it somewhat more difficult to detect if streams in the Elk Creek Basin are underseeded with salmonid fry as compared to streams in the Trail Creek Basin.

We were also unable to differentiate steelhead and cutthroat trout among subyearling trout caught in the weir traps. Identification of the different species of trout is not critical to completion of project objectives because adult cutthroat trout and adult steelhead must be transported around Elk Creek Dam to reach upstream spawning areas. We found that both species of migratory trout spawn in the Elk Creek and Trail Creek basins so pooling production estimates for each of the species should not affect comparisons of production rates in each of the two basins.

In addition, we were uncertain about our ability to differentiate trout from coho salmon when fry were less than 3.2 cm long. We suspect that most, if not all, of these fish were trout fry. We plan to test this hypothesis by measuring the lengths of “buttoned up” coho salmon fry at Cole M. Rivers Hatchery in 1996. We believe that it is best to measure fish at this stage of development because few of the coho salmon fry captured in weir traps in 1995 exhibited exposed yolk sacs.

Estimation of Resident Salmonids

Evaluation of sampling bias: Comparisons of lengths for subyearling salmonids captured on successive electrofishing passes indicated that population estimates were not biased by the small size of the fish. In most streams, fish lengths differed significantly among cohorts collected from different sampling locations within streams (Table 3). However, fish lengths differed significantly among cohorts collected on the first and second electrofishing passes in only one of 13 cases among subyearling trout and in only one of five cases among subyearling coho salmon (Table 3).

Table 3. Summary of comparisons of fork lengths from subyearling salmonids electrofished in 13 streams in the Trail Creek and Elk Creek basins, 1995. Each comparison was made with a two-way analysis of variance with sampling location and electrofishing pass as factors.

		Trout		Coho salmon	
Basin	Creek	Location	Pass	Location	Pass
		SMALL STREAMS NEAR THE ROGUE RIVER			
Trail Creek	Canyon	$P = 0.003$	$P = 0.786$	$P = 0.211$	$P = 0.088$
Elk Creek	Berry	$P = 0.012$	$P = 0.964$	--	--
		SMALL STREAMS			
Trail Creek	Romine	$P = 0.482$	$P = 0.295$	--	--
Trail Creek	Chicago	$P = 0.093$	$P = 0.022$	--	--
Elk Creek	Alco	$P < 0.001$	$P = 0.262$	--	--
Elk Creek	Middle	$P = 0.001$	$P = 0.565$	--	--
Elk Creek	Jones	$P = 0.002$	$P = 0.850$	--	--
		LARGE STREAMS			
Trail Creek	Wall	$P < 0.001$	$P = 0.118$	$P = 0.165$	$P = 0.504$
Trail Creek	West Fork	$P < 0.001$	$P = 0.205$	$P = 0.008$	$P = 0.569$
Elk Creek	West Branch	$P < 0.001$	$P = 0.871$	$P < 0.001$	$P = 0.044$
Elk Creek	Flat	$P < 0.001$	$P = 0.349$	--	--
Elk Creek	Bitterlick	$P < 0.001$	$P = 0.729$	--	--
Elk Creek	Sugarpine	$P < 0.001$	$P = 0.064$	$P < 0.001$	$P = 0.120$

In the two cases where cohort lengths differed, fish captured during the first electrofishing passes were smaller than cohorts captured on the second electrofishing passes. From a two-way analysis of variance of subyearling trout captured in Chicago Creek, least square means were 5.0 cm for fish from the first passes through sampling units and 4.7 cm for fish from the second passes through sampling units (Table 4). For subyearling coho salmon in the West Branch, a two-way analysis of variance estimated least square means of 6.7 cm for fish from the first passes through sampling units and 6.6 cm for fish from the second passes through sampling units (Table 4). We consider these differences to be inconsequential.

Subyearling salmonids captured in Canyon Creek, Berry Creek, and Chicago Creek were small compared with cohorts captured in other creeks (Table 4). Our findings indicated that the small sizes of fish did not bias population estimates developed for streams where mean lengths of subyearling salmonids exceeded 5.0 cm. Because fish will usually exceed 5 cm when streams are electrofished, particularly in large streams that are sampled later in the summer, we concluded that population estimates of subyearling salmonids resident in tributaries of Trail Creek and Elk Creek were not differentially biased by the small sizes of subyearling salmonids.

Table 4. Lengths of subyearling salmonids captured on successive electrofishing passes in 13 streams of the Trail Creek and Elk Creek basins, 1995. Mean lengths represent the least square means estimated from a two-way analysis of variance test.

	Trout						Coho salmon					
	Pass 1			Pass 2			Pass 1			Pass 2		
Stream	Mean	SE	n	Mean	SE	n	Mean	SE	n	Mean	SE	n
TRAIL CREEK BASIN												
Canyon Creek	5.0	0.1	274	5.0	0.1	92	5.2	0.1	112	4.8	0.2	36
Romine Creek	5.2	0.1	183	5.3	0.1	65	--	--	0	--	--	0
Chicago Creek	5.0	0.1	237	4.7	0.1	51	--	--	0	--	--	0
West Fork	5.1	0.1	575	5.0	0.1	247	6.0	0.1	167	5.9	0.1	74
Wall Creek	5.6	0.1	737	5.5	0.1	273	7.4	0.2	27	7.2	0.2	8
ELK CREEK BASIN												
Berry Creek	4.8	0.1	75	4.8	0.2	22	--	--	0	--	--	0
Alco Creek	5.8	0.1	207	5.7	0.1	62	--	--	0	--	--	0
Middle Creek	6.4	0.1	60	6.4	0.2	13	--	--	0	--	--	0
Jones Creek	5.4	0.1	29	5.4	0.2	8	--	--	0	--	--	0
West Branch	6.6	0.1	498	6.6	0.1	114	6.7	0.1	963	6.6	0.1	367
Flat Creek	7.3	0.1	473	7.4	0.1	112	8.0	--	1	--	--	0
Bitterlick Creek	6.7	0.1	138	6.7	0.1	37	--	--	0	--	--	0
Sugarpine Creek	5.9	0.1	153	5.5	0.2	27	6.6	0.1	669	6.5	0.1	270

Distribution: We found no juvenile coho salmon resident in any of the small streams electrofished, with the exception of Canyon Creek in the Trail Creek Basin (Table 5). In the large streams, we found juvenile coho salmon a maximum of 1 km upstream of the weir traps in three of the six streams sampled with electrofishing gear (Table 5). These findings indicated that traps were installed near the upstream end of the distribution of spawning coho salmon and that juveniles may not be produced upstream of trap sites in years when low flows limit the spawning distribution of adults.

Snorkel surveys indicated that juvenile coho salmon resided in Elk Creek upstream to the mouth of Sugarpine Creek. We are unsure why coho salmon were not found farther upstream. It is possible that the canyon just upstream of Bitterlick Creek presents a barrier to migrating adults.

Migratory trout were more widely distributed than coho salmon. In the small streams, electrofishing catches suggested that progeny of migratory adults reared a maximum of 1-2 km upstream of the trap sites (Table 5). In two of the small streams, we stopped electrofishing when subyearling trout were no longer present. In the other small streams, sampling stopped when we judged that a barrier blocked the upstream migration of adult trout (Table 5).

Table 5. Limits of upstream distribution estimated for subyearling salmonids electrofished in 13 streams in the Trail Creek and Elk Creek basins, 1995. Estimates represent the distance upstream from weir traps. Criteria for upstream limits of trout are listed because progeny of migratory trout could not be distinguished from progeny of resident trout.

		Coho salmon	Trout	
Basin	Creek	Km of habitat	Km of habitat	Selection criterion
		SMALL STREAMS NEAR THE ROGUE RIVER		
Trail Creek	Canyon	0.51	1.13	3 m barrier
Elk Creek	Berry	--	2.23	fish absent
		SMALL STREAMS		
Trail Creek	Romine	--	0.81	8 m barrier
Trail Creek	Chicago	--	1.50	3 m barrier
Elk Creek	Alco	--	1.87	4 m barrier
Elk Creek	Middle	--	0.67	3 m barrier
Elk Creek	Jones	--	0.93	fish absent
		LARGE STREAMS		
Trail Creek	Wall	1.40	2.63	4 m barrier
Trail Creek	West Fork	1.02	1.95	2 m barrier
Elk Creek	West Branch	4.39	7.91	population shift
Elk Creek	Flat	1.11	5.94	population shift
Elk Creek	Bitterlick	--	5.37	3 m barrier
Elk Creek	Sugarpine	4.97	4.97[a]	survey ended

[a] *Sampling terminated at upstream end of coho salmon distribution.*

We also judged that barriers to migrating adult trout were present in three of the six large streams electrofished (Table 5). Sampling in Sugarpine Creek terminated when we reached the upstream distribution of juvenile coho salmon. In Flat Creek and West Branch, we judged that shifts in the population structure of salmonids reflected the upstream limits in the spawning distribution of migratory trout.

At 6 km upstream of the weir trap in Flat Creek, yearling or older steelhead disappeared, all subyearling trout appeared to be cutthroat trout, and older trout were more abundant than subyearling trout. In sampling units farther downstream, subyearlings were 3-6 times more abundant than older salmonids and 32-84% of the subyearlings were judged to be juvenile steelhead. At 8 km upstream of the weir trap in West Branch, we found a bedrock ledge that may have been a barrier to migrating adult salmonids. We found yearling or older steelhead at units sampled downstream, but not upstream, of this site.

Results from electrofishing surveys in February and March supported the selection of sites to characterize the upstream distribution of migratory trout. Trout classified as steelhead accounted for 38% of the 93 trout captured in the areas later selected as migratory fish habitat, but accounted for only 15% of the 41 trout captured in areas farther upstream (Chi-square = 6.05, $P = 0.014$). In two creeks near the Rogue River that completely dried up in the summer of 1994, steelhead accounted for 90% of the 30 trout caught. These fish probably migrated into the streams during autumn or winter (Everest 1973).

Electrofishing in the late winter also indicated that few adult rainbow trout were present in tributaries of Elk Creek. Although we sampled prior to the spawning time of rainbow trout (Rivers 1964), none of the 41 fish classified as steelhead exhibited any evidence of maturation and all were less than 14 cm. The smallest mature rainbow trout reported by Rivers (1964) were 13 cm long.

However, we found mature cutthroat trout that appeared to have non-migratory life histories. In the areas later selected as migratory fish habitat, we classified 6% of 62 cutthroat trout as mature. In areas farther upstream, we classified 31% of 35 cutthroat trout as mature. Lengths of mature cutthroat trout ranged between 11 and 18 cm. Lengths of all trout collected by electrofishing in late winter are in Appendix Table A-29.

Mature cutthroat trout were more abundant in areas upstream of habitat accessible to migratory salmonids as compared to lower portions of streams. In areas accessible to migratory salmonids, we found mature cutthroat trout in only two of six streams (Table 6). In areas inaccessible to migratory adults, we found mature cutthroat trout in four of five streams (Table 6). Mature cutthroat trout were also more abundant in perennial streams (Flat Creek and West Branch) as compared to other streams that partially or completely dry up during summer. The presence of mature cutthroat trout in the upper portions of Alco Creek and Middle Creek indicate that the headwaters of these streams are perennial.

These results suggested that some progeny of resident cutthroat trout were classified as progeny of migratory trout when sampled in summer and that

Table 6. Minimum densities of cutthroat trout greater than 11 cm in pools of six tributaries of Elk Creek during February-March 1995. Densities are minimums because we made only one pass with electrofishing gear in each pool. Downstream habitat includes areas accessible to migrating adults while upstream habitat includes areas inaccessible to migrating adults.

	Downstream habitat		Upstream habitat	
Creek	Fish/pool	*N* pools	Fish/pool	*N* pools
Berry	0.00	30	--	0
Alco	0.00	21	0.06	18
Middle	0.00	15	0.32	22
Jones	0.00	20	0.00	30
West Branch	0.55	20	0.20	20
Flat	0.18	40	1.00	3

estimates of the number of subyearlings produced by migratory trout were too high. This source of error should have decreased the chance of detecting significant differences in production rates between streams of the Trail Creek and Elk Creek basins. While production rates did not differ between small streams, large streams in the Trail Creek Basin produced subyearling trout at greater rates than large streams in the Elk Creek Basin (*see* **Estimation of Total Production**, Page 19). Densities of mature cutthroat trout were greater in the large tributaries of Elk Creek, probably because the large tributaries of Trail Creek become intermittent in late summer (*see* **Physical Factors**, Page 22).

Population estimates: Rearing densities of subyearling trout were greater in the tributaries of Trail Creek than in tributaries of Elk Creek. Among small streams, densities averaged 1,149 trout/km in the two Trail Creek streams and 408 trout/km in the four Elk Creek streams. A t-test with data in Table 7 indicated that the difference in the means was significant at $P = 0.024$. This finding suggests that densities of subyearling trout were almost threefold greater in the smaller tributaries of Trail Creek as compared to the smaller tributaries of the Elk Creek. Lack of flow may account for the differences in densities of resident trout. We noted that the small tributaries of Elk Creek were dry by the end of the summer, while water remained in the small tributaries of Trail Creek. Thus, a greater proportion of the juvenile trout may have migrated from tributaries of Elk Creek as compared to tributaries of Trail Creek.

Among large streams, densities averaged 3,012 trout/km in the two Trail Creek streams and 373 trout/km in the four Elk Creek streams. A t-test with data in Table 7 indicated that the difference in the means was significant at $P < 0.001$. This finding indicated that densities of subyearling trout were almost sevenfold greater in the larger tributaries of Trail Creek as compared to the larger tributaries of the Elk Creek. Lack of flow could not have accounted for the differences in densities of resident trout because flow in the late summer was less in the large tributaries of Trail Creek as compared to the large tributaries of Elk Creek (*see* **Physical Factors**, Page 22).

Table 7. Density of subyearling salmonids estimated by electrofishing 13 streams in the Trail Creek and Elk Creek basins, 1995. Estimates cover the areas upstream of the weir traps.

		Fish/km (95% confidence interval)	
Basin	Creek	Trout	Coho salmon
	SMALL STREAMS NEAR THE ROGUE RIVER		
Trail Creek	Canyon	1,065 ± 350	1,065 ± 550
Elk Creek	Berry	172 ± 85	0 ± 0
	SMALL STREAMS		
Trail Creek	Romine	1,002 ± 322	0 ± 0
Trail Creek	Chicago	1,296 ± 213	0 ± 0
Elk Creek	Alco	519 ± 184	0 ± 0
Elk Creek	Middle	569 ± 284	0 ± 0
Elk Creek	Jones	135 ± 68	0 ± 0
	LARGE STREAMS		
Trail Creek	Wall	3,567 ± 1,535	135 ± 44
Trail Creek	West Fork	2,457 ± 692	1,537 ± 1,592
Elk Creek	West Branch	334 ± 110	1,456 ± 314
Elk Creek	Flat	586 ± 113	3 ± 3
Elk Creek	Bitterlick	367 ± 105	0 ± 0
Elk Creek	Sugarpine	204 ± 34	1,187 ± 429

We found no coho salmon resident in small streams except in Canyon Creek, which is near the mouth of Trail Creek (Table 7). Coho salmon were present in both of the large streams in the Trail Creek Basin and in three of four large streams in the Elk Creek Basin (Table 7). In the large streams, densities of coho salmon averaged 836 fry/km in the two Trail Creek streams and 661 fry/km in the four Elk Creek streams. A t-test with data in Table 7 indicated that the difference in the means was not significant ($P = 0.818$).

A sensitivity analysis developed from data in Table 7 suggested that there is an 80% chance, at the 95% confidence level, that annual sampling will detect a significant difference only if the average density in the Trail Creek streams exceeds the average density in the Elk Creek streams by about 1,600 fry/km. This analysis assumes that densities in the Trail Creek streams will remain highly variable. Variations in densities of rearing fish could change annually depending on the effects of water yield on the spawning distribution of adult fish. However, based on results from 1995, it appears there is little chance of detecting differences in the densities of juvenile coho salmon resident in streams within the Trail Creek and Elk Creek basins. Electrofishing catches of juvenile salmonids captured in the summer of 1995 are in Appendix Tables A-30 through A-32.

Predicted numbers of coho salmon: Numbers of subyearling coho salmon predicted from the model of Nickelson et al. (1992) and amounts of summer habitat estimated by ODFW for three tributaries of Elk Creek ranged between 2,718 and 10,173 fish. Predicted densities ranged between 1,530 and 2,171 fish/km (Table 8). Comparisons of predicted and observed values indicated that the available habitat in West Branch was close to being fully seeded with subyearling coho salmon (Table 8). This tributary was closest to the release site of adult coho salmon transported upstream of Elk Creek Dam. In contrast, the number of juveniles in Flat Creek was less than 1% of the predicted value while the number of juveniles in Sugarpine Creek was about 60% of the predicted value (Table 8). These findings indicated that streams in the Elk Creek Basin were not fully seeded with juvenile coho salmon.

Streams outside of the Elk Creek Basin also may not have been fully seeded with juvenile coho salmon in the summer of 1995. Estimates of aquatic habitat were not available for the two large streams in the Trail Creek Basin inhabited by coho salmon. Habitat surveys should be conducted in all other streams in the Trail Creek and Elk Creek basins so that seeding rates within basins can be compared directly. Comparisons of predicted and observed seeding levels for only tributaries of Elk Creek may have been biased because the predictive model developed by Nickelson et al. (1992) was developed for juvenile coho salmon in coastal streams of Oregon. Different environmental factors may affect summer densities of juveniles that inhabit inland areas of the southern portion of the distribution of coho salmon.

Table 8. Numbers and densities of subyearling coho salmon estimated by electrofishing three tributaries of Elk Creek in 1995 as compared to predictions of summer populations developed from the model of Nickelson et al. (1992) and ODFW surveys of aquatic habitat.

	Number of fish		Fish/km		
Stream	Observed	Predicted	Observed (95% CI)	Predicted	% seeded
West Branch	5,594	6,655	1,631 ± 314	1,929	85%
Flat Creek	3	2,718	3 ± 3	1,530	<1%
Sugarpine Creek	5,790	10,173	1,236 ± 429	2,171	57%

Estimation of Total Production

Production rates of subyearling trout were greatest in small streams that were closest to the Rogue River. Berry Creek (Elk Creek Basin) produced almost 9,000 trout fry/km and Canyon Creek (Trail Creek Basin) produced almost 12,000 trout fry/km (Table 9). Production rates of subyearling trout in small streams farther from the Rogue River ranged between 2,000 and 4,000 fry/km (Table 9). Production rates averaged 2,660 trout fry/km in the two tributaries of Trail Creek and 2,828 trout fry/km in the three tributaries of Elk Creek. A t-test with data in Table 9 indicated that the mean production rates in small streams did not differ significantly between the Trail Creek and Elk Creek basins (P = 0.854).

Table 9. Estimates of the minimum production of subyearling trout in 12 streams in the Trail Creek and Elk Creek basins, 1995. Production estimates are minimums because weir traps did not operate during the entire period that fry migrated from streams. Fry of unknown salmonids were included with production estimates of trout fry.

Basin	Creek	Km of habitat	Fish produced	Production/km (95% CI)
		SMALL STREAMS NEAR THE ROGUE RIVER		
Trail Creek	Canyon	1.13	13,537	11,980 ± 350
Elk Creek	Berry	2.23	19,344	8,674 ± 85
		SMALL STREAMS		
Trail Creek	Romine	0.81	2,445	3,019 ± 322
Trail Creek	Chicago	1.50	3,453	2,302 ± 213
Elk Creek	Alco	1.87	3,888	2,079 ± 184
Elk Creek	Middle	0.67	1,559	2,327 ± 284
Elk Creek	Jones	0.93	3,792	4,077 ± 68
		LARGE STREAMS		
Trail Creek	Wall	2.63	20,339	7,733 ± 1,535
Trail Creek	West Fork	1.95	14,686	7,531 ± 692
Elk Creek	West Branch	7.91	3,545	448 ± 110
Elk Creek	Flat	5.63	4,217	749 ± 113
Elk Creek	Bitterlick	5.37	2,091	389 ± 105

A sensitivity analysis with data in Table 9 suggested that there is an 80% chance, at the 95% confidence level, that annual sampling will detect a difference between small streams if the average production rate in the Trail Creek Basin exceeds the average production rate in the Elk Creek Basin by more than 1,500 fish/km. This analysis assumes that an additional tributary of Trail Creek, Walpole Creek, will be sampled and that the production rate will be intermediate to those in other small tributaries of Trail Creek.

In contrast to the results from sampling small streams, we found that trout production in the large streams differed between basins. Production rates averaged 7,630 trout fry/km in the Trail Creek Basin and 529 trout fry/km in the Elk Creek Basin (Table 9). A t-test with data in Table 9 indicated that the difference in the means was significant at $P < 0.001$. This finding suggested that the large tributaries of Trail Creek produced subyearling trout at more than a fourteenfold greater rate than the large tributaries of the Elk Creek.

Salmonid production in streams is affected by spawner numbers and suitability of habitat. At the present time, we believe that a difference in spawning escapement is the most likely factor that would account for the difference in production rates of subyearling trout within the larger tributaries of Trail Creek and Elk Creek. We do not believe that trout habitat in these streams differs enough to account for the difference in production rates. However, surveys should be conducted to compare the amount of spawning and rearing habitat in areas inhabited by migratory salmonids in the Trail Creek and Elk Creek basins.

Adult trout likely to spawn in large tributaries of Trail Creek and Elk Creek include summer steelhead, winter steelhead, migratory cutthroat trout, and resident trout, which remain in streams throughout the year. Electrofishing surveys to estimate the number of juvenile salmonids indicated that few adult trout were resident in the larger tributaries of Trail Creek and Elk Creek. In addition, the presence of fry produced by resident trout would have made it more difficult to detect a difference in production rates of trout fry because resident trout should have increased in abundance if blockage by Elk Creek Dam decreased the number of migratory adult salmonids that spawned in upstream areas during 1987-91. Few adult steelhead from those brood years returned to Elk Creek as compared to the number that passed the counting station at Gold Ray Dam (*see* **Adult Returns to Elk Creek**, Page 23).

One of the small streams near the Rogue River also produced large numbers of subyearling coho salmon. Canyon Creek in the Trail Creek Basin produced about 19,000 coho salmon fry/km although none were produced in Berry Creek, a tributary of Elk Creek also near the Rogue River (Table 10). The absence of juvenile coho salmon in Berry Creek may indicate that adults are effectively trapped below Elk Creek Dam. Juvenile coho salmon were captured in Berry Creek in 1991, prior to the start of trapping adult salmonids at the base of Elk Creek Dam (ODFW, unpublished data). Among small streams farther from the Rogue River, none in the Trail Creek or Elk Creek basins produced more than 10 coho salmon fry/km (Table 10).

Coho salmon tended to be produced in the large streams where production rates varied between 0 and 4,000 fry/km (Table 10). Production rates of subyearling coho salmon were highly variable in both the Trail Creek and Elk Creek basins. If variability in production remains great, there is little chance of detecting differences in the production rates by sampling annually in subsequent years. However, variation in production rates could change annually depending on the effect of water yield on the spawning distribution of adult fish.

In large streams, production rates of coho salmon averaged 2,114 fry/km in the two Trail Creek streams and 555 fry/km in the three Elk Creek streams. A t-test with data in Table 10 indicated that the difference in the means was not significant ($P = 0.388$). A sensitivity analysis with data in Table 10 suggested that there is an 80% chance, at the 95% confidence level, that annual sampling will detect a significant difference if the average production rate in the Trail Creek streams exceeds the annual production rate in the Elk Creek streams by 3,200 fry/km.

We found that Flat Creek and Bitterlick Creek in the Elk Creek Basin produced almost no coho salmon (Table 10). Poor adult returns from the 1987-91 brood years may be partly responsible. However, coho salmon were present in large numbers in Sugarpine Creek, which is located between Flat Creek and Bitterlick Creek, and in West Branch. We concluded that surveys should be conducted to compare the amount of spawning habitat in Flat and Bitterlick creeks to that in West Branch and Sugarpine creeks.

Table 10. Estimates of the minimum production of subyearling coho salmon in 12 streams in the Trail Creek and Elk Creek basins, 1995. Production estimates are minimums because weir traps did not operate during the entire period that fry migrated from streams.

Basin	Creek	Km of habitat	Fish produced	Production/km (95% CI)
		SMALL STREAMS NEAR THE ROGUE RIVER		
Trail Creek	Canyon	0.51	9,704	19,027 ± 550
Elk Creek	Berry	--	0	0 ± 0
		SMALL STREAMS		
Trail Creek	Romine	0.81[a]	7	8 ± 0
Trail Creek	Chicago	--	0	0 ± 0
Elk Creek	Alco	1.87[a]	4	2 ± 0
Elk Creek	Middle	--	0	0 ± 0
Elk Creek	Jones	--	0	0 ± 0
		LARGE STREAMS		
Trail Creek	Wall	1.40	243	174 ± 44
Trail Creek	West Fork	1.02	4,135	4,054 ± 1,592
Elk Creek	West Branch	4.39	7,294	1,662 ± 314
Elk Creek	Flat	1.11	3	3 ± 3
Elk Creek	Bitterlick	--	0	0 ± 0

[a] *Assumed to be the same as migratory trout*.

Physical Factors

Maximum water temperatures of stream with weir traps ranged between 14.6 and 24.8°C. In small streams, water temperatures peaked when flow became intermittent. In large streams, water temperatures peaked between 17 July and 5 August. Daily estimates of maximum water temperatures in each stream are summarized in Appendix Tables A-33 and A-34.

Maximum water temperature did not differ between large streams in the Trail Creek and Elk Creek basins. Peak water temperature averaged 22.0°C and ranged between 19.5 and 24.6°C in the two large streams in the Trail Creek Basin. Peak water temperature averaged 21.1°C and ranged between 19.5 and 23.4°C in the three large streams in the Elk Creek Basin. These findings indicated that differences in production rates of trout in the two basins are not likely explained by differences in maximum water temperature.

Flow estimates when streams were electrofished in summer ranged between 0.04 and 3.7 cfs. Flows exceeded 0.1 cfs only in Chicago Creek, Flat Creek, West Branch, Sugarpine Creek, and Bitterlick Creek. We observed that the lower portions of all the other streams, and Flat Creek, dried up by the end of summer.

Estimation of Recruitment Rates

Adult Returns to Elk Creek

Returns of wild adult steelhead to the collection facility on Elk Creek accounted for 1.3-2.0% of the wild adult steelhead that passed Gold Ray Dam during the 1992-93 through 1994-95 return years (Table 11). Returns of wild coho salmon to Elk Creek during the 1993-94 and 1994-95 return years accounted for 7.1-10.0% of the wild coho salmon that passed Gold Ray Dam (Table 11). Returns of wild coho salmon to Gold Ray Dam could not be estimated for the 1992-93 return year.

The Elk Creek Basin upstream of the dam accounts for about 9.5% of the area accessible to anadromous salmonids that pass Gold Ray Dam. Assuming that the spawning distribution of wild adult anadromous salmonids is similar to the distribution of accessible areas upstream of Gold Ray Dam, the data suggested that Elk Creek Dam was responsible decreasing the returns of wild adult steelhead to Elk Creek by 79% in 1992-93, 86% in 1993-94, and 83% in 1994-95. A similar analysis for wild coho salmon suggested that the dam may not have affected adult returns in 1993-94, but decreased adult returns to Elk Creek by 25% in 1994-95. Estimates of the production of subyearling trout and coho salmon in the Trail Creek and Elk Creek basins also indicated that Elk Creek Dam has reduced the production of anadromous salmonids in upstream areas (*see* **Estimation of Total Production** and **Predicted Numbers of Coho Salmon:**, both on Page 19).

Table 11. Returns of wild adult anadromous salmonids to Elk Creek as compared to those that passed Gold Ray Dam, 1992-93 through 1994-95. Steelhead less than 41 cm (half-pounders) are not included. Passage estimates at Gold Ray Dam were received from Michael Evenson, ODFW, Central Point.

Return year	Steelhead			Coho salmon		
	Elk Creek	Gold Ray Dam	% return	Elk Creek	Gold Ray Dam	% return
1992-93	112	5,541	2.0	40	--	--
1993-94	105	8,022	1.3	76	756	10.1
1994-95	201	12,515	1.6	232	3,265	7.1

Juvenile Migration from Elk Creek

Most marked fish released upstream of the rotary trap migrated downstream during the week of release (Table 12). This finding indicated that trap efficiency in week i could be estimated from pooled numbers of fish recaptured in week i and week i+1 (Thedinga et al. 1994).

Lack of significant differences in mean lengths between marked fish released upstream and subsequent recaptures indicated that the rotary trap captured salmonid fry in a size-independent manner (Table 13). However, recapture rates of subyearling trout differed significantly between weeks

Table 12. Number of marked subyearling salmonids recaptured in the rotary trap, 1995.

Time of recapture	Unknown salmonids	Trout	Coho salmon	Chinook salmon
Week of release	53	22	58	3
Week after release	2	3	2	0

(Chi-square = 13.74, $P < 0.001$). These findings indicate that trap efficiency should be estimated on a weekly basis in subsequent years of sampling, but that corrections for size-selectivity are not needed to estimate the number of salmonid fry that annually migrate from Elk Creek.

The rotary trap captured unknown salmonid fry and trout fry at similar rates. There was no significant difference (Chi-square = 1.50, $P = 0.471$) in the recapture rate for both types of fish marked and released between 14 May and 2 June. Coho salmon fry caught in the rotary trap were large enough to be distinguished from trout fry (Appendix Tables A-35 through A-37). Based on this finding, we pooled trap catches of unknown salmonid fry with trap catches of trout fry to estimate the number of trout fry that migrated from Elk Creek. The number of juvenile salmonids caught in the rotary trap are in Appendix tables A-38 and A-39.

Table 13. Comparisons of mean lengths of marked fish released and recaptured in the rotary trap, 1995. Comparisons were made with paired t-tests.

Fish type	Week of marking	Mean length (cm)		*P* for difference
		Marked	Recaptured	
0+ unknown salmonids	05/28-06/03	3.04	3.03	0.619
0+ trout	05/21-05/27	3.88	4.14	0.207
0+ trout	05/28-06/03	3.59	3.52	0.681
0+ coho salmon	05/14-05/20	4.63	4.83	0.232
0+ coho salmon	05/21-05/27	5.67	5.63	0.650

Estimated numbers of juvenile salmonids that migrated from Elk Creek during the period the rotary trap fished in 1995 are in Table 14. We concluded that the confidence intervals associated with estimates of the numbers of subyearling trout and subyearling coho salmon were small enough to be able to accurately estimate rates of recruitment in future years. However, we were unable to evaluate whether the number of yearling coho salmon can be accurately estimated because of the small numbers of smolts captured in 1995. This evaluation should be conducted in 1996.

In addition, we were unable to operate the 8-foot rotary trap when the flow in Elk Creek decreased to less than 120 cfs. A 5-foot rotary trap is needed to sample the large number of subyearling salmonids that migrate from the creek at lower flows.

Table 14. Estimated number of juvenile salmonids that migrated from Elk Creek, 4 May - 2 June, 1995.

Fish type	Age	95% confidence interval
Trout[a]	0+	27,581 ± 6,556
Coho salmon	0+	3,631 ± 1,089
Chinook salmon	0+	121 ± 163
Coho salmon[b]	$\geq$ 1+	48 ± [d]
Cutthroat	$\geq$ 1+	371 ± 509
Steelhead[b,c]	$\geq$ 1+	349 ± [d]

[a] *Includes fry classified as unknown salmonids*.
[b] *Assumed trap efficiency was the same as for age $\geq$ 1+ cutthroat.*
[c] *May include some rainbow trout*.
[d] *Confidence interval could not be estimated*.

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APPENDIX A

Summary of Results from Sampling in 1995

Appendix Table A-1. Number of mature coho salmon, steelhead, and cutthroat trapped at the fish collection facility on Elk Creek, 1994-95 return year. Coho salmon jacks were less than 50 cm long and half-pounders were less than 41 cm long. Lengths of all cutthroat exceeded 30 cm and none exhibited hatchery marks. Data does not include fish transported multiple times.

Week of capture	Coho salmon				Steelhead				Cutthroat
	Jacks		Adults		Half-pounders		Adults		
	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	Hatchery	
10/29-11/04	1	2	3	0	0	0	0	0	0
11/05-11/11	2	1	15	0	0	0	2	0	0
11/12-11/18	0	0	5	0	0	0	0	0	0
11/19-11/25	7	0	31	0	0	0	0	0	0
11/26-12/02	20	5	72	9	0	0	19	1	10
12/03-12/09	2	2	22	3	0	0	0	0	1
12/10-12/16	0	0	6	3	0	0	0	0	5
12/17-12/23	5	1	24	10	0	0	17	0	7
12/24-12/31	1	0	12	13	0	0	1	1	0
01/01-01/07	0	0	2	2	0	0	0	0	0
01/08-01/14	0	0	2	1	0	0	27	0	3
01/15-01/21	0	0	0	0	1	0	17	0	1
01/22-01/28	0	0	0	0	0	0	4	0	0
01/29-02/04	0	0	0	0	1	0	23	0	4
02/05-02/11	0	0	0	0	0	0	9	1	0
02/12-02/18	0	0	0	0	0	0	0	0	0
02/19-02/25	0	0	0	0	0	0	16	0	1
02/26-03/04	0	0	0	0	0	0	6	0	0
03/05-03/11	0	0	0	0	0	0	14	0	0
03/12-03/18	0	0	0	0	0	0	25	1	6
03/19-03/25	0	0	0	0	0	0	11	0	0
03/26-04/01	0	0	0	0	1	0	3	0	0
04/02-04/08	0	0	0	0	0	0	1	0	0
04/09-04/15	0	0	0	0	0	0	1	0	0
04/16-04/22	0	0	0	0	0	0	2	0	0
04/23-04/29	0	0	0	0	0	0	1	1	1
04/30-05/06	0	0	0	0	0	0	2	1	0
05/07-05/13	0	0	0	0	0	0	0	0	0
05/13-05/20	0	0	0	0	0	0	0	1	0
Annual Total	38	11	194	41	3	0	201	7	39

Appendix Table A-2. Number of mature chinook salmon trapped at the fish collection facility on Elk Creek, 1994-95 return year. Jacks were less than 60 cm long. Data does not include fish transported multiple times.

Week of capture	Jacks		Adults	
	Marked	Unmarked	Marked	Unmarked
10/29-11/04	0	3	2	0
11/05-11/11	1	14	1	6
11/12-11/18	0	3	0	1
11/19-11/25	0	1	0	0
11/26-12/02	0	2	0	1
Annual Total	1	23	3	8

Appendix Table A-3. Number of juvenile salmonids trapped at the fish collection facility on Elk Creek, 1994-95. All fish were wild except for one marked steelhead caught in December.

Month of capture	Coho salmon	Steelhead	Cutthroat
October	0	8	1
November	0	55	1
December	1	16	0
January	0	5	0
February	0	3	0
Total catch	1	86	2

Appendix Table A-4. Characteristics of creeks examined as potential streams for estimation of the production of juvenile salmonids, 1994-1995.

Creek	Km of habitat[a]	Km from river	Elevation at mouth (ft)	Access[b]	Gradient[c]	Length of stream (km)[d]
ELK CREEK BASIN						
Berry	2	2	1,460	Fair	Low	2.6
West Branch	9	5	1,560	Good	Moderate	11.7
Alco	2	10	1,660	Good	Steep	3.8
Middle	1	12	1,700	Good	Steep	4.5
Flat	7	14	1,740	Good	Low	10.1
Jones	1	15	1,780	Fair	Steep	3.7
Sugarpine	10	17	1,820	Fair	Low	13.8
Elkhorn	3	20	1,980	Fair	Moderate	6.2
Hawk	<1	22	2,060	Good	Moderate	7.8
Dodes	<1	18	1,880	Good	Moderate	6.2
Button	<1	21	1,960	Good	Moderate	7.6
Bitterlick	8	21	2,000	Good	Moderate	13.5
Swanson	<1	22	2,080	Good	Steep	7.7
Brush	2	24	2,240	Good	Moderate	6.0
TRAIL CREEK BASIN						
Canyon	1	3	1,520	Fair	Moderate	4.2
Paradise	<1	8	1,680	Poor	Steep	2.4
Romine	1	9	1,700	Good	Moderate	4.0
Walpole	1	10	1,760	Good	Moderate	3.3
Chicago	2	12	1,860	Good	Steep	4.0
West Fork[e]	2	12	1,860	Good	Low	6.2
Wall	3	10	1,880	Fair	Low	6.5
BIG BUTTE CREEK BASIN						
Crowfoot	2	5	1,640	Poor	Moderate	5.4
Clark	1	6	1,660	Poor	Steep	12.4
McNeil	7	7	1,660	Poor	Moderate	14.6
Gray	1	12	1,900	Fair	Low	3.4
Dog	1	13	1,940	Fair	Steep	7.4
Box	<1	15	2,080	Fair	Steep	5.0
Eighty Acre	4	24	2,640	Good	Low	7.5
Jackass	5	28	2,860	Good	Low	7.4

[a] *As judged during the initial survey.*
[b] *To a trap site and to remainder of the stream.*
[c] *Near the mouth of the stream.*
[d] *As estimated from topographical maps.*
[e] *Potential trap site was upstream of mouth.*

Appendix Table A-4. Continued.

Creek	Km of habitat[a]	Km from river	Elevation at mouth (ft)	Access[b]	Gradient[c]	Length of stream (km)[d]
			LITTLE BUTTE CREEK BASIN			
Lake	6	27	1,640	Fair	Low	12.0
Lost	5	33	1,840	Fair	Low	13.0
Deer	2	39	2,060	Good	Moderate	5.2
Soda	1	41	2,140	Fair	Low	6.8
Dead Indian	1	47	2,560	Poor	Steep	14.1
			EVANS CREEK BASIN			
Pleasante	8	13	1,120	Fair	Low	19.3
Sykes	4	17	1,160	Fair	Moderate	6.2
May	3	21	1,240	Fair	Moderate	6.1
Ramsey	1	30	1,460	Fair	Steep	5.8
Rasberry	1	34	1,600	Good	Moderate	1.7
Battle	5	35	1,640	Good	Low	4.9
Salt	1	40	1,800	Good	Steep	4.1
Rock	6	41	1,840	Good	Low	10.2
Morrison	6	42	1,780	Fair	Moderate	9.1
East Fork[e]	2	44	1,840	Good	Steep	14.7

Appendix Table A-5. Number of fish captured in the weir trap on Berry Creek, 1995. Trapping began on 9 April and ended on 30 July.

Week of capture	Unknown salmonids Age 0+	Trout Age 0+	Coho salmon Age 0+	Coho salmon Age 1+	Cutthroat trout Age >= 1+	Steelhead[a] trout Age >= 1+
04/09-04/15[b]	144	0	0	0	1	2
04/16-04/22[b]	82	0	1	0	1	5
04/23-04/29	351	0	7	0	1	7
04/30-05/06	195	232	3	0	2	3
05/07-05/13	100	529	0	0	5	34
05/14-05/20	0	2,804	0	0	6	8
05/21-05/27	0	6,745	0	0	0	0
05/28-06/03	0	3,996	0	0	0	0
06/04-06/10	0	1,824	0	0	0	0
06/11-06/17	0	1,158	0	0	0	0
06/18-06/24	0	525	0	0	1	0
06/25-07/01	0	231	0	0	0	0
07/02-07/08	0	38	0	0	0	0
07/09-07/15	0	7	0	0	0	0
07/16-07/22	0	0	0	0	0	0
07/23-07/29	0	0	0	0	0	0
07/30-08/05	0	0	0	0	0	0
Annual total[b]	872	18,089	11	0	17	59

[a] *May include resident rainbow trout.*
[b] *Trap was inoperable during 13-19 April.*

Appendix Table A-6. Number of fish captured in the weir trap on Alco Creek, 1995. Trapping began on 30 March and ended on 27 July.

Week of capture	Unknown salmonids Age 0+	Trout Age 0+	Coho salmon Age 0+	Coho salmon Age 1+	Cutthroat trout Age >= 1+	Steelhead[a] trout Age >= 1+
03/26-04/01[b]	0	0	0	0	2	1
04/02-04/08[b]	0	0	0	0	7	3
04/09-04/15[b]	0	0	0	0	2	0
04/16-04/22[b]	11	0	0	0	0	0
04/23-04/29	5	0	0	0	7	0
04/30-05/06	7	0	0	0	1	0
05/07-05/13	0	0	0	0	7	1
05/14-05/20	0	0	0	0	13	5
05/21-05/27	0	96	0	0	6	0
05/28-06/03	0	757	0	0	1	0
06/04-06/10	0	599	0	0	2	0
06/11-06/17	0	251	0	0	1	0
06/18-06/24	0	207	2	0	0	0
06/25-07/01	0	589	2	0	0	0
07/02-07/08	0	72	0	0	0	0
07/09-07/15	0	322	0	0	0	0
07/16-07/22	0	3	0	0	0	0
07/23-07/29	0	0	0	0	0	0
Annual total[b]	23	2,896	4	0	49	10

[a] *May include resident rainbow trout.*
[b] *Trap was inoperable during 6-8 April and 13-19 April.*

Appendix Table A-7. Number of fish captured in the weir trap on Middle Creek, 1995. Trapping began on 30 March and ended on 27 July.

Week of capture	Unknown salmonids Age 0+	Trout Age 0+	Coho salmon Age 0+	Coho salmon Age 1+	Cutthroat trout Age >= 1+	Steelhead[a] trout Age >= 1+
03/26-04/01	0	0	0	0	0	0
04/02-04/08	0	0	0	0	1	4
04/09-04/15[b]	93	0	0	0	2	0
04/16-04/22[b]	11	0	0	0	0	0
04/23-04/29	10	0	0	0	8	1
04/30-05/06	56	1	0	0	1	2
05/07-05/13	1	1	0	0	4	1
05/14-05/20	0	17	0	0	6	0
05/21-05/27	0	72	0	0	3	0
05/28-06/03	0	220	0	0	0	0
06/04-06/10	0	190	0	0	0	0
06/11-06/17	0	138	0	0	0	0
06/18-06/24	0	108	0	0	0	0
06/25-07/01	0	185	0	0	0	0
07/02-07/08	0	37	0	0	0	0
07/09-07/15	0	20	0	0	0	0
07/16-07/22	0	1	0	0	0	0
07/23-07/29	0	0	0	0	0	0
Annual total[b]	171	990	0	0	34	8

[a] *May include resident rainbow trout.*
[b] *Trap was inoperable during 13-18 April.*

Appendix Table A-8. Number of fish captured in the weir trap on Jones Creek, 1995. Trapping began on 9 April and ended on 29 June.

Week of capture	Unknown salmonids Age 0+	Trout Age 0+	Coho salmon Age 0+	Coho salmon Age 1+	Cutthroat trout Age >= 1+	Steelhead[a] trout Age >= 1+
04/09-04/15[b]	38	0	0	0	2	1
04/16-04/22[b]	103	0	0	0	0	2
04/23-04/29	152	0	0	0	8	3
04/30-05/06	13	91	0	0	1	1
05/07-05/13	1	153	0	0	10	5
05/14-05/20	0	328	0	0	21	5
05/21-05/27	0	788	0	0	4	1
05/28-06/03	0	906	0	0	3	0
06/04-06/10	0	512	0	0	0	0
06/11-06/17	0	254	0	0	2	0
06/18-06/24	0	233	0	0	0	0
06/25-07/01	0	95	0	0	0	0
Annual total[b]	307	3,360	0	0	51	18

[a] *May include resident rainbow trout.*
[b] *Trap was inoperable during 13-19 April.*

Appendix Table A-9. Number of fish captured in the weir trap on the West Branch of Elk Creek, 1995. Trapping began on 18 May and ended on 13 November.

Week of capture	Unknown salmonids Age 0+	Trout Age 0+	Coho salmon Age 0+	Coho salmon Age 1+	Cutthroat trout Age >= 1+	Steelhead[a] trout Age >= 1+
05/14-05/20	0	1	4	8	19	20
05/21-05/27	110	29	11	21	19	22
05/28-06/03	908	71	158	3	8	6
06/04-06/10	1,034	104	64	0	2	2
06/11-06/17[b]	78	35	33	0	4	0
06/18-06/24[b]	0	39	18	0	6	1
06/25-07/01	0	92	120	0	4	3
07/02-07/08	0	105	148	0	5	1
07/09-07/15	0	40	138	0	3	0
07/16-07/22	0	92	109	0	3	0
07/23-07/29	0	49	54	0	1	0
07/30-08/05	0	19	16	0	0	0
08/06-08/12	0	13	11	0	0	0
08/13-08/19	0	4	1	0	2	0
08/20-08/26	0	1	1	0	0	0
08/27-09/02	0	0	3	0	0	0
09/03-09/09	0	0	3	0	0	0
09/10-09/16	0	0	4	0	0	0
09/17-09/23	0	0	2	0	0	0
09/24-09/30	0	0	2	0	0	0
10/01-10/07	0	1	3	0	0	0
10/08-10/14	0	0	0	0	0	0
10/15-10/21	0	0	1	0	0	1
10/22-10/28	0	0	0	0	0	0
10/29-11/04	0	0	0	0	0	0
11/05-11/11	0	0	0	0	0	0
11/12-11/18	0	0	0	0	6	1
Annual total[b]	2,130	695	904	32	82	55

[a] *May include resident rainbow trout.*
[b] *Trap was inoperable during 15-19 June.*

Appendix Table A-10. Number of fish captured in the weir trap on Flat Creek, 1995. Trapping began on 24 May and ended on 24 August.

Week of capture	Unknown salmonids Age 0+	Trout Age 0+	Coho salmon Age 0+	Coho salmon Age 1+	Cutthroat trout Age >= 1+	Steelhead[a] trout Age >= 1+
05/21-05/27	0	4	0	0	17	6
05/28-06/03	0	64	0	0	8	3
06/04-06/10	0	166	0	0	6	3
06/11-06/17[b]	0	115	0	0	1	0
06/18-06/24[b]	0	32	0	0	1	1
06/25-07/01	0	302	0	0	3	2
07/02-07/08	0	135	0	0	0	0
07/09-07/15	0	87	0	0	0	0
07/16-07/22	0	15	0	0	0	0
07/23-07/29	0	1	0	0	0	0
07/30-08/05	0	1	0	0	0	0
08/06-08/12	0	0	0	0	0	0
08/13-08/19	0	0	0	0	0	0
08/20-08/26	0	0	0	0	0	0
Annual total[b]	0	922	0	0	36	15

[a] *May include resident rainbow trout.*
[b] *Trap was inoperable during 16-19 June.*

Appendix Table A-11. Number of fish captured in the weir trap on Bitterlick Creek, 1995. Trapping began on 26 May and ended on 25 September.

Week of capture	Unknown salmonids Age 0+	Trout Age 0+	Coho salmon Age 0+	Coho salmon Age 1+	Cutthroat trout Age >= 1+	Steelhead[a] trout Age >= 1+
05/21-05/27	0	0	0	0	12	6
05/28-06/03	0	0	0	0	29	20
06/04-06/10	33	0	0	0	11	5
06/11-06/17[b]	50	0	0	0	8	1
06/18-06/24[b]	0	0	0	0	0	0
06/25-07/01[b]	6	0	0	0	8	1
07/02-07/08	0	2	0	0	6	3
07/09-07/15	0	1	0	0	7	1
07/16-07/22	0	0	0	0	3	0
07/23-07/29	0	22	0	0	1	1
07/30-08/05	0	3	0	0	0	0
08/06-08/12	0	2	0	0	0	0
08/13-08/19	0	2	0	0	0	0
08/20-08/26	0	0	0	0	0	0
08/27-09/02	0	1	0	0	0	0
09/03-09/09	0	0	0	0	0	0
09/10-09/16	0	0	0	0	0	0
09/17-09/23	0	0	0	0	0	0
09/24-09/30	0	0	0	0	0	0
Annual total[b]	89	33	0	0	85	38

[a] *May include resident rainbow trout.*
[b] *Trap was inoperable during 16-26 June.*

Appendix Table A-12. Number of fish captured in the weir trap on Canyon Creek, 1995. Trapping began on 7 April and ended on 31 July.

Week of capture	Unknown salmonids Age 0+	Trout Age 0+	Coho salmon Age 0+	Coho salmon Age 1+	Cutthroat trout Age >= 1+	Steelhead[a] trout Age >= 1+
04/02-04/08	6	0	142	0	4	0
04/09-04/15[b]	39	0	551	0	3	0
04/16-04/22[b]	1,336	0	1,761	0	0	0
04/23-04/29	2,582	0	3,986	0	14	3
04/30-05/06	767	104	576	3	3	2
05/07-05/13	1,093	67	828	0	10	1
05/14-05/20	641	107	237	0	8	0
05/21-05/27	724	318	152	0	0	1
05/28-06/03	2,230	459	246	0	0	0
06/04-06/10	708	418	175	0	0	0
06/11-06/17	38	337	165	0	3	0
06/18-06/24	0	112	48	0	1	0
06/25-07/01	0	135	74	0	0	0
07/02-07/08	0	66	106	0	0	0
07/09-07/15	0	30	50	0	0	0
07/16-07/22	0	13	31	0	0	0
07/23-07/29	0	6	27	0	0	0
07/30-08/05	0	0	3	0	0	0
Annual total[b]	10,164	2,172	9,158	3	46	7

[a] *May include resident rainbow trout.*
[b] *Trap was inoperable during 13-19 June.*

Appendix Table A-13. Number of fish captured in the weir trap on Romine Creek, 1995. Trapping began on 6 April and ended on 28 July.

Week of capture	Unknown salmonids Age 0+	Trout Age 0+	Coho salmon Age 0+	Coho salmon Age 1+	Cutthroat trout Age >= 1+	Steelhead[a] trout Age >= 1+
04/02-04/08[b]	0	0	0	0	2	1
04/09-04/15[b]	2	0	0	0	0	0
04/16-04/22[b]	20	0	0	0	0	0
04/23-04/29	12	0	0	0	3	0
04/30-05/06	10	0	0	1	0	0
05/07-05/13	5	11	0	0	4	0
05/14-05/20	1	132	0	0	6	0
05/21-05/27	0	162	0	0	0	0
05/28-06/03[c]	0	381	5	0	0	0
06/04-06/10	0	277	2	0	1	0
06/11-06/17	0	206	0	0	0	0
06/18-06/24	0	279	0	0	0	0
06/25-07/01	0	99	0	0	0	0
07/02-07/08	0	11	0	0	0	0
07/09-07/15	0	23	0	0	0	0
07/16-07/22	0	0	0	0	0	0
07/23-07/29	0	1	0	0	0	0
Annual total[b]	53	1,582	7	1	16	1

[a] *May include resident rainbow trout.*
[b] *Trap was inoperable during 8-11 April and 13-19 April.*
[c] *An unknown number of fish escaped prior to discovery of a hole in the weir on 28 May.*

Appendix Table A-14. Number of fish captured in the weir trap on Chicago Creek, 1995. Trapping began on 6 April and ended on 30 August.

Week of capture	Unknown salmonids Age 0+	Trout Age 0+	Coho salmon Age 0+	Coho salmon Age 1+	Cutthroat trout Age >= 1+	Steelhead[a] trout Age >= 1+
04/02-04/08	0	0	0	0	4	0
04/09-04/15[b]	0	0	0	0	5	2
04/16-04/22[b]	29	0	0	0	3	0
04/23-04/29	178	0	0	0	12	1
04/30-05/06	192	0	0	0	4	0
05/07-05/13	79	174	0	0	7	0
05/14-05/20	27	51	0	0	10	0
05/21-05/27	35	43	0	0	7	1
05/28-06/03	57	50	0	0	7	0
06/04-06/10	43	115	0	0	6	0
06/11-06/17	9	118	0	0	3	0
06/18-06/24	8	76	0	0	4	0
06/25-07/01	0	60	0	0	0	0
07/02-07/08	0	49	0	0	1	0
07/09-07/15	0	22	0	0	2	0
07/16-07/22	0	35	0	0	2	0
07/23-07/29	0	26	0	0	0	0
07/30-08/05	0	14	0	0	0	0
08/06-08/12	0	11	0	0	0	0
08/13-08/19	0	4	0	0	0	0
08/20-08/26	0	4	0	0	0	0
08/27-09/02	0	6	0	0	0	0
Annual total[b]	657	858	0	0	77	4

[a] *May include resident rainbow trout.*
[b] *Trap was inoperable during 10-11 April and 13-19 April.*

Appendix Table A-15. Number of fish captured in the weir trap on the West Fork of Trail Creek, 1995. Trapping began on 19 May and ended on 30 August.

Week of capture	Unknown salmonids Age 0+	Trout Age 0+	Coho salmon Age 0+	Coho salmon Age 1+	Cutthroat trout Age >= 1+	Steelhead[a] trout Age >= 1+
05/14-05/20	12	6	35	1	7	3
05/21-05/27	141	84	568	1	15	18
05/28-06/03	389	631	609	0	6	2
06/04-06/10	1,529	1,037	272	0	6	1
06/11-06/17	606	1,156	350	0	0	1
06/18-06/24	311	941	142	0	1	0
06/25-07/01	57	1,124	252	0	1	0
07/02-07/08	0	935	190	0	1	0
07/09-07/15	0	541	86	0	0	0
07/16-07/22	0	269	43	0	0	0
07/23-07/29	0	92	6	0	0	0
07/30-08/05	0	41	7	0	0	0
08/06-08/12	0	13	1	0	0	0
08/13-08/19	0	7	1	0	0	0
08/20-08/26	0	13	4	0	0	0
Annual total	3,045	6,890	2,566	2	37	25

[a] *May include resident rainbow trout.*

Appendix Table A-16. Number of fish captured in the weir trap on Wall Creek, 1995. Trapping began on 25 May and ended on 29 August.

Week of capture	Unknown salmonids Age 0+	Trout Age 0+	Coho salmon Age 0+	Coho salmon Age 1+	Cutthroat trout Age >= 1+	Steelhead[a] trout Age >= 1+
05/21-05/27	67	790	0	0	6	8
05/28-06/03	195	2,903	8	0	4	3
06/04-06/10	69	1,198	6	0	3	1
06/11-06/17	1	577	3	0	2	0
06/18-06/24	0	432	1	0	2	0
06/25-07/01	0	2,165	30	0	0	0
07/02-07/08	0	1,610	3	0	1	0
07/09-07/15	0	443	1	0	1	0
07/16-07/22	0	400	2	0	1	0
07/23-07/29	0	82	0	0	0	0
07/30-08/05	0	8	0	0	0	0
08/06-08/12	0	5	0	0	0	0
08/13-08/19	0	1	0	0	0	0
08/20-08/26	0	1	0	0	0	0
Annual total	332	10,615	54	0	20	12

[a] *May include resident rainbow trout.*

Appendix Table A-17. Mean fork length (cm) of subyearling salmonids captured in the weir trap on Berry Creek, 1995.

Week of capture	Unknown salmonids			Trout			Coho salmon		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
04/09-04/15	2.92	0.15	144	--	--	0	--	--	0
04/16-04/22	3.02	0.14	76	--	--	0	3.50	--	1
04/23-04/29	2.74	0.25	170	--	--	0	3.53	0.11	4
04/30-05/06	2.99	0.16	96	3.43	0.21	152	3.73	0.21	3
05/07-05/13	2.93	0.10	25	3.51	0.26	116	--	--	0
05/14-05/20	--	--	0	3.90	0.35	149	--	--	0
05/21-05/27	--	--	0	4.09	0.42	176	--	--	0
05/28-06/03	--	--	0	4.31	0.51	274	--	--	0
06/04-06/10	--	--	0	4.47	0.52	146	--	--	0
06/11-06/17	--	--	0	4.30	0.60	79	--	--	0
06/18-06/24	--	--	0	4.49	0.54	60	--	--	0
06/25-07/01	--	--	0	4.83	0.63	168	--	--	0
07/02-07/08	--	--	0	5.33	0.77	30	--	--	0
07/09-07/15	--	--	0	6.30	--	1	--	--	0

Appendix Table A-18. Mean fork length (cm) of subyearling salmonids captured in the weir trap on Alco Creek, 1995.

Week of capture	Unknown salmonids			Trout			Coho salmon		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
04/16-04/22	2.78	0.16	11	--	--	0	--	--	0
04/23-04/29	2.68	0.16	5	--	--	0	--	--	0
04/30-05/06	2.92	0.04	6	--	--	0	--	--	0
05/07-05/13	--	--	0	--	--	0	--	--	0
05/14-05/20	--	--	0	--	--	0	--	--	0
05/21-05/27	--	--	0	4.67	0.34	71	--	--	0
05/28-06/03	--	--	0	5.10	0.36	165	--	--	0
06/04-06/10	--	--	0	5.25	0.41	220	--	--	0
06/11-06/17	--	--	0	5.46	0.41	106	--	--	0
06/18-06/24	--	--	0	5.72	0.41	19	6.25	0.25	2
06/25-07/01	--	--	0	5.82	0.48	224	--	--	0
07/02-07/08	--	--	0	6.45	0.75	2	--	--	0
07/09-07/15	--	--	0	6.02	0.45	92	--	--	0
07/16-07/22	--	--	0	6.87	0.74	3	--	--	0

Appendix Table A-19. Mean fork length (cm) of subyearling salmonids captured in the weir trap on Middle Creek, 1995.

Week of capture	Unknown salmonids			Trout			Coho salmon		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
04/09-04/15	2.84	0.09	91	--	--	0	--	--	0
04/16-04/22	3.12	0.16	11	--	--	0	--	--	0
04/23-04/29	2.81	0.03	10	--	--	0	--	--	0
04/30-05/06	2.85	0.08	52	3.80	--	1	--	--	0
05/07-05/13	2.80	--	1	4.00	--	1	--	--	0
05/14-05/20	--	--	0	4.69	0.26	12	--	--	0
05/21-05/27	--	--	0	4.93	0.35	51	--	--	0
05/28-06/03	--	--	0	5.09	0.47	125	--	--	0
06/04-06/10	--	--	0	5.21	0.34	84	--	--	0
06/11-06/17	--	--	0	5.62	0.36	64	--	--	0
06/18-06/24	--	--	0	5.90	0.28	7	--	--	0
06/25-07/01	--	--	0	6.17	0.41	74	--	--	0
07/02-07/08	--	--	0	6.34	0.49	25	--	--	0
07/09-07/15	--	--	0	6.64	0.53	11	--	--	0

Appendix Table A-20. Mean fork length (cm) of subyearling salmonids captured in the weir trap on Jones Creek, 1995.

Week of capture	Unknown salmonids			Trout			Coho salmon		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
04/09-04/15	2.83	0.12	38	--	--	0	--	--	0
04/16-04/22	3.16	0.10	100	--	--	0	--	--	0
04/23-04/29	3.16	0.12	115	--	--	0	--	--	0
04/30-05/06	--	--	0	3.47	0.17	91	--	--	0
05/07-05/13	--	--	0	3.72	0.22	149	--	--	0
05/14-05/20	--	--	0	4.07	0.24	161	--	--	0
05/21-05/27	--	--	0	4.37	0.25	219	--	--	0
05/28-06/03	--	--	0	4.75	0.29	144	--	--	0
06/04-06/10	--	--	0	5.08	0.37	149	--	--	0
06/11-06/17	--	--	0	5.31	0.41	84	--	--	0
06/18-06/24	--	--	0	5.54	0.36	23	--	--	0
06/25-07/01	--	--	0	5.50	0.48	46	--	--	0

Appendix Table A-21. Mean fork length (cm) of subyearling salmonids captured in the weir trap on the West Branch of Elk Creek, 1995.

Week of capture	Unknown salmonids			Trout			Coho salmon		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
05/14-05/20	--	--	0	--	--	0	4.10	0.22	3
05/21-05/27	2.86	0.11	9	3.85	0.32	13	4.73	0.58	3
05/28-06/03	2.91	0.10	170	4.17	0.46	66	4.86	0.57	110
06/04-06/10	2.95	0.13	268	3.57	0.50	23	5.50	0.33	21
06/11-06/17	--	--	0	3.60	0.59	10	5.36	0.51	26
06/18-06/24	--	--	0	--	--	0	5.21	0.59	7
06/25-07/01	--	--	0	4.02	0.77	36	5.96	0.54	40
07/02-07/08	--	--	0	5.08	0.88	27	5.85	0.46	34
07/09-07/15	--	--	0	5.57	0.92	9	6.01	0.49	50
07/16-07/22	--	--	0	4.94	0.81	57	5.89	0.57	55
07/23-07/29	--	--	0	4.74	0.81	39	6.04	0.38	48
07/30-08/05	--	--	0	5.03	0.85	19	5.93	0.32	16
08/06-08/12	--	--	0	4.61	0.76	13	6.22	0.45	11
08/13-08/19	--	--	0	4.35	0.32	4	7.30	--	1
08/20-08/26	--	--	0	4.30	--	1	5.90	--	1
08/27-09/02	--	--	0	--	--	0	5.97	0.54	3
09/03-09/09	--	--	0	--	--	0	6.03	0.61	3
09/10-09/16	--	--	0	--	--	0	6.10	0.21	4
09/17-09/23	--	--	0	--	--	0	6.35	0.05	2
09/24-09/30	--	--	0	--	--	0	6.60	0.10	2
10/01-10/07	--	--	0	7.80	--	1	6.37	0.12	3
10/08-10/14	--	--	0	--	--	0	--	--	0
10/15-10/21	--	--	0	--	--	0	7.20	--	1

Appendix Table A-22. Mean fork length (cm) of subyearling salmonids captured in the weir trap on Flat Creek, 1995.

Week of capture	Unknown salmonids			Trout			Coho salmon		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
05/21-05/27	--	--	0	4.60	0.21	4	--	--	0
05/28-06/03	--	--	0	5.07	0.25	49	--	--	0
06/04-06/10	--	--	0	5.46	0.37	77	--	--	0
06/11-06/17	--	--	0	6.02	0.35	70	--	--	0
06/18-06/24	--	--	0	6.33	0.52	3	--	--	0
06/25-07/01	--	--	0	6.40	0.49	73	--	--	0
07/02-07/08	--	--	0	6.67	0.54	31	--	--	0
07/09-07/15	--	--	0	6.95	0.56	43	--	--	0
07/16-07/22	--	--	0	7.10	0.56	12	--	--	0
07/23-07/29	--	--	0	7.00	--	1	--	--	0
07/30-08/05	--	--	0	7.60	--	1	--	--	0

Appendix Table A-23. Mean fork length (cm) of subyearling salmonids captured in the weir trap on Bitterlick Creek, 1995.

Week of capture	Unknown salmonids			Trout			Coho salmon		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
06/04-06/10	2.99	0.07	32	--	--	0	--	--	0
06/11-06/17	2.90	0.00	3	--	--	0	--	--	0
06/18-06/24	--	--	0	--	--	0	--	--	0
06/25-07/01	--	--	0	--	--	0	--	--	0
07/02-07/08	--	--	0	3.60	0.20	2	--	--	0
07/09-07/15	--	--	0	--	--	0	--	--	0
07/16-07/22	--	--	0	--	--	0	--	--	0
07/23-07/29	--	--	0	6.01	0.94	22	--	--	0
07/30-08/05	--	--	0	5.80	0.93	3	--	--	0
08/06-08/12	--	--	0	5.90	0.20	2	--	--	0
08/13-08/19	--	--	0	6.00	0.10	2	--	--	0
08/20-08/26	--	--	0	--	--	0	--	--	0
08/27-09/02	--	--	0	7.20	--	1	--	--	0

Appendix Table A-24. Mean fork length (cm) of subyearling salmonids captured in the weir trap on Canyon Creek, 1995.

Week of capture	Unknown salmonids			Trout			Coho salmon		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
04/02-04/08	3.03	0.07	6	--	--	0	3.48	0.09	142
04/09-04/15	2.87	0.17	3	--	--	0	3.55	0.13	32
04/16-04/22	3.05	0.14	131	--	--	0	3.50	0.13	136
04/23-04/29	3.05	0.16	124	--	--	0	3.50	0.12	242
04/30-05/06	2.84	0.16	210	3.32	0.20	34	3.53	0.15	126
05/07-05/13	2.93	0.10	162	3.48	0.27	47	3.58	0.15	258
05/14-05/20	2.81	0.15	228	3.39	0.32	78	3.56	0.20	129
05/21-05/27	2.80	0.22	176	3.42	0.31	168	3.91	0.32	105
05/28-06/03	2.94	0.15	178	3.57	0.40	122	4.01	0.32	125
06/04-06/10	2.95	0.21	226	3.36	0.33	104	4.17	0.46	48
06/11-06/17	--	--	0	3.71	0.60	56	4.47	0.55	37
06/18-06/24	--	--	0	3.67	0.65	21	4.56	0.37	10
06/25-07/01	--	--	0	3.85	0.49	36	4.40	0.38	13
07/02-07/08	--	--	0	3.69	0.42	19	4.34	0.46	33
07/09-07/15	--	--	0	3.96	0.57	11	4.30	0.45	22
07/16-07/22	--	--	0	3.78	0.40	12	4.23	0.39	23
07/23-07/29	--	--	0	3.42	0.23	5	4.25	0.27	27
07/30-08/05	--	--	0	--	--	0	4.50	0.22	3

Appendix Table A-25. Mean fork length (cm) of subyearling salmonids captured in the weir trap on Romine Creek, 1995.

Week of capture	Unknown salmonids			Trout			Coho salmon		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
04/09-04/15	2.80	0.00	2	--	--	0	--	--	0
04/16-04/22	2.78	0.07	20	--	--	0	--	--	0
04/23-04/29	2.70	0.11	8	--	--	0	--	--	0
04/30-05/06	2.87	0.15	9	--	--	0	--	--	0
05/07-05/13	2.94	0.05	5	3.81	0.13	11	--	--	0
05/14-05/20	2.80	--	1	4.16	0.30	103	--	--	0
05/21-05/27	--	--	0	4.32	0.43	114	--	--	0
05/28-06/03	2.70	0.16	3	4.62	0.45	173	5.56	0.24	5
06/04-06/10	--	--	0	4.70	0.46	87	6.10	0.00	2
06/11-06/17	--	--	0	5.04	0.42	56	--	--	0
06/18-06/24	--	--	0	5.43	0.49	18	--	--	0
06/25-07/01	--	--	0	5.23	0.49	21	--	--	0
07/02-07/08	--	--	0	4.65	0.15	2	--	--	0
07/09-07/15	--	--	0	5.10	0.64	7	--	--	0
07/16-07/22	--	--	0	--	--	0	--	--	0
07/23-07/29	--	--	0	5.20	--	1	--	--	0

Appendix Table A-26. Mean fork length (cm) of subyearling salmonids captured in the weir trap on Chicago Creek, 1995.

Week of capture	Unknown salmonids			Trout			Coho salmon		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
04/16-04/22	2.78	0.04	4	--	--	0	--	--	0
04/23-04/29	2.87	0.13	104	--	--	0	--	--	0
04/30-05/06	2.87	0.15	71	--	--	0	--	--	0
05/07-05/13	2.89	0.18	69	3.23	0.07	168	--	--	0
05/14-05/20	2.94	0.11	12	3.28	0.12	34	--	--	0
05/21-05/27	3.03	0.09	21	3.53	0.25	24	--	--	0
05/28-06/03	2.96	0.07	44	3.50	0.33	32	--	--	0
06/04-06/10	2.96	0.08	27	3.37	0.27	33	--	--	0
06/11-06/17	--	--	0	3.39	0.26	22	--	--	0
06/18-06/24	--	--	0	3.51	0.29	18	--	--	0
06/25-07/01	--	--	0	4.11	0.37	18	--	--	0
07/02-07/08	--	--	0	4.10	0.42	16	--	--	0
07/09-07/15	--	--	0	4.34	0.34	5	--	--	0
07/16-07/22	--	--	0	4.15	0.47	29	--	--	0
07/23-07/29	--	--	0	4.26	0.48	26	--	--	0
07/30-08/05	--	--	0	4.06	0.43	14	--	--	0
08/06-08/12	--	--	0	4.21	0.42	11	--	--	0
08/13-08/19	--	--	0	4.83	0.41	4	--	--	0
08/20-08/26	--	--	0	4.65	0.73	4	--	--	0
08/27-09/02	--	--	0	4.45	0.14	6	--	--	0

Appendix Table A-27. Mean fork length (cm) of subyearling salmonids captured in the weir trap on the West Fork of Trail Creek, 1995.

Week of capture	Unknown salmonids			Trout			Coho salmon		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
05/14-05/20	2.97	0.12	3	3.20	--	1	4.47	0.45	10
05/21-05/27	2.97	0.14	127	3.64	0.51	48	4.75	0.35	148
05/28-06/03	3.04	0.10	126	3.77	0.54	148	4.91	0.44	165
06/04-06/10	2.97	0.09	174	3.76	0.56	143	5.00	0.47	87
06/11-06/17	--	--	0	4.04	0.66	181	5.08	0.54	102
06/18-06/24	--	--	0	3.75	0.69	216	4.97	0.55	27
06/25-07/01	--	--	0	4.15	0.75	211	5.28	0.58	118
07/02-07/08	--	--	0	4.17	0.72	134	5.35	0.64	52
07/09-07/15	--	--	0	4.11	0.70	134	5.03	0.60	37
07/16-07/22	--	--	0	4.20	0.72	79	5.12	0.47	19
07/23-07/29	--	--	0	4.19	0.59	48	5.33	0.44	6
07/30-08/05	--	--	0	4.03	0.56	30	5.00	0.64	7
08/06-08/12	--	--	0	3.66	0.42	13	5.10	--	1
08/13-08/19	--	--	0	3.68	0.33	6	4.60	--	1
08/20-08/26	--	--	0	4.72	0.55	13	5.48	0.48	4

Appendix Table A-28. Mean fork length (cm) of subyearling salmonids captured in the weir trap on Wall Creek, 1995.

Week of capture	Unknown salmonids			Trout			Coho salmon		
	Mean	SD	*N*	Mean	SD	*N*	Mean	SD	*N*
05/21-05/27	3.01	0.11	51	3.70	0.34	196	--	--	0
05/28-06/03	2.96	0.16	111	3.89	0.47	183	5.29	0.37	8
06/04-06/10	2.91	0.17	30	4.05	0.55	276	5.38	0.34	6
06/11-06/17	3.00	--	1	4.38	0.64	154	5.87	0.29	3
06/18-06/24	--	--	0	4.60	0.70	86	6.70	--	1
06/25-07/01	--	--	0	4.99	0.66	133	6.16	0.55	12
07/02-07/08	--	--	0	5.19	0.65	155	5.30	--	1
07/09-07/15	--	--	0	5.27	0.68	112	--	--	0
07/16-07/22	--	--	0	5.51	0.75	177	6.50	--	1
07/23-07/29	--	--	0	5.24	0.57	28	--	--	0
07/30-08/05	--	--	0	5.07	0.09	3	--	--	0
08/06-08/12	--	--	0	5.54	0.17	5	--	--	0

Appendix Table A-29. Lengths of trout caught by electrofishing five tributaries of Elk Creek in February-March, 1995.

	Mid-point of interval for fork length (cm)												
Species	5	6	7	8	9	10	11	12	13	14	15	16	17
IN HABITAT OF MIGRATORY SALMONIDS													
Steelhead	0	9	6	10	4	2	2	1	1	0	0	0	0
Cutthroat	2	17	12	3	6	3	5	3	4	1	0	1	0
UPSTREAM FROM HABITAT OF MIGRATORY SALMONIDS													
Steelhead	2	2	0	0	1	0	0	0	0	0	0	0	0
Cutthroat	0	0	10	5	1	4	4	6	2	1	2	0	0

Appendix Table A-30. Electrofishing catches of juvenile salmonids in areas accessible to migratory adults in the Trail Creek Basin, 1995.

	Age 0+				Age ≥ 1+			
	Trout		Coho salmon		Steelhead[a]		Cutthroat	
Unit	Pass 1	Pass 2	Pass 1	Pass 2	Pass 1	Pass 2	Pass 1	Pass 2
CANYON CREEK[b]								
2	5	4	67	12	0	0	5	0
5	22	4	57	8	0	0	3	0
8	13	7	10	2	0	0	2	0
11	40	11	0	0	0	0	6	0
14	47	18	0	0	0	0	3	0
17	43	12	0	0	0	0	9	1
20	63	17	0	0	0	0	4	1
23	46	16	0	0	0	0	6	1
ROMINE CREEK[b]								
2	17	6	0	0	0	0	0	0
5	21	4	0	0	0	0	0	0
8	40	6	0	0	0	0	0	0
11	47	13	0	0	0	0	0	0
14	75	25	0	0	0	0	2	4
CHICAGO CREEK[b]								
2	46	11	0	0	0	0	8	2
7	44	13	0	0	1	0	7	0
12	49	12	0	0	0	0	7	3
17	22	14	0	0	1	0	9	1
22	71	14	0	0	0	0	9	1
27	69	10	0	0	0	0	5	0
WEST FORK[c]								
2	171	41	85	28	0	0	1	0
6	189	36	287	44	4	0	5	0
10	301	90	17	2	0	0	2	0
14	193	38	0	0	6	0	10	1
18	119	29	0	0	3	1	9	3
WALL CREEK[d]								
2	223	52	13	3	4	1	2	0
6	159	52	12	6	0	0	1	1
10	273	102	0	0	0	0	0	2
18	170	60	2	1	0	0	4	0
26	186	40	0	0	1	0	4	3
34	81	20	0	0	0	0	5	1
42	56	8	0	0	0	0	14	2

[a] *May include resident rainbow trout.*
[b] *Unit lengths were about 50 m.*
[c] *Unit lengths were about 100 m.*
[d] *Unit lengths were about 100 m (Units 2-10) and about 50 m (Units 18-42).*

Appendix Table A-31. Electrofishing catches of juvenile salmonids in areas accessible to migratory adults in small streams in the Elk Creek Basin, 1995. Sampling units were about 50 m long and fish listed as steelhead may include some rainbow trout.

	Age 0+				Age ≥ 1+			
	Trout		Coho salmon		Steelhead[a]		Cutthroat	
Unit	Pass 1	Pass 2	Pass 1	Pass 2	Pass 1	Pass 2	Pass 1	Pass 2
				BERRY CREEK				
2	4	0	0	0	0	0	0	0
5	6	4	0	0	0	0	0	0
8	2	1	0	0	0	0	0	0
11	8	4	0	0	0	0	0	0
14	7	0	0	0	0	0	0	0
17	4	2	0	0	0	0	0	0
20	7	3	0	0	0	0	0	0
23	7	3	0	0	0	0	0	0
26	6	1	0	0	0	0	0	0
29	5	0	0	0	0	0	0	0
32	2	0	0	0	0	0	0	0
35	14	3	0	0	0	0	0	0
38	2	1	0	0	0	0	0	0
41	1	0	0	0	0	0	0	0
				ALCO CREEK				
2	2	0	0	0	0	0	0	0
5	6	1	0	0	0	0	0	0
8	63	13	0	0	0	0	1	0
11	14	4	0	0	1	0	2	0
15	19	3	0	0	0	0	0	0
17	8	0	0	0	0	0	0	0
20	10	5	0	0	0	0	0	0
23	22	9	0	0	0	0	1	0
26	9	6	0	0	0	0	1	1
29	22	11	0	0	0	0	3	2
32	30	9	0	0	0	0	10	5
35	2	1	0	0	0	0	9	1
				MIDDLE CREEK				
2	3	0	0	0	0	0	0	0
5	44	9	0	0	0	0	0	0
8	40	6	0	0	0	0	0	0
11	13	4	0	0	0	0	0	0
				JONES CREEK				
2	10	2	0	0	0	0	0	0
5	6	3	0	0	0	0	0	0
8	5	0	0	0	0	0	0	0
11	2	0	0	0	0	0	0	0
14	6	1	0	0	0	0	0	0
17	3	0	0	0	0	0	1	0

Appendix Table A-32. Electrofishing catches of juvenile salmonids in areas accessible to migratory adults in large streams in the Elk Creek Basin, 1995. Sampling units were about 100 m long and fish listed as steelhead may include some rainbow trout.

	Age 0+				Age $\geq$ 1+			
	Trout		Coho salmon		Steelhead[a]		Cutthroat	
Unit	Pass 1	Pass 2	Pass 1	Pass 2	Pass 1	Pass 2	Pass 1	Pass 2
				WEST BRANCH				
2	72	10	118	27	2	1	4	0
6	46	7	131	34	3	1	6	2
10	46	11	177	63	7	2	7	1
14	15	4	111	26	4	0	11	0
18	26	6	111	25	3	0	15	1
22	17	3	140	34	4	1	12	4
26	5	1	98	17	4	2	11	4
30	4	0	109	15	4	1	9	5
34	5	1	109	41	7	2	16	3
38	8	3	88	28	2	0	16	6
42	24	1	42	9	7	4	25	1
46	8	2	0	0	4	1	19	6
52	20	10	0	0	22	8	37	6
58	54	11	0	0	5	1	36	5
62	57	15	0	0	4	1	23	5
66	28	3	0	0	6	2	36	10
70	10	0	0	0	4	3	31	7
76	26	6	0	0	1	0	28	6
				FLAT CREEK				
2	29	6	0	0	3	1	4	1
6	62	12	0	0	2	0	2	0
10	86	19	0	0	5	0	4	1
14	45	10	1	0	8	3	12	2
18	45	8	0	0	5	1	7	1
22	85	19	0	0	4	1	2	1
26	52	8	0	0	3	1	6	3
30	47	15	0	0	2	1	12	3
34	35	7	0	0	5	2	9	3
38	50	8	0	0	2	1	14	4
42	59	12	0	0	2	0	11	3
46	29	15	0	0	2	0	10	1
50	48	10	0	0	2	0	10	3
54	25	4	0	0	0	0	24	1
58	15	2	0	0	0	0	17	3

Appendix Table A-32. Continued.

	Age 0+				Age ≥ 1+			
	Trout		Coho salmon		Steelhead[a]		Cutthroat	
Unit	Pass 1	Pass 2	Pass 1	Pass 2	Pass 1	Pass 2	Pass 1	Pass 2
				BITTERLICK CREEK				
4	38	15	0	0	16	1	14	2
12	31	12	0	0	5	1	15	7
20	28	4	0	0	7	0	15	3
28	29	15	0	0	4	1	23	7
36	25	10	0	0	2	1	20	5
44	11	2	0	0	10	0	11	3
52	18	6	0	0	7	0	8	4
				SUGARPINE CREEK				
2	11	2	187	80	7	0	16	3
6	9	5	156	49	4	1	8	7
10	29	5	127	13	4	0	15	3
14	25	4	159	57	2	0	25	3
18	24	5	95	31	4	2	10	4
22	15	2	52	16	3	2	13	0
26	17	6	44	6	2	1	6	2
30	10	2	64	7	0	0	11	1
34	17	1	43	5	0	0	11	5
38	11	3	45	9	0	0	11	1
42	14	2	43	10	1	0	13	4
46	12	4	64	11	1	0	19	5
50	20	2	37	9	0	0	12	2

Appendix Table A-33. Mean daily maximum water temperature (^{o}C) in streams trapped in the Elk Creek Basin, 1995.

Week	Berry	Alco	Middle	Jones	West Branch	Flat	Bitterlick
05/14-05/20	15.6	12.7	11.8	11.7	--	--	--
05/21-05/27	16.5	14.4	13.3	13.0	--	--	--
05/28-06/03	17.3	16.2	14.4	14.1	--	--	17.0
06/04-06/10	15.3	12.8	12.4	11.9	13.2	13.9	10.9
06/11-06/17	14.6	12.6	11.9	11.8	12.6	13.0	10.7
06/18-06/24	15.7	13.6	12.5	12.4	13.5	13.6	11.2
06/25-07/01	19.0	18.4	15.5	--	17.5	19.9	15.4
07/02-07/08	19.3	17.9	15.6	--	17.3	19.9	15.6
07/09-07/15	18.8	16.3	14.8	--	16.1	18.1	14.5
07/16-07/22	20.4	20.0	16.8	--	19.0	22.4	17.9
07/23-07/29	20.3	--	--	--	18.8	21.9	18.4
07/30-08/05	--	--	--	--	18.6	21.3	18.9
08/06-08/12	--	--	--	--	17.1	19.1	17.4
08/13-08/19	--	--	--	--	15.8	16.9	16.0
08/20-08/26	--	--	--	--	16.2	--	17.2
08/27-09/02	--	--	--	--	16.1	--	17.1
09/03-09/09	--	--	--	--	15.9	--	16.6
09/10-09/16	--	--	--	--	17.0	--	17.6
09/17-09/23	--	--	--	--	16.4	--	16.8
09/24-09/30	--	--	--	--	14.5	--	--
Annual	22.3	20.6	17.4	14.6	19.5	23.4	20.3

Appendix Table A-34. Mean daily maximum water temperature (^{o}C) in streams trapped in the Trail Creek Basin, 1995.

Week	Canyon	Romine	Chicago	Wall	West Fork
05/14-05/20	13.1	13.9	12.2	0.0	--
05/21-05/27	14.7	15.5	13.4	0.0	--
05/28-06/03	16.7	16.9	14.8	0.0	--
06/04-06/10	13.5	14.5	11.8	14.8	12.6
06/11-06/17	13.1	13.8	11.5	14.0	12.3
06/18-06/24	14.3	15.4	12.6	15.4	13.0
06/25-07/01	18.7	20.0	16.4	21.4	17.0
07/02-07/08	18.2	20.2	15.9	21.5	17.0
07/09-07/15	16.7	19.1	14.5	19.5	15.8
07/16-07/22	19.6	23.2	17.2	23.5	18.3
07/23-07/29	19.2	--	16.9	23.3	18.2
07/30-08/05	--	--	16.8	23.3	18.5
08/06-08/12	--	--	15.2	20.7	16.7
08/13-08/19	--	--	13.8	19.2	15.4
08/20-08/26	--	--	14.4	19.3	16.7
Annual	20.3	24.8	17.9	24.6	19.5

Appendix Table A-35. Mean fork length (cm) of subyearling coho salmon marked and recaptured at the rotary trap on Elk Creek, 1995.

Week of capture	Marked			Recaptured		
	Mean	SD	*N*	Mean	SD	*N*
04/30-05/06	3.93	0.42	3	--	--	0
05/07-05/13	4.51	0.48	17	--	--	0
05/14-05/20	4.63	0.47	55	4.83	0.55	10
05/21-05/27	5.67	0.50	243	5.63	0.48	37
05/28-06/03	5.68	0.67	35	5.10	0.08	3

Appendix Table A-36. Mean fork length (cm) of subyearling trout marked and recaptured at the rotary trap on Elk Creek, 1995.

Week of capture	Marked			Recaptured		
	Mean	SD	*N*	Mean	SD	*N*
05/07-05/13	3.45	0.21	6	--	--	0
05/14-05/20	3.43	0.43	43	3.70	0.60	2
05/21-05/27	3.88	0.74	244	4.21	0.82	17
05/28-06/03	3.59	0.49	91	3.52	0.43	9

Appendix Table A-37. Mean fork length (cm) of unknown salmonid fry marked and recaptured at the rotary trap on Elk Creek, 1995.

Week of capture	Marked			Recaptured		
	Mean	SD	*N*	Mean	SD	*N*
04/30-05/06	3.00	--	1	--	--	0
05/07-05/13	3.03	0.09	10	3.00	--	1
05/14-05/20	3.02	0.15	108	3.08	0.09	6
05/21-05/27	3.03	0.11	169	3.01	0.08	7
05/28-06/03	3.04	0.07	338	3.03	0.07	43

Appendix Table A-38. Number of subyearling salmonids captured in the rotary trap on Elk Creek, 1995. Trapping began on 4 May and ended on 2 June.

Week of capture	Unknown salmonids			Trout			Coho salmon			Chinook salmon		
	Caught	Marked	Recaptured	Caught	Marked	Recaptured	Caught	Marked	Recaptured	Caught	Marked	Recaptured
04/30-05/06	2	0	0	0	0	0	3	2	0	1	1	0
05/07-05/13	10	9	1	6	5	0	18	17	0	0	0	0
05/14-05/20	123	110	6	64	45	2	60	56	8	5	4	0
05/21-05/27	221	169	7	373	244	17	282	243	37	7	3	2
05/28-06/03	870	336	43	691	89	9	143	35	3	10	2	0

Appendix Table A-39. Number of yearling or older juvenile salmonids captured in the rotary trap on Elk Creek, 1995. Trapping began on 4 May and ended on 2 June. Some steelhead may have been juvenile rainbow trout.

Week of capture	Steelhead			Cutthroat			Coho salmon		
	Caught	Marked	Recaptured	Caught	Marked	Recaptured	Caught	Marked	Recaptured
04/30-05/06	3	1	0	1	0	0	1	0	0
05/07-05/13	7	4	0	12	5	1	0	0	0
05/14-05/20	9	5	0	9	14	0	1	1	0
05/21-05/27	6	4	0	3	3	1	2	2	0
05/28-06/03	4	1	0	5	2	0	0	0	0