



Subregional Long-Term Wastewater Project

ANADROMOUS FISH MIGRATION STUDY PROGRAM 1991-1995

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT

Prepared for

**City of Santa Rosa
and
U.S. Army Corps of Engineers**

April 1996

Prepared by

**Merritt Smith Consulting
Environmental Science and Communication**

3675 Mt. Diablo Blvd. #120 Lafayette, CA 94549

For

HARLAND BARTHOLOMEW & ASSOCIATES, INC.



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TABLE OF CONTENTS

1.0 SUMMARY	1
2.0 INTRODUCTION	2
2.1 Project Background	2
2.2 Study Area	6
2.2.1 Migration Corridor	6
2.2.2 Headwaters and Watersheds	7
2.2.3 Reclaimed Water Discharges	9
2.3 Scope of Field Studies	9
3.0 FYKE NET MONITORING	11
3.1 Introduction	11
3.2 Methods	11
3.2.1 Net Construction	11
3.2.2 Net Locations	12
3.2.3 Net Deployment	12
3.2.4 Handling, Marking, and Releasing Fish	13
3.2.5 Sampling Strategy	13
3.2.6 Estimating Reclaimed Water Concentration	13
3.3 Results	15
3.3.1 Stream Flow	15
3.3.2 Reclaimed Water Discharges	17
3.3.3 Fyke Net Catch	17
3.3.4 Upmigrating Steelhead Catch in Relation to Reclaimed Water Concentration	21
4.0 HABITAT AND JUVENILE ABUNDANCE MONITORING	28
4.1 Introduction	28
4.2 Methods	28
4.2.1 Habitat Characterization	28
4.2.2 Juvenile Abundance Surveys	30
4.3 Results	30
4.3.1 Habitat Condition	30
4.3.2 Juvenile Abundance and Population Age Structure	31
5.0 DISCUSSION	43
6. CONCLUSIONS	46
7.0 REFERENCES	47

8.0 APPENDICES.....49

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1.0 SUMMARY

The Anadromous Fish Migration Study Program initiated in 1993-94 was continued in 1994-95, with the results described in this report. This program included six months of fyke-netting of steelhead (*Oncorhynchus mykiss*) and other fishes moving upstream and downstream in tributaries of the Laguna de Santa Rosa (Santa Rosa Creek and Mark West Creek) potentially affected by the City's reclaimed water discharges. Fyke nets were also deployed in a reference stream (Maacama Creek) that does not receive any reclaimed water. The study also included watershed-wide monitoring of habitat quality, spawning success, and juvenile rearing in the above-mentioned streams, and in an additional reference stream (Green Valley Creek). Studies conducted from January through March in 1991, 1992, and 1993 concentrated on fyke-netting of steelhead migrating upstream, and only in Santa Rosa and Mark West creeks. A summary of the anadromous fish migration studies conducted since 1988 appears in Table 2.1.

Unusually heavy rains in the 1994-95 wet season caused high stream flows for extended periods during the prime season for expected steelhead migration. As a result, the number of days when fyke nets could be operated was about half as many as in the preceding wet season, and few steelhead adults were captured in Santa Rosa and Mark West creeks. The numbers of fish captured in the 1994-95 migration season were too few to reveal any potential relationship to the concentration of reclaimed water in the migration corridor. However, when combined with data from the previous years of the study (1991-1994), the 1994-95 data augment and reaffirm the conclusion reached at the end of the 1993-94 study (MSC 1995): steelhead show no avoidance of reclaimed water.

The unusually wet winter of 1994-95 led to greatly improved habitat conditions in the upstream juvenile rearing areas during the summer of 1995, relative to conditions prevalent the summer before (which followed a very dry winter). Juvenile rearing areas are located in Santa Rosa and Mark West Creeks upstream of any reclaimed water discharges. In the summer of 1995, study area streams flowed continuously throughout the reaches occupied by juvenile salmonids, and summer survivorship was correspondingly high. In the previous summer (1994), diversions by agricultural and residential water users exacerbated already dry conditions, lowering water tables to such an extent that large areas of juvenile habitat went completely dry, and summer survivorship of juveniles throughout most of the study area was poor.

The overall conclusion after five years of intensive study is that the discharge of reclaimed water during the wet season into the migration corridor for salmonids using the Laguna system has no measurable impact on salmonid migration or population size. Rearing habitat conditions faced by juveniles residing upstream in the watersheds is a far more important factor affecting the juvenile population size.

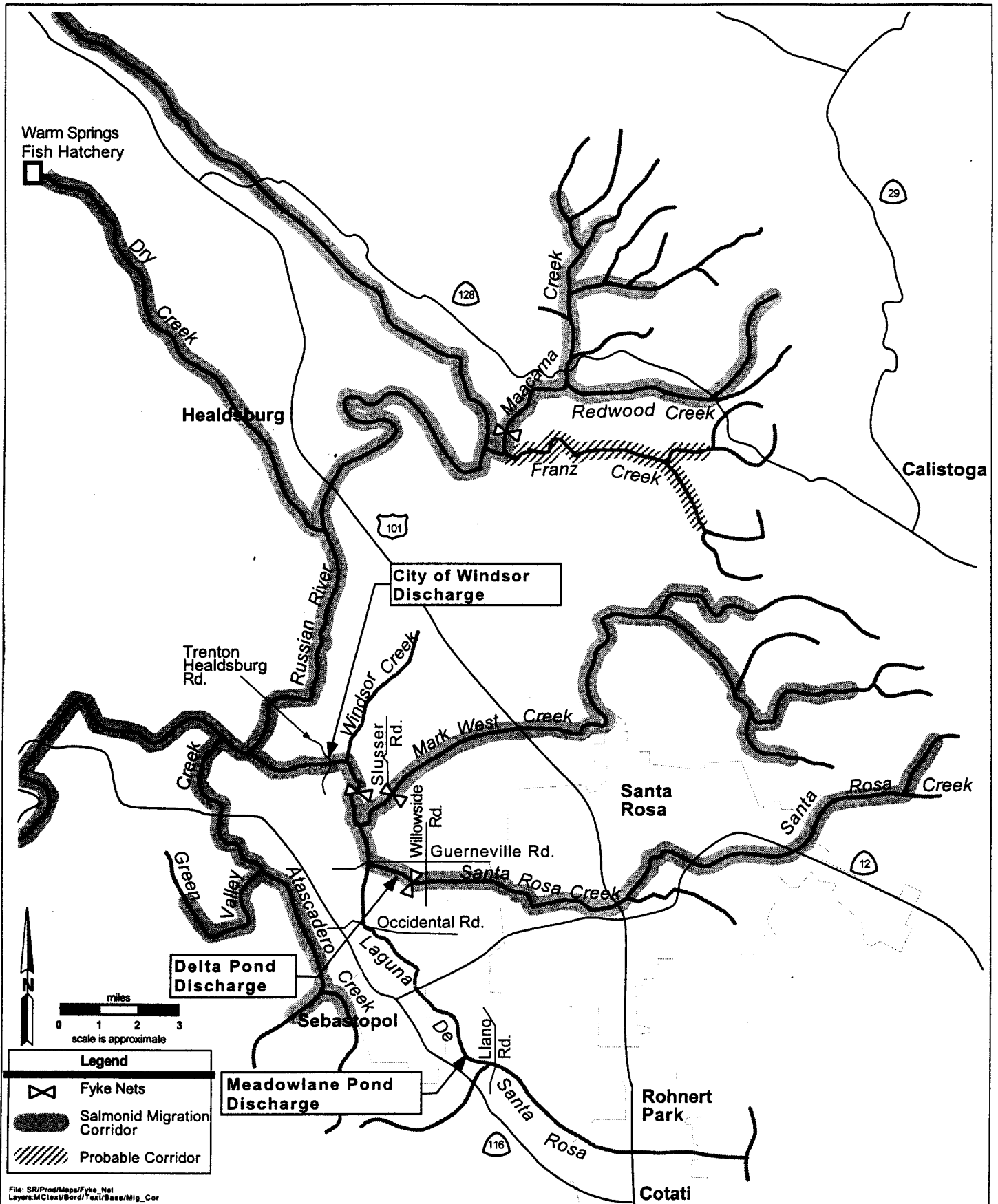
2.0 INTRODUCTION

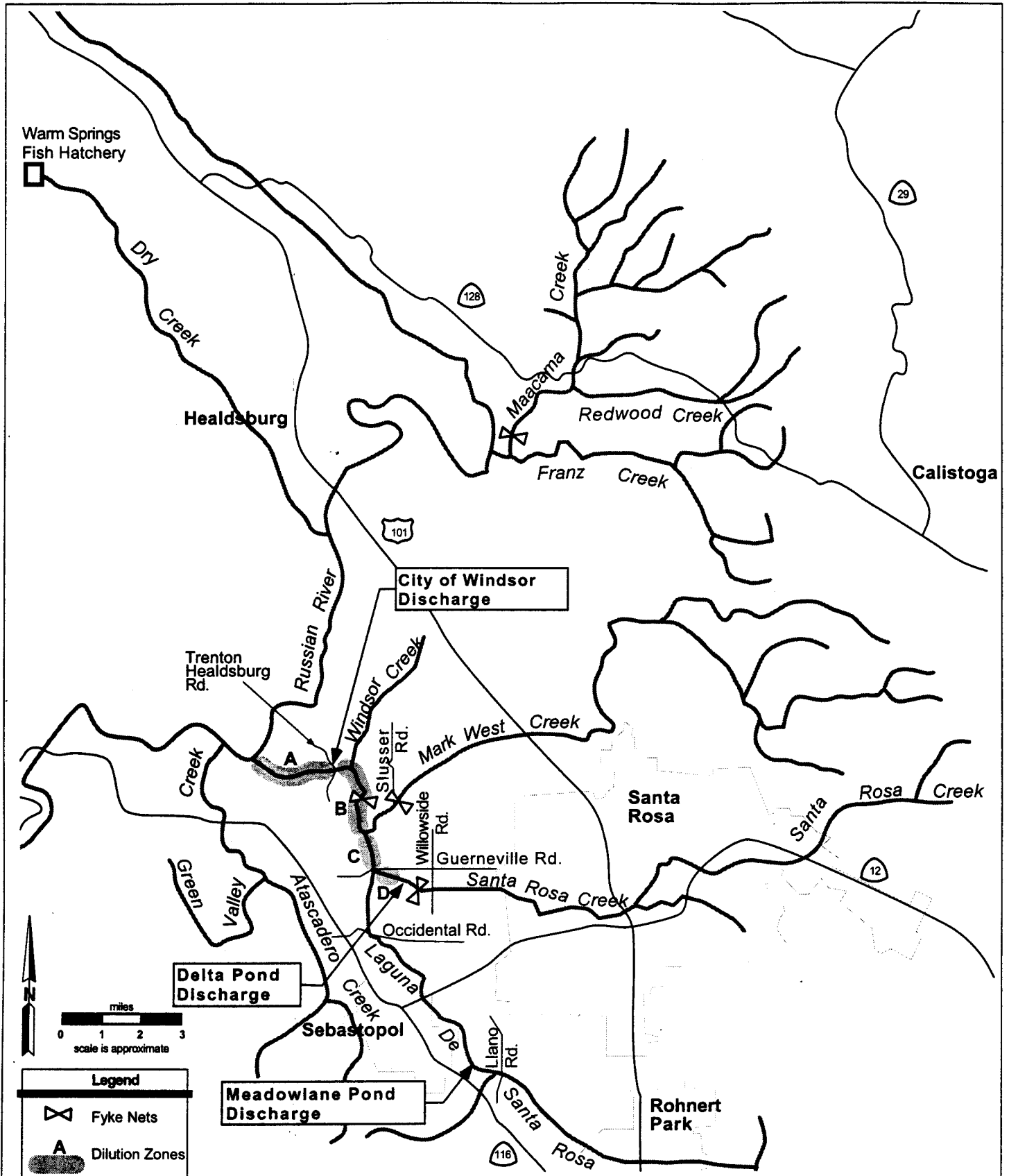
Steelhead trout (*Oncorhynchus mykiss*) and coho salmon (*O. kisutch*) stocks indigenous to the study area migrate from the Pacific Ocean, up the Russian River, and into its tributaries to reproduce (Figure 2-1). The Laguna de Santa Rosa is one of the Russian River tributaries through which these anadromous fish migrate. The Santa Rosa Subregional Reclamation System (Subregional System) and the City of Windsor discharge reclaimed water (i.e., tertiary-treated reclaimed water) to the Laguna de Santa Rosa system at the locations shown in Figure 2-2. This report summarizes the City of Santa Rosa's Anadromous Fish Migration Study Program, which has included studies of the effects of reclaimed water and other environmental factors on the migration and reproductive success of anadromous (i.e., fish species whose adults live in the ocean but return to fresh water to spawn) fishes in the Laguna de Santa Rosa system. Steelhead have been petitioned for listing by the National Marine Fisheries Service (NMFS). No state listing for the steelhead currently exists. Coho are listed by NMFS as "proposed threatened" under the Endangered Species Act, and listed by California Department of Fish And Game (CDFG) as "endangered". This section of the report describes the project background, the study area, and the scope of the field studies.

2.1 PROJECT BACKGROUND

The Anadromous Fish Migration Study Program has been conducted in the Laguna system in three phases listed in Table 2.1 and described below.

- **Visual Monitoring.** Anadromous fish (primarily steelhead trout) migrate into the Laguna system to spawn during the winter. At the request of the CDFG, the City of Santa Rosa (which operates the Subregional System) visually monitored anadromous fish migration during the winters of 1988-89 and 1989-90. The objective of the study was to characterize the timing of movements and approximate size of the anadromous fish populations migrating through the Laguna. This phase of the study program did not produce any useful results in terms of run size or timing because of the low numbers of fish observed. Many fish presumably passed the observation points unseen, either at night or during turbid, high-water conditions.





Note: Fyke Nets were used to trap upstream migrating steelhead.
The four zones (A-D) differ in reclaimed water concentrations.

Upstream Fyke-netting. During the winters of 1990-91, 1991-92 and 1992-93, nets were deployed in the Laguna system to capture and count the number of adult salmonids migrating upstream into the two Laguna tributaries believed to have reproducing populations (Mark West Creek and Santa Rosa Creek). The number of anadromous fish caught was compared to stream flow and reclaimed water concentration in the Laguna system. Fyke nets are effective only when stream flows are relatively low, but reclaimed water concentration tends to be highest when stream flows are low. Thus, any effect of the reclaimed water on fish passage would most likely be observed during relatively low flow conditions. Those studies (Roth, et al. 1991, 1992, 1993) showed that adult steelhead migrated through the reclaimed water zone in Santa Rosa Creek when reclaimed water concentrations were very high (up to 70 percent of the Laguna flow). Fish caught in Mark West Creek were captured after migrating through reclaimed water concentrations of up to 40 percent. Catches appeared to be related to season, rainfall patterns, and streamflow. Not all migrating fish could be caught because the netting method cannot be employed following rains that create high flows, when most adult steelhead tend to migrate.

- **Watershed-wide Monitoring.** The City of Santa Rosa initiated the preparation of an Environmental Impact Report and Environmental Impact Statement in 1993 to evaluate alternatives for the management of reclaimed water through 2010. Because alternatives potentially involve increasing the rate of reclaimed water discharge (and thus the concentration of reclaimed water in the Laguna) and removing the discharge from the Laguna, the scope of the Phase 2 Anadromous Fish Migration Study Program was reviewed and modified to reflect the alternatives formulation process. The review process involved the input of key agencies (CDFG, Regional Water Quality Control Board, and National Marine Fisheries Service) and interested public. The Phase 3 study program was expanded to include not only fyke-netting of upstream migrating salmonids, but also of downstream migrating adults and juveniles. In addition, surveys of habitat quality and number of juvenile salmonids in representative portions of each watershed where reproduction occurs were included. A report produced following the 1993-94 study (MSC 1995) provided a synthesis of the studies completed to date, detailed descriptions of the study strategy and methodology, and a description of salmonid life histories in California. This report summarizes the results of the Phase 2 and 3 studies, including the 1994-95 study. Additional information on methodology and salmonid life histories is given in the previous report (MSC 1995).

Table 2.1.

Summary of Anadromous Fish Migration Studies

Year	Visual Monitoring	Fyke Netting		Habitat/Juvenile Density Surveys
		Upstream Migrating Adults	Downstream Migrating Adults & Smolts	
1988-1989	Winter			
1989-1990	Winter			
1990-1991		Jan - Mar		
1991-1992		Jan - Mar		
1992-1993		Jan - Mar		Fall
1993-1994		Nov - Apr	Nov - Apr	Summer, Fall
1994-1995		Nov - Apr	Nov - Apr	Summer, Fall

2.2 STUDY AREA

2.2.1 Migration Corridor

Under the terms of its current discharge permit, the Subregional System releases reclaimed water to the Laguna de Santa Rosa during winter months, when volumes released are limited to one percent of the flow in the Russian River (except during unusual hydrologic conditions when discharges are limited to five percent of river flow). The Laguna de Santa Rosa is a tributary of the Russian River, and has several tributaries, including Mark West Creek and Santa Rosa Creek (Figure 2-1). Mark West Creek and Santa Rosa Creek are believed to be the only Laguna tributaries presently supporting salmonid spawning runs (Bill Cox, Area Biologist, CDFG *pers. comm* 1994, and this study).

Reclaimed water releases from the Subregional System are made at various times from several points, including Meadowlane Pond adjacent to the treatment plant on Llano Road, Delta Pond on Santa Rosa Creek near Willowside Road, and from irrigation storage reservoirs along the Laguna between Llano Road and Occidental Road (Figure 2-2). In addition, the City of Windsor (Windsor) releases reclaimed water to the Laguna at Trenton-Healdsburg Road at a maximum rate of one percent of Laguna flow at that location. Although reclaimed water concentrations resulting from Santa Rosa discharges to the Laguna are limited to between one and five percent of Russian River flow, the concentrations in the Laguna system can be much higher.

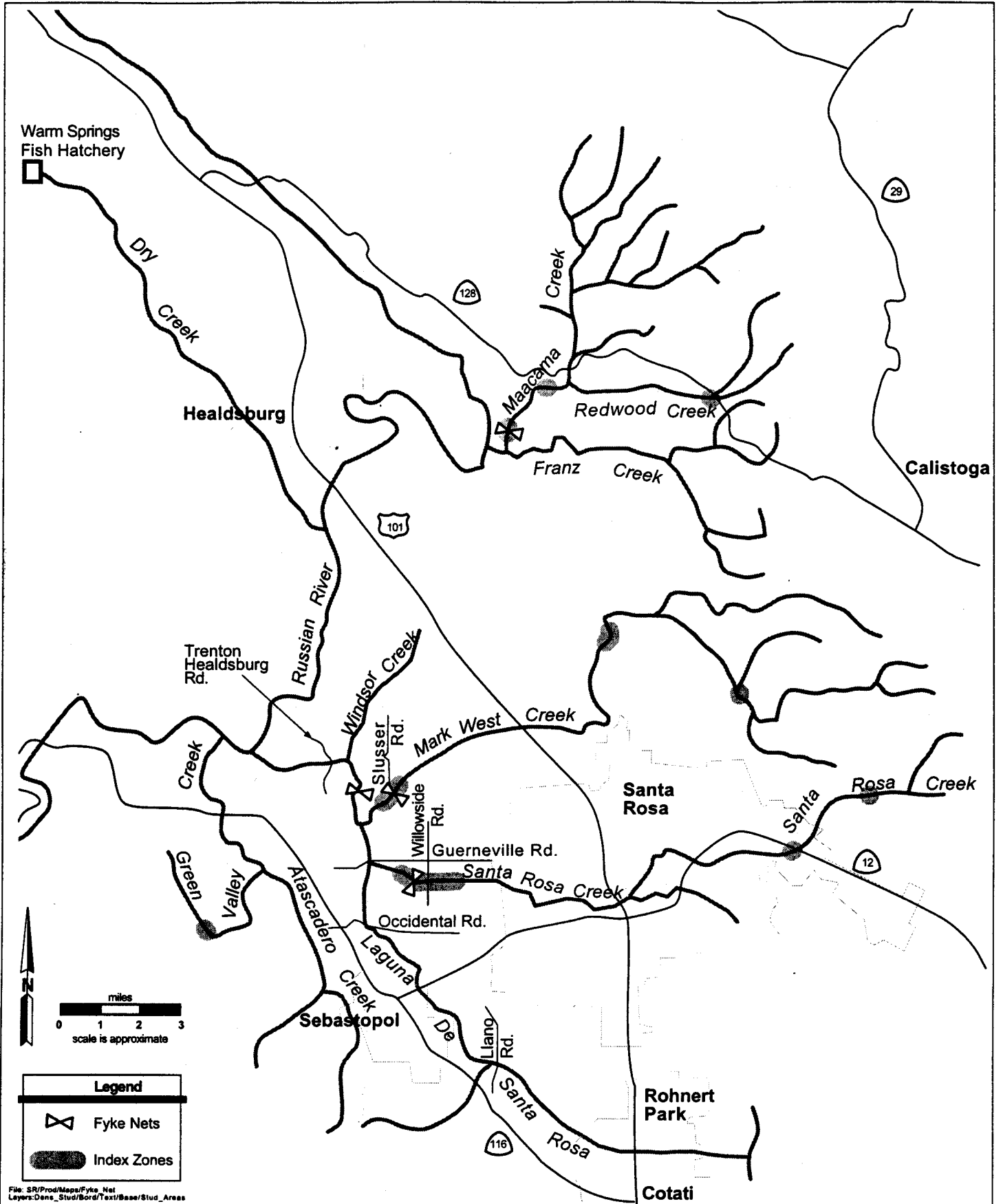
Fish migrating through the Laguna system experience different reclaimed water concentrations in each of several reaches called “Dilution Zones” in Figure 2-2. Between the Russian River and the Windsor discharge at Trenton-Healdsburg Road (Zone A, 2.9 miles), the Laguna carries all discharges from both Windsor and the Subregional System, diluted by the combined flows of all tributaries. Between Trenton-Healdsburg Road and the confluence with Mark West Creek (Zone B, 2.0 miles), the Laguna carries all discharges from the Subregional System (none from Windsor), diluted by combined flows from all tributaries except Windsor Creek (Windsor Creek flows further dilute discharges in the final 0.2-mile stretch of Zone B). Between the confluence with Mark West Creek and the confluence with Santa Rosa Creek (Zone C, 1.6 miles), the Laguna carries the same amount of discharge as in Zone B, but is diluted only by flows from Santa Rosa Creek and the Laguna upstream of its confluence with Santa Rosa Creek. Santa Rosa Creek, between its confluence with the Laguna and the Delta Pond discharge (Zone D, 0.6 miles), carries only the Delta Pond discharge, diluted only by flow in Santa Rosa Creek.

Thus, adult fish migrating from the Russian River to Mark West Creek must pass through Zones A and B (approximately 4.9 miles), and fish en route to Santa Rosa Creek must pass through Zones A, B, C, and D (approximately 7.1 miles).

2.2.2 Headwaters and Watersheds

The headwaters of the study streams are shown in Figure 2-3, which also shows the locations of Maacama Creek and Green Valley Creek. Maacama Creek, which does not receive any reclaimed water, flows into the Russian River east of Healdsburg, draining the watershed on the east side of the Russian River immediately north of the area drained by Mark West Creek. Maacama Creek is similar in size, hydrology, topography, and other respects to Santa Rosa Creek and Mark West Creek, and was selected as a control or reference stream for this study. Fyke nets were set in Maacama Creek just upstream from its confluence with Franz Creek. Locations of fyke nets and areas where habitat evaluations and juvenile salmonid density studies were conducted are also shown in Figure 2-3. Due to access restrictions, Redwood Creek (an upstream tributary of Maacama Creek) was used as the “upper” reach of Maacama Creek in the habitat and juvenile density studies.

Green Valley Creek is the lower portion of a small stream system that enters the Russian River about a mile downstream from the mouth of the Laguna de Santa Rosa (Figure 2-3). Green Valley Creek has small runs of steelhead and coho (Bill Cox, Area Biologist, CDFG, *pers. comm.* 1994, and this study), but also receives reclaimed water discharged by the Forestville/Graton wastewater treatment plant. Thus, Green Valley Creek serves in this study as an analog of the Laguna system.



2.2.3 Reclaimed Water Discharges

Reclaimed water is discharged to the Laguna de Santa Rosa system by the Subregional System between October 1 and May 14 at rates of up to five percent of Russian River flow. Reclaimed water consists of tertiary-treated municipal sewage from the greater Santa Rosa area. Reclaimed water is produced at the Laguna treatment plant, where extended aeration converts ammonia (potentially toxic to aquatic life) to nitrate (not toxic), and filtration removes solids. Reclaimed water quality meets federal water quality criteria established to protect aquatic life, with the exception of cyanides (*Water Quality Impact Analysis*, MSC 1996c). As such, Santa Rosa's reclaimed water is considered to be of high quality relative to other municipal reclaimed waters. Nonetheless, pollutants (such as metals and organic constituents) that could potentially affect aquatic life are present in reclaimed water in low concentrations. A detailed description of reclaimed water quality is presented in *Reclaimed Water Quality* Technical Report, (MSC 1996a), and *Reclaimed Water Quality Update* Technical Report, (MSC 1996b).

2.3 SCOPE OF FIELD STUDIES

The Phase 3 study program was developed to characterize stages of the anadromous fish life cycle that are potentially affected by reclaimed water. These include upstream migration of adults, spawning success as reflected by juvenile numbers and growth in rearing areas, and migration of smolts and post-spawned steelhead adults (“kelts”) through the Laguna to the sea. This approach was developed by a cooperative effort of state and federal agencies, interested public, and the HBA Consulting Team. Specifically, the study involved the following elements:

- **Monitoring of adult salmonids migrating from the sea to the spawning areas of Santa Rosa Creek, Mark West Creek and Maacama Creek using fyke nets.** Fyke nets are traps which funnel fish into holding cages. These nets are effective only during low to moderate streamflow periods. In Phase 2 (1990-91, 1991-92 and 1992-93 seasons), the fyke nets were deployed from January through March in the lower reaches of Santa Rosa Creek and Mark West Creek. In Phase 3, fyke nets were deployed from October 1993 through April 1994 and from November 1994 through April 1995 in the lower reaches of Santa Rosa Creek, Mark West Creek and Maacama Creek. Fyke nets were also deployed for 33 days in March and April 1994 at a site in the Laguna downstream from the confluences of Santa Rosa and Mark West creeks. A one-week no-discharge window was provided to test whether fish catches increase when discharges are suspended. The window was provided by the Subregional System in February 1994 and again in February 1995, during periods when upstream movements of adult steelhead are most likely to occur.
- **Monitoring of post-spawned adult steelhead returning to the sea, plus steelhead and coho smolts migrating downstream from the nursery areas in Santa Rosa Creek, Mark West Creek and Maacama Creek to the sea.** Downstream fyke nets

were deployed at the same sites and time periods described above for Phase 3 studies of upmigrating adults. Coho adults invariably die after spawning and do not return to the sea.

- **Estimation of the number of juveniles of each year class (young-of-the year, yearlings, age 2 and older) in three representative reaches of Santa Rosa Creek, Mark West Creek and Maacama Creek (the upper reach studied in Maacama Creek was located on Redwood Creek, a major tributary of Maacama Creek), and in one reach of Green Valley Creek.** Habitat quality was also assessed in the same reaches of these creeks. The juvenile density and habitat surveys were first conducted in November 1993, before winter storms stimulated outmigration of smolts. The juvenile density and habitat surveys were conducted at the same locations in July and October 1994 and again in July and October-November 1995.

The results of the fyke-netting portions of the study are presented in Section 3.0 of this report, and the results of the habitat and juvenile density surveys in Section 4.0.

3.0 FYKE NET MONITORING

3.1 INTRODUCTION

The upstream passage of steelhead through the Laguna de Santa Rosa into Mark West Creek and Santa Rosa Creek relative to reclaimed water releases was studied using fyke nets during January through March for three winters (1991, 1992, and 1993). The 1993-94 fyke-netting program was expanded to include trapping of downstream migrants and trapping in a control stream without reclaimed water (Maacama Creek). Trapping duration was extended, a no-discharge "window" in February was evaluated, and a fyke net location was added in the lower Laguna to evaluate trapping effectiveness and Laguna residence time of migrants. The expanded program was designed in part to evaluate movements of any coho that may use these streams, as well as steelhead. The same program was followed during the 1994-95 migration season, except that trapping was not conducted at any Laguna sites, since sufficient data on trapping efficiency and travel time was obtained in 1993-94.

The main focus of these studies is not to count all migrants, but to investigate migration during potentially worst-case (high) reclaimed water concentrations, which occur during periods of relatively low stream flow. Placing the nets just upstream of the discharge zones provides the means for capturing fish that have moved through a known reclaimed water exposure. However, since fyke net sites near the discharges are located in downstream reaches of the streams (70 - 80 square miles of drainage area upstream of traps), rising water following major storms often exceeds 150 cfs, and will often overwhelm the nets. This means that upstream fyke net catches in the lower reaches of the streams cannot be used to estimate the total number of fish in a spawning run. Many (probably most) fish will migrate during periods when flow is too great for the fyke nets to fish effectively or to be deployed. Flows too high for the nets to fish typically dilute reclaimed water concentrations to low (and possibly ecologically insignificant) levels.

3.2 METHODS

3.2.1 Net Construction

Fyke nets were used to trap migrating fish and retain them alive. The traps were deployed in pairs at each site, with one trap facing upstream (to capture fish moving downstream), and the other facing downstream (to capture upmigrants). The trap (fyke) is a long nylon-mesh funnel kept open by a series of square steel frames. Inside the fyke are two conical throats (i.e., smaller funnels) which direct the fish toward the cod end (the narrow closed end furthest from the entrance) and prevent their escape. Attached to the fyke are two wing nets which are angled across the stream to direct migrating fish into the fyke. The dimensions of these nets and details of their installation are provided in a previous report

(MSC 1995). The net design is appropriate for stream flows up to about 150 cubic feet per second (cfs) at the net sites in the creeks studied. The limitation of being able to fish efficiently only at flows under about 150 cfs is discussed in Section 3.2.5.

3.2.2 Net Locations

During the 1993-94 study, fyke nets were located in Santa Rosa Creek and Mark West Creek at the same sites used during the first three years, and at a new site in Maacama Creek. Beginning in late March 1994, nets were also placed in the lower Laguna, to investigate outmigrant residence time and to evaluate trapping efficiency. For a few days in late March and early April 1994, nets were also placed at sites in the upper Laguna, in an attempt to verify that none of the upper Laguna tributaries are a source of salmonid smolts. The same locations were used in the 1994-95 study, with the following exceptions: 1) No fyke nets were used in the Laguna; and 2) at the Santa Rosa Creek site persistent attacks by river otters on entrapped fish during November 1994 forced relocation of the nets to a new site about 1.5 miles upstream. The locations of the fyke netting sites are shown in Figures 2-2 and 2-3 and listed below:

- Mark West Creek -- adjacent to the ranch of Mr. Tom Cunningham, just east of Slusser Road, 1.9 miles upstream from the confluence of Mark West Creek and the Laguna.
- Santa Rosa Creek -- prior to December 1994, 0.3 miles above the Delta Pond discharge, 0.6 miles west of Willowside Road. Beginning 7 December 1994, about 1.8 miles above Delta Pond discharge, 0.9 miles east of Willowside Road (not shown in Figures 2-2 or 2-3).
- Maacama Creek -- 0.4 miles downstream from the Chalk Hill Road bridge.

3.2.3 Net Deployment

The 1994-95 fyke net fishing season began on 7 November 1994, following the season's first major rainfall that began on 4 November. Fyke-netting was terminated on 28 April 1995. The unusually heavy rainfall that occurred during the 1994-95 wet season produced flooding that precluded any fyke-netting for long periods, most notably a 40-day period that included the entire month of January, and a three week period in March. At other times, nets were necessarily removed for a few days following normal rainfall events, and for a few days at a time early and late in the season, when lack of rain led to low streamflow and little or no fish movement. Experience in prior years, especially 1993-94, showed that little information was gained by fishing continuously during dry periods after salmonids had stopped moving.

3.2.4 Handling, Marking, and Releasing Fish

The nets were checked once each day, when all captured fish were transferred from the fyke net to a small holding pen where they could be identified, counted, and measured (salmonids only) before being released to continue in the direction they had been moving prior to capture. All fish (as well as other vertebrates such as frogs and turtles) were identified and counted. All salmonids were measured (fork length), and notes were made on gender and condition of adults, and on condition of juveniles. Dorsal fins were examined for deformities which are typical of hatchery-raised fish. Adult steelhead were marked by punching a small hole with a paper punch in the membranous part of the caudal (tail) fin; on the upper lobe if upmigrating and on the lower lobe if downmigrating. Recaptured fish were not punched further upon recapture.

3.2.5 Sampling Strategy

The sampling strategy used for the placement of nets to study passage through the reclaimed water discharge zone was determined by the configuration of the discharge setting as well as by features of salmonid life history.

Migrating salmonids often move during the night and rest in sheltered locations, such as overhanging stream banks, by day. Since fish may easily move several miles per night, they could be expected to travel from the Russian River to a point upstream of the discharges in one night. In that event, a fish captured at a point immediately upstream from a discharge can be assumed to have been exposed to reclaimed water concentrations that occurred in the Laguna the previous night. This assumption was made in the interpretation of data presented in this report.

A no-discharge "window" of seven days duration was provided by the Subregional System, from 20-26 February 1995. The purpose of providing this window was to test whether or not the absence of reclaimed water during the prime period for expected steelhead movement would result in an increase in the number of upmigrants captured.

3.2.6 Estimating Reclaimed Water Concentration

Estimates of reclaimed water concentration in the Laguna discharge Zones A through D are based on daily reclaimed water discharge data and daily estimates of stream flow in each zone. Reclaimed water discharge data were provided by the Subregional System staff and by the City of Windsor.

The stream flow estimates for 1994-95 are based on data from stream stage (depth) recording equipment located in Santa Rosa Creek at Willowside Road, Mark West Creek at Slusser Road, and the lower Laguna at Trenton-Healdsburg Road. The gages were installed and maintained as part of the Anadromous Fish Migration Project. Stream stage data were converted to flow using stage curves that were developed empirically for each gage location using the method described for Trenton-Healdsburg Road in (Roth et al.

1992). The regression equations that were used to convert 1994-95 stage data to estimates of flow are summarized in Table 3-1.

Table 3-1.

Regression Equations Used to Convert 1994-95 Stage Heights to Flow Rates.

Location	Regression Equation ^a
Laguna at Trenton-Healdsburg Road	For x < 2 ft: $y = 3.5276x^3 + 2.4802x^2 + 6.0987x - 0.0157$ For x > 2 ft: $y = -0.3477x^3 + 14.247x^2 + 6.6009x - 6.066$
Mark West Creek	For x < 0.5 ft: $y = 5.9517x + 0.027$ For x > 0.5 ft: $y = 0.8773x^3 + 8.8061x^2 + 19.443 - 4.9253$
Windsor Creek	taken as 21.7% of Mark West Creek flow
Santa Rosa Creek	for all x: $y = 51.985x^2 - 26.576x + 11.343$

a y = flow in cfs, and x = water depth in feet.

Flow and reclaimed water concentration in each of the zones (Zones A through D, figure 2-2) were calculated according to Table 3-2.

Table 3-2.

Calculation of Stream Flow and Reclaimed Water Concentration in Discharge Zones.

Zone	Stream Flow	Reclaimed Water Concentration
A	Flow in Laguna at Trenton-Healdsburg Road plus Windsor discharge	Total Subregional System and Windsor discharges divided by stream flow in Zone A
B	Flow in Laguna at Trenton-Healdsburg Road minus flow in Windsor Creek	Total Subregional System discharge divided by stream flow in Zone B
C	Flow in Laguna at Trenton-Healdsburg Road minus flow in Mark West Creek minus flow in Windsor Creek	Total Subregional System discharge divided by stream flow in Zone C
D	Santa Rosa Creek flow	Delta Pond discharge divided by the sum of Delta Pond discharge and Santa Rosa Creek flow measured at Willowside Road

3.3 RESULTS

3.3.1 Stream Flow

Estimated average daily flows during the fyke-netting season are shown in Appendix 3-1. Figure 3-1 shows the estimated average daily flow at the gage locations in Santa Rosa Creek, Mark West Creek and the lower Laguna at Trenton-Healdsburg Road. Field observations show that water consistently rises more quickly following rainfall events in Santa Rosa Creek than in Mark West Creek, probably because of the relatively large amount of impermeable surface (e.g., pavement) especially in the lower Santa Rosa Creek watershed. This difference between the creeks is apparent when hourly flows are considered, but is not always obvious in Figure 3-1 because the data have been reduced to daily average flows.

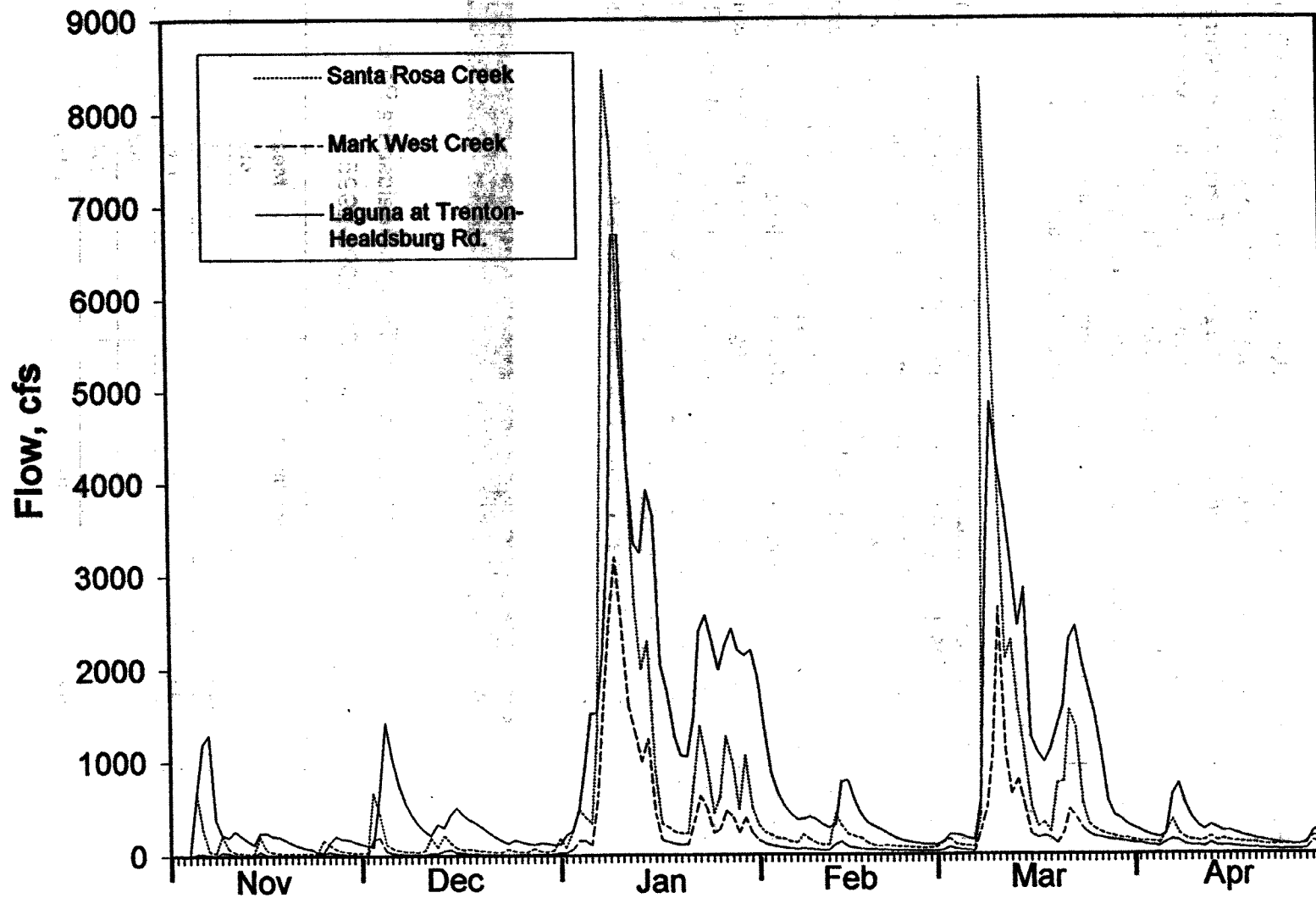
The 1994-95 season was unusually wet. Total rainfall recorded at the treatment plant on Llano Road was 28.1 inches from January through March 1995 (as opposed to 8.4 inches for the same months in 1994). Flows exceeding 8,000 cfs occurred twice in Santa Rosa Creek (Figure 3-1, Appendix 3-1), and Laguna flows exceeding 2,000 cfs occurred for extended periods at Trenton-Healdsburg Road. The data for January 8-10 and March 9-10 show that for brief periods, flow was much greater in Santa Rosa Creek than further downstream in the Laguna at Trenton-Healdsburg Road. This illustrates the rapid response time of the Santa Rosa Creek hydrograph mentioned above. Stream gages were not functioning during the flood periods (9-15 January and 10-15 March). Flow estimates in Appendix 3-1 for those periods (italicized) were calculated based on a regression of Russian River flow at Hacienda Bridge on Laguna flows at Trenton-Healdsburg Bridge. Minimum and mean flows at Trenton-Healdsburg Road are compared for each year since 1991 in Table 3-3.

Table 3-3.

Minimum and Mean Flows at Trenton-Healdsburg Road
January 1 - March 31, 1991-1995

Year	Minimum cfs	Mean cfs
1991	33	455
1992	35	630
1993	115	1,168
1994	23	294
1995	101	1,456

Figure 3-1. Streamflow in the Laguna de Santa Rosa and its Tributaries, 1994-1995



3.3.2 Reclaimed Water Discharges

The location and daily volume of discharges from the Subregional System and City of Windsor, and daily estimates of reclaimed water concentration in each of the four zones are provided in Appendix 3-1. Because flows were high, reclaimed water concentrations in the Laguna system were relatively low in 1994-95. The concentrations were usually less than 20 percent, except in zone D (Santa Rosa Creek), where concentrations of 40-56 percent occurred in December. During the previous winter, which was very dry with low flows, concentrations as high as 92 percent occurred, and 50-60 percent concentrations prevailed in Zone D during much of December and January (MSC 1995). The maximum daily reclaimed water concentration was rarely less than five percent in the fish migration corridors in 1993-94, whereas in 1994-95, it was less than five percent on about one-third to one-half of the days during the study period (Table 3-4).

Table 3-4.

Summary of Reclaimed Water Concentrations in Laguna Zones

Year	Zones A-D ^a		Zones A&B ^b		Total Days ^c
Jan - Mar	# days under 5%	# days over 5%	# days under 5%	# days over 5%	
1991	10	77	15	72	87
1992	20	66	18	68	86
1993	21	68	35	54	89
1994	11 ^d	79	14 ^d	76	90
1995	33 ^e	57	46 ^e	44	90

^a Migration corridor of Santa Rosa Creek.

^b Migration corridor of Mark West Creek.

^c Total number of days in January, February and March of each year that reclaimed water concentration was calculated for this study.

^d Ten of these days were provided as part of a no-discharge "window" to test its effect on fish migration.

^e Seven of these days were provided as part of a no-discharge "window" to test its effect on fish migration.

3.3.3 Fyke Net Catch

Appendix 3-2 contains the salmonid catch data illustrated in both tables and graphs for each day fished at each net site. Also included are daily rainfall data (Llano Road) and information about net effectiveness. Appendix 3-3 provides information on the length and sex of each salmonid caught, whether it was marked, notes on reproductive condition, and previous marks. Appendix 3-4 is a summary of salmonid adult recaptures, based on analysis of data in Appendix 3-3. Appendices 3-5-1 to 3-5-3 summarize data on steelhead

smolts captured moving downstream, and data on coho and chinook salmon (*Oncorhynchus tshawytscha*) smolts captured moving upstream and downstream are provided in Appendix 3-5-4. Appendix 3-6 summarizes fishing effectiveness, and Appendix 3-7 lists all vertebrates captured in each fyke net for each day of the study. Fish catches are summarized according to whether they were caught moving upstream or moving downstream. However, not all trapped fish can be assumed to be migrating, since some upstream and downstream movements are undoubtedly local, especially among resident non-salmonid species.

A total of 25 species of fish, two reptile species, and three amphibian species were captured in the fyke nets in 1994-95 (Appendix 3-7). Slightly more than half the fish species are native to the Russian River system, the rest are introduced. The native species, in addition to steelhead and coho, include three species listed by the state as species of special concern: Navarro roach (*Lavinia symmetricus navarroensis*), Russian River tule perch (*Hysterocarpus traskii pomø*), and hardhead (*Mylopharodon conocephalus*). Other native fish species captured include Sacramento blackfish (*Orthodon microlepidotus*), Sacramento squawfish (*Ptychocheilus grandis*), Sacramento sucker (*Catostomus occidentalis*), Threespine stickleback (*Gasterosteus aculeatus*), Coastrange sculpin (*Cottus aleuticus*), Prickly sculpin (*C. asper*), and Hitch (*Lavinia exilicauda*). Chinook salmon (*Oncorhynchus tshawytscha*) are not considered native to the Russian River (Moyle, 1976), but have been introduced by CDFG. One of the reptiles, northwestern pond turtle (*Clemmys marmorata marmorata*), is a native species and is a state species of special concern. The other turtle (pond slider, *Pseudemys scripta*) is the "pet store turtle", native to the American south and midwest. Two of the amphibians are natives: western toad (*Bufo boreas*) and red-bellied newt (*Taricha rivularis*). The third, bullfrog (*Rana catesbeiana*) is introduced.

There were two long periods of high water when the fyke nets were not in service, from late December through early February, and again for a three-week period in March (Appendix 3-2). As a result, only five adult steelhead were captured in Santa Rosa Creek (one moving upstream, four downstream), and only six in Mark West Creek (five moving upstream, one downstream), as shown in Table 3-5. All of the adults captured in Santa Rosa and Mark West creeks were wild fish (i.e., not hatchery-raised). Hatchery-raised fish can be recognized by abnormalities in the dorsal and sometimes the pectoral fins. Some hatchery stocks are adipose fin-clipped as smolts.

In contrast, a total of 47 captures of adults occurred in Maacama Creek. However, most of those captured in Maacama Creek were obviously hatchery fish. These fish had the usual fin abnormalities, but also had been punched in the caudal fin indicating that they were excess spawners relocated upstream from the hatchery (R. Gunter, Hatchery Manager, CDFG, *pers. comm.*, 1995). Some disorientation among these fish is typical, because they were taken when ready to spawn from their natal stream (Dry Creek) and then relocated to the Russian River many miles upstream. Unable to detect olfactory cues from their natal stream, they wander up unfamiliar streams looking for places to spawn.

Only 19 of the adult steelhead captured in Maacama Creek were wild fish, and two of these were recaptures (Appendix 3-3-3,3-4).

Steelhead smolt captures in 1994-95 were less than ten percent of the preceding year in Santa Rosa Creek, and 13 percent in Maacama Creek (Table 3-5). In Mark West Creek the number of smolts was also lower, but only by about a third.

Two coho smolts were captured in Santa Rosa Creek in February 1995 (Tables 3-5). Both specimens had the adipose fin clipped off, indicating hatchery origin. One coho smolt, also with a clipped adipose fin, was captured in Mark West Creek. In Maacama Creek, only four coho smolts (all wild) were captured in 1994-95 (compared to 167 in the previous year (MSC 1995).

A few chinook (king) salmon were captured in Santa Rosa Creek and in Maacama Creek in 1994-95 (Table 3-5). Chinook have not been captured in any of the previous years of this study. One adult chinook was captured in Santa Rosa Creek in November, and five juveniles were captured moving downstream in Santa Rosa Creek in late April. Chinook salmon smolt as young-of-the-year fish a few months after they are spawned.

Table 3-5.

Summary of Fyke Net Salmonid Catch

Creek	Fishing Begun	Fishing Ended	Total Days		Steelhead Catch				Coho Catch				Chinook Catch			
			Fished		Juveniles		Adults ^b		Juveniles		Adults		Juveniles		Adults	
			Down ^a	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up
1993-1994 Fishing Season																
SRC ^c	15-Oct	1-May	128	129	653	218	23	16	1	3	0	0	0	0	0	0
MWC ^c	15-Oct	1-May	123	125	317	104	19	15	4	0	0	0	0	0	0	0
MAAC ^c	30-Nov	1-May	119	122	601	204	26	32	163	4	8	1	0	0	0	0
1994-1995 Fishing Season																
SRC	7-Nov	27-Apr	59	59	54	18	4	1	1	1	0	0	5	0	1	0
MWC	7-Nov	27-Apr	57	58	195	17	1	5	1	0	0	0	0	0	0	0
MAAC	16-Nov	27-Apr	56	56	78	35	9	38	4	0	4	6	0	0	6	3

^a “Down” and “Up” refer to the direction the fish were migrating when captured.

^b including half-pounders

^c SRC = Santa Rosa Creek, MWC = Mark West Creek, MAAC = Maacama Creek

3.3.4 Upmigrating Steelhead Catch in Relation to Reclaimed Water Concentration

The estimated concentration of reclaimed water in each of the four zones was calculated as a percentage of estimated streamflow, and is tabulated for each day in Appendix 3-1. Fish caught in Santa Rosa Creek must swim through zones A through D, and fish caught in Mark West Creek through zones A and B. Figures 3-2 and 3-3 show the catches of upmigrating steelhead in Santa Rosa Creek and Mark West Creek in relation to the reclaimed water concentration through which they migrated. The catches are shown in Figures 3-4 and 3-5 in relation to stream flow and reclaimed water concentration for Santa Rosa Creek and Mark West Creek, respectively. Each filled circle represents a single fish; unfilled circles represent days fished, but no fish caught. So few fish were captured in 1994-95, little can be concluded from these data alone. The data are combined for all the years of the study in Figures 3-6 and 3-7.

For Santa Rosa Creek (Figure 3-6), no pattern of catches is discernible. Steelhead were captured throughout nearly the entire range of concentration of reclaimed water, and at high and low flows. For Mark West Creek (Figure 3-7) steelhead are, on average, exposed to lower reclaimed water concentrations in their migratory corridor than are those using Santa Rosa Creek. As in Santa Rosa Creek, adult steelhead were caught as they moved upstream through a wide proportion of the reclaimed water concentrations present in the Mark West Creek corridor, and over a wide range of flows. In both streams, upmigrating steelhead were captured throughout the range of concentrations at which most of the fishing effort was expended. No range of reclaimed water concentration, range of stream flow, or combination of these factors, appear from the data to indicate an influence on adult steelhead migration in either Santa Rosa Creek or Mark West Creek. No upmigrants were captured in either stream during the no-discharge window provided in February 1995 (Figures 3-2 and 3-3)

Figure 3-2. Santa Rosa Creek, 1994-1995: Fishing Effort, Upmigrating Steelhead Catch and Reclaimed Water Concentration

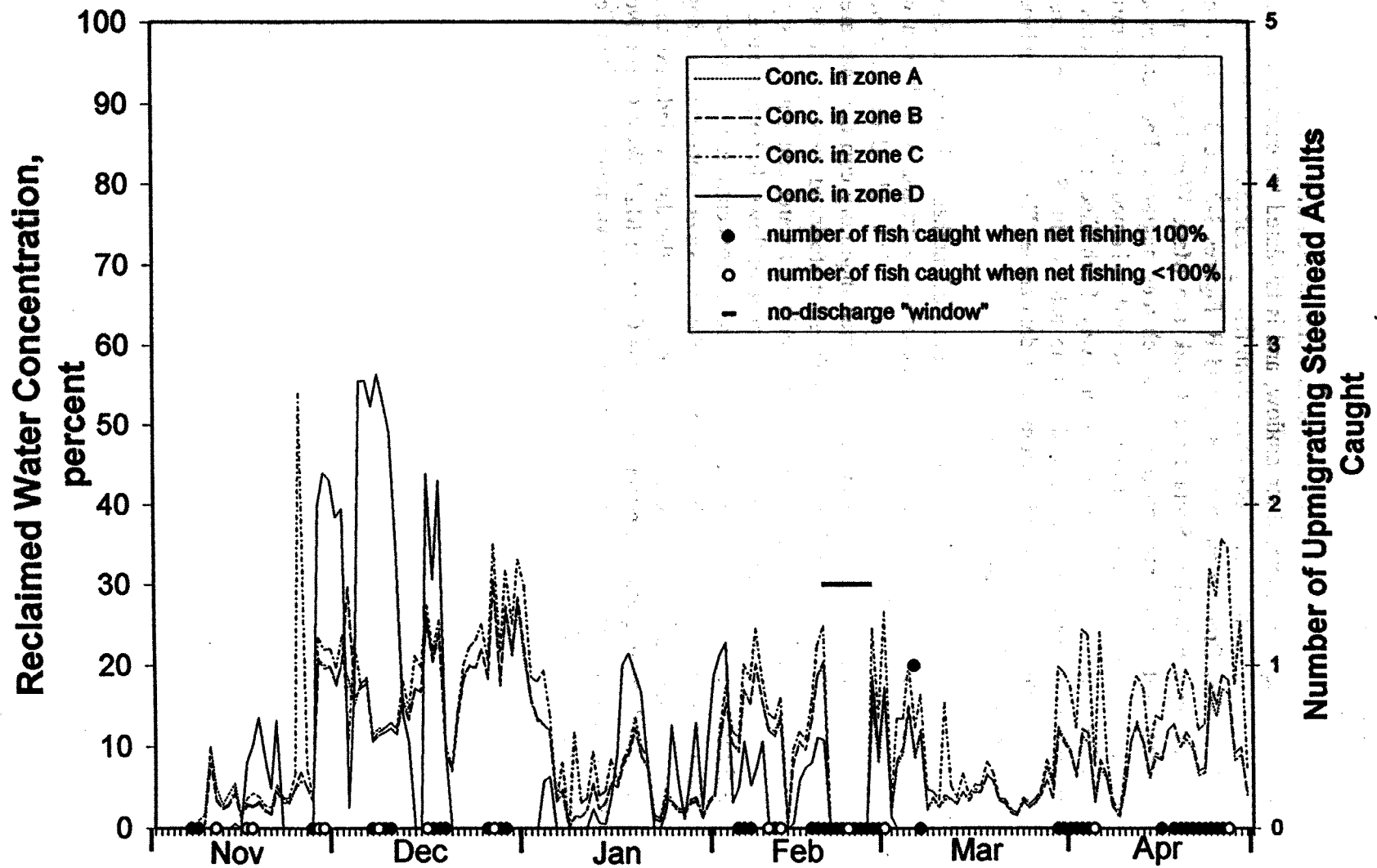


Figure 3-3. Mark West Creek, 1994-1995: Fishing Effort, Upmigrating Steelhead Catch and Reclaimed Water Concentration

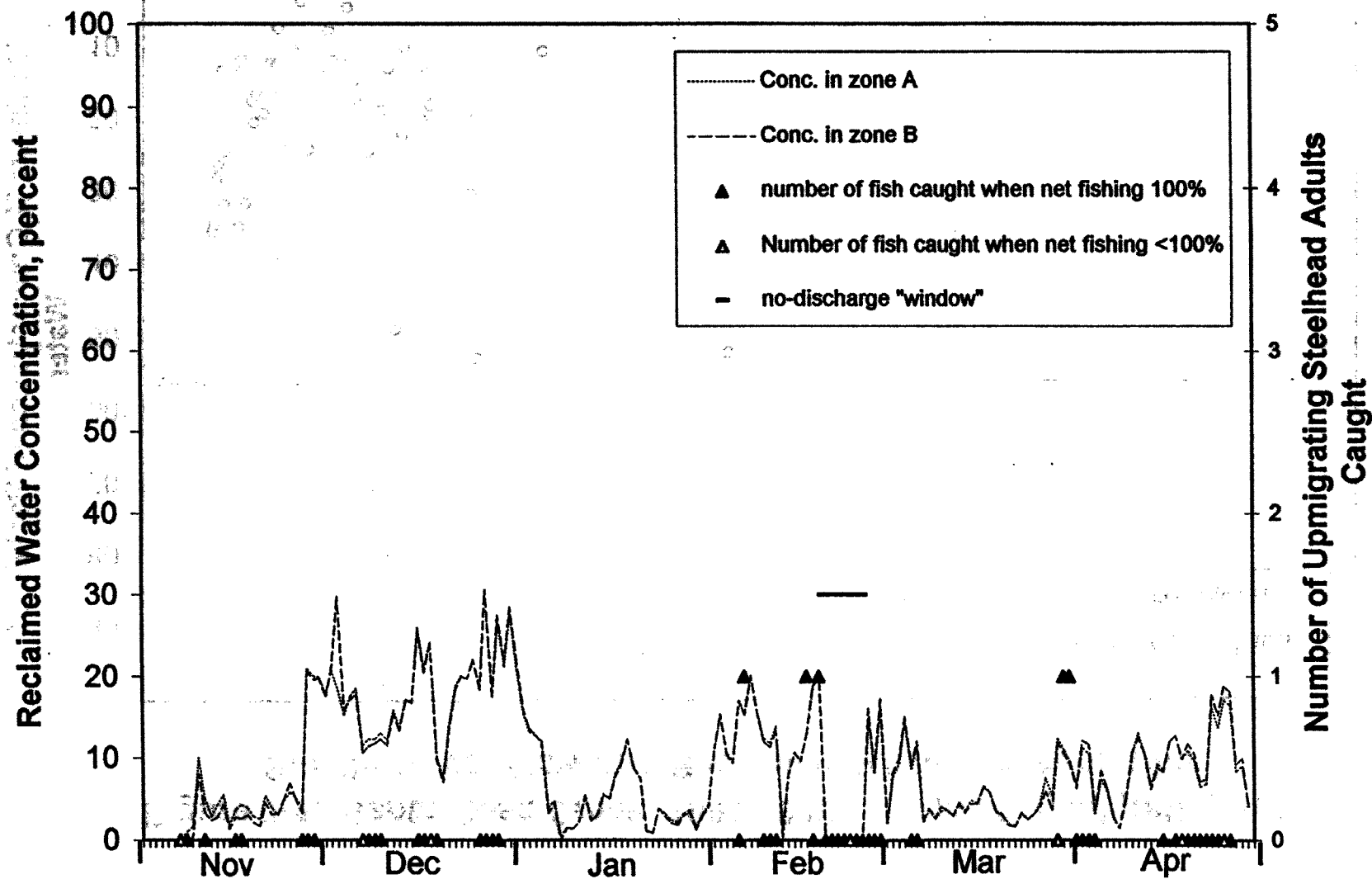


Figure 3-4. Santa Rosa Creek, 1994-1995: Catch of Upmigrating Adult Steelhead vs. Flow and Reclaimed Water Concentration

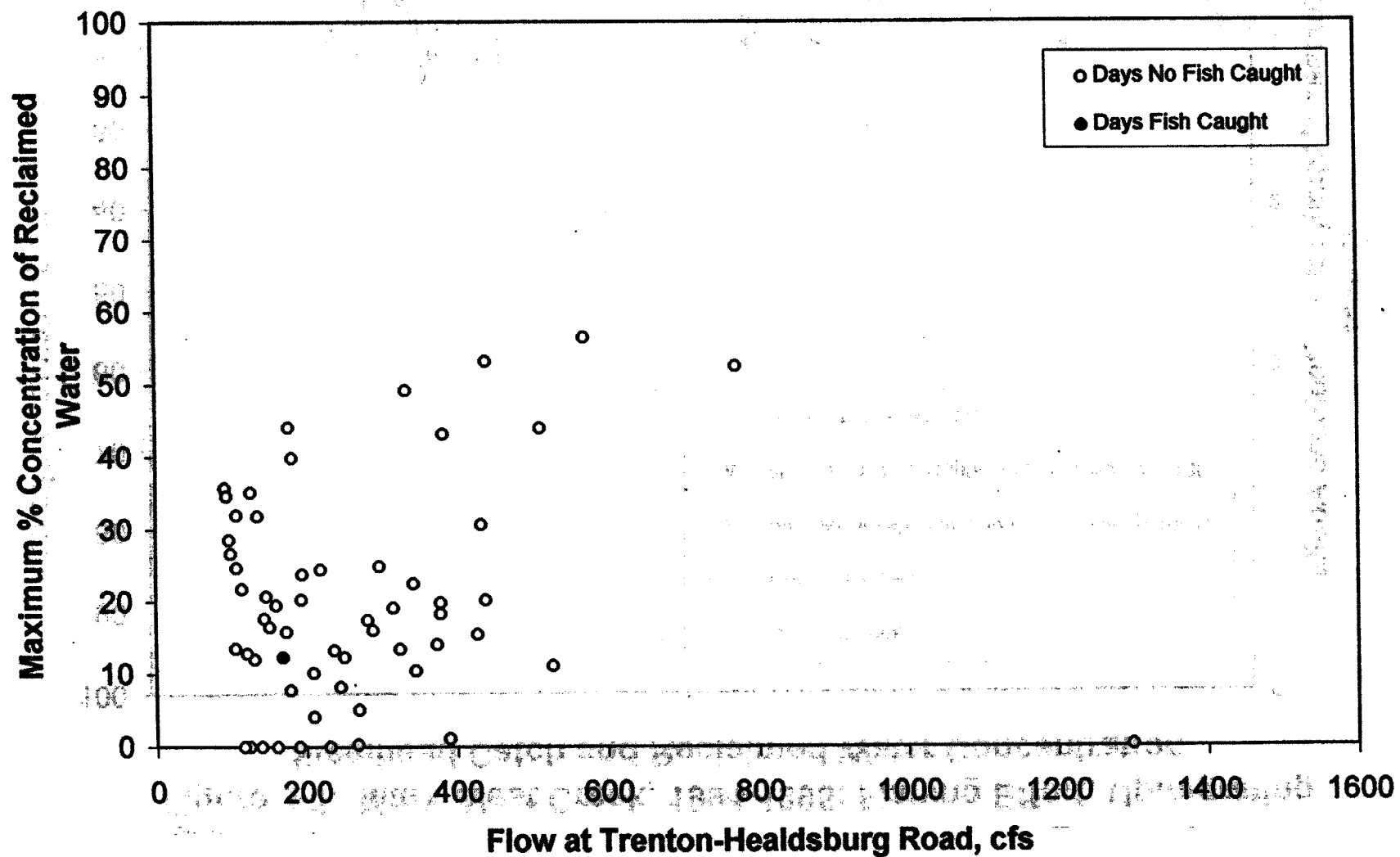


Figure 3-5. Mark West Creek, 1994-1995: Catch of Upmigrating Adult Steelhead vs. Flow and Reclaimed Water Concentration

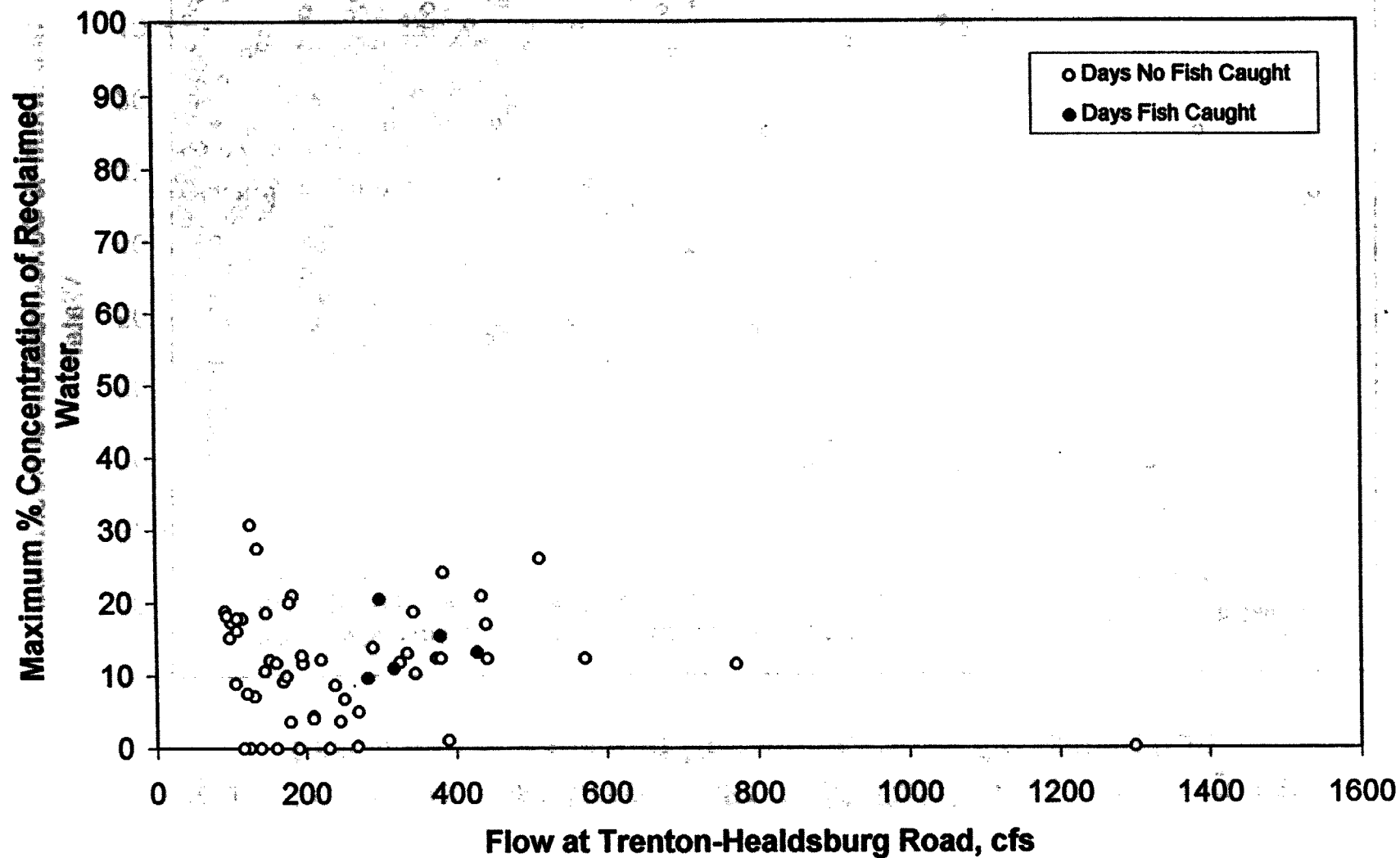


Figure 3-6. Santa Rosa Creek, 1991-1995: Catch of Upmigrating Adult Steelhead vs. Flow and Reclaimed Water Concentration

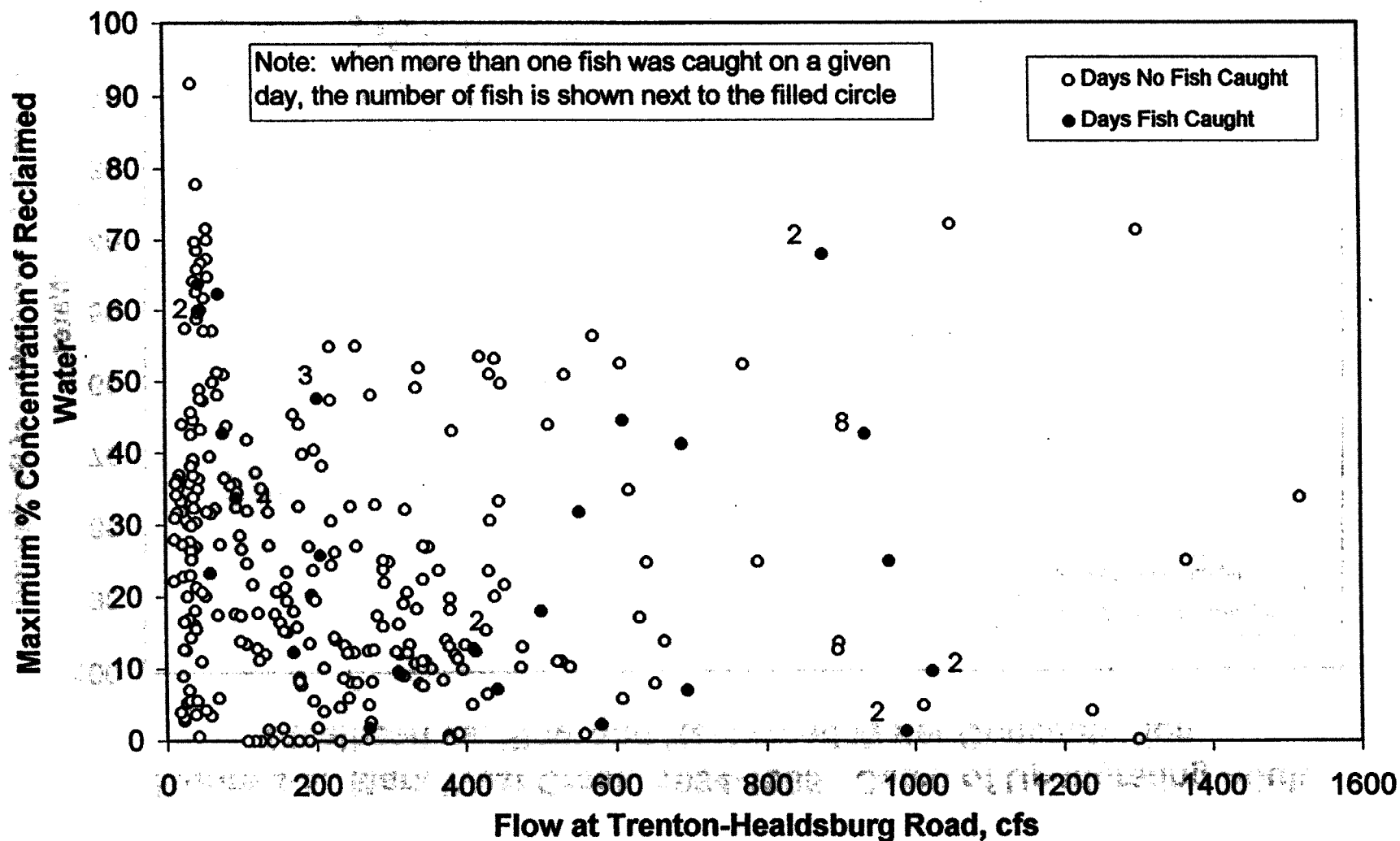
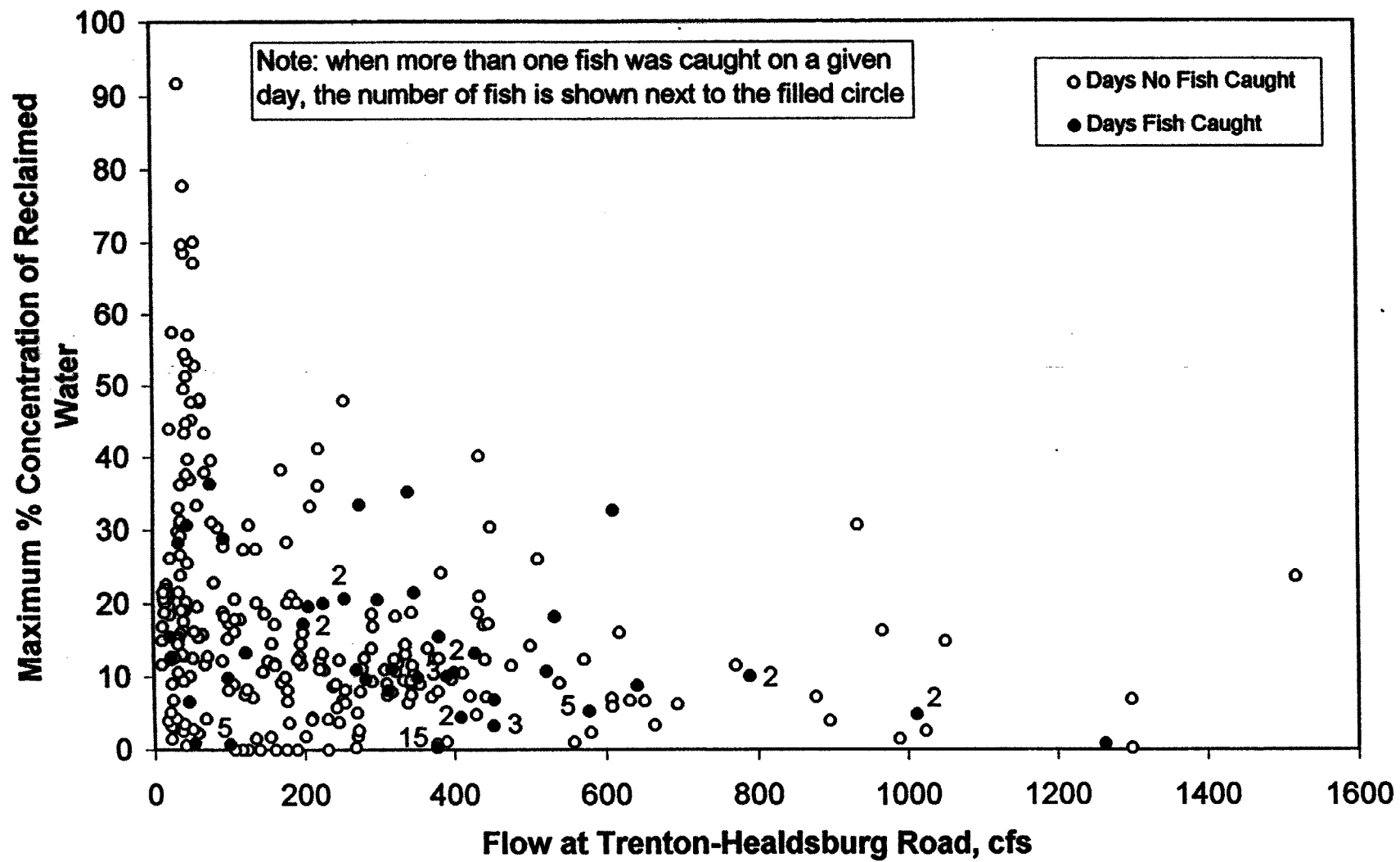


Figure 3-7. Mark West Creek, 1991-1995: Catch of Upmigrating Adult Steelhead vs. Flow and Reclaimed Water Concentration



4.0 HABITAT AND JUVENILE ABUNDANCE MONITORING

4.1 INTRODUCTION

In addition to the fyke net studies of upmigrating adult steelhead trout and coho salmon, the Anadromous Fish Migration Study Program begun in 1993-94 included efforts to study other aspects of reproduction and ecology of these populations during the freshwater phases of their life cycles in the study streams. The objective of this part of the study was to evaluate spawning success, fry or fingerling production, and juvenile survivorship (the number of juveniles that survive to become smolts and go to sea). The study program included surveys of the quality and quantity of habitat available for spawning and rearing, surveys of juvenile abundance, visual surveys of redd (nest) sites and spawning activity, and counts of outmigrating smolts captured by downstream fyke nets operating side-by-side with the fyke nets designed to intercept adult fish moving upstream. This program, in conjunction with the fyke net studies of adult migration, helps to complete a picture of the relative success of all of the key links in the life cycles of these fishes in the study area, with the exception of the time spent at sea. The smolt trapping program is described above in Section 3.0. This section describes the surveys of habitat condition and juvenile abundance.

The focus of this investigation is Santa Rosa Creek, and, to a lesser extent, Mark West Creek, and the potential impacts of the City's reclaimed water discharges on migratory salmonids that use these streams for spawning and rearing through the juvenile phases of their life cycles. It was acknowledged at the outset of the study that numerous other human activities (channelization, diversions and de-watering, dam construction, riparian forest clearing, trash dumping, runoff of agricultural and urban wastes, and exotic species introductions) had historically affected, and continue to affect, habitat conditions in these streams, as in most of the streams in the region. It is also widely known that all of these activities can have detrimental effects on fish populations, especially salmonids (Barnhart 1986, Moyle et al. 1989, Nehlsen et al. 1991). The task, then, was to identify and separate the possible impacts of the City's reclaimed water discharges from the other factors, and to assess the City's contribution, if any, to the cumulative impacts of all the factors on the populations of steelhead (and possibly coho) using these streams.

4.2 METHODS

4.2.1 Habitat Characterization

In each of the principal study streams (Santa Rosa Creek, Mark West Creek, and Maacama Creek), "index zones" were established for periodic surveys of habitat condition

and juvenile density. An index zone is a particular reach or portion of stream that is surveyed in some way and then re-surveyed periodically in the same manner, as a means of documenting seasonal or other types of change. After making habitat observations in most reaches of all study area streams, the index zones were selected to be representative of the larger system. Each stream was divided into upper, middle, and lower reaches, based on elevation, average gradient, and distance from the Russian River (Table 4-1), and an index zone was selected for surveys within each reach. One index zone was also established in Green Valley Creek, which supports small runs of steelhead and coho. Figure 2-3 shows the study area and locations of the index zones.

Table 4-1.

Habitat and Juvenile Density Index Zones

Creek	Reach	Elevation (ft)^a	Location
Santa Rosa Creek	Upper	600-640	Cougar Lane
	Middle	310-320	Fish ladder to Hwy 12 Bridge
	Lower	60-80	Delta Pond to Fulton Rd.
Mark West Creek	Upper	600-640	Alpine Rd. to St. Helena Rd.
	Middle	400-440	Downstream from Mark West Lodge
	Lower	50-60	River Rd. Bridge to Cunningham ranch
Maacama Creek	Upper	500-520	(Redwood Creek) Hwy 128 Bridge to Peter Michael Winery
	Middle	200-240	Downstream from Camp Maacama, along 128
	Lower	140-160	Chalk Hill Road
Green Valley Creek	Upper		[none]
	Middle	150-180 ^b	Allen Ranch
	Lower		[none]

^a feet above sea level

^b stream lower in Russian River Watershed; distance from river corresponds to middle reaches of other streams

In the initial surveys (October-November 1993), the entire length of each index zone was surveyed by a team of two people. The stream habitat was classified by the habitat unit approach (Bisson et al. 1982, Hankin 1986), in which a unit is defined as a continuous portion of the stream of variable length, within which only one habitat type is present or is dominant. Details of the survey rationale and the methods used in this study are provided in a previous report (MSC 1995). The main product of the habitat surveys is a physical description of each habitat unit in each index zone, and a suitability ranking ("Salmonid Habitat Score") from one to three for each unit.

In subsequent surveys (July and October 1994, July and October 1995), all of the habitat units in each index zone were examined again, and any changes in the descriptions of each unit were noted, with emphasis on differences that would affect the habitat score.

4.2.2 Juvenile Abundance Surveys

Fish were sampled in selected units within each index zone by repeated passes through the unit with a beach seine of appropriate length for the unit. The methods for selecting the units and conducting the sampling are explained in detail in MSC (1995). Captured fish were kept alive in aerated buckets during the sampling process, then released into the unit after sampling was completed. All fish and other aquatic vertebrates were identified to species, and the salmonids (steelhead or coho) were also measured (fork length) and examined for general condition. The same units were sampled in each survey. Comparison of the numbers and sizes of fish in each unit near the beginning (July) and end (October-November) of the summer dry period allows estimation of percent retention within the sampling area over this critical time period, as well as inferences regarding spawning success and juvenile growth rate. In some cases, fish within many of the sampling units in the July surveys were already isolated by dry areas between the units (which remained dry until the fall rains, thus eliminating the possibility of emigration), so the number remaining in the fall in those cases can be used as a direct estimate of percent survival over the summer dry period.

4.3 RESULTS

4.3.1 Habitat Condition

In the report prepared following completion of the 1993-94 studies (MSC 1995), the habitat condition of each study stream was described, and comparisons were made among streams and stream reaches. The general findings are summarized as follows: the first survey (Fall 1993) revealed that each stream reach surveyed had habitat apparently suitable for salmonid spawning and juvenile rearing, with lower Santa Rosa Creek (Santa Rosa Flood Control Channel) presenting the least suitable condition (Green Valley Creek was surveyed only in its middle reach). The most suitable conditions were found in upper Santa Rosa Creek and upper Maacama Creek.

In the July 1994 survey it was found that all of the lower Santa Rosa Creek zone was unsuitable for salmonids at this time because of high water temperature, and that all of the units in lower Maacama were completely dry, as were many of the units in middle Maacama and upper Mark West Creek. Apparently, the naturally low summer streamflow at these sites following a low rainfall season (1993-94 was an unusually low rainfall year) was greatly exacerbated by water diversions for agriculture and other purposes. In contrast, ample flow was maintained throughout the summer in upper Santa Rosa Creek, which has few diversions. Middle Santa Rosa Creek, middle and lower Mark West Creek,

and middle Green Valley Creek all had reduced or absent surface flow, but had cool water remaining in pools throughout the summer, due to subsurface flow.

By the time of the fall 1994 survey, surface flow (or at least standing water in pools) had returned to the formerly dry sites, so that each index zone appeared again to have suitable salmonid habitat, but some zones had no salmonids. This shows that, while habitat quality may be a good predictor of potential fish productivity or carrying capacity, it is not necessarily a good predictor of actual fish abundance at any given time; recent local history (e.g., rainfall diversions, and spawning success) can be more important.

Rainfall for the 1994-95 rainy season was unusually high, allowing a convenient opportunity to compare the effects of a very dry year (1993-94) on habitat, salmonid reproduction, and juvenile success with the effects of a very wet year during the next rainy season. Two different, partially offsetting effects of the wet year on stream habitat were revealed:

- The heavy flooding of the 1994-95 winter caused a net increase in sediment deposition at all of the index zones. Virtually every pool unit was found to be shallower in summer and fall 1995 than in the previous surveys, which is a negative result in terms of habitat suitability for fishes. Deposition of fine sediment is often a major factor limiting food supply for salmonids (interstitial spaces in the substrate are plugged by sediment, and insect production plummets). Also, the pools are critical to fish survival during the annual summer dry season, and any reduction in pool depth presumably increases crowding among the fish in the pools, increases vulnerability to predators, and increases the probability for the pools to becoming dry or too warm during the summer.
- Streamflow persisted throughout summer 1995 at all of the index zones, probably because of both an increase in available groundwater and a decrease in the amount of water needed for agricultural diversions. Thus, even though the suitability for salmonids in many units had been diminished somewhat by sediment deposition, suitability in summer 1995 was greatly increased (because of flow) relative to the preceding summer.

Because the results of the 1993-94 study (MSC 1995) showed that there was no relationship between traditional parameters of habitat suitability (e.g., pool-riffle ratios, substrate texture, and pool depth) and juvenile abundance, no further analyses or comparisons of habitat suitability will be conducted for this report. The obvious factors affecting juvenile abundance and survival in the study streams (e.g., artificial de-watering of stream reaches) will be discussed further in Section 5.

4.3.2 Juvenile Abundance and Population Age Structure

The numbers of juvenile steelhead and coho collected in each unit sampled in each of the two surveys in 1995 are provided in Appendix 4-1. Salmonid catches for the past three

years are summarized as the mean number per habitat unit for each index zone in Appendix Table 4-2. The total number of fish captured in all passes of the seine in each unit is used as a conservative estimate of the true number of fish in the unit. Appendix 4-3 lists the total number of each species of fish and other vertebrates collected per index zone.

Figures 4-1 to 4-3 show the mean number of steelhead per habitat unit found near the beginning of the summer dry period (July sampling) compared with the number found in the fall (October-November sampling) for each year of the study.

This comparison illustrates the impact of summer drought on juvenile survival. Figure 4-1 shows that summer mortality in 1994 was nearly 100 percent at upper Mark West Creek, compared with 65 percent at upper Maacama Creek and 45 percent at upper Santa Rosa Creek. Emigration can be ruled out as a possible explanation for the summer decline in numbers at upper Mark West and upper Maacama creeks because the fish found in July were already isolated by absence of surface flow between the drying pools. Summer mortality was greatly reduced following the very wet winter of 1995.

Another approach to studying the effects of dry versus wet years on juvenile success is to examine the growth of juvenile fish over the summer dry period. Length-frequency histograms of juvenile steelhead are provided in Figures 4-4 to 4-7, for each stream reach and sampling period. Young-of-the-year steelhead (i.e., those produced in the preceding spawning season) are those in the 30-130 mm size class in the fall surveys, with slight variation among streams. The young-of-the-year fish are always those represented by the clusters furthest to the left in the figures. All other age classes (two, three, four years old), are represented by smaller and less distinct clusters further to the right. The mean lengths of young-of-the-year steelhead and coho at each index zone are shown in Appendix 4-4. Juvenile coho (all young-of-the-year fish) were found only at Green Valley Creek in 1995 (Figure 4-8).

The daily average growth rate of young-of-the-year fish during summer 1995 is provided in Appendix 4-5, showing, among other things, that fish generally grow at a faster rate the lower they are in the stream system (because of greater space and food available, and higher water temperature).

Figure 4-1. Summer Survivorship of Juvenile Steelhead at Upper Index Zones Following Dry vs. Wet Rainfall Seasons

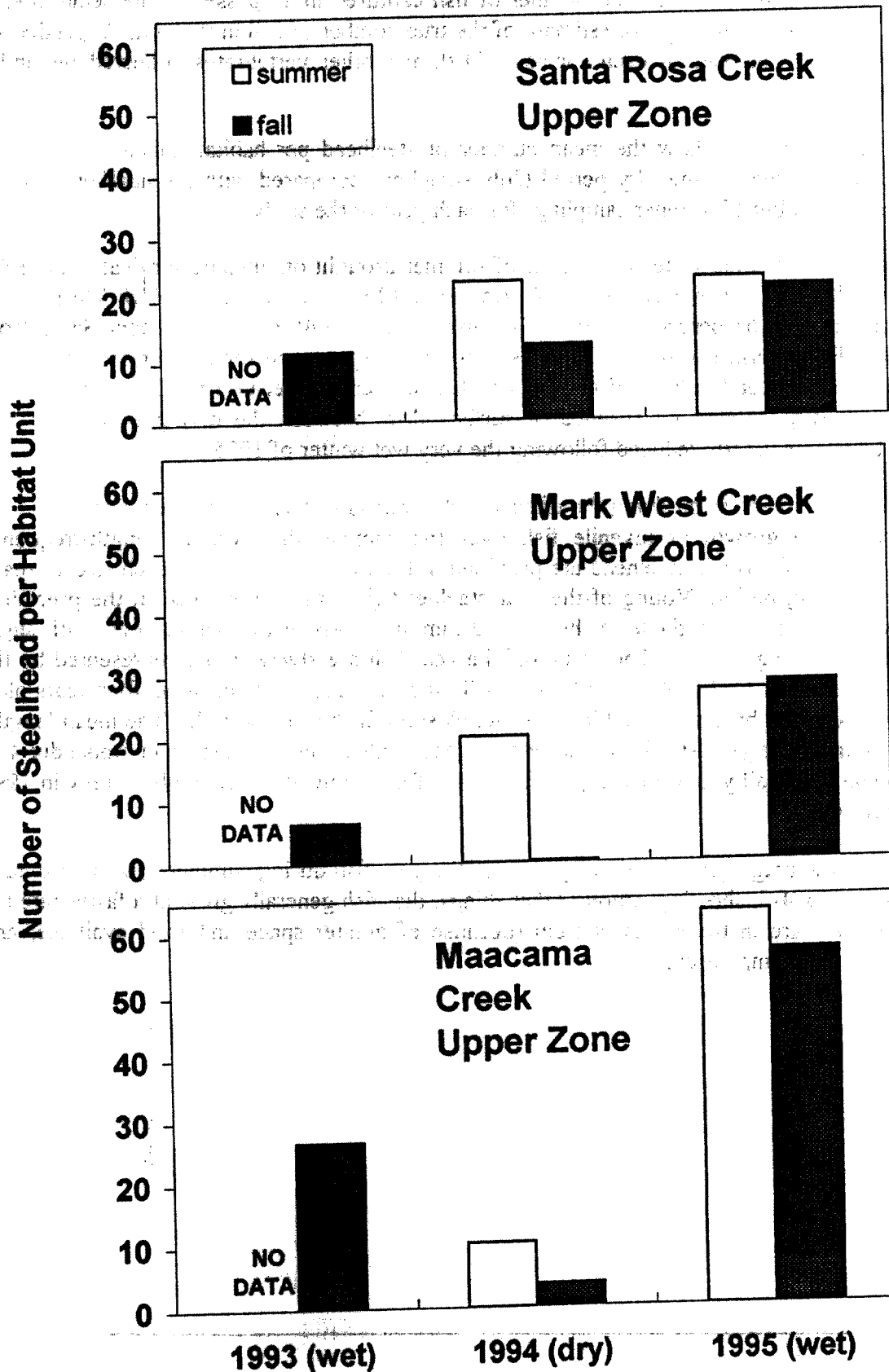


Figure 4-2. Summer Survivorship of Juvenile Steelhead at Middle Index Zones Following Dry vs. Wet Rainfall Seasons

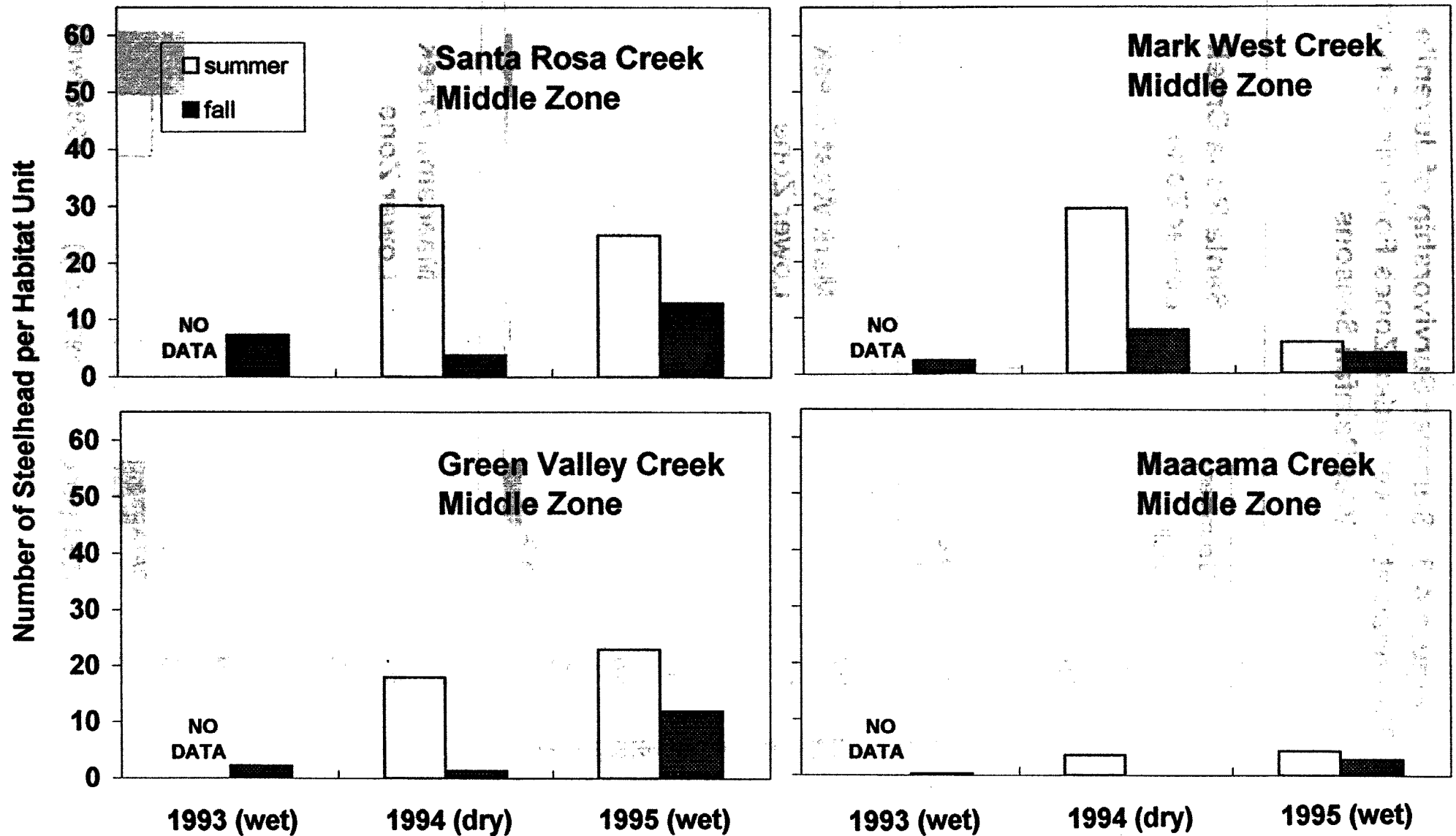
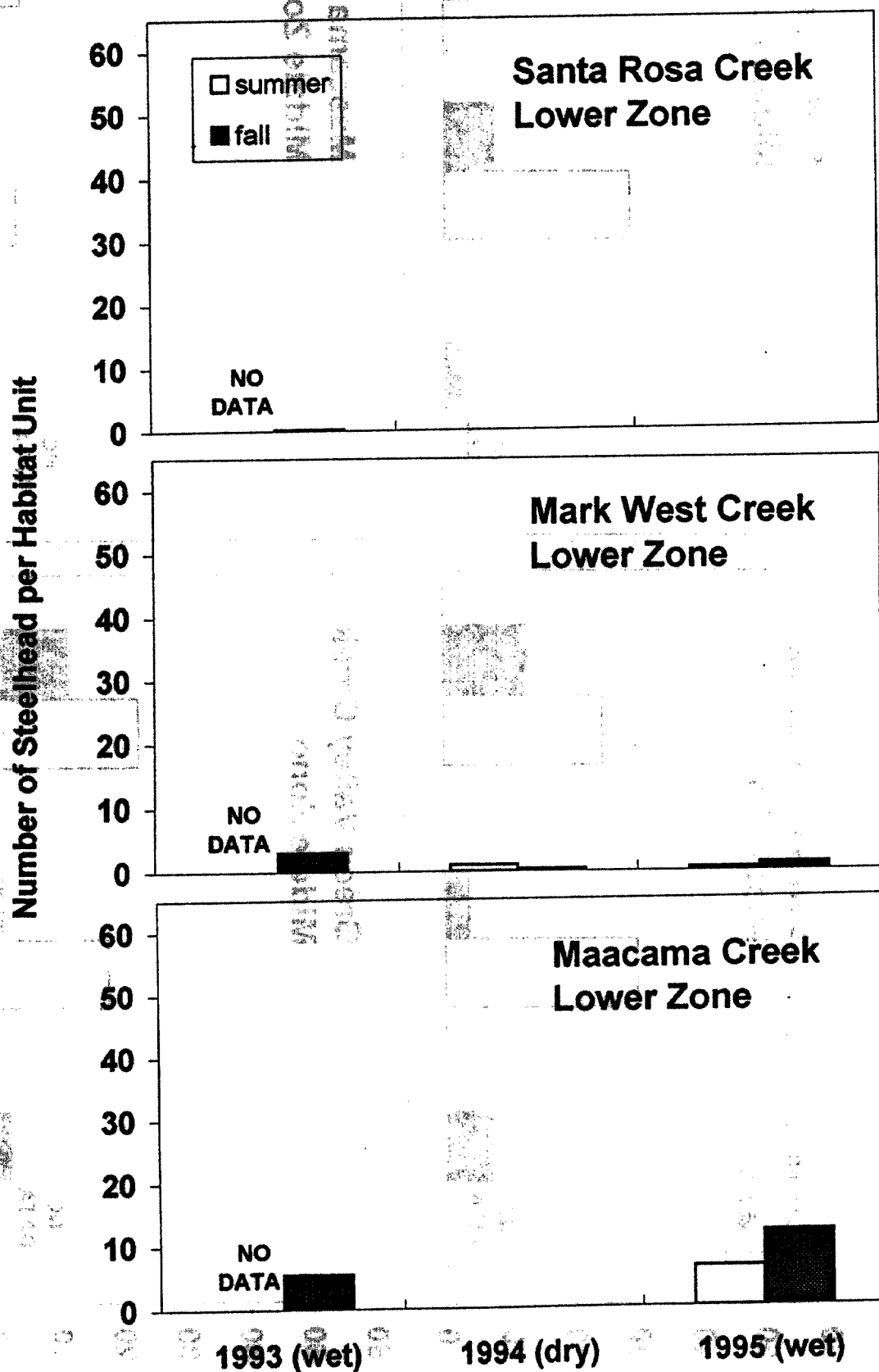
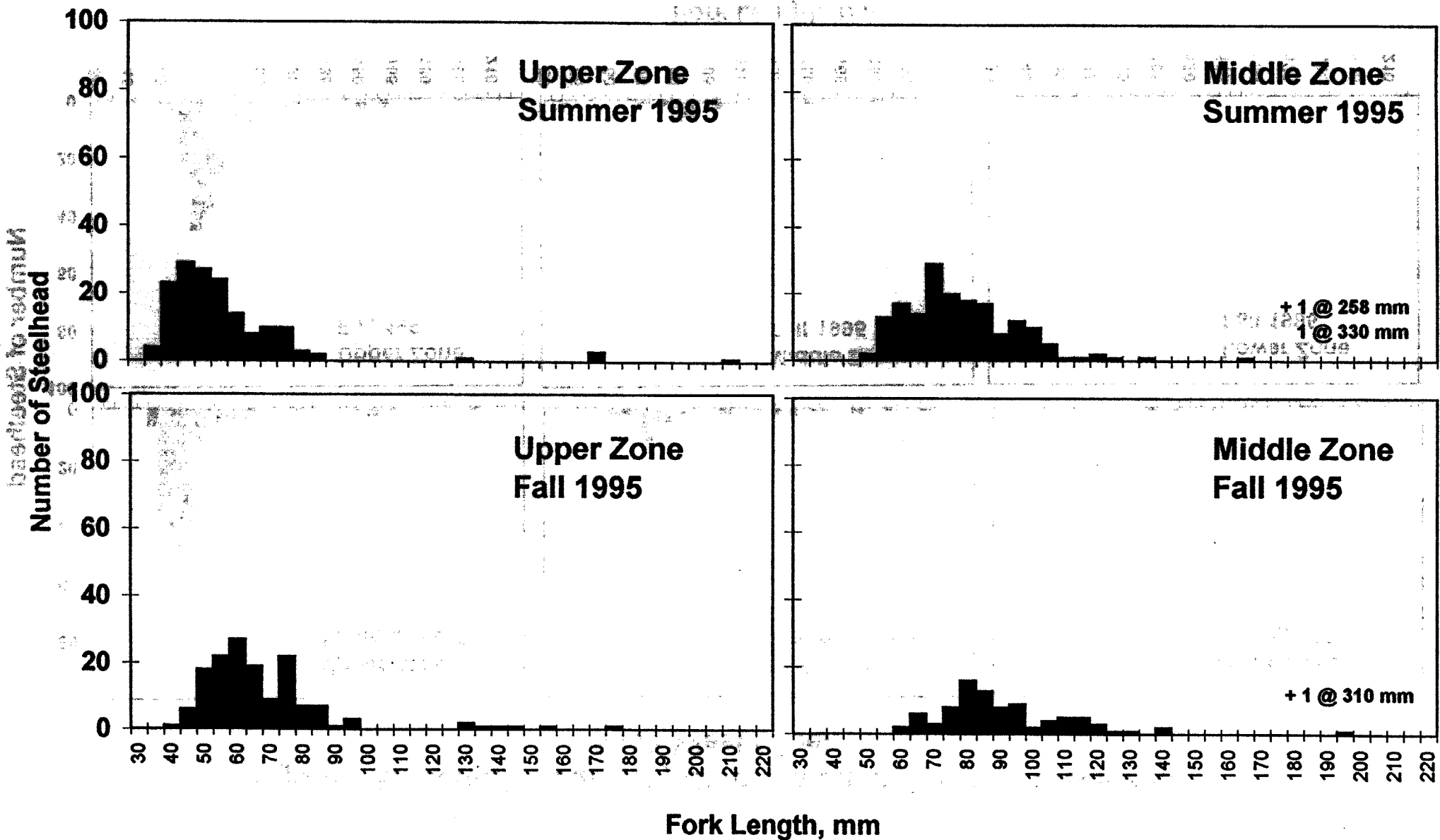


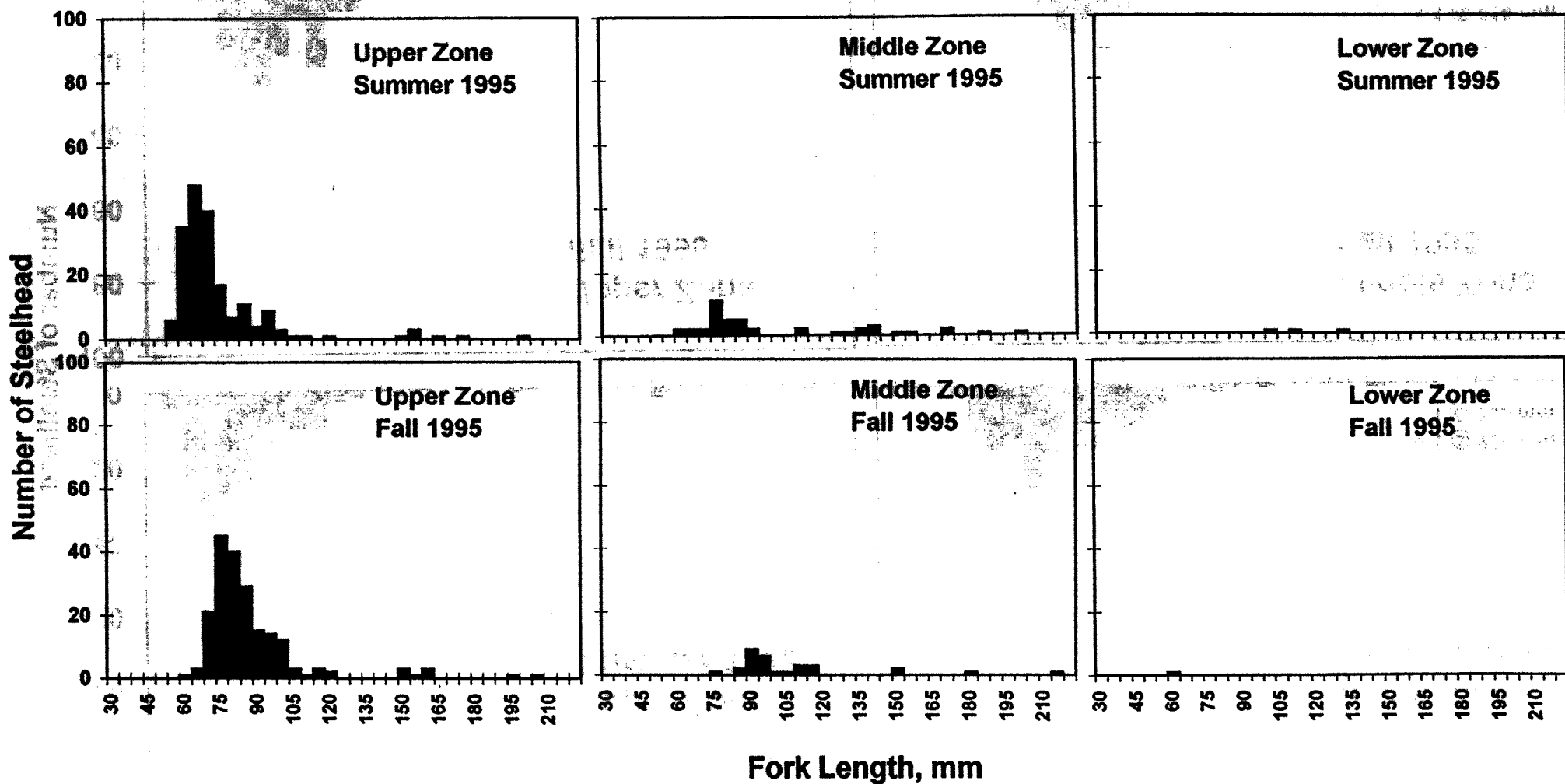
Figure 4-3. Summer Survivorship of Juvenile Steelhead at Lower Index Zones Following Dry vs. Wet Rainfall Seasons



**Figure 4-4. Length-frequency Distribution of Juvenile Steelhead,
Santa Rosa Creek**



**Figure 4-5. Length-frequency Distribution of Juvenile Steelhead,
Mark West Creek**



**Figure 4-6. Length-frequency Distribution of Juvenile Steelhead,
Maacama Creek**

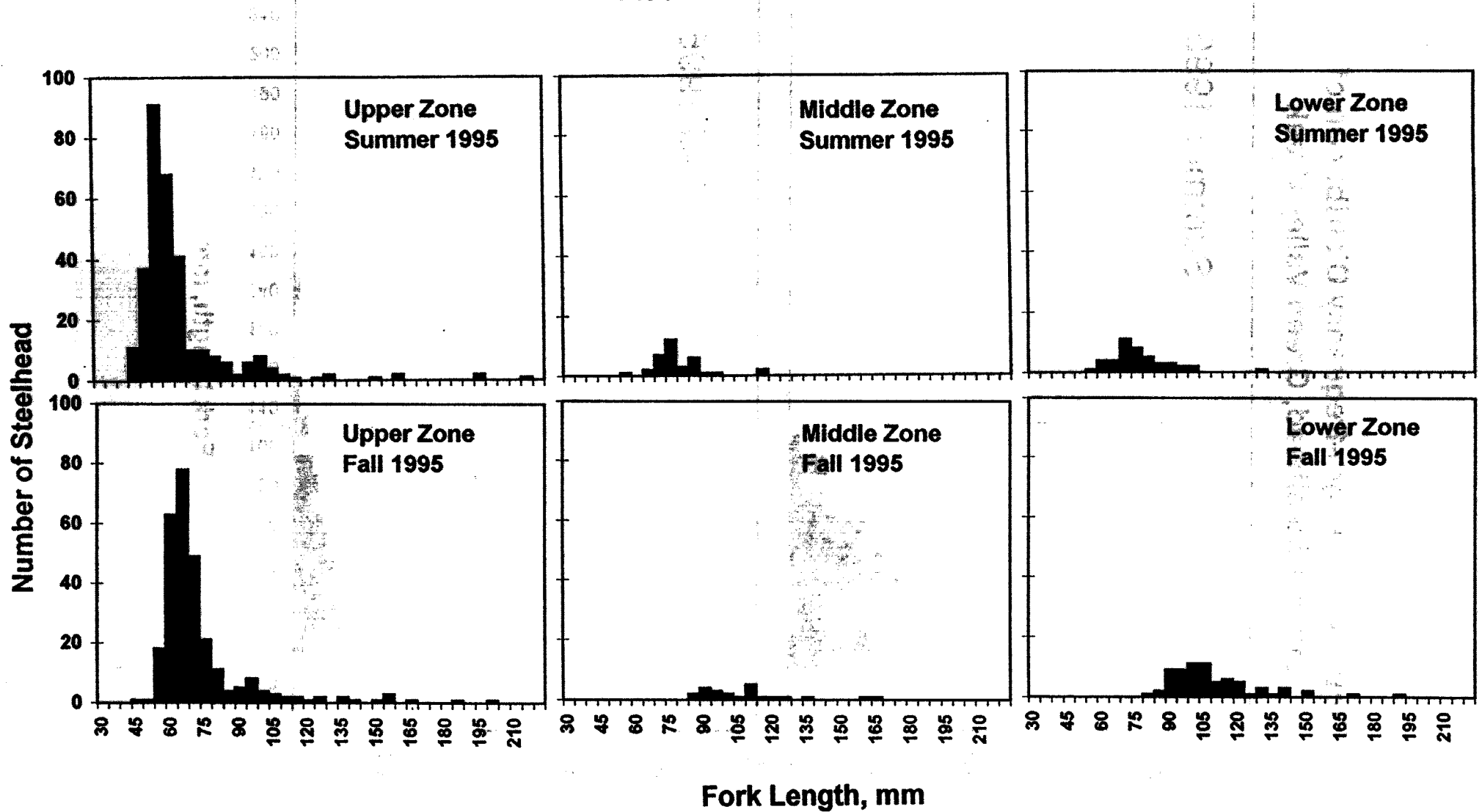


Figure 4-7. Length-frequency Distribution of Juvenile Steelhead, Green Valley Creek

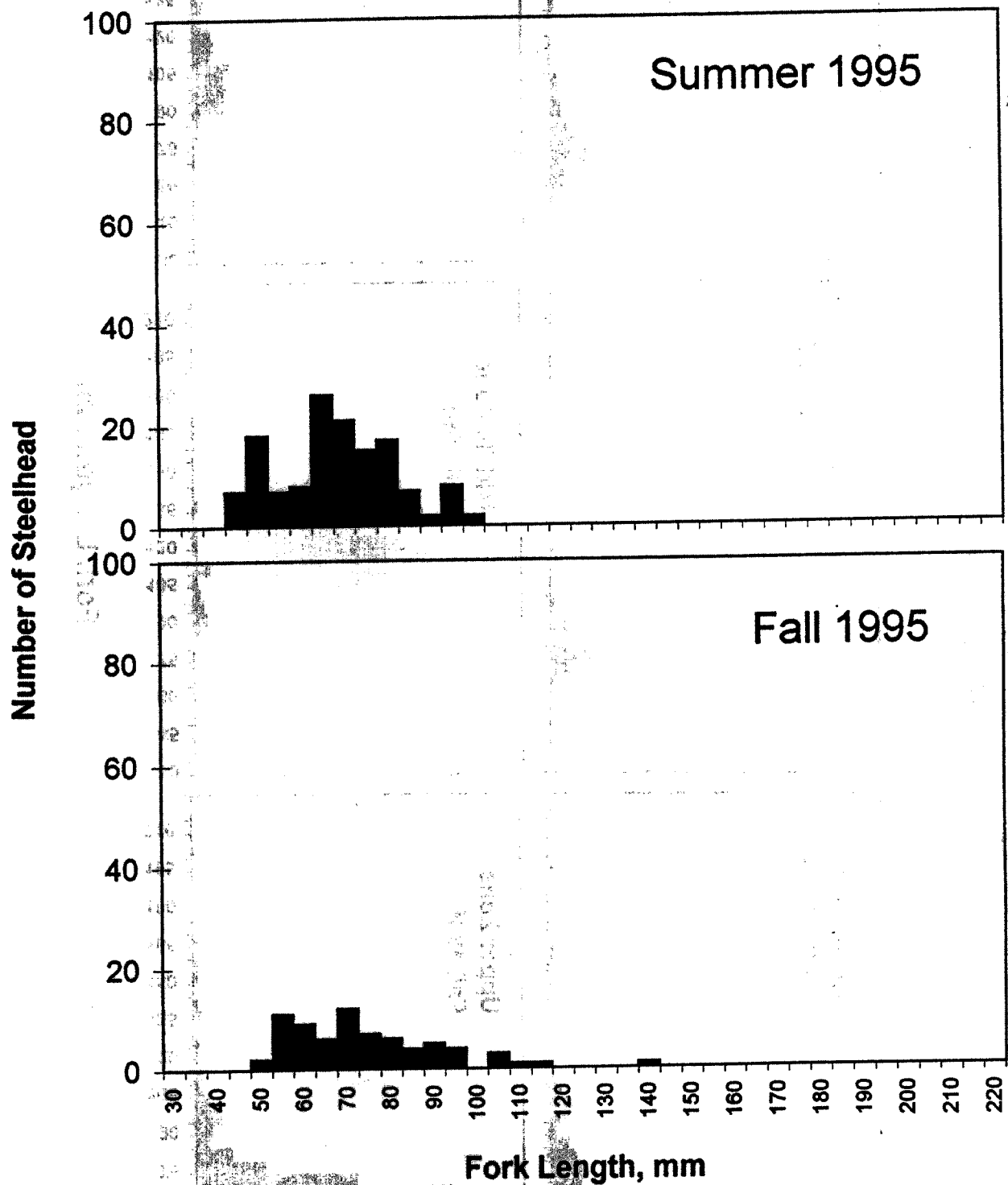
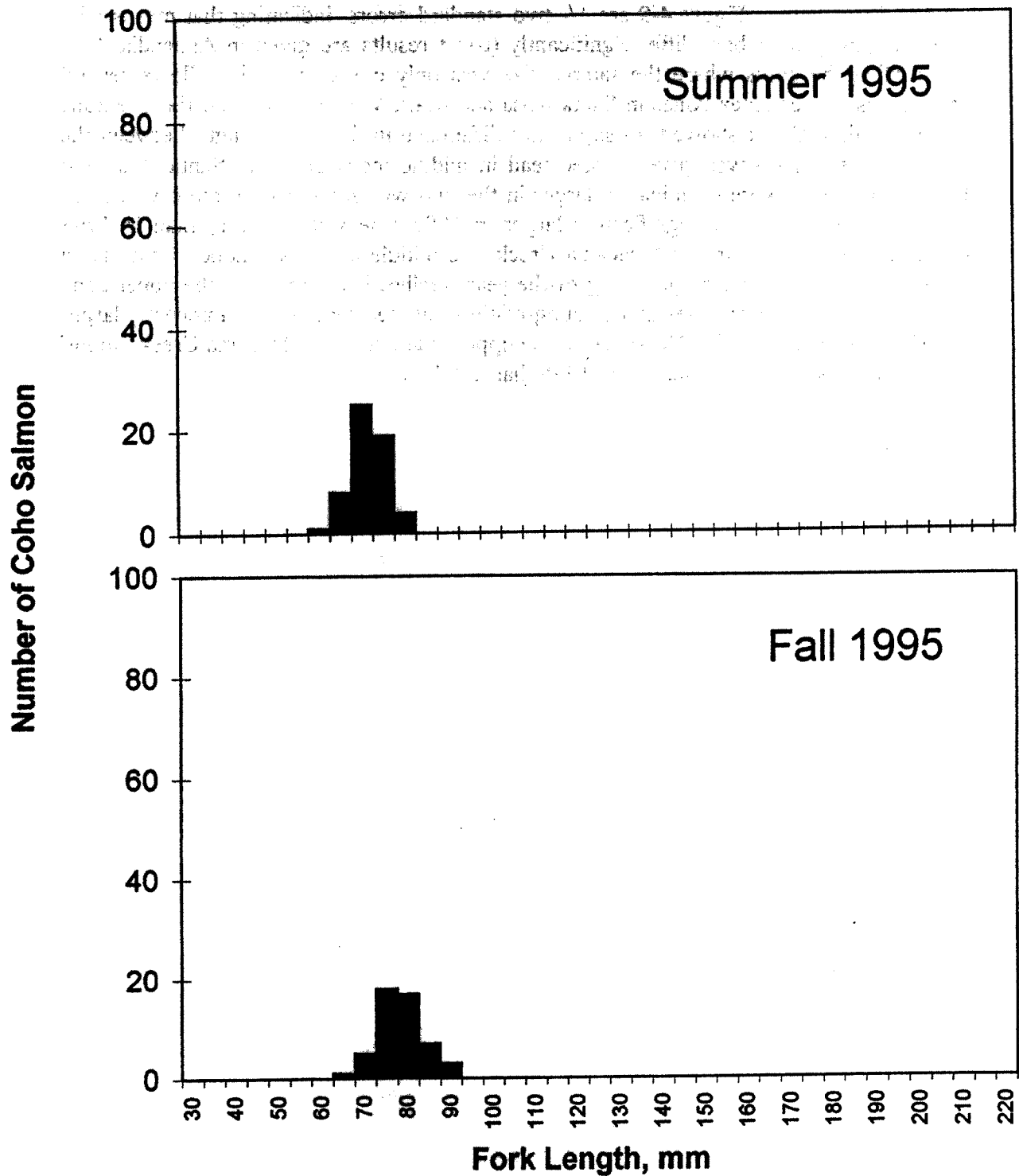
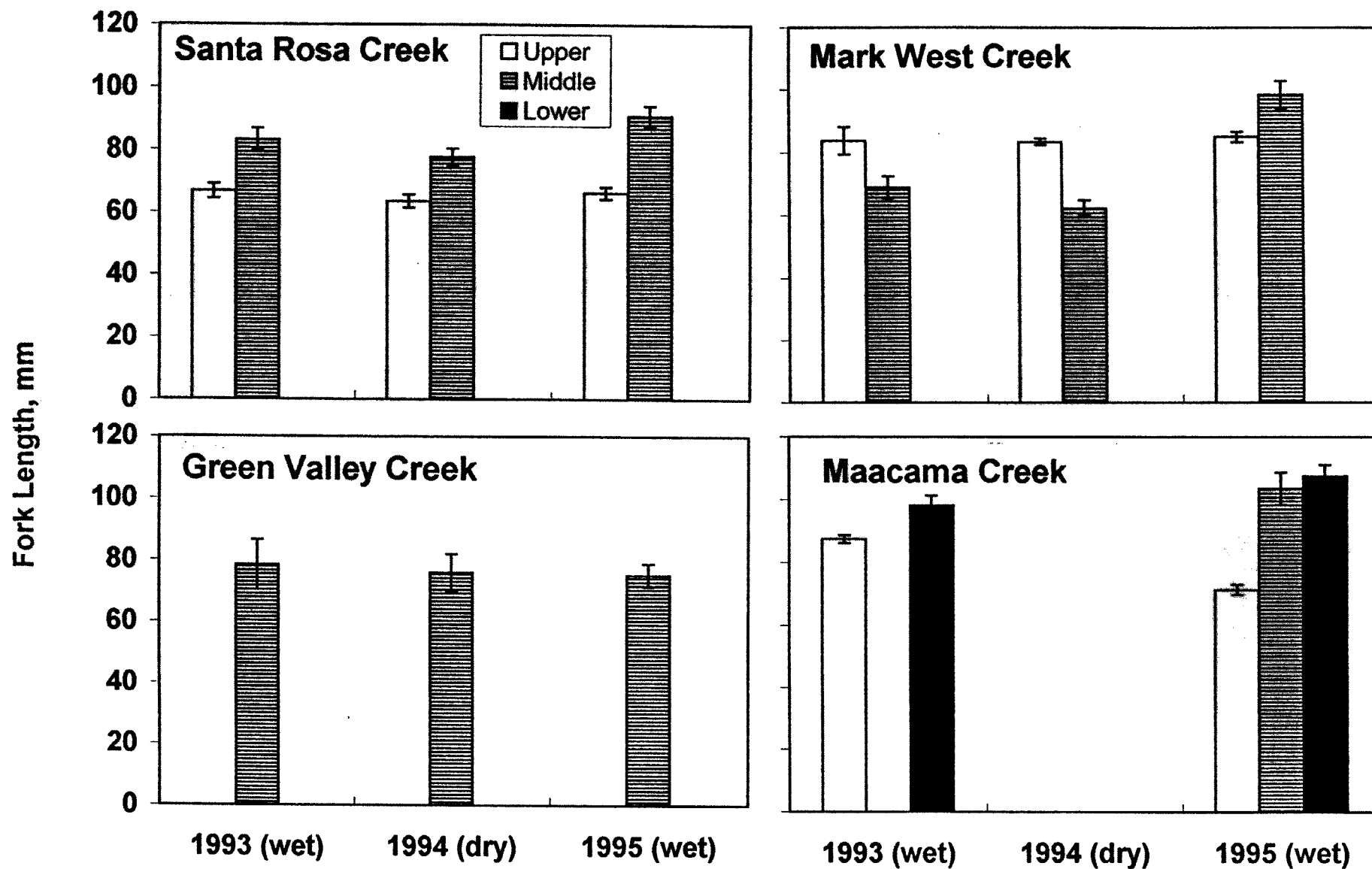


Figure 4-8. Length-frequency Distribution of Juvenile Coho Salmon, Green Valley Creek



The relationship between growth of steelhead in their first year and rainfall can also be examined by comparing the sizes of fish in the fall surveys for each of the past three years (see Figure 4-9 and Appendix 4-6). The 1993 and 1995 winters were wet; the 1994 winter was dry. Error bars in Figure 4-9 are +/- two standard errors, indicating that means with non-overlapping error bars differ significantly (t-test results are given in Appendix 4-7). Disregarding the cases where the sample size was only one or two fish allows several comparisons: upper index zones in Santa Rosa and Mark West Creeks, and the one zone in Green Valley Creek showed no significant difference in fall mean length between the past three years. However, juvenile steelhead in middle index zones in Santa Rosa and Mark West Creeks were significantly larger in the two wet years than in the dry year. In both cases they were also significantly larger in 1995 (the wettest year) than in 1993 (above normal water year). In Maacama Creek, the middle and lower zones went dry in summer 1994, and only a single young-of-the year steelhead was found in the upper zone in Fall 1994. In the lower index zone, young-of-the-year steelhead were significantly larger in 1995 (wettest) than 1993. However, at the upper index zone in Maacama Creek, young steelhead were significantly *smaller* in 1995 than 1993.

Figure 4-9. Mean Fork Lengths (mm \pm 2 s.e.) in Fall of Young-of-the-year Steelhead, 1993-1995



5.0 DISCUSSION

The fyke-netting program conducted in 1994-95 turned out to be of limited usefulness because so many days of potential fishing were lost, owing to high water levels resulting from unusually heavy rainfall. Only 56-59 days were fished at each site, as opposed to 119-129 days in 1993-94 (Table 3-5). Most of the fishing days missed were during the prime season to expect steelhead movements in Santa Rosa Creek and Mark West Creek, based on the studies conducted during the four preceding years. Most of the steelhead movement in these two streams probably occurred during long periods of high water when the fyke nets were not in service.

The small catches of salmonids, considered only in the context of the 1994-95 study, have little explanatory value with regard to the potential effects of reclaimed water discharged into the Laguna de Santa Rosa. However, when combined with the data obtained from the previous four years of study, they add to and reaffirm the conclusion reached at the end of the 1993-94 program (MSC 1995): No evidence was found to support the hypothesis that reclaimed water has a negative effect on the movements of salmonids through the Laguna de Santa Rosa migration corridor. If the homing instinct of steelhead were impaired by reclaimed water, it is logical to expect that more fish would be caught at lower concentrations or when reclaimed water was absent, and fewer at higher concentrations. Yet adult steelhead move up and down the corridor without apparent regard to the presence or concentration of reclaimed water, and large numbers of smolts moving downstream through the corridor and out to sea are strong evidence that steelhead that reproduce in the Laguna system successfully complete all of the freshwater phases of their life cycle.

Although it is likely that most of the outmigrating smolts in each stream were not captured during the high water events in 1994-95, it is also likely that the true number of smolts was lower, owing to the relatively high mortality, particularly in Maacama Creek, of juveniles documented in the rearing areas during the dry summer of 1994 (MSC 1995).

The other part of the study program (habitat and juvenile abundance surveys throughout the watersheds) adds vital information to the overall picture of the health and viability of the salmonid runs in the Laguna watershed. Annual successful spawning and juvenile rearing in the watersheds upstream of the zones affected by winter discharge of reclaimed water cast further doubt on the hypothesis that reclaimed water has negative effects on steelhead homing instinct or spawning success.

Additionally, the habitat and juvenile studies elucidate real threats to the continued viability of these spawning runs: human-induced habitat alteration in the spawning and rearing areas exacerbates the effects of natural climatic variation. In dry years, water users divert so much water from the rearing areas of the streams that some areas go completely dry (upper Mark West Creek, upper, middle, and lower Maacama Creek), with obviously

fatal consequences for juvenile fish of any native species. In addition to de-watering the streams and exacerbating the effects of drought, some of the observed diversion intakes are unscreened pipes, which undoubtedly entrain juvenile fish, sending them to their deaths in fields or stock tanks. In wet years, water users do not need to divert as much water during the summer, streams flow all summer long, and juvenile survival is dramatically increased. Although summer survivorship of juvenile salmonids was clearly much better after a wet year than after a dry year, the effect of a wet year on summer growth is not clear (Figure 4-9). In three cases, there were no significant differences in fall mean length among the three years studied; in three cases, juveniles were significantly larger after wet years; and in one case, the fish were significantly smaller after the wettest year than after an above-normal rainfall year. Data from upper Maacama Creek, which had a much higher density of juvenile steelhead in summer 1995 than any other site (63 fish per unit, see Figure 4-1), suggest the possibility that the higher juvenile abundance (hence greater competition for food and space), coupled with reduced food production (resulting from sediment deposition during the previous wet season flooding), led to a reduction in growth rate in summer 1995 at this site.

The status of coho populations in study area streams remains uncertain. Wild adult spawners were intercepted in Maacama Creek in 1994-95, as in the previous year, but none were caught in Santa Rosa or Mark West Creeks in either of the past two winters (two adults were captured in Mark West Creek in the 1992-93 winter). The capture of a few wild coho smolts in fyke nets in Mark West Creek and Santa Rosa Creek in the 1993-94 fishing season suggested that there may have been some coho spawning in these streams in 1992-93 (MSC 1995). However, no coho juveniles have been found in any of the juvenile abundance surveys conducted in these streams from 1993-1995, and no adults have been captured in fyke nets since the two caught in 1992-93. The few (four total) coho smolts captured in Santa Rosa Creek and Mark West Creek in 1994-95 were all adipose fin-clipped, indicating hatchery origin. Since coho year classes usually act as separate populations, it is possible that, if there is a remnant spawning run of coho in these two creeks, it may consist of offspring of a single year class, with adults returning every third year. If so, the next spawning run would be expected to occur in the 1996-97 winter.

In Maacama Creek the coho spawners captured in fyke nets in December 1994 may have had their redds destroyed by the floods in January 1995, as no juveniles were found in any of the Maacama index zones during surveys conducted in summer and fall 1995. A similar situation may also have occurred in 1994. Maacama Creek had a fairly strong year class which was seen in fall 1993 surveys and captured as smolts the following winter. The adults from this year class would also be expected to return to spawn in the winter of 1996-97. Coho spawning in Green Valley Creek was successful in 1994-95, as juveniles were found in every habitat unit sampled in summer and fall 1995; thus two out of the three year classes seem to persist in Green Valley Creek.

The chinook salmon captured in fyke nets in Santa Rosa Creek and Maacama Creek in 1994-95 could indicate that spawning runs are becoming, or have become established in

these streams. However, both streams are rather small for chinook, and the recent captures may represent nothing more than an oddity occurring only in an unusually wet winter. Chinook are frequently known to stray into non-natal streams during heavy rainfall years (Moyle 1976; R. Gunter, Hatchery Manager, CDFG, *pers. comm.*, 1995). The CDFG has been attempting for the past 20 years to establish self-reproducing runs of chinook in the Russian River system, via releases from the Warm Springs Hatchery. The adults captured in the fyke nets during the 1994-95 study probably did not originate at the Warm Springs Hatchery, as no hatchery marks were evident. They could, however, be second or third generation offspring of hatchery stock that have begun spawning in Santa Rosa Creek, Maacama Creek, or other area streams; or they could be strays from the Eel River or other streams. No chinook juveniles were released from the Warm Springs Hatchery in spring 1995 (R. Gunter, Hatchery Manager, CDFG, *pers. comm.* 1995), so those captured in Santa Rosa Creek probably resulted from fish spawning in Santa Rosa Creek or a nearby stream.

6. CONCLUSIONS

Data collected after five years of study support the following conclusions:

- Santa Rosa Creek and Mark West Creek contain self-sustaining populations of wild steelhead.
- Upmigrating steelhead adults do not appear to be affected by reclaimed water in the migration corridor. No evidence has been found to support the hypothesis that the presence of reclaimed water in the migration corridor has any impact on homing behavior or movements of steelhead.
- Steelhead abundance appears to be determined by summer survivorship of juveniles in the upstream nursery areas, not by the number of spawning adults. Summer survivorship in the nursery areas can be greatly affected by water diversions, especially in Maacama Creek and Mark West Creek.
- Coho salmon are no longer found in Santa Rosa Creek, but still reproduce in nearby creeks (Green Valley Creek and Maacama Creek, possibly Mark West Creek), at least in some years.

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8.0 APPENDICES

Appendix 3-1. Daily Stream Flow and Reclaimed Water Discharge, 1994-1995

Date	Stream Flow, cfs			Reclaimed Water Discharge, cfs			Reclaimed Water Concentration, percent of Stream Flow			
	Santa Rosa Creek	Mark West Creek	Trenton-Healdsburg Rd.	Santa Rosa		City of Windsor	Zone A	Zone B	Zone C	Zone D
				Upper Laguna	Delta Pond					
4-Nov-94	16.5	2.1	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-Nov-94	691.9	27.6	680.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-Nov-94	286.5	28.8	1200.0	0.8	0.0	0.0	0.1	0.1	0.1	0.0
7-Nov-94	53.7	16.9	1300.0	0.8	0.0	2.0	0.2	0.1	0.1	0.0
8-Nov-94	37.3	12.0	390.0	0.5	0.0	3.7	1.1	0.1	0.1	0.0
9-Nov-94	219.3	40.6	228.0	0.8	0.0	3.1	1.7	0.4	0.4	0.0
10-Nov-94	80.2	34.1	200.0	15.6	0.0	5.1	10.1	8.1	9.9	0.0
11-Nov-94	43.4	18.3	271.2	9.0	0.0	5.0	5.0	3.4	3.6	0.0
12-Nov-94	34.5	14.6	218.5	5.3	0.0	1.2	3.0	2.4	2.6	0.0
13-Nov-94	29.7	13.0	164.2	4.5	0.0	2.6	4.3	2.8	3.0	0.0
14-Nov-94	27.6	12.0	126.0	5.3	0.2	1.7	5.6	4.4	4.9	0.6
15-Nov-94	210.3	50.0	244.8	2.9	0.3	1.3	1.8	1.4	1.8	0.1
16-Nov-94	67.6	20.0	246.4	0.8	6.0	2.4	3.7	2.8	3.1	8.2
17-Nov-94	42.6	16.4	210.7	0.6	4.8	3.9	4.4	2.6	2.8	10.1
18-Nov-94	35.3	14.8	207.5	0.8	5.6	1.9	3.9	3.1	3.3	13.6
19-Nov-94	31.3	13.3	173.0	0.6	3.1	1.3	2.9	2.2	2.4	9.0
20-Nov-94	30.0	12.4	138.4	0.8	1.5	1.3	2.6	1.7	1.9	4.9
21-Nov-94	29.4	11.9	111.6	0.5	4.5	1.2	5.5	4.5	5.1	13.2
22-Nov-94	28.0	11.5	90.4	2.8	0.0	0.8	3.9	3.2	3.6	0.0
23-Nov-94	27.1	11.1	75.0	2.3	0.0	0.0	3.1	3.2	3.8	0.0
24-Nov-94	27.6	10.9	48.2	2.3	0.0	0.0	4.8	5.1	6.6	0.0
25-Nov-94	169.6	27.0	36.8	2.2	0.0	0.0	5.9	7.0	54.1	0.0
26-Nov-94	120.3	44.2	146.8	6.8	0.0	0.9	5.2	5.0	7.3	0.0
27-Nov-94	75.2	27.1	210.4	6.8	0.0	1.9	4.1	3.3	3.8	0.0
28-Nov-94	54.6	21.9	183.3	0.6	36.2	2.1	21.0	20.6	23.5	39.9
29-Nov-94	42.9	18.1	178.7	0.6	33.7	1.8	20.0	19.6	21.9	44.0
30-Nov-94	38.1	15.9	151.2	0.2	28.9	1.3	19.9	19.7	22.1	43.2
1-Dec-94	35.4	14.5	132.5	0.6	22.1	1.1	17.8	17.6	19.8	38.4
2-Dec-94	33.8	13.5	113.1	0.9	22.1	0.5	20.7	20.9	23.8	39.5
3-Dec-94	677.0	179.4	101.2	0.9	17.6	0.0	18.3	29.8	11.0	2.5
4-Dec-94	451.0	194.4	673.5	0.9	100.2	2.1	15.3	16.0	23.2	18.2
5-Dec-94	124.1	54.5	1425.6	86.9	155.2	10.0	17.6	17.1	17.8	55.6
6-Dec-94	81.0	31.5	1063.8	86.2	101.3	12.2	18.6	17.7	18.3	55.6
7-Dec-94	59.1	22.7	771.3	16.6	65.1	8.2	11.5	10.7	11.0	52.4
8-Dec-94	49.6	19.3	571.8	0.9	64.2	6.0	12.3	11.5	11.9	56.4
9-Dec-94	44.5	18.0	441.2	0.9	50.6	3.3	12.3	11.8	12.3	53.2
10-Dec-94	41.3	16.6	335.8	0.9	39.9	3.4	13.0	12.3	12.9	49.1
11-Dec-94	54.4	16.7	265.3	0.9	29.2	2.7	12.3	11.5	12.3	35.0
12-Dec-94	193.0	31.0	215.9	0.9	31.4	2.4	15.9	15.5	18.1	14.0
13-Dec-94	92.6	31.0	334.8	32.6	11.0	2.8	13.8	13.3	14.7	10.6
14-Dec-94	220.7	55.9	298.6	48.9	0.0	2.8	17.2	17.1	21.2	0.0
15-Dec-94	143.1	64.5	434.8	70.4	0.0	4.0	16.9	16.7	19.8	0.0
16-Dec-94	81.5	36.0	512.2	65.0	63.9	5.9	26.0	25.5	27.5	43.9
17-Dec-94	65.1	27.6	434.2	58.8	28.8	4.3	21.0	20.4	21.9	30.7
18-Dec-94	72.6	25.5	383.9	35.4	54.9	3.1	24.1	23.9	25.6	43.1
19-Dec-94	56.7	23.0	347.0	27.1	6.2	2.8	10.3	9.7	10.4	9.8

Appendix 3-1. Daily Stream Flow and Reclaimed Water Discharge, 1994-1995

Date	Stream Flow, cfs			Reclaimed Water Discharge, cfs			Reclaimed Water Concentration, percent of Stream Flow			
	Santa Rosa Creek	Mark West Creek	Trenton-Healdsburg Rd.	Santa Rosa		City of Windsor	Zone A	Zone B	Zone C	Zone D
				Upper Laguna	Delta Pond					
20-Dec-94	50.7	20.6	303.2	21.2	0.0	2.5	7.8	7.1	7.6	0.0
21-Dec-94	46.5	19.0	249.4	32.3	0.0	2.6	13.8	13.2	14.3	0.0
22-Dec-94	42.9	17.7	198.6	35.6	0.0	2.0	18.7	18.3	20.1	0.0
23-Dec-94	40.8	16.7	161.3	31.4	0.0	1.1	20.0	19.9	22.3	0.0
24-Dec-94	72.4	19.8	138.5	26.5	0.0	1.1	19.8	19.7	23.1	0.0
25-Dec-94	47.9	19.4	164.0	35.3	0.0	1.1	22.0	22.1	25.1	0.0
26-Dec-94	40.9	16.7	148.1	26.5	0.0	1.3	18.6	18.3	20.7	0.0
27-Dec-94	39.3	15.7	128.0	38.2	0.0	1.1	30.4	30.7	35.1	0.0
28-Dec-94	75.7	20.3	115.9	19.8	0.0	0.5	17.5	17.8	21.7	0.0
29-Dec-94	44.6	18.3	137.1	36.5	0.0	0.0	26.6	27.4	31.8	0.0
30-Dec-94	39.7	16.7	129.1	27.4	0.0	0.0	21.2	21.8	25.2	0.0
31-Dec-94	52.4	16.4	120.2	33.3	0.0	0.0	27.7	28.5	33.2	0.0
1-Jan-95	184.8	29.2	116.9	24.3	0.0	0.0	20.8	22.0	29.8	0.0
2-Jan-95	87.7	30.2	220.2	34.0	0.0	0.0	15.5	15.9	18.5	0.0
3-Jan-95	257.5	62.2	267.0	34.5	0.0	0.9	13.2	13.6	18.0	0.0
4-Jan-95	494.3	157.3	496.8	28.5	30.8	4.6	12.7	12.8	19.4	5.9
5-Jan-95	413.3	157.5	949.6	78.7	28.3	8.8	12.1	11.7	14.1	6.4
6-Jan-95	341.8	111.9	1521.3	49.8	0.0	11.2	4.0	3.3	3.6	0.0
7-Jan-95	1378.1	631.8	1527.3	61.9	0.0	11.6	4.8	4.5	8.2	0.0
8-Jan-95	4938.2	1565.0	2179.9	0.0	0.0	9.8	0.4	0.0	0.0	0.0
9-Jan-95	8461.5	2500.0	3405.3	42.9	0.0	9.0	1.5	1.5	11.8	0.0
10-Jan-95	7600.0	3200.0	6701.2	87.6	0.0	7.2	1.4	1.5	3.1	0.0
11-Jan-95	5400.0	2500.0	6701.2	131.3	4.6	13.5	2.2	2.2	3.7	0.1
12-Jan-95	4200.0	1600.0	4232.0	110.5	104.6	13.2	5.4	5.5	9.4	2.4
13-Jan-95	2700.0	1300.0	3345.8	54.6	17.3	12.5	2.5	2.3	4.1	0.6
14-Jan-95	2000.0	1000.0	3244.5	81.7	11.1	12.5	3.2	3.1	4.6	0.6
15-Jan-95	2300.0	1250.0	3927.8	112.2	93.0	12.4	5.5	5.6	8.5	3.9
16-Jan-95	900.0	450.0	3631.5	86.2	91.3	11.7	5.2	5.0	5.8	9.2
17-Jan-95	341.3	167.1	2054.7	71.2	86.0	10.6	8.1	7.8	8.5	20.1
18-Jan-95	299.4	144.0	1746.9	78.9	81.8	10.0	9.7	9.4	10.2	21.5
19-Jan-95	246.0	122.3	1284.5	95.9	58.0	5.3	12.3	12.2	13.6	19.1
20-Jan-95	234.1	114.0	1067.2	45.2	46.9	0.9	8.7	8.8	9.9	16.7
21-Jan-95	234.0	119.8	1055.4	59.4	20.1	0.0	7.5	7.7	8.7	7.9
22-Jan-95	826.4	367.4	1483.8	16.7	0.0	0.0	1.1	1.2	1.6	0.0
23-Jan-95	1388.8	635.1	2398.8	21.0	0.0	0.0	0.9	0.9	1.3	0.0
24-Jan-95	988.9	500.1	2576.4	73.0	24.4	4.0	3.9	3.9	5.0	2.4
25-Jan-95	447.3	234.4	2278.5	0.3	65.0	9.8	3.3	2.9	3.3	12.7
26-Jan-95	625.2	277.4	1985.0	1.9	38.1	9.9	2.5	2.1	2.4	5.7
27-Jan-95	1273.4	477.3	2254.8	25.2	15.5	10.1	2.2	1.9	2.4	1.2
28-Jan-95	979.3	404.8	2429.0	0.8	69.3	9.6	3.3	3.0	3.6	6.6
29-Jan-95	486.8	243.7	2198.2	0.8	72.7	8.8	3.7	3.4	3.9	13.0
30-Jan-95	1066.0	398.5	2138.1	0.9	26.5	8.8	1.7	1.3	1.7	2.4
31-Jan-95	507.7	233.3	2198.4	0.9	63.9	7.4	3.3	3.0	3.4	11.2
1-Feb-95	319.2	159.0	1899.4	0.8	74.3	4.3	4.2	4.0	4.4	18.9
2-Feb-95	241.7	124.7	1362.4	84.5	65.3	1.4	11.1	11.2	12.4	21.3
3-Feb-95	211.6	102.1	878.3	69.3	62.7	3.3	15.3	15.4	17.5	22.8

Appendix 3-1. Daily Stream Flow and Reclaimed Water Discharge, 1994-1995

Date	Stream Flow, cfs			Reclaimed Water Discharge, cfs			Reclaimed Water Concentration, percent of Stream Flow			
	Santa Rosa Creek	Mark West Creek	Trenton-Healdsburg Rd.	Santa Rosa		City of Windsor	Zone A	Zone B	Zone C	Zone D
				Upper Laguna	Delta Pond					
4-Feb-95	178.4	85.8	866.7	61.4	5.9	3.3	10.5	10.4	12.0	3.2
5-Feb-95	171.7	74.9	528.3	39.1	9.3	3.3	9.7	9.5	11.1	5.1
6-Feb-95	144.4	67.1	439.7	54.9	17.3	3.3	17.1	17.0	20.2	10.7
7-Feb-95	132.2	61.2	379.8	48.4	7.4	3.3	15.4	15.2	18.3	5.3
8-Feb-95	212.7	66.9	384.2	57.2	17.3	3.3	20.1	20.2	24.6	7.5
9-Feb-95	165.5	59.4	408.3	41.6	20.0	3.2	15.7	15.6	18.3	10.8
10-Feb-95	122.4	52.4	374.6	43.8	0.0	3.2	12.4	12.1	14.1	0.0
11-Feb-95	108.0	49.1	326.2	35.7	0.0	3.3	11.8	11.3	13.4	0.0
12-Feb-95	103.4	46.8	290.7	37.4	0.0	3.3	13.9	13.3	16.0	0.0
13-Feb-95	440.4	113.3	325.0	0.8	0.0	3.1	1.2	0.3	0.4	0.0
14-Feb-95	311.0	134.6	783.8	58.5	2.0	2.9	8.1	8.0	9.8	0.6
15-Feb-95	219.5	81.9	787.6	67.9	13.9	3.3	10.8	10.6	11.9	6.0
16-Feb-95	195.7	67.9	572.1	37.6	15.9	2.7	9.8	9.6	10.9	7.5
17-Feb-95	177.0	60.6	427.9	39.1	15.6	1.7	13.1	13.2	15.5	8.1
18-Feb-95	124.8	55.0	344.5	46.6	15.8	1.7	18.5	18.7	22.5	11.2
19-Feb-95	96.4	50.9	299.6	47.3	11.8	1.7	20.2	20.5	24.9	10.9
20-Feb-95	89.8	47.8	269.2	0.0	0.0	0.8	0.3	0.0	0.0	0.0
21-Feb-95	94.4	45.1	231.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22-Feb-95	89.3	42.6	190.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23-Feb-95	84.8	40.7	161.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
24-Feb-95	82.3	38.9	140.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25-Feb-95	76.3	37.5	125.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26-Feb-95	70.0	36.3	117.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27-Feb-95	67.3	35.1	108.6	0.8	15.5	0.0	15.0	16.1	24.7	18.7
28-Feb-95	71.9	33.9	106.5	0.9	7.9	0.0	8.3	8.9	13.5	9.9
1-Mar-95	73.8	33.1	101.3	0.8	15.5	0.0	16.0	17.3	26.6	17.3
2-Mar-95	131.5	42.8	132.7	0.8	2.0	0.0	2.1	2.3	3.5	1.5
3-Mar-95	162.4	74.8	212.6	16.4	0.0	0.0	7.7	8.4	13.5	0.0
4-Mar-95	104.8	53.6	215.2	20.1	0.0	0.0	9.3	9.9	13.4	0.0
5-Mar-95	94.7	46.2	194.6	27.8	0.0	0.0	14.3	15.1	20.1	0.0
6-Mar-95	88.8	41.0	170.2	14.9	0.0	0.0	8.7	9.2	12.4	0.0
7-Mar-95	81.2	38.2	152.7	17.5	0.0	0.0	11.5	12.1	16.5	0.0
8-Mar-95	433.5	257.2	599.8	13.9	0.0	0.0	2.3	2.6	4.9	0.0
9-Mar-95	8367.4	500.0	3174.8	117.9	0.0	0.0	3.7	3.8	4.6	0.0
10-Mar-95	6200.0	1100.0	4864.0	126.2	0.0	0.0	2.6	2.7	3.6	0.0
11-Mar-95	4000.0	2650.0	4190.9	148.7	0.0	3.1	3.6	4.1	15.4	0.0
12-Mar-95	2100.0	1100.0	3731.2	127.3	0.0	10.7	3.7	3.6	5.3	0.0
13-Mar-95	2300.0	650.0	3160.1	89.3	0.0	11.3	3.2	3.0	3.8	0.0
14-Mar-95	1550.0	800.0	2455.1	101.0	0.0	12.5	4.6	4.4	6.8	0.0
15-Mar-95	1050.0	500.0	2856.7	92.0	0.0	11.2	3.6	3.3	4.1	0.0
16-Mar-95	525.4	220.0	1260.0	53.7	0.0	7.7	4.8	4.4	5.4	0.0
17-Mar-95	301.5	175.0	1090.0	46.6	0.0	3.8	4.6	4.4	5.3	0.0
18-Mar-95	335.1	195.0	990.0	62.3	0.0	4.0	6.7	6.6	8.3	0.0
19-Mar-95	244.6	175.0	1115.0	63.3	0.0	3.4	6.0	5.9	7.0	0.0
20-Mar-95	759.5	120.0	1360.0	45.6	0.0	3.9	3.6	3.4	3.8	0.0
21-Mar-95	779.0	230.0	1600.0	47.6	0.0	5.0	3.3	3.1	3.6	0.0

Appendix 3-1. Daily Stream Flow and Reclaimed Water Discharge, 1994-1995

Date	Stream Flow, cfs			Reclaimed Water Discharge, cfs			Reclaimed Water Concentration, percent of Stream Flow			
	Santa Rosa Creek	Mark West Creek	Trenton-Healdsburg Rd.	Santa Rosa		City of Windsor	Zone A	Zone B	Zone C	Zone D
				Upper Laguna	Delta Pond					
22-Mar-95	1546.8	485.0	2300.0	40.8	0.0	5.0	2.0	1.9	2.4	0.0
23-Mar-95	1361.2	390.0	2450.0	38.1	0.0	5.2	1.8	1.6	1.9	0.0
24-Mar-95	547.9	275.0	2060.0	67.1	0.0	3.3	3.4	3.4	3.9	0.0
25-Mar-95	324.2	220.0	1790.0	45.6	0.0	0.0	2.5	2.6	3.0	0.0
26-Mar-95	268.0	185.0	1490.0	46.7	0.0	0.0	3.1	3.2	3.7	0.0
27-Mar-95	228.0	175.0	1060.0	41.3	0.0	5.9	4.4	4.0	4.9	0.0
28-Mar-95	206.5	160.0	580.0	32.8	0.0	12.7	7.7	6.0	8.5	0.0
29-Mar-95	190.3	150.0	415.0	14.2	0.0	9.2	5.5	3.7	6.1	0.0
30-Mar-95	170.6	140.0	380.0	41.6	0.0	6.4	12.4	11.9	19.9	0.0
31-Mar-95	168.7	130.0	318.3	30.6	0.0	4.9	11.0	10.6	19.1	0.0
1-Apr-95	147.0	120.0	283.5	24.0	0.0	3.7	9.6	9.3	17.4	0.0
2-Apr-95	138.2	110.0	251.8	14.5	0.0	2.8	6.8	6.4	12.3	0.0
3-Apr-95	132.7	100.0	221.1	24.3	0.0	0.8	11.3	12.2	24.4	0.0
4-Apr-95	128.6	90.0	196.8	20.7	0.0	0.0	10.5	11.7	23.8	0.0
5-Apr-95	118.7	85.0	179.5	5.9	0.0	0.0	3.3	3.6	7.7	0.0
6-Apr-95	226.4	125.0	219.9	16.4	0.0	0.0	7.5	8.5	24.2	0.0
7-Apr-95	369.1	155.0	638.8	38.8	0.0	0.0	6.1	6.4	8.6	0.0
8-Apr-95	217.3	140.0	757.1	20.4	0.0	0.0	2.7	2.8	3.5	0.0
9-Apr-95	169.2	100.0	544.9	8.0	0.0	0.0	1.5	1.5	1.9	0.0
10-Apr-95	149.9	90.0	388.3	19.8	0.0	0.0	5.1	5.4	7.1	0.0
11-Apr-95	135.2	90.0	302.1	30.5	0.0	1.9	10.7	10.8	15.8	0.0
12-Apr-95	141.0	78.0	257.6	30.3	0.0	3.9	13.1	12.6	18.6	0.0
13-Apr-95	180.2	110.6	308.1	29.9	0.0	2.8	10.5	10.5	17.2	0.0
14-Apr-95	133.8	84.0	269.3	15.8	0.0	2.6	6.7	6.3	9.4	0.0
15-Apr-95	156.6	80.4	242.5	20.0	0.0	2.8	9.3	8.9	13.8	0.0
16-Apr-95	134.4	81.6	239.0	18.6	0.0	2.4	8.7	8.4	13.3	0.0
17-Apr-95	132.3	73.2	216.4	24.1	0.0	2.3	12.1	12.0	18.9	0.0
18-Apr-95	123.2	66.6	194.8	23.1	0.0	2.1	12.8	12.8	20.3	0.0
19-Apr-95	119.3	60.3	174.9	16.1	0.0	1.5	9.9	9.9	15.9	0.0
20-Apr-95	119.7	58.7	161.3	17.5	0.0	0.2	10.9	11.8	19.5	0.0
21-Apr-95	101.6	53.4	145.6	14.2	0.0	0.0	9.8	10.6	17.6	0.0
22-Apr-95	96.0	49.6	132.2	8.7	0.0	0.0	6.6	7.1	12.1	0.0
23-Apr-95	96.1	46.7	121.8	8.4	0.0	0.0	6.9	7.5	12.9	0.0
24-Apr-95	94.1	44.1	108.8	17.6	0.0	0.0	16.2	17.8	31.9	0.0
25-Apr-95	91.9	42.0	98.8	13.6	0.0	0.0	13.8	15.2	28.5	0.0
26-Apr-95	89.1	40.0	93.4	15.9	0.0	0.0	17.1	18.8	35.7	0.0
27-Apr-95	91.3	41.2	95.8	15.8	0.0	0.0	16.5	18.2	34.6	0.0
28-Apr-95	126.1	45.7	105.4	8.8	0.0	0.0	8.4	9.2	17.7	0.0
29-Apr-95	180.7	127.7	238.1	21.0	0.0	0.5	9.0	10.0	25.4	0.0
30-Apr-95	174.2	104.1	257.3	9.6	0.0	2.0	4.5	4.1	7.3	0.0

Note: flows shown in *italics* are estimates based on Russian River flows for dates when stream gages were inoperative due to floods.

Appendix 3-2-1. Santa Rosa Creek: Fyke Net Salmonid Catch, 1994-1995.

Rain = rainfall reported for Laguna Wastewater Treatment Plant, Llano Road Fishing Codes: 1 = OK; 2 = net overwhelmed or wings not down; 3 = hole(s) in net; 4 = tampering Down = fish moving downstream; Up = fish moving upstream															
Date	Rain, Inches	Fishing Code		Steelhead				Coho				Chinook			
		Down	Up	Juveniles Down	Juveniles Up	Adults Down	Adults Up	Juveniles Down	Juveniles Up	Adults Down	Adults Up	Juveniles Down	Juveniles Up	Adults Down	Adults Up
4-Nov-94	0.70			0	0	0	0	0	0	0	0	0	0	0	0
5-Nov-94	2.98														
6-Nov-94	0.43														
7-Nov-94	0.00	3	1	1	0	0	0	0	0	0	0	0	0	0	0
8-Nov-94	0.01	1	1	0	0	0	0	0	0	0	0	0	0	0	0
9-Nov-94	0.77														
10-Nov-94	0.02														
11-Nov-94	0.00	1	3	0	0	0	0	0	0	0	0	0	0	0	0
12-Nov-94															
13-Nov-94															
14-Nov-94	0.00														
15-Nov-94	1.00														
16-Nov-94	0.02	3	3	1	0	0	0	0	0	0	0	0	0	0	0
17-Nov-94	0.02	3	3	0	0	0	0	0	0	0	0	0	0	0	0
18-Nov-94	0.00														
19-Nov-94	0.00														
20-Nov-94	0.02														
21-Nov-94	0.00														
22-Nov-94															
23-Nov-94	0.00														
24-Nov-94	0.41														
25-Nov-94	0.48														
26-Nov-94	0.04														
27-Nov-94	0.19	3	1	1	4	0	0	0	0	0	0	0	0	0	0
28-Nov-94	0.02	3	3	6	6	0	0	0	0	0	0	0	0	1	0
29-Nov-94	0.00	3	3	1	0	0	0	0	0	0	0	0	0	0	0
30-Nov-94	0.00														
1-Dec-94	0.03														
2-Dec-94	0.10														
3-Dec-94	1.18														
4-Dec-94	0.05														
5-Dec-94	0.01														
6-Dec-94	0.11														
7-Dec-94	0.01	1	1	0	0	1	0	0	0	0	0	0	0	0	0
8-Dec-94	0.01	3	3	0	0	0	0	0	0	0	0	0	0	0	0
9-Dec-94	0.00	1	1	5	0	0	0	0	0	0	0	0	0	0	0
10-Dec-94	0.03	3	1	2	0	0	0	0	0	0	0	0	0	0	0
11-Dec-94	0.49														
12-Dec-94	0.19														
13-Dec-94	0.01														
14-Dec-94	0.43														
15-Dec-94	0.01														
16-Dec-94	0.00	3	3	3	0	2	0	0	0	0	0	0	0	0	0
17-Dec-94	0.03	1	1	4	3	0	0	0	0	0	0	0	0	0	0
18-Dec-94	0.04	1	1	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 3-2-1. Santa Rosa Creek: Fyke Net Salmonid Catch, 1994-1995.

Rain = rainfall reported for Laguna Wastewater Treatment Plant, Llano Road Fishing Codes: 1 = OK; 2 = net overwhelmed or wings not down; 3 = hole(s) in net; 4 = tampering Down = fish moving downstream; Up = fish moving upstream															
Date	Rain, Inches	Fishing Code		Steelhead				Coho				Chinook			
				Juveniles		Adults		Juveniles		Adults		Juveniles		Adults	
		Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up
19-Dec-94	0.00	1	1	2	1	0	0	0	0	0	0	0	0	0	0
20-Dec-94	0.00														
21-Dec-94	0.01														
22-Dec-94	0.00														
23-Dec-94	0.00														
24-Dec-94	0.23														
25-Dec-94	0.00														
26-Dec-94	0.00	1	1	0	0	1	0	0	0	0	0	0	0	0	0
27-Dec-94	0.34	2	2	0	0	0	0	0	0	0	0	0	0	0	0
28-Dec-94	0.00	1	1	0	1	0	0	0	0	0	0	0	0	0	0
29-Dec-94		3	1	1	0	0	0	0	0	0	0	0	0	0	0
30-Dec-94	0.00														
31-Dec-94	0.32														
1-Jan-95	0.52														
2-Jan-95	0.19														
3-Jan-95	0.26														
4-Jan-95	0.71														
5-Jan-95	0.25														
6-Jan-95	0.51														
7-Jan-95	0.48														
8-Jan-95	2.04														
9-Jan-95	1.28														
10-Jan-95	0.45														
11-Jan-95	0.30														
12-Jan-95	0.26														
13-Jan-95	1.94														
14-Jan-95	0.54														
15-Jan-95	0.03														
16-Jan-95	0.00														
17-Jan-95															
18-Jan-95															
19-Jan-95	0.00														
20-Jan-95	0.19														
21-Jan-95	0.17														
22-Jan-95	1.18														
23-Jan-95	0.43														
24-Jan-95	0.30														
25-Jan-95	0.04														
26-Jan-95	1.10														
27-Jan-95	0.70														
28-Jan-95	0.19														
29-Jan-95	0.05														
30-Jan-95	0.85														
31-Jan-95	0.01														
1-Feb-95	0.00														

Appendix 3-2-1. Santa Rosa Creek. Fyke Net Salmonid Catch, 1994-1995.

Rain = rainfall reported for Laguna Wastewater Treatment Plant, Llano Road Fishing Codes: 1 = OK; 2 = net overwhelmed or wings not down; 3 = hole(s) in net; 4 = tampering Down = fish moving downstream; Up = fish moving upstream															
Date	Rain, Inches	Fishing Code		Steelhead				Coho				Chinook			
		Down	Up	Juveniles		Adults		Juveniles		Adults		Juveniles		Adults	
				Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up
2-Feb-95															
3-Feb-95															
4-Feb-95															
5-Feb-95		1	1	0	0	0	0	0	0	0	0	0	0	0	0
6-Feb-95		2	1	0	0	0	0	0	0	0	0	0	0	0	0
7-Feb-95	0.00	1	1	0	0	0	0	0	0	0	0	0	0	0	0
8-Feb-95	0.15														
9-Feb-95	0.00														
10-Feb-95	0.00	1	2	1	0	0	0	0	0	0	0	0	0	0	0
11-Feb-95	0.02	1	1	0	0	0	0	0	0	0	0	0	0	0	0
12-Feb-95	0.04	2	2	0	1	0	0	1	1	0	0	0	0	0	0
13-Feb-95	0.88														
14-Feb-95	0.02														
15-Feb-95	0.00														
16-Feb-95															
17-Feb-95		1	1	0	0	0	0	0	0	0	0	0	0	0	0
18-Feb-95		1	1	1	0	0	0	0	0	0	0	0	0	0	0
19-Feb-95		1	1	0	0	0	0	0	0	0	0	0	0	0	0
20-Feb-95		1	1	0	0	0	0	0	0	0	0	0	0	0	0
21-Feb-95	0.00	1	1	1	0	0	0	0	0	0	0	0	0	0	0
22-Feb-95	0.03	1	1	0	0	0	0	0	0	0	0	0	0	0	0
23-Feb-95	0.00	3	4	0	0	0	0	0	0	0	0	0	0	0	0
24-Feb-95		1	1	0	0	0	0	0	0	0	0	0	0	0	0
25-Feb-95	0.00	1	1	0	1	0	0	0	0	0	0	0	0	0	0
26-Feb-95	0.01	1	1	0	0	0	0	0	0	0	0	0	0	0	0
27-Feb-95	0.00	1	1	0	0	0	0	0	0	0	0	0	0	0	0
28-Feb-95	0.00	1	1	1	0	0	0	0	0	0	0	0	0	0	0
1-Mar-95	0.01	2	2	0	0	0	0	0	0	0	0	0	0	0	0
2-Mar-95	0.45														
3-Mar-95	0.12														
4-Mar-95	0.05														
5-Mar-95	0.00														
6-Mar-95		1	1	2	0	0	1	0	0	0	0	0	0	0	0
7-Mar-95	0.00	1	1	0	0	0	0	0	0	0	0	0	0	0	0
8-Mar-95	2.30														
9-Mar-95	2.14														
10-Mar-95	0.87														
11-Mar-95	0.07														
12-Mar-95	0.11														
13-Mar-95	1.51														
14-Mar-95	0.48														
15-Mar-95	0.02														
16-Mar-95	0.00														
17-Mar-95	0.02														
18-Mar-95	0.44														

Appendix 3-2-1. Santa Rosa Creek: Fyke Net Salmonid Catch, 1994-1995.

Rain = rainfall reported for Laguna Wastewater Treatment Plant, Llano Road Fishing Codes: 1 = OK; 2 = net overwhelmed or wings not down; 3 = hole(s) in net; 4 = tampering Down = fish moving downstream; Up = fish moving upstream															
Date	Rain, Inches	Fishing Code		Steelhead				Coho				Chinook			
		Down	Up	Juveniles		Adults		Juveniles		Adults		Juveniles		Adults	
		Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up
19-Mar-95	0.04														
20-Mar-95	1.20														
21-Mar-95	0.46														
22-Mar-95	1.28														
23-Mar-95	0.43														
24-Mar-95	0.00														
25-Mar-95															
26-Mar-95															
27-Mar-95															
28-Mar-95															
29-Mar-95															
30-Mar-95		1	1	4	0	0	0	0	0	0	0	0	0	0	0
31-Mar-95		1	1	1	0	0	0	0	0	0	0	0	0	0	0
1-Apr-95		1	1	0	0	0	0	0	0	0	0	0	0	0	0
2-Apr-95		1	1	4	0	0	0	0	0	0	0	0	0	0	0
3-Apr-95		3	1	5	0	0	0	0	0	0	0	0	0	0	0
4-Apr-95		1	1	3	0	0	0	0	0	0	0	0	0	0	0
5-Apr-95	0.00	2	2	0	1	0	0	0	0	0	0	0	0	0	0
6-Apr-95	0.43														
7-Apr-95	0.28														
8-Apr-95	0.13														
9-Apr-95	0.00														
10-Apr-95															
11-Apr-95	0.00														
12-Apr-95	0.19														
13-Apr-95	0.07														
14-Apr-95	0.00														
15-Apr-95	0.28														
16-Apr-95	0.00	3	1	0	0	0	0	0	0	0	0	0	0	0	0
17-Apr-95	0.02														
18-Apr-95	0.00	2	1	0	0	0	0	0	0	0	0	0	0	0	0
19-Apr-95	0.02	1	1	0	0	0	0	0	0	0	0	0	0	0	0
20-Apr-95	0.10	1	1	2	0	0	0	0	0	0	0	0	0	0	0
21-Apr-95	0.00	1	1	0	0	0	0	0	0	0	0	0	0	0	0
22-Apr-95		1	1	0	0	0	0	0	0	0	0	2	0	0	0
23-Apr-95		2	1	1	0	0	0	0	0	0	0	0	0	0	0
24-Apr-95		1	1	1	0	0	0	0	0	0	0	0	0	0	0
25-Apr-95		2	1	0	0	0	0	0	0	0	0	0	0	0	0
26-Apr-95	0.00	1	1	0	0	0	0	0	0	0	0	1	0	0	0
27-Apr-95	0.07	2	2	0	0	0	0	0	0	0	0	2	0	0	0
28-Apr-95	0.29														
29-Apr-95	0.21														
30-Apr-95	0.67														

Appendix 3-2-2. Mark West Creek: Fyke Net Salmonid Catch, 1994-1995.

Rain = rainfall reported for Laguna Wastewater Treatment Plant, Llano Road Fishing Codes: 1 = OK; 2 = net overwhelmed or wings not down; 3 = hole(s) in net; 4 = tampering Down = fish moving downstream; Up = fish moving upstream															
Date	Rain, Inches	Fishing Code		Steelhead				Coho				Chinook			
				Juveniles		Adults		Juveniles		Adults		Juveniles		Adults	
		Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up
4-Nov-94	0.70														
5-Nov-94	2.98														
6-Nov-94	0.43														
7-Nov-94	0.00	1	3	1	1	0	0	0	0	0	0	0	0	0	0
8-Nov-94	0.01	1	1	0	0	0	0	0	0	0	0	0	0	0	0
9-Nov-94	0.77														
10-Nov-94	0.02														
11-Nov-94	0.00	1	1	0	1	0	0	0	0	0	0	0	0	0	0
12-Nov-94															
13-Nov-94															
14-Nov-94	0.00														
15-Nov-94	1.00														
16-Nov-94	0.02	1	1	0	0	0	0	0	0	0	0	0	0	0	0
17-Nov-94	0.02	1	1	0	0	0	0	0	0	0	0	0	0	0	0
18-Nov-94	0.00														
19-Nov-94	0.00														
20-Nov-94	0.02														
21-Nov-94	0.00														
22-Nov-94															
23-Nov-94	0.00														
24-Nov-94	0.41														
25-Nov-94	0.48														
26-Nov-94	0.04														
27-Nov-94	0.19	3	1	0	0	0	0	0	0	0	0	0	0	0	0
28-Nov-94	0.02	1	1	0	0	0	0	0	0	0	0	0	0	0	0
29-Nov-94	0.00	1	1	1	0	0	0	0	0	0	0	0	0	0	0
30-Nov-94	0.00														
1-Dec-94	0.03														
2-Dec-94	0.10														
3-Dec-94	1.18														
4-Dec-94	0.05														
5-Dec-94	0.01														
6-Dec-94	0.11														
7-Dec-94	0.01	2	2	0	0	0	0	0	0	0	0	0	0	0	0
8-Dec-94	0.01	1	1	3	4	1	0	0	0	0	0	0	0	0	0
9-Dec-94	0.00	1	1	2	2	0	0	0	0	0	0	0	0	0	0
10-Dec-94	0.03	1	1	4	2	0	0	0	0	0	0	0	0	0	0
11-Dec-94	0.49														
12-Dec-94	0.19														
13-Dec-94	0.01														
14-Dec-94	0.43														
15-Dec-94	0.01														
16-Dec-94	0.00	1	1	6	0	0	0	0	0	0	0	0	0	0	0
17-Dec-94	0.03	1	1	0	0	0	0	0	0	0	0	0	0	0	0
18-Dec-94	0.04	1	3	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 3-2-2. Mark West Creek: Fyke Net Salmonid Catch, 1994-1995.

Rain = rainfall reported for Laguna Wastewater Treatment Plant, Llano Road Fishing Codes: 1 = OK; 2 = net overwhelmed or wings not down; 3 = hole(s) in net; 4 = tampering Down = fish moving downstream; Up = fish moving upstream															
Date	Rain, Inches	Fishing Code		Steelhead				Coho				Chinook			
				Juveniles		Adults		Juveniles		Adults		Juveniles		Adults	
		Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up
19-Dec-94	0.00	1	1	0	0	0	0	0	0	0	0	0	0	0	0
20-Dec-94	0.00														
21-Dec-94	0.01														
22-Dec-94	0.00														
23-Dec-94	0.00														
24-Dec-94	0.23														
25-Dec-94	0.00														
26-Dec-94	0.00	1	1	0	1	0	0	0	0	0	0	0	0	0	0
27-Dec-94	0.34	1	1	0	0	0	0	0	0	0	0	0	0	0	0
28-Dec-94	0.00	1	1	0	0	0	0	0	0	0	0	0	0	0	0
29-Dec-94		1	1	0	0	0	0	0	0	0	0	0	0	0	0
30-Dec-94	0.00														
31-Dec-94	0.32														
1-Jan-95	0.52														
2-Jan-95	0.19														
3-Jan-95	0.26														
4-Jan-95	0.71														
5-Jan-95	0.25														
6-Jan-95	0.51														
7-Jan-95	0.48														
8-Jan-95	2.04														
9-Jan-95	1.28														
10-Jan-95	0.45														
11-Jan-95	0.30														
12-Jan-95	0.26														
13-Jan-95	1.94														
14-Jan-95	0.54														
15-Jan-95	0.03														
16-Jan-95	0.00														
17-Jan-95															
18-Jan-95															
19-Jan-95	0.00														
20-Jan-95	0.19														
21-Jan-95	0.17														
22-Jan-95	1.18														
23-Jan-95	0.43														
24-Jan-95	0.30														
25-Jan-95	0.04														
26-Jan-95	1.10														
27-Jan-95	0.70														
28-Jan-95	0.19														
29-Jan-95	0.05														
30-Jan-95	0.85														
31-Jan-95	0.01														
1-Feb-95	0.00														

Appendix 3-2-2. Mark West Creek: Fyke Net Salmonid Catch, 1994-1995.

Rain = rainfall reported for Laguna Wastewater Treatment Plant, Llano Road Fishing Codes: 1 = OK; 2 = net overwhelmed or wings not down; 3 = hole(s) in net; 4 = tampering Down = fish moving downstream; Up = fish moving upstream															
Date	Rain, Inches	Fishing Code		Steelhead				Coho				Chinook			
				Juveniles		Adults		Juveniles		Adults		Juveniles		Adults	
		Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up
2-Feb-95															
3-Feb-95															
4-Feb-95															
5-Feb-95															
6-Feb-95			1		1		0		0		0		0		0
7-Feb-95	0.00	1	1	9	0	0	1	1	0	0	0	0	0	0	0
8-Feb-95	0.15														
9-Feb-95	0.00														
10-Feb-95	0.00	1	1	11	0	0	0	0	0	0	0	0	0	0	0
11-Feb-95	0.02	1	1	7	0	0	0	0	0	0	0	0	0	0	0
12-Feb-95	0.04	1	1	0	0	0	0	0	0	0	0	0	0	0	0
13-Feb-95	0.88														
14-Feb-95	0.02														
15-Feb-95	0.00														
16-Feb-95															
17-Feb-95		1	1	13	1	0	1	0	0	0	0	0	0	0	0
18-Feb-95		1	1	6	0	0	0	0	0	0	0	0	0	0	0
19-Feb-95		1	1	4	0	0	1	0	0	0	0	0	0	0	0
20-Feb-95		1	1	7	0	0	0	0	0	0	0	0	0	0	0
21-Feb-95	0.00	1	1	21	0	0	0	0	0	0	0	0	0	0	0
22-Feb-95	0.03	1	1	1	0	0	0	0	0	0	0	0	0	0	0
23-Feb-95	0.00	1	1	1	0	0	0	0	0	0	0	0	0	0	0
24-Feb-95		1	3	0	0	0	0	0	0	0	0	0	0	0	0
25-Feb-95	0.00	1	1	1	0	0	0	0	0	0	0	0	0	0	0
26-Feb-95	0.01	1	1	0	0	0	0	0	0	0	0	0	0	0	0
27-Feb-95	0.00	1	1	0	0	0	0	0	0	0	0	0	0	0	0
28-Feb-95	0.00	1	1	0	0	0	0	0	0	0	0	0	0	0	0
1-Mar-95	0.01	1	1	0	0	0	0	0	0	0	0	0	0	0	0
2-Mar-95	0.45														
3-Mar-95	0.12														
4-Mar-95	0.05														
5-Mar-95	0.00														
6-Mar-95		1	1	1	1	0	0	0	0	0	0	0	0	0	0
7-Mar-95	0.00	1	1	0	0	0	0	0	0	0	0	0	0	0	0
8-Mar-95	2.30														
9-Mar-95	2.14														
10-Mar-95	0.87														
11-Mar-95	0.07														
12-Mar-95	0.11														
13-Mar-95	1.51														
14-Mar-95	0.48														
15-Mar-95	0.02														
16-Mar-95	0.00														
17-Mar-95	0.02														
18-Mar-95	0.44														

Appendix 3-2-2. Mark West Creek: Fyke Net Salmonid Catch, 1994-1995.

Rain = rainfall reported for Laguna Wastewater Treatment Plant, Llano Road Fishing Codes: 1 = OK; 2 = net overwhelmed or wings not down; 3 = hole(s) in net; 4 = tampering Down = fish moving downstream; Up = fish moving upstream															
Date	Rain, Inches	Fishing Code		Steelhead				Coho				Chinook			
				Juveniles		Adults		Juveniles		Adults		Juveniles		Adults	
		Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up
19-Mar-95	0.04														
20-Mar-95	1.20														
21-Mar-95	0.46														
22-Mar-95	1.28														
23-Mar-95	0.43														
24-Mar-95	0.00														
25-Mar-95															
26-Mar-95															
27-Mar-95															
28-Mar-95															
29-Mar-95															
30-Mar-95		2	2	0	0	0	0	0	0	0	0	0	0	0	0
31-Mar-95		1	1	5	0	0	1	0	0	0	0	0	0	0	0
1-Apr-95		1	1	13	0	0	1	0	0	0	0	0	0	0	0
2-Apr-95		1	1	0	0	0	0	0	0	0	0	0	0	0	0
3-Apr-95		1	1	3	1	0	0	0	0	0	0	0	0	0	0
4-Apr-95		1	1	57	0	0	0	0	0	0	0	0	0	0	0
5-Apr-95	0.00	1	1	8	0	0	0	0	0	0	0	0	0	0	0
6-Apr-95	0.43														
7-Apr-95	0.28														
8-Apr-95	0.13														
9-Apr-95	0.00														
10-Apr-95															
11-Apr-95	0.00														
12-Apr-95	0.19														
13-Apr-95	0.07														
14-Apr-95	0.00														
15-Apr-95	0.28														
16-Apr-95	0.00	1	1	1	1	0	0	0	0	0	0	0	0	0	0
17-Apr-95	0.02														
18-Apr-95	0.00	2	1	1	0	0	0	0	0	0	0	0	0	0	0
19-Apr-95	0.02	2	2	0	0	0	0	0	0	0	0	0	0	0	0
20-Apr-95	0.10	1	1	3	0	0	0	0	0	0	0	0	0	0	0
21-Apr-95	0.00	1	1	0	0	0	0	0	0	0	0	0	0	0	0
22-Apr-95		1	1	0	1	0	0	0	0	0	0	0	0	0	0
23-Apr-95		1	1	1	0	0	0	0	0	0	0	0	0	0	0
24-Apr-95		1	1	0	0	0	0	0	0	0	0	0	0	0	0
25-Apr-95		1	1	3	0	0	0	0	0	0	0	0	0	0	0
26-Apr-95	0.00	1	3	1	0	0	0	0	0	0	0	0	0	0	0
27-Apr-95	0.07	1	1	0	0	0	0	0	0	0	0	0	0	0	0
28-Apr-95	0.29														
29-Apr-95	0.21														
30-Apr-95	0.67														

Appendix 3-2-3. Maacama Creek: Fyke Net Salmonid Catch, 1994-1995.

Rain = rainfall reported for Laguna Wastewater Treatment Plant, Llano Road															
Fishing Codes: 1 = OK; 2 = net overwhelmed or wings not down; 3 = hole(s) in net; 4 = tampering															
Down = fish moving downstream; Up = fish moving upstream															
Date	Rain, Inches	Fishing Code		Steelhead				Coho				Chinook			
		Down	Up	Juveniles Down	Juveniles Up	Adults Down	Adults Up	Juveniles Down	Juveniles Up	Adults Down	Adults Up	Juveniles Down	Juveniles Up	Adults Down	Adults Up
4-Nov-94	0.70														
5-Nov-94	2.98														
6-Nov-94	0.43														
7-Nov-94	0.00														
8-Nov-94	0.01														
9-Nov-94	0.77														
10-Nov-94	0.02														
11-Nov-94	0.00														
12-Nov-94															
13-Nov-94															
14-Nov-94	0.00														
15-Nov-94	1.00														
16-Nov-94	0.02	1	1	0	2	0	0	0	0	0	0	0	0	0	0
17-Nov-94	0.02	1	1	0	3	0	0	0	0	0	0	0	0	0	0
18-Nov-94	0.00														
19-Nov-94	0.00														
20-Nov-94	0.02														
21-Nov-94	0.00														
22-Nov-94															
23-Nov-94	0.00														
24-Nov-94	0.41														
25-Nov-94	0.48														
26-Nov-94	0.04														
27-Nov-94	0.19	1	3	0	4	0	0	0	0	0	0	0	0	0	0
28-Nov-94	0.02	1	1	0	3	0	0	0	0	0	0	0	0	0	0
29-Nov-94	0.00	1	1	0	2	0	0	0	0	0	0	0	0	0	0
30-Nov-94	0.00														
1-Dec-94	0.03														
2-Dec-94	0.10														
3-Dec-94	1.18														
4-Dec-94	0.05														
5-Dec-94	0.01														
6-Dec-94	0.11														
7-Dec-94	0.01	1	1	0	2	0	1	0	0	0	0	0	0	0	0
8-Dec-94	0.01	1	1	1	7	0	0	0	0	0	0	0	0	0	0
9-Dec-94	0.00	1	1	0	2	0	0	0	0	0	0	0	0	0	0
10-Dec-94	0.03	1	1	0	2	0	0	0	0	0	0	0	0	1	0
11-Dec-94	0.49														
12-Dec-94	0.19														
13-Dec-94	0.01														
14-Dec-94	0.43														
15-Dec-94	0.01														
16-Dec-94	0.00	2,3	2	0	0	0	0	0	0	0	2	0	0	0	0
17-Dec-94	0.03	2	1	0	1	0	0	0	0	1	0	0	0	1	1
18-Dec-94	0.04	3	3	0	0	0	0	0	0	0	2	0	0	0	2

Appendix 3-2-3. Maacama Creek: Fyke Net Salmonid Catch, 1994-1995.

Rain = rainfall reported for Laguna Wastewater Treatment Plant, Llano Road Fishing Codes: 1 = OK; 2 = net overwhelmed or wings not down; 3 = hole(s) in net; 4 = tampering Down = fish moving downstream; Up = fish moving upstream															
Date	Rain, Inches	Fishing Code		Steelhead				Coho				Chinook			
				Juveniles		Adults		Juveniles		Adults		Juveniles		Adults	
		Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up
19-Dec-94	0.00	1	1	0	0	0	0	0	0	1	1	0	0	3	0
20-Dec-94	0.00														
21-Dec-94	0.01														
22-Dec-94	0.00														
23-Dec-94	0.00														
24-Dec-94	0.23														
25-Dec-94	0.00														
26-Dec-94	0.00	1	1	0	0	0	0	0	0	0	0	0	0	0	0
27-Dec-94	0.34	2	1	0	0	0	0	0	0	0	0	0	0	0	0
28-Dec-94	0.00	1	1	0	0	0	0	0	0	1	1	0	0	0	0
29-Dec-94		1	1	0	0	0	0	0	0	1	0	0	0	0	0
30-Dec-94	0.00														
31-Dec-94	0.32														
1-Jan-95	0.52														
2-Jan-95	0.19														
3-Jan-95	0.26														
4-Jan-95	0.71														
5-Jan-95	0.25														
6-Jan-95	0.51														
7-Jan-95	0.48														
8-Jan-95	2.04														
9-Jan-95	1.28														
10-Jan-95	0.45														
11-Jan-95	0.30														
12-Jan-95	0.26														
13-Jan-95	1.94														
14-Jan-95	0.54														
15-Jan-95	0.03														
16-Jan-95	0.00														
17-Jan-95															
18-Jan-95															
19-Jan-95	0.00														
20-Jan-95	0.19														
21-Jan-95	0.17														
22-Jan-95	1.18														
23-Jan-95	0.43														
24-Jan-95	0.30														
25-Jan-95	0.04														
26-Jan-95	1.10														
27-Jan-95	0.70														
28-Jan-95	0.19														
29-Jan-95	0.05														
30-Jan-95	0.85														
31-Jan-95	0.01														
1-Feb-95	0.00														

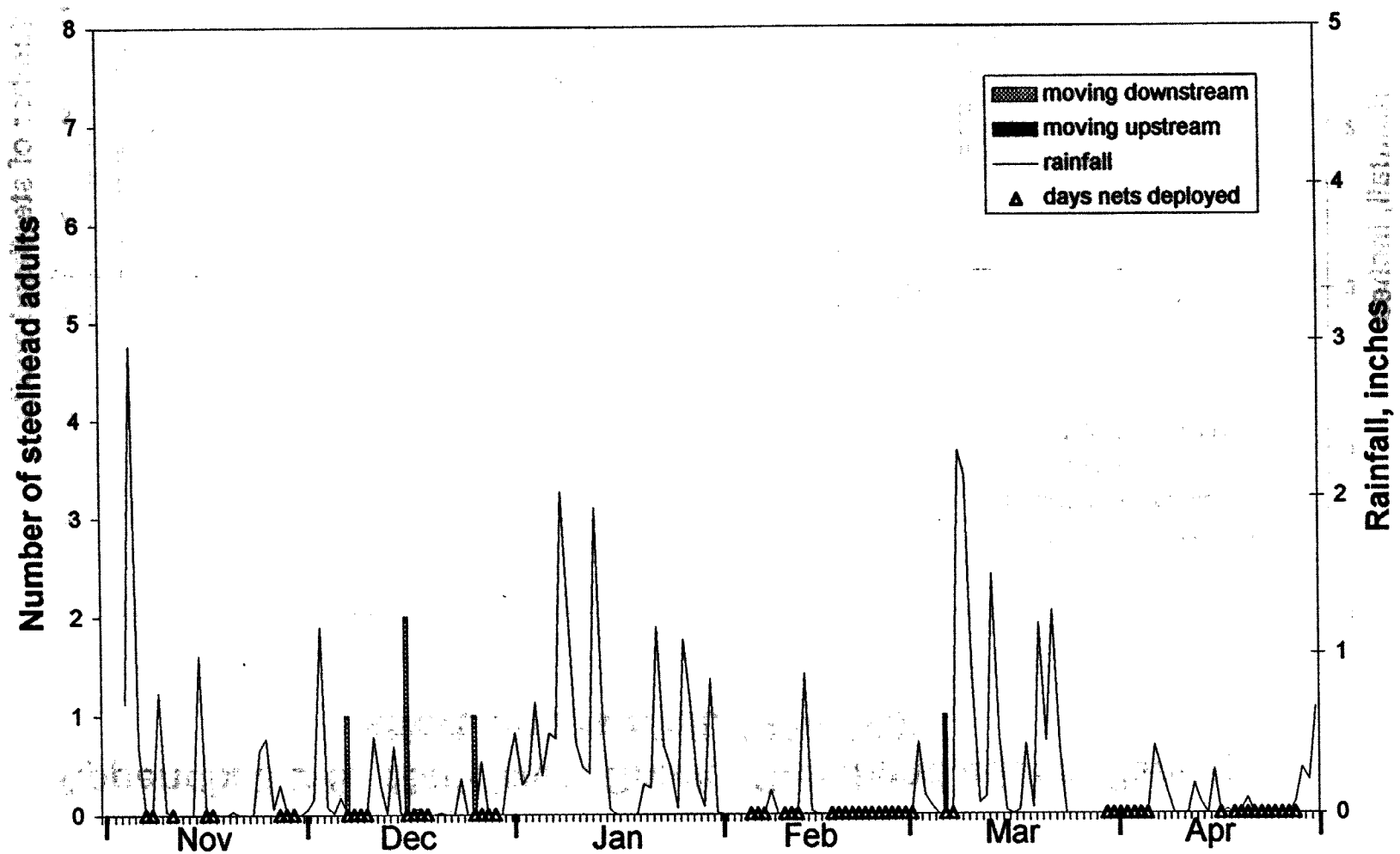
Appendix 3-2-3: Maacama Creek: Fyke Net Salmonid Catch, 1994-1995.

Rain = rainfall reported for Laguna Wastewater Treatment Plant, Llano Road Fishing Codes: 1 = OK; 2 = net overwhelmed or wings not down; 3 = hole(s) in net; 4 = tampering Down = fish moving downstream; Up = fish moving upstream															
Date	Rain, Inches	Fishing		Steelhead				Coho				Chinook			
		Code		Juveniles		Adults		Juveniles		Adults		Juveniles		Adults	
		Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up
2-Feb-95															
3-Feb-95															
4-Feb-95															
5-Feb-95		2	1	2	3	0	6	0	0	0	0	0	0	0	0
6-Feb-95		1	1	1	0	1	6	0	0	0	0	0	0	0	0
7-Feb-95	0.00	1	1	0	0	0	1	0	0	0	0	0	0	0	0
8-Feb-95	0.15														
9-Feb-95	0.00														
10-Feb-95	0.00	1	1	13	1	0	0	1	0	0	0	0	0	0	0
11-Feb-95	0.02	1	1	9	0	0	0	1	0	0	0	0	0	0	0
12-Feb-95	0.04	1	1	3	0	0	0	0	0	0	0	0	0	0	0
13-Feb-95	0.88														
14-Feb-95	0.02														
15-Feb-95	0.00														
16-Feb-95															
17-Feb-95		1	1	0	1	0	1	0	0	0	0	0	0	0	0
18-Feb-95		1	1	0	2	1	0	0	0	0	0	0	0	0	0
19-Feb-95		1	1	0	0	1	2	0	0	0	0	0	0	0	0
20-Feb-95		1	1	2	0	1	3	0	0	0	0	0	0	0	0
21-Feb-95	0.00	2	1	0	0	1	0	0	0	0	0	0	0	0	0
22-Feb-95	0.03	1	1	5	0	1	0	0	0	0	0	0	0	0	0
23-Feb-95	0.00	1	1	0	0	0	0	0	0	0	0	0	0	1	0
24-Feb-95		1	1	1	0	0	1	0	0	0	0	0	0	0	0
25-Feb-95	0.00	1	1	2	0	0	1	0	0	0	0	0	0	0	0
26-Feb-95	0.01	1	1	0	0	0	0	0	0	0	0	0	0	0	0
27-Feb-95	0.00	1	3	2	0	0	1	0	0	0	0	0	0	0	0
28-Feb-95	0.00	1	1	0	0	2	0	0	0	0	0	0	0	0	0
1-Mar-95	0.01	1	1	0	0	0	0	0	0	0	0	0	0	0	0
2-Mar-95	0.45	2	2	1	0	0	1	0	0	0	0	0	0	0	0
3-Mar-95	0.12														
4-Mar-95	0.05														
5-Mar-95	0.00														
6-Mar-95															
7-Mar-95	0.00	1	1	0	0	0	1	0	0	0	0	0	0	0	0
8-Mar-95	2.30														
9-Mar-95	2.14														
10-Mar-95	0.87														
11-Mar-95	0.07														
12-Mar-95	0.11														
13-Mar-95	1.51														
14-Mar-95	0.48														
15-Mar-95	0.02														
16-Mar-95	0.00														
17-Mar-95	0.02														
18-Mar-95	0.44														

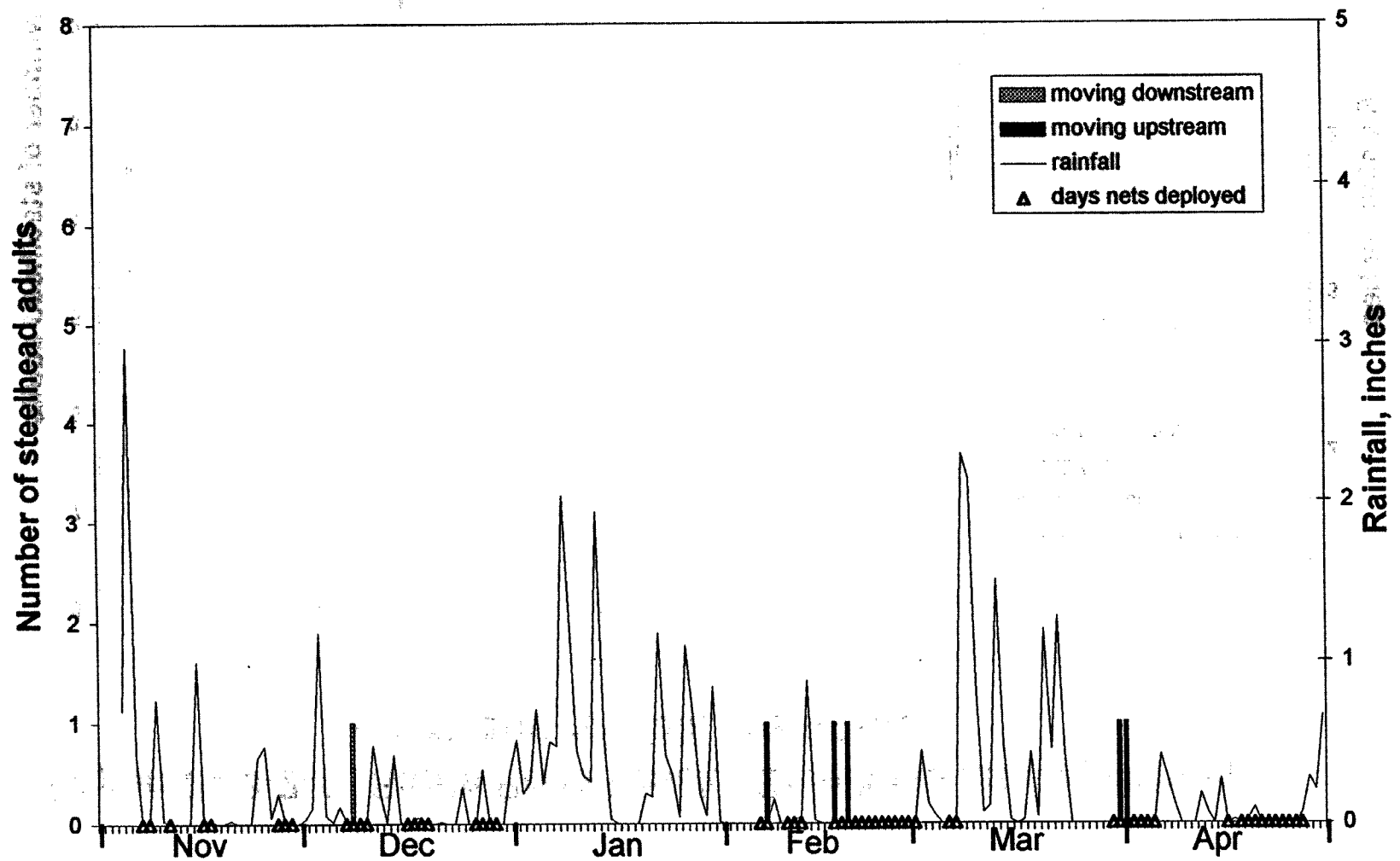
Appendix 3-2-3. Maacama Creek: Fyke Net Salmonid Catch, 1994-1995.

Rain = rainfall reported for Laguna Wastewater Treatment Plant, Llano Road Fishing Codes: 1 = OK; 2 = net overwhelmed or wings not down; 3 = hole(s) in net; 4 = tampering Down = fish moving downstream; Up = fish moving upstream															
Date	Rain, Inches	Fishing		Steelhead				Coho				Chinook			
		Code		Juveniles		Adults		Juveniles		Adults		Juveniles		Adults	
		Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up
19-Mar-95	0.04														
20-Mar-95	1.20														
21-Mar-95	0.48														
22-Mar-95	1.28														
23-Mar-95	0.43														
24-Mar-95	0.00														
25-Mar-95															
26-Mar-95															
27-Mar-95															
28-Mar-95															
29-Mar-95															
30-Mar-95		1	1	0	0	0	3	1	0	0	0	0	0	0	0
31-Mar-95		2	3	6	0	0	3	0	0	0	0	0	0	0	0
1-Apr-95		1	3	1	0	0	1	1	0	0	0	0	0	0	0
2-Apr-95		1	1	0	0	0	1	0	0	0	0	0	0	0	0
3-Apr-95		1	1	1	0	0	2	0	0	0	0	0	0	0	0
4-Apr-95		1	1	0	0	0	2	0	0	0	0	0	0	0	0
5-Apr-95	0.00	3	1	7	0	0	0	0	0	0	0	0	0	0	0
6-Apr-95	0.43														
7-Apr-95	0.28														
8-Apr-95	0.13														
9-Apr-95	0.00														
10-Apr-95															
11-Apr-95	0.00														
12-Apr-95	0.19														
13-Apr-95	0.07														
14-Apr-95	0.00														
15-Apr-95	0.28														
16-Apr-95	0.00	1	3	0	0	0	0	0	0	0	0	0	0	0	0
17-Apr-95	0.02														
18-Apr-95	0.00	2	2	0	0	0	0	0	0	0	0	0	0	0	0
19-Apr-95	0.02	3	2	0	0	0	0	0	0	0	0	0	0	0	0
20-Apr-95	0.10	1	1	1	0	0	0	0	0	0	0	0	0	0	0
21-Apr-95	0.00	1	1	5	0	0	0	0	0	0	0	0	0	0	0
22-Apr-95		1	1	5	0	0	0	0	0	0	0	0	0	0	0
23-Apr-95		1	3	0	0	0	1	0	0	0	0	0	0	0	0
24-Apr-95		1	1	6	0	0	0	0	0	0	0	0	0	0	0
25-Apr-95		1	1	1	0	0	0	0	0	0	0	0	0	0	0
26-Apr-95	0.00	1	1	2	0	1	0	0	0	0	0	0	0	0	0
27-Apr-95	0.07	2	1	1	0	0	0	0	0	0	0	0	0	0	0
28-Apr-95	0.29														
29-Apr-95	0.21														
30-Apr-95	0.67														

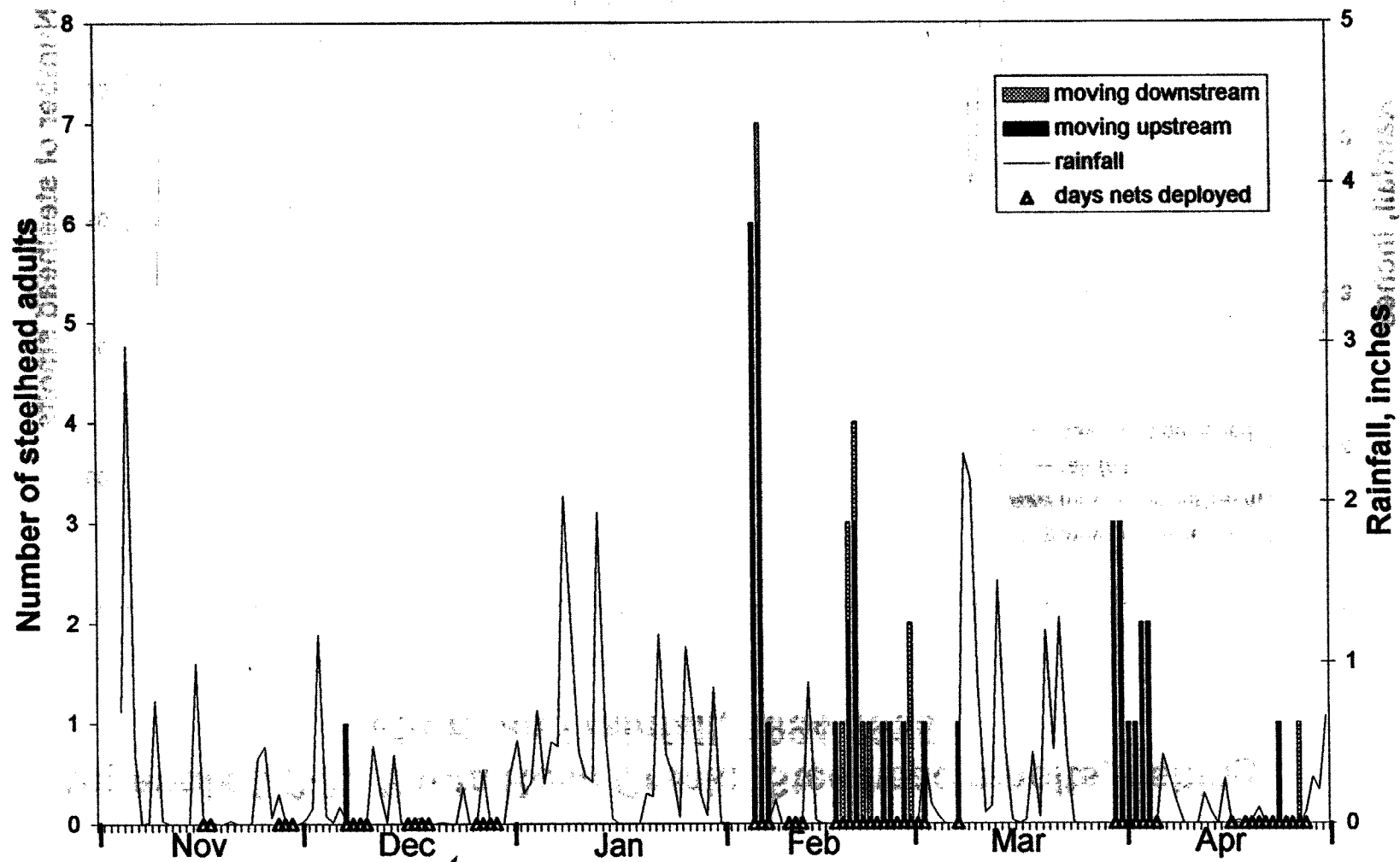
Appendix 3-2-4. Santa Rosa Creek: Steelhead adults, fishing effort, and rainfall, 1994-1995.



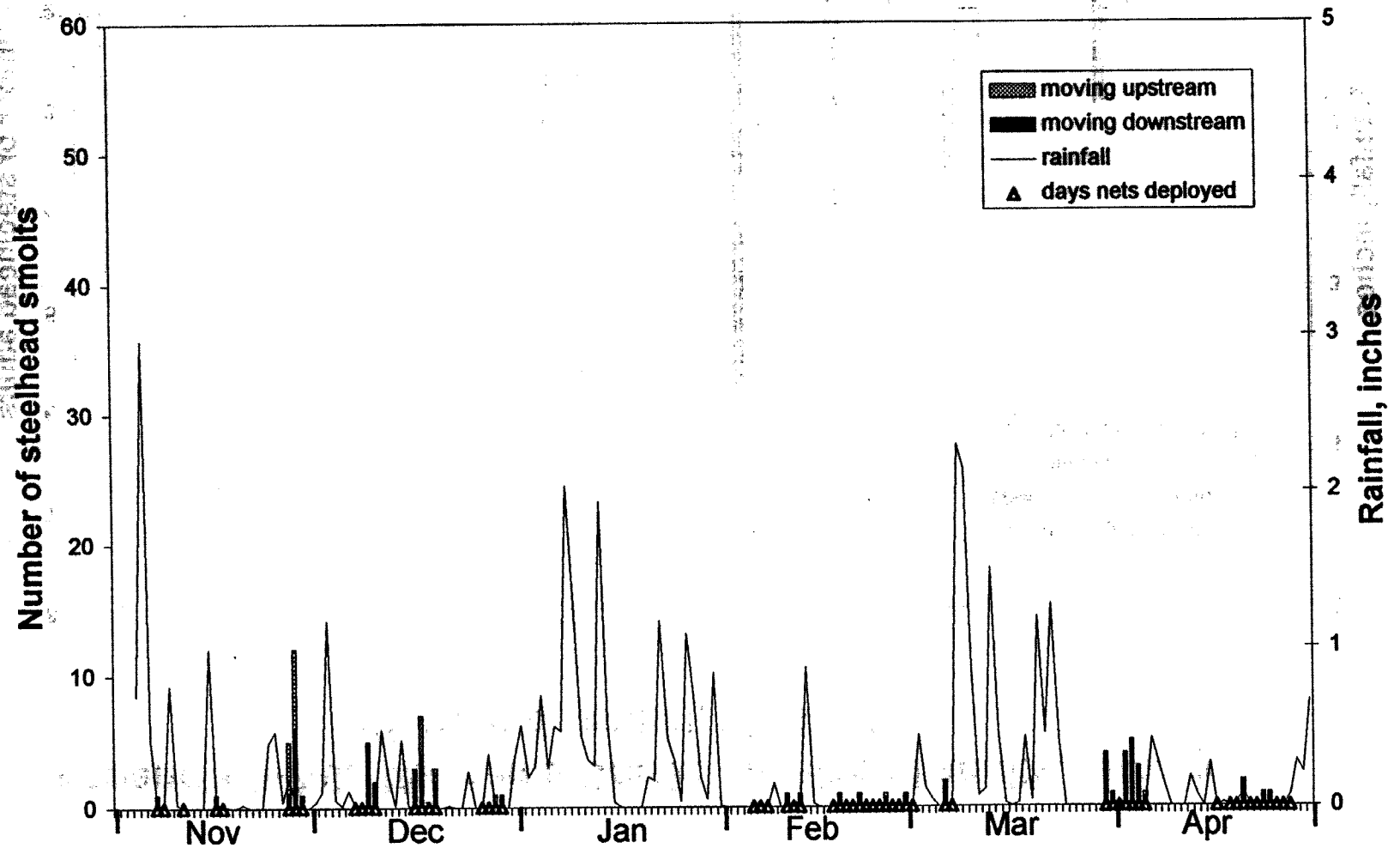
Appendix 3-2-5. Mark West Creek: Steelhead adults, fishing effort, and rainfall, 1994-1995



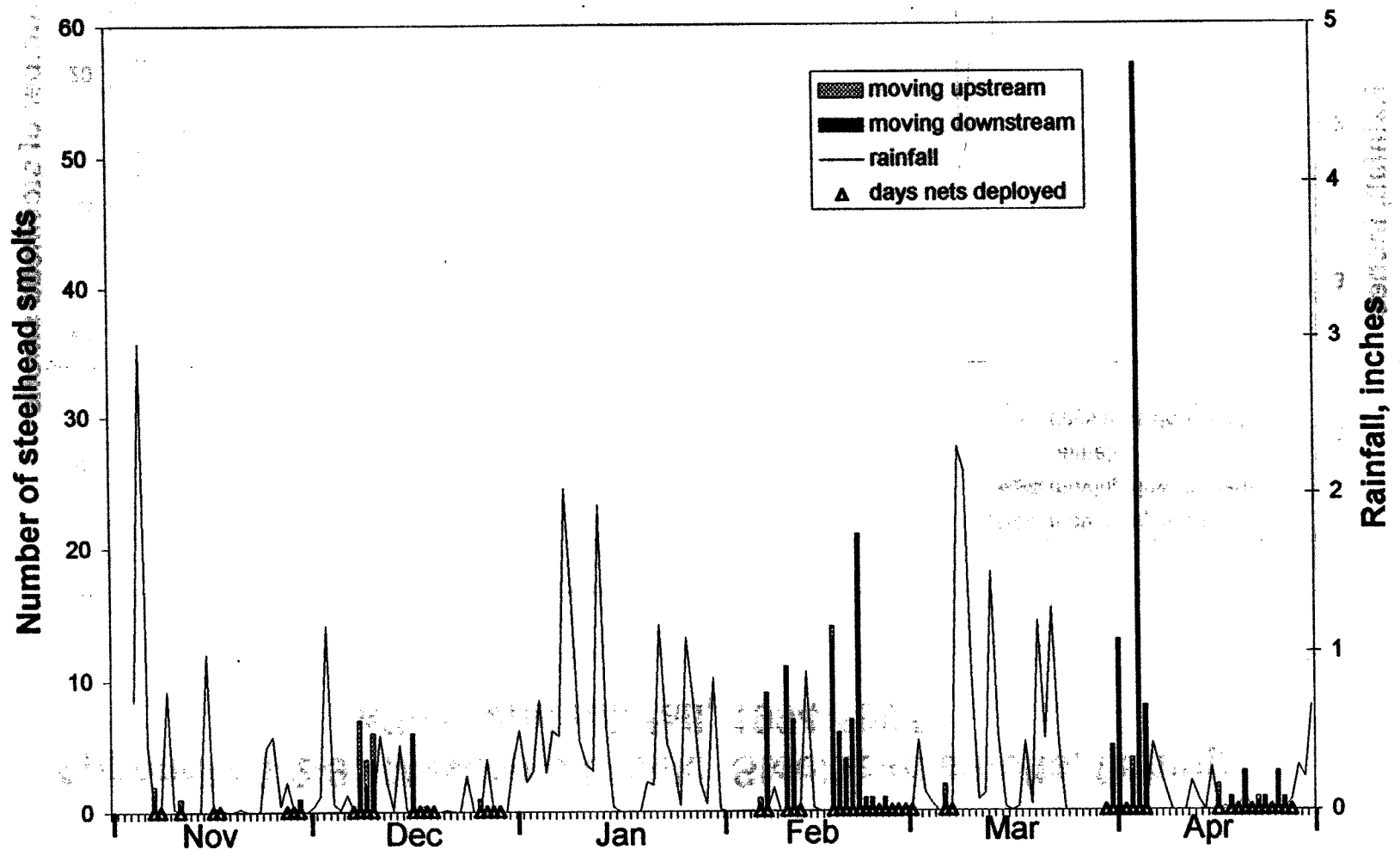
Appendix 3-2-6. Maacama Creek: Steelhead adults, fishing effort, and rainfall, 1994-1995



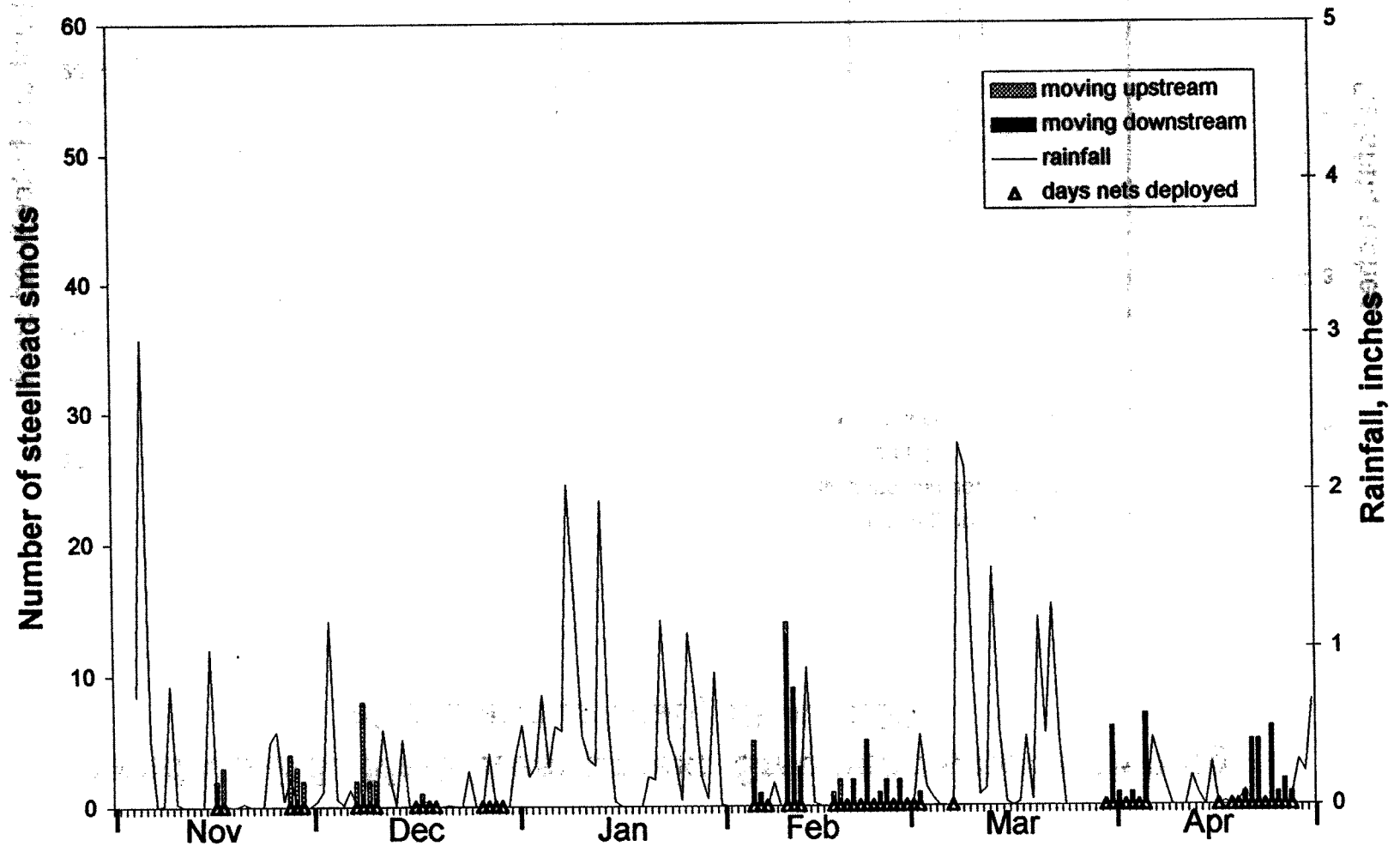
Appendix 3-2-7. Santa Rosa Creek: Steelhead smolts, fishing effort, and rainfall, 1994-1995



Appendix 3-2-8. Mark West Creek: Steelhead smolts, fishing effort, and rainfall, 1994-1995



Appendix 3-2-9. Maacama Creek: Steelhead smolts, fishing effort, and rainfall, 1994-1995



Appendix 3-3-1. Santa Rosa Creek: Salmonid Adults and Half-pounders Captured, 1994-1995.

Steelhead Moving upstream						
#	Date	Sex	Fork Length, mm	Marked?		Remarks
SRu1	6-Mar-95	f	640	punch	ripe	
Steelhead moving downstream						
SRd1	7-Dec-94	f?	710	punch	green	
SRd2	16-Dec-94	m	705	punch	ripe	
SRd3	16-Dec-94	f	660	punch	green	
SRd4	26-Dec-94	f	671	punch	green	
Chinook Salmon Moving downstream						
SRds1	28-Nov-94	m	605			

Appendix 3-3-2. Mark West Creek: Salmonid Adults and Half-pounders Captured, 1994-1995.

Steelhead Moving upstream					
#	Date	Sex	Fork Length, mm	Marked?	Remarks
MWu1	7-Feb-95	f	580	punch	green
MWu2	17-Feb-95	f	638	punch	green
MWu3	19-Feb-95	f	515	punch	slender; green?
MWu4	31-Mar-95	m	720	punch	slightly broken kype
MWu5	1-Apr-95	f?	540	punch	green
Steelhead Moving downstream					
MWd1	8-Dec-94	f?	727	punch	green

Appendix 3-3-3. Maacama Creek: Salmonid Adults and Half-pounders Captured, 1994-1995.

Steelhead Moving upstream					
#	Date	Sex	Fork Length, mm	Marked?	Remarks
MAu1	7-Dec-94	m	348	punch	half-pounder
MAu2	5-Feb-95	f	740	punch	green
MAu3	5-Feb-95	m	658		previously punched lower caudal lobe; right pectoral fin missing; right operculum cracked
MAu4	5-Feb-95	m	620	punch	ripe
MAu5	5-Feb-95	m	628		previously punched both caudal lobes; both pectoral fins missing
MAu6	5-Feb-95	f	608	punch	green
MAu7	5-Feb-95	m	590	punch	ripe
MAu8	6-Feb-95	m	628		previously punched both caudal lobes; both pectoral fins missing
MAu9	6-Feb-95	m	658		hatchery fin; previously punched twice in lower caudal lobe
MAu10	6-Feb-95	m	720		hatchery fin; previously punched both caudal lobes
MAu11	6-Feb-95	m	495		ripe; hatchery fin; previously clipped adipose fin
MAu12	6-Feb-95	f	648		white spot on back behind head fold
MAu13	6-Feb-95	m	567	punch	ripe
MAu14	7-Feb-95	m	655		ripe; hatchery fin; previously punched twice in lower caudal lobe
MAu15	17-Feb-95	m	645	punch	ripe; hatchery fin?
MAu16	19-Feb-95	m	675		ripe; previously punched twice in caudal fin; rt. side bruised; kipe worn
MAu17	19-Feb-95	m	588	punch	ripe
MAu18	20-Feb-95	m	720		ripe; previously punched twice in caudal fin; battered
MAu19	20-Feb-95	f	722	punch	ripe
MAu20	20-Feb-95	m	685	punch	wound on left side
MAu21	24-Feb-95	?	705		green; hatchery fin; previously punched in upper and lower caudal lobes
MAu22	25-Feb-95	m	700		ripe; previously punched twice in caudal fin
MAu23	27-Feb-95	m	730		ripe; hatchery fin; previously punched twice in caudal fin; both pectoral fins missing; fatally wounded (by mink?)
MAu24	2-Mar-95	m	732		ripe; hatchery fin; previously punched twice in upper caudal lobe
MAu25	7-Mar-95	m	639		ripe; hatchery fin; previously punched in upper and lower caudal lobes
MAu26	30-Mar-95	m	718	punch	ripe; hatchery fin; battered
MAu27	30-Mar-95	m	678	punch	ripe; hatchery fin; kype broken; hole (possible old punch) in dorsal lobe
MAu28	30-Mar-95	f	697		previously punched twice in caudal fin
MAu29	31-Mar-95	m	705		ripe; hatchery fin; previously punched twice in caudal fin; battered
MAu30	31-Mar-95	f?	630	punch	green
MAu31	31-Mar-95	m	570	punch	ripe
MAu32	1-Apr-95	m	640		ripe; hatchery fin; previously punched twice in caudal fin; both pectoral fins missing; lower jaw split
MAu33	2-Apr-95	m	682		ripe; hatchery fin; previously punched twice in caudal fin
MAu34	3-Apr-95	m	650	punch	ripe
MAu35	3-Apr-95	f	536	punch	green
MAu36	4-Apr-95	f	688		ripe; previously punched twice in caudal fin
MAu37	4-Apr-95	m	503		ripe; hatchery fin; broken lower jaw
MAu38	23-Apr-95	m	515	punch	ripe

Appendix 3-3-3. Maacama Creek: Salmonid Adults and Half-pounders Captured, 1994-1995.

Steelhead Moving downstream					
#	Date	Sex	Fork Length, mm	Marked?	Remarks
MAd1	6-Feb-95	m	675	punch	wild; spawned out; large patches of skin gone; fungus on back & side
MAd2	18-Feb-95	m	750	punch	hatchery fin; spawned out; abraded belly; broken kype; fungus
MAd3	19-Feb-95	m			battered; spawned out? (swam down while cleaning nets)
MAd4	20-Feb-95	m	675		previously punched twice in caudal fin; this is MAu16
MAd5	21-Feb-95	?	668		hatchery fin; spawned out; previously punched twice in caudal fin; wounds both sides; beat-up
MAd6	22-Feb-95	m	670		ripe; recent punch upper caudal lobe; bite out of side; this is MAu20
MAd7	28-Feb-95	f	720		spawned out; recent punch upper caudal lobe; this is MAu19
MAd8	28-Feb-95	?			(swam down while cleaning nets)
MAd9	26-Apr-95	m?	530		thin; spawned out?

Coho Salmon Moving upstream					
MAuc1	16-Dec-94	m	520	punch	ripe
MAuc2	16-Dec-94	m	700	punch	ripe
MAuc3	18-Dec-94	m	477	punch	ripe
MAuc4	18-Dec-94	f	702	punch	ripe; large kype
MAuc5	19-Dec-94	m	601	punch	
MAuc6	28-Dec-94	m	485	punch	ripe; previously adipose fin clipped

Coho Salmon Moving downstream					
MAdc1	17-Dec-94	m	700		fresh punch upper caudal lobe; this is MAuc2
MAdc2	19-Dec-94	m	477		fresh punch on upper caudal lobe; this is MAuc3
MAdc3	28-Dec-94	m	540	punch	tail worn
MAdc4	29-Dec-94	m	490		fresh punch on upper caudal lobe; this is MAuc6

Chinook Salmon Moving upstream					
MAuk1	17-Dec-94	m	540	punch	ripe; lower part of caudal fin worn
MAuk2	18-Dec-94	m	640	punch	ripe
MAuk3	18-Dec-94	m	489	punch	ripe

Chinook Salmon Moving downstream					
MAdk1	10-Dec-94	m	520	punch?	ripe; battered
MAdk2	17-Dec-94	m	515		ripe; battered; previously punched upper lobe; is this MAdk1?
MAdk3	19-Dec-94	m	537	punch	ripe
MAdk4	19-Dec-94	m	540		previously punched upper caudal lobe; this is MAuk1
MAdk5	19-Dec-94	m	492		previously punched upper caudal lobe; this is MAuk3
MAdk6	23-Feb-95	m	770		monibund

Appendix 3-4. Adult Salmonid Recapture Summary

Capture Date	#	sex	capture		recapture		Days elapsed	Remarks
			site	direction	site	direction		
Steelhead Marked in Maacama Creek, Recaptured in Maacama Creek								
19-Feb	MAu16	m	MAAC	up	MAAC	down	1	returned fish released by hatchery; came up ripe, went down ripe
20-Feb	MAu19	f	MAAC	up	MAAC	down	8	wild fish; came up ripe, went down spent
20-Feb	MAu20	m	MAAC	up	MAAC	down	2	wild fish; came up ripe, went down ripe
Coho Salmon Marked in Maacama Creek, Recaptured in Maacama Creek								
16-Dec	MAuc2	m	MAAC	up	MAAC	down	1	wild fish; came up ripe, went down ripe
18-Dec	MAuc3	m	MAAC	up	MAAC	down	1	wild fish; came up ripe, went down ripe
28-Dec	MAuc6	m	MAAC	up	MAAC	down	1	hatchery fish; came up ripe, went down ripe
Chinook Salmon Marked in Maacama Creek, Recaptured in Maacama Creek								
10-Dec	MAdk1	m	MAAC	down	MAAC	down	7	went down ripe; swam back up while nets not set; went down ripe
17-Dec	MAuk1	m	MAAC	up	MAAC	down	2	went up ripe; went down ripe
18-Dec	MAuk3	m	MAAC	up	MAAC	down	1	went up ripe; went down ripe

Appendix 3-5-1. Santa Rosa Creek: Fork length-frequency (mm) of steelhead smolts captured moving downstream in fyke nets, by two-week intervals, 1994-1995.

interval	7-Nov 20-Nov	21-Nov 4-Dec	5-Dec 18-Dec	19-Dec 1-Jan	2-Jan 15-Jan	16-Jan 29-Jan	30-Jan 12-Feb	13-Feb 26-Feb	27-Feb 12-Mar	13-Mar 26-Mar	27-Mar 9-Apr	10-Apr 23-Apr	24-Apr 7-May
days fished	5	3	7	5	0	0	6	10	5	0	7	7	4
total fish	1	8	14	3	0	0	1	2	3	0	16	3	1
fish per day	0.2	2.7	2.0	0.6	0.0	0.0	0.2	0.2	0.6	0.0	2.3	0.4	0.3
25-29	1											1	
30											AGE 0		
35													
40													
45													
50					1								
55			AGE 1										
60							1						
65													
70				1									
75				2									
80													
85													
90													
95			1	1									
100		3											
105													
110													
115			1										
120		1	1										
125			1	1				1					
130													
135													
140		1											
145													
150		AGE 2	1										
155			1										
160			1							1			
165		2	1										
170									1		2	1	
175											2		
180											4		
185													
190			1								2	1	
195			1										
200									1		3		
205								1					
210			1										
215									1				
220		AGE 3									2		
225													
230													
235													
240													
245													
250													
255													
260		AGE 4											
265													
270													
age 1 mean	87.0	105.8	98.9	93.0			60.0	134.0					
age 2 mean		159.0	170.7					205.0	185.0		182.9	181.5	180.0
age 3 mean			212.0						215.0		220.0		
age 4 mean													

Appendix 3-5-2. Mark West Creek: Fork length-frequency (mm) of steelhead smolts captured moving downstream in fyke nets, by two-week intervals, 1994-1995.

Interval	7-Nov 20-Nov	21-Nov 4-Dec	5-Dec 18-Dec	19-Dec 1-Jan	2-Jan 15-Jan	16-Jan 29-Jan	30-Jan 12-Feb	13-Feb 26-Feb	27-Feb 12-Mar	13-Mar 26-Mar	27-Mar 9-Apr	10-Apr 23-Apr	24-Apr 7-May
days fished	5	3	7	5	0	0	4	10	5	0	7	7	4
total fish	2	1	15	0	0	0	27	47	1	0	86	6	4
fish per day	0.4	0.3	2.1	0.0	0.0	0.0	6.8	4.7	0.2	0.0	12.3	0.9	1.0
25-29													
30													
35													
40													
45													
50													
55													
60													
65		AGE 1											
70													
75													
80													
85													
90													
95	1						1	1					
100			3				2						
105							1				1		
110		1	1										
115			1										
120			1				2						
125			2					1			1		
130							1						
135								1					
140								1					
145								1			2		
150		AGE 2									7		
155			2					3			8		1
160								1			6		1
165							3	2	1		1		
170			2				3	2	1		1	1	
175							3	2			11	2	1
180			1				1	5			14	1	
185							1	2			8		
190							3	3			2	1	
195							2	8			1		
200							2	4			2		
205							1	3			1		
210													
215			1					2					
220		AGE 3	1				1	1					
225								1					
230													
235													
240								1					
245													
250													
255								1					
260		AGE 4											
265	1												
270													
age 1 mean	267.0	110.0	114.0				108.5	112.0			116.5		
age 2 mean			167.8				181.6	182.4	167.0		168.3	178.5	164.5
age 3 mean			219.0				221.0	224.0					
age 4 mean	267.0							255.0					

Appendix 3-5-3. Maacama Creek: Fork length-frequency (mm) of steelhead smolts captured moving downstream in fyke nets, by two week intervals, 1994-1995.

interval	7-Nov 20-Nov	21-Nov 4-Dec	5-Dec 18-Dec	19-Dec 1-Jan	2-Jan 15-Jan	16-Jan 29-Jan	30-Jan 12-Feb	13-Feb 26-Feb	27-Feb 12-Mar	13-Mar 26-Mar	27-Mar 9-Apr	10-Apr 23-Apr	24-Apr 7-May
days fished	2	3	7	5	0	0	6	10	5	0	7	7	4
total fish	0	1	1	0	0	0	28	10	3	0	15	11	9
fish per day	0.0	0.3	0.1	0.0	0.0	0.0	4.7	1.0	0.6	0.0	2.1	1.6	2.3
25-29													
30													
35													
40													
45													
50													
55													
60													
65		AGE 1											
70													
75													
80													
85													
90													
95													
100													
105													
110		1											
115												1	
120							1				1		
125													
130													
135													
140							1				1	1	1
145											1		
150		AGE 2							1		3	1	
155							2	1				2	
160							1				3		1
165							2	1			1		
170								2			1	1	
175							2	2			1	2	1
180							7	1	1		1		1
185							1					1	5
190							2	1					
195							1				1	1	
200							1				1		
205							1						
210			1				1	1				1	
215							2	1					
220		AGE 3					2	1	1				
225													
230													
235													
240													
245													
250													
255							1						
260		AGE 4											
265													
270													
age 1 mean		110.0					128.0				129.0	115.0	
age 2 mean							178.9	174.4	168.0		165.9	168.9	178.1
age 3 mean			214.0				222.8	221.5	225.0			216.0	
age 4 mean							257.0						

Appendix 3-5-4. Coho and Chinook Salmon Smolts Captured in Fyke Nets in Santa Rosa, Mark West, and Maacama Creeks, 1994-1995.

Coho Salmon Smolts Captured in Santa Rosa Creek moving upstream			
#	Date	Fork Length mm	Remarks
SRcsu1	12-Feb-95	165	adipose fin clipped

Coho Salmon Smolts Captured in Santa Rosa Creek moving downstream			
SRcsd1	12-Feb-95	175	adipose fin clipped

Coho Salmon Smolts Captured in Mark West Creek moving downstream			
MWcsd1	7-Feb-95	149	adipose fin clipped

Coho Salmon Smolts Captured in Maacama Creek moving downstream			
MAcsd1	10-Feb-95	115	wild
MAcsd2	11-Feb-95	101	wild
MAcsd3	30-Mar-95	150	wild
MAcsd4	1-Apr-95	146	wild

Chinook Salmon Smolts Captured in Santa Rosa Creek moving downstream			
SRksd1	22-Apr-95	92	no clips or marks
SRksd2	22-Apr-95	78	no clips or marks
SRksd3	26-Apr-95	84	no clips or marks
SRksd4	27-Apr-95	84	no clips or marks
SRksd5	27-Apr-95	91	no clips or marks

Appendix 3-6. Fyke Net Fishing Effectiveness Summary, 1994-1995.

	Santa Rosa Creek				Mark West Creek				Maacama Creek			
	moving downstream		moving upstream		moving downstream		moving upstream		moving downstream		moving upstream	
	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
days fishing OK	37	62.7	45	78.3	52	91.2	51	87.9	44	78.6	45	80.4
days overwhelmed	9	15.3	6	10.2	4	7.0	3	5.2	8	14.3	4	7.1
days with holes	13	22.0	7	11.9	1	1.8	4	6.9	3	5.4	7	12.5
days over & holes	0	0.0	0	0.0	0	0.0	0	0.0	1	1.8	0	0.0
days tampering	0	0.0	1	1.7	0	0.0	0	0.0	0	0.0	0	0.0
total	59	100	59	100	57	100	58	100	56	100	56	100

Appendix 3-7-1. Santa Rosa Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Nov-94												Dec-94											
		7		8		11		16		17		27		28		29		7		8		9		10	
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn
Petromyzontidae																									
Pacific lamprey ammocete	<i>Lampetra tridentata</i> <i>Lampetra</i> sp.																								
Salmonidae																									
Coho salmon juvenile	<i>Oncorhynchus kisutch</i>																								
Chinook salmon adult	<i>Oncorhynchus tshawytscha</i>													1											
Chinook salmon juvenile	<i>Oncorhynchus tshawytscha</i>																								
Steelhead adult	<i>Oncorhynchus mykiss</i>																	1							
Steelhead juvenile	<i>Oncorhynchus mykiss</i>	1						1				4	1	6	6	1						5		2	
Cyprinidae																									
Navarro roach	<i>Lavinia symmetricus navarroensis</i>	3	3	11		3	11	1	32	8	3	6	19	2	53	1		2		1	2	2	15	1	3
Sacramento blackfish	<i>Orthodon microlepidotus</i>					4						3	5	1											
Sacramento squawfish	<i>Ptychocheilus grandis</i>																								
Hitch	<i>Lavinia exilicauda</i>																								
Carp	<i>Cyprinus carpio</i>																								
Golden shiner	<i>Notemigonus crysoleucas</i>																	1							
Fathead minnow	<i>Pimephales promelas</i>	1																				1			
Catostomidae																									
Sacramento sucker	<i>Catostomus occidentalis</i>	9	1			10		11	1			1	1	31		3		2		3		15		2	
Ictaluridae																									
Black bullhead	<i>Ictalurus melas</i>											2		2											
Brown bullhead	<i>Ictalurus nebulosus</i>			4																					
White catfish	<i>Ictalurus catus</i>	2	1			1																			
Poeciliidae																									
Mosquitofish	<i>Gambusia affinis</i>			1								2						1						1	
Gasterosteidae																									
Threespine stickleback	<i>Gasterosteus aculeatus</i>																								
Centrarchidae																									
Bluegill	<i>Lepomis macrochirus</i>	2	1		1	4																			
Green sunfish	<i>Lepomis cyanellus</i>					2																1			
Redear sunfish	<i>Lepomis microlophus</i>																								
Black crappie	<i>Pomoxis nigromaculatus</i>	4																							
Embiotocidae																									
Russian River tule perch	<i>Hysteroecarpus traski poma</i>													1											
Cottidae																									
Coastrange sculpin	<i>Cottus aleuticus</i>					1																			
Prickly sculpin	<i>Cottus asper</i>									1															
Other Vertebrata																									
Common merganser	<i>Mergus merganser</i>																								
Northwestern pond turtle	<i>Clemmys marmorata marmorata</i>																								
Bullfrog	<i>Rana catesbeiana</i>														1									1	
Bullfrog tadpole	<i>Rana catesbeiana</i>	2	1	15	1	3	2			2	1	3	1	3	1	6	1	7		4		4			6
Western toad	<i>Bufo boreas</i>																								

Appendix 3-7-1. Santa Rosa Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Dec-94												Feb-95											
		16		17		18		19		26		27		28		29		5		6		7		10	
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn
Petromyzontidae																									
Pacific lamprey ammocete	Lampetra tridentata Lampetra sp.																								
Salmonidae																									
Coho salmon juvenile	Oncorhynchus kisutch																								
Chinook salmon adult	Oncorhynchus tshawytscha																								
Chinook salmon juvenile	Oncorhynchus tshawytscha																								
Steelhead adult	Oncorhynchus mykiss		2							1				1		1									1
Steelhead juvenile	Oncorhynchus mykiss		3	3	4			1	2																
Cyprinidae																									
Navarro roach	Lavinia symmetricus navarroensis	1		3	6	1		2	3			1		2	1		2	3	3	2		5	6		
Sacramento blackfish	Orthodon microlepidotus		8																						
Sacramento squawfish	Ptychocheilus grandis																		1						
Hitch	Lavinia exilicauda			1	3																				
Carp	Cyprinus carpio																								
Golden shiner	Notemigonus crysoleucas		1																						
Fathead minnow	Pimephales promelas																								
Catostomidae																									
Sacramento sucker	Catostomus occidentalis		25		5	1							1		1		2				1	2		1	
Ictaluridae																									
Black bullhead	Ictalurus melas																								
Brown bullhead	Ictalurus nebulosus																								
White catfish	Ictalurus catus				2																				
Poeciliidae																									
Mosquitofish	Gambusia affinis																								
Gasterosteidae																									
Threespine stickleback	Gasterosteus aculeatus																								
Centrarchidae																									
Bluegill	Lepomis macrochirus																								
Green sunfish	Lepomis cyanellus																								
Redear sunfish	Lepomis microlophus																		1						
Black crappie	Pomoxis nigromaculatus																								
Embiotocidae																									
Russian River tule perch	Hysterocarpus traski poma																								
Cottidae																									
Coastrange sculpin	Cottus aleuticus																								1
Prickly sculpin	Cottus asper																								
Other Vertebrata																									
Common merganser	Mergus merganser																								
Northwestern pond turtle	Clemmys marmorata marmorata																								
Bullfrog	Rana catesbeiana																								
Bullfrog tadpole	Rana catesbeiana		3	1				1		1		1						1	2						1
Western toad	Bufo boreas																								

Appendix 3-7-1. Santa Rosa Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Feb-95																							
		11		12		17		18		19		20		21		22		23		24		25		26	
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn
Petromyzontidae																									
Pacific lamprey ammocete	<i>Lampetra tridentata</i> <i>Lampetra</i> sp.																								
Salmonidae																									
Coho salmon juvenile	<i>Oncorhynchus kisutch</i>			1	1																				
Chinook salmon adult	<i>Oncorhynchus tshawytscha</i>																								
Chinook salmon juvenile	<i>Oncorhynchus tshawytscha</i>																								
Steelhead adult	<i>Oncorhynchus mykiss</i>																								
Steelhead juvenile	<i>Oncorhynchus mykiss</i>			1				1						1								1			
Cyprinidae																									
Navarro roach	<i>Lavinia symmetricus navarroensis</i>	1		6		4	2	2		3	5	2	6	15	1	13	7	9	4	1	9	5	6	1	1
Sacramento blackfish	<i>Orthodon microlepidotus</i>																								
Sacramento squawfish	<i>Ptychocheilus grandis</i>													2		2						1			
Hitch	<i>Lavinia exilicauda</i>																								
Carp	<i>Cyprinus carpio</i>																								
Golden shiner	<i>Notemigonus crysoleucas</i>																								
Fathead minnow	<i>Pimephales promelas</i>															1									
Catostomidae																									
Sacramento sucker	<i>Catostomus occidentalis</i>					1										1	1								
Ictaluridae																									
Black bullhead	<i>Ictalurus melas</i>																								
Brown bullhead	<i>Ictalurus nebulosus</i>																								
White catfish	<i>Ictalurus catus</i>																								
Poeciliidae																									
Mosquitofish	<i>Gambusia affinis</i>																								
Gasterosteidae																									
Threespine stickleback	<i>Gasterosteus aculeatus</i>									1												1			
Centrarchidae																									
Bluegill	<i>Lepomis macrochirus</i>																								
Green sunfish	<i>Lepomis cyanellus</i>											1					1								
Redear sunfish	<i>Lepomis microlophus</i>																								
Black crappie	<i>Pomoxis nigromaculatus</i>																								
Embiotocidae																									
Russian River tule perch	<i>Hysterothorax traski</i>																								
Cottidae																									
Coastrange sculpin	<i>Cottus aleuticus</i>													1						1	1				1
Prickly sculpin	<i>Cottus asper</i>																								
Other Vertebrata																									
Common merganser	<i>Mergus merganser</i>												1												
Northwestern pond turtle	<i>Clemmys marmorata marmorata</i>													1	2										1
Bullfrog	<i>Rana catesbeiana</i>														1						1		1		
Bullfrog tadpole	<i>Rana catesbeiana</i>																						2		
Western toad	<i>Bufo boreas</i>	1				1		1		1								1							

Appendix 3-7-1. Santa Rosa Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Feb-95				Mar-95								Apr-95											
		27		28		1		6		7		30		31		1		2		3		4		5	
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn
Petromyzontidae																									
Pacific lamprey ammocete	<i>Lampetra tridentata</i> <i>Lampetra</i> sp.											1		1											
Salmonidae																									
Coho salmon juvenile	<i>Oncorhynchus kisutch</i>																								
Chinook salmon adult	<i>Oncorhynchus tshawytscha</i>																								
Chinook salmon juvenile	<i>Oncorhynchus tshawytscha</i>																								
Steelhead adult	<i>Oncorhynchus mykiss</i>						1																		
Steelhead juvenile	<i>Oncorhynchus mykiss</i>			1			2					4		1			4		5		3		1		
Cyprinidae																									
Navarro roach	<i>Lavinia symmetricus navarroensis</i>	3	8			1	2	6	6	10	4	19	8	8	18	2	58	15	46	2	3	8	5	25	
Sacramento blackfish	<i>Orthodon microlepidotus</i>																			2					
Sacramento squawfish	<i>Ptychocheilus grandis</i>			1																					
Hitch	<i>Lavinia exilicauda</i>																								
Carp	<i>Cyprinus carpio</i>																								
Golden shiner	<i>Notemigonus crysoleucas</i>																								
Fathead minnow	<i>Pimephales promelas</i>											1					2	1							
Catostomidae																									
Sacramento sucker	<i>Catostomus occidentalis</i>							1	1			1		1			1		1		1		4		
Ictaluridae																									
Black bullhead	<i>Ictalurus melas</i>																								
Brown bullhead	<i>Ictalurus nebulosus</i>									1		1													
White catfish	<i>Ictalurus catus</i>																	1							
Poeciliidae																									
Mosquitofish	<i>Gambusia affinis</i>																								
Gasterosteidae																									
Threespine stickleback	<i>Gasterosteus aculeatus</i>			1				1								1									
Centrarchidae																									
Bluegill	<i>Lepomis macrochirus</i>									1		1						1							
Green sunfish	<i>Lepomis cyanellus</i>															1								1	
Redear sunfish	<i>Lepomis microlophus</i>																								
Black crappie	<i>Pomoxis nigromaculatus</i>																								
Embiotocidae																									
Russian River tule perch	<i>Hysterochirus traski</i> pomo																								
Cottidae																									
Coastrange sculpin	<i>Cottus aleuticus</i>	1		2				1		2												1			
Prickly sculpin	<i>Cottus asper</i>																								
Other Vertebrata																									
Common merganser	<i>Mergus merganser</i>																								
Northwestern pond turtle	<i>Clemmys marmorata marmorata</i>					1		1				1				1		1		1		1		1	
Bullfrog	<i>Rana catesbeiana</i>																	1						1	
Bullfrog tadpole	<i>Rana catesbeiana</i>									1		1								1					
Western toad	<i>Bufo boreas</i>																							1	

Appendix 3-7-1. Santa Rosa Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Apr-95													
		16		18		19		20		21		22		23	
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn
Petromyzontidae															
Pacific lamprey ammocete	<i>Lampetra tridentata</i> <i>Lampetra</i> sp.												1		
Salmonidae															
Coho salmon juvenile	<i>Oncorhynchus kisutch</i>														
Chinook salmon adult	<i>Oncorhynchus tshawytscha</i>														
Chinook salmon juvenile	<i>Oncorhynchus tshawytscha</i>											2			1
Steelhead adult	<i>Oncorhynchus mykiss</i>														2
Steelhead juvenile	<i>Oncorhynchus mykiss</i>							2					1	1	
Cyprinidae															
Navarro roach	<i>Lavinia symmetricus navarroensis</i>	1		1	6	1	4	5	9	11	34	36	8	14	22
Sacramento blackfish	<i>Orthodon microlepidotus</i>														2
Sacramento squawfish	<i>Ptychocheilus grandis</i>														
Hitch	<i>Lavinia exilicauda</i>														
Carp	<i>Cyprinus carpio</i>														1
Golden shiner	<i>Notemigonus crysoleucas</i>														1
Fathead minnow	<i>Pimephales promelas</i>														
Catostomidae															
Sacramento sucker	<i>Catostomus occidentalis</i>						8						2		
Ictaluridae															
Black bullhead	<i>Ictalurus melas</i>														
Brown bullhead	<i>Ictalurus nebulosus</i>														
White catfish	<i>Ictalurus catus</i>									1					
Poeciliidae															
Mosquitofish	<i>Gambusia affinis</i>														
Gasterosteidae															
Threespine stickleback	<i>Gasterosteus aculeatus</i>														1
Centrarchidae															
Bluegill	<i>Lepomis macrochirus</i>						1		1		1				2
Green sunfish	<i>Lepomis cyanellus</i>								1				1		1
Redear sunfish	<i>Lepomis microlophus</i>														
Black crappie	<i>Pomoxis nigromaculatus</i>														
Embiotocidae															
Russian River tule perch	<i>Hysterothorax traski</i>														
Cottidae															
Coastrange sculpin	<i>Cottus aleuticus</i>										1	1		1	
Prickly sculpin	<i>Cottus asper</i>														
Other Vertebrata															
Common merganser	<i>Mergus merganser</i>														
Northwestern pond turtle	<i>Emmys marmorata marmorata</i>														2
Bullfrog	<i>Rana catesbeiana</i>									2			1		1
Bullfrog tadpole	<i>Rana catesbeiana</i>														1
Western toad	<i>Bufo boreas</i>					1					4		1	1	2

Appendix 3-7-2. Mark West Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Nov-94														Dec-94										
		7		8		11		16		17		27		28		29		7		8		9		10		
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	
Petromyzontidae																										
Pacific lamprey	<i>Lampetra tridentata</i>	1			1										1											
Salmonidae																										
Coho salmon juvenile	<i>Oncorhynchus kisutch</i>																									
Steelhead adult	<i>Oncorhynchus mykiss</i>																				1					
Steelhead juvenile	<i>Oncorhynchus mykiss</i>	1	1				1										1				4	3	2	2	2	4
Cyprinidae																										
Navarro roach	<i>Lavinia symmetricus navarroensis</i>		15	1	5	33	45		2	8	3		4	1			1	3		2	2		3		1	
Catostomidae																										
Sacramento sucker	<i>Catostomus occidentalis</i>		4				1						1		4				1	1	1		2	8	1	5
Poeciliidae																										
Mosquitofish	<i>Gambusia affinis</i>				1																					
Gasterosteidae																										
Threespine stickleback	<i>Gasterosteus aculeatus</i>	1	2	2			4			1					1			1	1		1	1	3			
Centrarchidae																										
Bluegill	<i>Lepomis macrochirus</i>		3				6												1		1				1	
Green sunfish	<i>Lepomis cyanellus</i>	1		2		1	3																			
Embiotocidae																										
Russian River tule perch	<i>Hysterocarpus traski pomo</i>				1	1							1													
Cottidae																										
Coastrange sculpin	<i>Cottus aleuticus</i>	1	10	2	7	39	16			2			1	4		2		1		2	3	3	1			
Prickly sculpin	<i>Cottus asper</i>																1								1	1
Other Vertebrata																										
Northwestern pond turtle	<i> Clemmys marmorata marmorata</i>																									
Pond slider	<i> Trachemys scripta</i>																									
Bullfrog	<i> Rana catesbeiana</i>																		1		2					
Bullfrog tadpole	<i> Rana catesbeiana</i>																									
Western toad	<i> Bufo boreas</i>																									
Red-bellied newt	<i> Taricha rivularis</i>												1													

Appendix 3-7-2. Mark West Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Dec-94												Feb-95													
		16		17		18		19		26		27		28		29		6		7		10		11		12	
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn
Petromyzontidae																											
Pacific lamprey	<i>Lampetra tridentata</i>																										
Salmonidae																											
Coho salmon juvenile	<i>Oncorhynchus kisutch</i>																				1						
Steelhead adult	<i>Oncorhynchus mykiss</i>																			1							
Steelhead juvenile	<i>Oncorhynchus mykiss</i>	6								1								1		9		11		7			
Cyprinidae																											
Navarro roach	<i>Lavinia symmetricus navarroensis</i>	1		17						14	8	6	2				1	43	7	3		1		5		7	
Catostomidae																											
Sacramento sucker	<i>Catostomus occidentalis</i>	3		2						2	2	3					1			1		1	1			1	
Poeciliidae																											
Mosquitofish	<i>Gambusia affinis</i>																										
Gasterosteidae																											
Threespine stickleback	<i>Gasterosteus aculeatus</i>			1													1	1									
Centrarchidae																											
Bluegill	<i>Lepomis macrochirus</i>																										
Green sunfish	<i>Lepomis cyanellus</i>																								1		
Embiotocidae																											
Russian River tule perch	<i>Hysterocarpus traski pomo</i>									1																	
Cottidae																											
Coastrange sculpin	<i>Cottus aleuticus</i>	4	1		1					1		3						1		1		2	1	5			
Prickly sculpin	<i>Cottus asper</i>																										
Other Vertebrata																											
Northwestern pond turtle	<i>Clemmys marmorata marmorata</i>																										
Pond slider	<i>Trachemys scripta</i>																										
Bullfrog	<i>Rana catesbeiana</i>	1																									
Bullfrog tadpole	<i>Rana catesbeiana</i>		1			2		2										2	1			5		6		7	
Western toad	<i>Bufo boreas</i>																							1			
Red-bellied newt	<i>Taricha rivularis</i>																										

Appendix 3-7-2. Mark West Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Dec-94												Feb-95													
		16		17		18		19		26		27		28		29		6		7		10		11		12	
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	up	dn	up	dn	up	dn	up	dn	
Petromyzontidae																											
Pacific lamprey	<i>Lampetra tridentata</i>																										
Salmonidae																											
Coho salmon juvenile	<i>Oncorhynchus kisutch</i>																			1							
Steelhead adult	<i>Oncorhynchus mykiss</i>																		1								
Steelhead juvenile	<i>Oncorhynchus mykiss</i>	6								1								1		9		11		7			
Cyprinidae																											
Navarro roach	<i>Lavinia symmetricus navarroensis</i>	1		17						14	8	6	2				1	43	7	3		1		5		7	
Catostomidae																											
Sacramento sucker	<i>Catostomus occidentalis</i>	3		2						2	2	3					1			1		1	1			1	
Poeciliidae																											
Mosquitofish	<i>Gambusia affinis</i>																										
Gasterosteidae																											
Threespine stickleback	<i>Gasterosteus aculeatus</i>			1													1	1									
Centrarchidae																											
Bluegill	<i>Lepomis macrochirus</i>																										
Green sunfish	<i>Lepomis cyanellus</i>																							1			
Embiotocidae																											
Russian River tule perch	<i>Hysterocarpus traski pomo</i>									1																	
Cottidae																											
Coastrange sculpin	<i>Cottus aleuticus</i>	4	1		1					1		3						1		1		2	1	5			
Prickly sculpin	<i>Cottus asper</i>																										
Other Vertebrata																											
Northwestern pond turtle	<i>Clemmys marmorata marmorata</i>																										
Pond slider	<i>Trachemys scripta</i>																										
Bullfrog	<i>Rana catesbeiana</i>	1																									
Bullfrog tadpole	<i>Rana catesbeiana</i>		1			2		2										2	1			5		6		7	
Western toad	<i>Bufo boreas</i>																							1			
Red-bellied newt	<i>Taricha rivularis</i>																										

Appendix 3-7-2. Mark West Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Feb-95																							
		17		18		19		20		21		22		23		24		25		26		27		28	
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn
Petromyzontidae																									
Pacific lamprey	<i>Lampetra tridentata</i>	1																		1					
Salmonidae																									
Coho salmon juvenile	<i>Oncorhynchus kisutch</i>																								
Steelhead adult	<i>Oncorhynchus mykiss</i>	1			1														1						
Steelhead juvenile	<i>Oncorhynchus mykiss</i>	1	13		6		4		7		21		1		1					1					
Cyprinidae																									
Navarro roach	<i>Lavinia symmetricus navarroensis</i>	3	16	2	34	7	21	2	8		2			1		1	5	3	2		1		1	1	
Catostomidae																									
Sacramento sucker	<i>Catostomus occidentalis</i>	2				1	2	2		1								2							
Poeciliidae																									
Mosquitofish	<i>Gambusia affinis</i>																								
Gasterosteidae																									
Threespine stickleback	<i>Gasterosteus aculeatus</i>		1											1				1							
Centrarchidae																									
Bluegill	<i>Lepomis macrochirus</i>					2																			
Green sunfish	<i>Lepomis cyanellus</i>								1																
Embiotocidae																									
Russian River tule perch	<i>Hysterocarpus traski pomo</i>												1												
Cottidae																									
Coastrange sculpin	<i>Cottus aleuticus</i>		6	1	9		8	1	8	1				1		2	6	2	9		1				
Prickly sculpin	<i>Cottus asper</i>										1														
Other Vertebrata																									
Northwestern pond turtle	<i>Clemmys marmorata marmorata</i>									1															
Pond slider	<i>Trachemys scripta</i>																								
Bullfrog	<i>Rana catesbeiana</i>				1																1				
Bullfrog tadpole	<i>Rana catesbeiana</i>				2		4	2	1		4							1		3					2
Western toad	<i>Bufo boreas</i>																								
Red-bellied newt	<i>Taricha rivularis</i>																								

Appendix 3-7-2. Mark West Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Mar-95										Apr-95													
		1		6		7		30		31		1		2		3		4		5		16		18	
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn
Petromyzontidae																									
Pacific lamprey	<i>Lampetra tridentata</i>							1		1		1				1									2
Salmonidae																									
Coho salmon juvenile	<i>Oncorhynchus kisutch</i>																								
Steelhead adult	<i>Oncorhynchus mykiss</i>									1		1													
Steelhead juvenile	<i>Oncorhynchus mykiss</i>			1	1					5		13				1	3	57		8	1	1			1
Cyprinidae																									
Navarro roach	<i>Lavinia symmetricus navarroensis</i>			1	1		1	3	5	6	2	2	1	5	22	28	6		1	8	2	2	2		2
Catostomidae																									
Sacramento sucker	<i>Catostomus occidentalis</i>				1											1									
Poeciliidae																									
Mosquitofish	<i>Gambusia affinis</i>																								
Gasterosteidae																									
Threespine stickleback	<i>Gasterosteus aculeatus</i>		1							1	1		1			1		1	2	2	1				
Centrarchidae																									
Bluegill	<i>Lepomis macrochirus</i>																								
Green sunfish	<i>Lepomis cyanellus</i>			1																					
Embiotocidae																									
Russian River tule perch	<i>Hysterocarpus traski pomo</i>																			1					
Cottidae																									
Coastrange sculpin	<i>Cottus aleuticus</i>									2	1		1	1		4	2		1	1	1	2	1		2
Prickly sculpin	<i>Cottus asper</i>																								
Other Vertebrata																									
Northwestern pond turtle	<i>Clemmys marmorata marmorata</i>																								
Pond slider	<i>Trachemys scripta</i>																								
Bullfrog	<i>Rana catesbeiana</i>			1				1		1						1									
Bullfrog tadpole	<i>Rana catesbeiana</i>						1	9		10		7	3			1		3		1					2
Western toad	<i>Bufo boreas</i>																								
Red-bellied newt	<i>Taricha rivularis</i>																								

Appendix 3-7-2. Mark West Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Apr-95													
		19		20		21		22		23		24		25	
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn
Petromyzontidae															
Pacific lamprey	<i>Lampetra tridentata</i>			1										1	
Salmonidae															
Coho salmon juvenile	<i>Oncorhynchus kisutch</i>														
Steelhead adult	<i>Oncorhynchus mykiss</i>														
Steelhead juvenile	<i>Oncorhynchus mykiss</i>			3				1		1				3	1
Cyprinidae															
Navarro roach	<i>Levinia symmetricus navarroensis</i>	11	3	31	8	45	5	60	16	8	5	10	3	6	11
Catostomidae															
Sacramento sucker	<i>Catostomus occidentalis</i>											1		1	
Poeciliidae															
Mosquitofish	<i>Gambusia affinis</i>														
Gasterosteidae															
Threespine stickleback	<i>Gasterosteus aculeatus</i>					2				1	1	2			
Centrarchidae															
Bluegill	<i>Lepomis macrochirus</i>							1				2			
Green sunfish	<i>Lepomis cyanellus</i>									1					
Embiotocidae															
Russian River tute perch	<i>Hysterocarpus traski poma</i>			1						1		1			
Cottidae															
Coastrange sculpin	<i>Cottus aleuticus</i>		1	4	2	3		2		6		6	1	2	
Prickly sculpin	<i>Cottus asper</i>														
Other Vertebrata															
Northwestern pond turtle	<i>Clemmys marmorata marmorata</i>														
Pond slider	<i>Trachemys scripta</i>					1									
Bullfrog	<i>Rana catesbeiana</i>														
Bullfrog tadpole	<i>Rana catesbeiana</i>		1		2	2				2					
Western toad	<i>Bufo boreas</i>														
Red-bellied newt	<i>Taricha rivularis</i>														

Appendix 3-7-3. Maacama Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Nov-94												Dec-94											
		16		17		27		28		29		7		8		9		10		16		17		18	
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn
Petromyzontidae																									
Pacific lamprey	<i>Lampetra tridentata</i>																								
Salmonidae																									
Coho salmon adult	<i>Oncorhynchus kisutch</i>																								
Coho salmon juvenile	<i>Oncorhynchus kisutch</i>																								
Chinook salmon adult	<i>Oncorhynchus tshawytscha</i>																								
Steelhead adult	<i>Oncorhynchus mykiss</i>																								
Steelhead half-pounder	<i>Oncorhynchus mykiss</i>																								
Steelhead juvenile	<i>Oncorhynchus mykiss</i>	2		3		4		3		2		2		7	1	2		2				1			
Cyprinidae																									
Navarro roach	<i>Lavinia symmetricus navarroensis</i>	3				10	1	13	2	2	1	1	3		3			1	1	1	1	1			
Hardhead	<i>Mylopharodon conocephalus</i>	7		1		4				1	1			1				1							
Sacramento blackfish	<i>Orthodon microlepidotus</i>																								
Sacramento squawfish	<i>Ptychocheilus grandis</i>																								
Hitch	<i>Lavinia eximicauda</i>																								
Fathead minnow	<i>Pimephales promelas</i>																								
Catostomidae																									
Sacramento sucker	<i>Catostomus occidentalis</i>																								
Ictaluridae																									
Brown bullhead	<i>Ictalurus nebulosus</i>																								
Gasterosteidae																									
Threespine stickleback	<i>Gasterosteus aculeatus</i>																								
Centrarchidae																									
Bluegill	<i>Lepomis macrochirus</i>																								
Cottidae																									
Coastrange sculpin	<i>Cottus aleuticus</i>																								
Prickly sculpin	<i>Cottus asper</i>																								
Other Vertebrata																									
Northwestern pond turtle	<i>Emmys marmorata marmorata</i>																								
Bullfrog	<i>Rana catesbeiana</i>																								
Bullfrog tadpole	<i>Rana catesbeiana</i>																								
Western toad	<i>Bufo boreas</i>																								

Appendix 3-7-3. Maacama Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Dec-94										Feb-95															
		19		26		27		28		29		5		6		7		10		11		12		17		18	
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn
Petromyzontidae																											
Pacific lamprey	<i>Lampetra tridentata</i>																										
Salmonidae																											
Coho salmon adult	<i>Oncorhynchus kisutch</i>	1	1					1	1	1																	
Coho salmon juvenile	<i>Oncorhynchus kisutch</i>																	1		1							
Chinook salmon adult	<i>Oncorhynchus tshawytscha</i>	3																									
Steelhead adult	<i>Oncorhynchus mykiss</i>											6		6	1	1								1			1
Steelhead half-pounder	<i>Oncorhynchus mykiss</i>																										
Steelhead juvenile	<i>Oncorhynchus mykiss</i>											3	2		1			1	13	9		3	1			2	
Cyprinidae																											
Navarro roach	<i>Lavinia symmetricus navarroensis</i>					2	2					3		1	2	1		1								2	1
Hardhead	<i>Mylopharodon conocephalus</i>					2		5																			
Sacramento blackfish	<i>Orthodon microlepidotus</i>																										
Sacramento squawfish	<i>Ptychocheilus grandis</i>							1						1	1							1		1		1	
Hitch	<i>Lavinia exilicauda</i>		1																								
Fathead minnow	<i>Pimephales promelas</i>																										
Catostomidae																											
Sacramento sucker	<i>Catostomus occidentalis</i>		2			1		1								1		1		1			1				
Ictaluridae																											
Brown bullhead	<i>Ictalurus nebulosus</i>																3								1		
Gasterosteidae																											
Threespine stickleback	<i>Gasterosteus aculeatus</i>																										
Centrarchidae																											
Bluegill	<i>Lepomis macrochirus</i>											34		10		2		2		1					1		
Cottidae																											
Coastrange sculpin	<i>Cottus aleuticus</i>		6		1			1						1						2							
Prickly sculpin	<i>Cottus asper</i>	1				3																					
Other Vertebrata																											
Northwestern pond turtle	<i>Clemmys marmorata marmorata</i>																										
Bullfrog	<i>Rana catesbeiana</i>											1															
Bullfrog tadpole	<i>Rana catesbeiana</i>											1															
Western toad	<i>Bufo boreas</i>																										

Appendix 3-7-3. Maacama Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Feb-95																Mar-95							
		19		20		21		22		23		24		25		26		27		28		1		2	
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn
Petromyzontidae																									
Pacific lamprey	<i>Lampetra tridentata</i>	1		6		1						1													1
Salmonidae																									
Coho salmon adult	<i>Oncorhynchus kisutch</i>																								
Coho salmon juvenile	<i>Oncorhynchus kisutch</i>																								
Chinook salmon adult	<i>Oncorhynchus tshawytscha</i>										1														
Steelhead adult	<i>Oncorhynchus mykiss</i>	2	1	3	1	1		1			1		1					1		2				1	
Steelhead half-pounder	<i>Oncorhynchus mykiss</i>																								
Steelhead juvenile	<i>Oncorhynchus mykiss</i>				2				5			1		2					2						1
Cyprinidae																									
Navarro roach	<i>Lavinia symmetricus navarroensis</i>			1				1			1	4				1				1		2			
Hardhead	<i>Mylopharodon conocephalus</i>									2					2	1	1	3							
Sacramento blackfish	<i>Orthodon microlepidotus</i>																								
Sacramento squawfish	<i>Ptychocheilus grandis</i>					1	1		1			1	1												
Hitch	<i>Lavinia exilicauda</i>																								
Fathead minnow	<i>Pimephales promelas</i>																								
Catostomidae																									
Sacramento sucker	<i>Catostomus occidentalis</i>			1				1							2		2					3			
Ictaluridae																									
Brown bullhead	<i>Ictalurus nebulosus</i>							1																	
Gasterosteidae																									
Threespine stickleback	<i>Gasterosteus aculeatus</i>																								
Centrarchidae																									
Bluegill	<i>Lepomis macrochirus</i>				1		1		1			1													
Cottidae																									
Coastrange sculpin	<i>Cottus aleuticus</i>	1	2		1		1	1	1					2		1									1
Prickly sculpin	<i>Cottus asper</i>					2						1													
Other Vertebrata																									
Northwestern pond turtle	<i>Clemmys marmorata marmorata</i>								2																
Bullfrog	<i>Rana catesbeiana</i>																								
Bullfrog tadpole	<i>Rana catesbeiana</i>			1		1																			
Western toad	<i>Bufo boreas</i>																								

Appendix 3-7-3. Maacama Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

		Mar-95										Apr-95													
		7		30		31		1		2		3		4		5		16		18		19		20	
		up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn
Petromyzontidae																									
Pacific lamprey	<i>Lampetra tridentata</i>							1														1			
Salmonidae																									
Coho salmon adult	<i>Oncorhynchus kisutch</i>																								
Coho salmon juvenile	<i>Oncorhynchus kisutch</i>				1			1																	
Chinook salmon adult	<i>Oncorhynchus tshawytscha</i>																								
Steelhead adult	<i>Oncorhynchus mykiss</i>	1		3		3		1		1		2		2											
Steelhead half-pounder	<i>Oncorhynchus mykiss</i>																								
Steelhead juvenile	<i>Oncorhynchus mykiss</i>					6		1				1				7								1	
Cyprinidae																									
Navarro roach	<i>Lavinia symmetricus navarroensis</i>	1		4		1						1				1		1						1	2
Hardhead	<i>Mylopharodon conocephalus</i>																								
Sacramento blackfish	<i>Orthodon microlepidotus</i>																								
Sacramento squawfish	<i>Ptychocheilus grandis</i>					1		1								1									
Hitch	<i>Lavinia exilicauda</i>																								
Fathead minnow	<i>Pimephales promelas</i>																								
Catostomidae				1																					
Sacramento sucker	<i>Catostomus occidentalis</i>	1				4		3										1						1	
Ictaluridae																									
Brown bullhead	<i>Ictalurus nebulosus</i>							1																	
Gasterosteidae																									
Threespine stickleback	<i>Gasterosteus aculeatus</i>																			1					
Centrarchidae																									
Bluegill	<i>Lepomis macrochirus</i>				2			1																	
Cottidae																									
Coastrange sculpin	<i>Cottus aleuticus</i>			1		1								1										1	
Prickly sculpin	<i>Cottus asper</i>																								
Other Vertebrata																									
Northwestern pond turtle	<i>Clemmys marmorata marmorata</i>																								
Bullfrog	<i>Rana catesbeiana</i>																								
Bullfrog tadpole	<i>Rana catesbeiana</i>							1																	
Western toad	<i>Bufo boreas</i>																								

Appendix 3-7-3. Maacama Creek: Fyke Net Catches of Various Species of Fish and Other Vertebrates, 1994-1995. up = moving upstream; dn = moving downstream.

			Apr-95													
			21		22		23		24		25		26		27	
			up	dn	up	dn	up	dn	up	dn	up	dn	up	dn	up	dn
Petromyzontidae																
Pacific lamprey		<i>Lampetra tridentata</i>					1		1				1	1		3
Salmonidae																
Coho salmon adult		<i>Oncorhynchus kisutch</i>														
Coho salmon juvenile		<i>Oncorhynchus kisutch</i>														
Chinook salmon adult		<i>Oncorhynchus tshawytscha</i>														
Steelhead adult		<i>Oncorhynchus mykiss</i>					1							1		
Steelhead half-pounder		<i>Oncorhynchus mykiss</i>														
Steelhead juvenile		<i>Oncorhynchus mykiss</i>		5		5			6		1		2		1	
Cyprinidae																
Navarro roach		<i>Lavinia symmetricus navarroensis</i>	1	6		8		4	8	8	1	6	2	10	1	9
Hardhead		<i>Mylopharodon conocephalus</i>									3					
Sacramento blackfish		<i>Orthodon microlepidotus</i>														
Sacramento squawfish		<i>Ptychocheilus grandis</i>	3		1		3				2		1			
Hitch		<i>Lavinia exilicauda</i>														
Fathead minnow		<i>Pimephales promelas</i>														
Catostomidae																
Sacramento sucker		<i>Catostomus occidentalis</i>			2		1		3	2			1		1	
Ictaluridae																
Brown bullhead		<i>Ictalurus nebulosus</i>														
Gasterosteidae																
Threespine stickleback		<i>Gasterosteus aculeatus</i>														
Centrarchidae																
Bluegill		<i>Lepomis macrochirus</i>														
Cottidae																
Coastrange sculpin		<i>Cottus aleuticus</i>			1						2				1	
Prickly sculpin		<i>Cottus asper</i>														
Other Vertebrata																
Northwestern pond turtle		<i>Clemmys marmorata marmorata</i>											2			
Bullfrog		<i>Rana catesbeiana</i>			1		1									
Bullfrog tadpole		<i>Rana catesbeiana</i>														
Western toad		<i>Bufo boreas</i>	3		1		2									

Appendix 4-1-1. Santa Rosa Creek Juvenile Abundance Data, 1995.

Upper Santa Rosa Creek (Cougar Lane)					
Habitat Unit	Habitat Type	Summer 1995 survey		Fall 1995 survey	
		Date Sampled	Total Steelhead	Date Sampled	Total Steelhead
1(lower)	pool	20-Jul-95	28	23-Oct-95	30
1(upper)	pool	20-Jul-95	32	23-Oct-95	28
2	riffle	20-Jul-95	4	23-Oct-95	0
3	pool	20-Jul-95	20	23-Oct-95	29
4	riffle	20-Jul-95	22	23-Oct-95	16
6(lower)	pool	20-Jul-95	20	23-Oct-95	24
6(upper)	pool	20-Jul-95	33	23-Oct-95	22

Middle Santa Rosa Creek (fish ladder to Hwy 12 bridge)					
Habitat Unit	Habitat Type	Summer 1995 survey		Fall 1995 survey	
		Date Sampled	Total Steelhead	Date Sampled	Total Steelhead
1	pool	1-Aug-95	31	31-Oct-95	13
2+3	riffle/pool	1-Aug-95	17	31-Oct-95	10
5	pool	1-Aug-95	10	31-Oct-95	0
6	pool	1-Aug-95	41	31-Oct-95	21
19	pool	1-Aug-95	21	31-Oct-95	27
34	riffle/pool	1-Aug-95	10	31-Oct-95	3
35	pool	1-Aug-95	44	31-Oct-95	16

Lower Santa Rosa Creek (above and below Willowside bridge)					
Habitat Unit	Habitat Type	Summer 1995 survey		Fall 1995 survey	
		Date Sampled	Total Steelhead	Date Sampled	Total Steelhead
1	glide/pool	4-Aug-95	0	26-Oct-95	0
8(upper)	pool	4-Aug-95	0	26-Oct-95	0
18	riffle	4-Aug-95	0	26-Oct-95	0
21	riffle/glide	4-Aug-95	0	26-Oct-95	0
24A	riffle/glide	4-Aug-95	nh	26-Oct-95	nh
24	riffle/glide	4-Aug-95	0	26-Oct-95	0
32(upper)	glide/pool	4-Aug-95	0	26-Oct-95	0
34	glide/pool	4-Aug-95	0	26-Oct-95	0

Appendix 4-1-2. Mark West Creek Juvenile Abundance Data, 1995.

Upper Mark West Creek (Alpine Road)					
		Summer 1995 Survey		Fall 1995 Survey	
Habitat Unit	Habitat Type	Date Sampled	Total Steelhead	Date Sampled	Total Steelhead
1	glide	24-Jul-95	33	2-Nov-95	55
2	rifle	24-Jul-95	15	2-Nov-95	11
3	pool	24-Jul-95	7	2-Nov-95	11
5	pool/glide	24-Jul-95	18	2-Nov-95	9
7	pool	24-Jul-95	3	2-Nov-95	6
7A	pool	24-Jul-95	19	2-Nov-95	8
8	pool	24-Jul-95	95	2-Nov-95	98

Middle Mark West Creek (downstream from Mark West Lodge)					
		Summer 1995 Survey		Fall 1995 Survey	
Habitat Unit	Habitat Type	Date Sampled	Total Steelhead	Date Sampled	Total Steelhead
12	pool/glide	31-Jul-95	5	1-Nov-95	4
18	glide	31-Jul-95	5	1-Nov-95	2
20	pool	31-Jul-95	1	1-Nov-95	0
22	pool	31-Jul-95	23	1-Nov-95	16
24	pool/glide	31-Jul-95	7	1-Nov-95	6
26(middle)	glide	31-Jul-95	0	1-Nov-95	0
26(upper)	pool	31-Jul-95	1	1-Nov-95	1
26A	pool	31-Jul-95	2	1-Nov-95	0

Lower Mark West Creek (River Road Bridge to Cunningham Ranch)					
		Summer 1995 Survey		Fall 1995 Survey	
Habitat Unit	Habitat Type	Date Sampled	Total Steelhead	Date Sampled	Total Steelhead
27	pool	27-Jul-95	0	26-Oct-95	1
28 (lower)	rifle	27-Jul-95	0	26-Oct-95	0
28 (upper)	rifle	27-Jul-95	0	26-Oct-95	0
32	glide	27-Jul-95	2	26-Oct-95	0
34	glide	27-Jul-95	0	26-Oct-95	0
36	pool	27-Jul-95	1	26-Oct-95	0

Appendix 4-1-3. Maacama Creek Juvenile Abundance Data, 1995.

Upper Maacama/Redwood Creek (Redwood Cr., Hwy 128 to Yellowjacket)							
		Summer 1995 survey			Fall 1995 survey		
Habitat Unit	Habitat Type	Date Sampled	Total Coho	Total Steelhead	Date Sampled	Total Coho	Total Steelhead
1L	pool	25-Jul-95	0	18	24-Oct-95	0	5
2L	glide	25-Jul-95	0	47	24-Oct-95	0	26
3L	pool	25-Jul-95	0	67	24-Oct-95	0	35
1	glide	25-Jul-95	0	106	24-Oct-95	0	183
3	pool	25-Jul-95	0	76	25-Oct-95	0	34

Middle Maacama/Redwood Creek (Camp Maacama)							
		Summer 1995 survey			Fall 1995 survey		
Habitat Unit	Habitat Type	Date Sampled	Total Coho	Total Steelhead	Date Sampled	Total Coho	Total Steelhead
2	pool	2-Aug-95	0	0	25-Oct-95	0	2
3	pool	2-Aug-95	0	4	25-Oct-95	0	1
4	rifle	2-Aug-95	0	1	25-Oct-95	0	2
5	pool	2-Aug-95	0	12	25-Oct-95	0	7
9A	pool	2-Aug-95	0	1	25-Oct-95	0	6
10(upper)	glide	2-Aug-95	0	4	25-Oct-95	0	0
20(lower)	pool	2-Aug-95	0	6	25-Oct-95	0	0
20(upper)	pool	2-Aug-95	0	7	25-Oct-95	0	5

Lower Maacama/Redwood Creek (Chalk Hill Road)							
		Summer 1995 survey			Fall 1995 survey		
Habitat Unit	Habitat Type	Date Sampled	Total Coho	Total Steelhead	Date Sampled	Total Coho	Total Steelhead
1	pool	26-Jul-95	0	0	27-Oct-95	0	24
3,4	pool	21-Jul-95	0	19	27-Oct-94	0	0
7	pool/glide	21-Jul-95	0	2	27-Oct-94	0	1
8(upper)	pool	21-Jul-95	0	2	27-Oct-94	0	0
9	pool	21-Jul-95	0	0			
11	pool	21-Jul-95	0	2	27-Oct-94	0	5
13	pool/glide	26-Jul-95	0	19	27-Oct-94	0	41

Appendix 4-1-4. Green Valley Creek Juvenile Abundance Data, 1995.

Middle Green Valley Creek (Allen Ranch)							
Habitat Unit	Habitat Type	Summer 1995 survey			Fall 1995 survey		
		Date Sampled	Total Coho	Total Steelhead	Date Sampled	Total Coho	Total Steelhead
6	pool	18-Jul-95	12	15	30-Oct-95	10	2
13(lower)	pool	18-Jul-95	9	24	30-Oct-95	3	2
13(upper)	pool	18-Jul-95	7	24	30-Oct-95	7	11
14	pool	18-Jul-95	8	36	30-Oct-95	7	40
15	pool	18-Jul-95	6	18	30-Oct-95	6	14
17(lower)	pool	18-Jul-95	15	21	30-Oct-95	18	3

Appendix 4-3-1. Santa Rosa Creek: Total numbers of fish and other vertebrates captured by seine in each index zone, 1995

		Summer 1995			Fall 1995		
		Upper	Middle	Lower	Upper	Middle	Lower
Petromyzontidae							
Brook lamprey	<i>Lampetra sp.</i>					1	
Ammocete larva	<i>Lampetra sp.</i>					1	
Salmonidae							
Steelhead juvenile	<i>Onchormynchus mykiss</i>	159	174	9	149	90	
Cyprinidae							
California roach	<i>Hesperoleucus symmetricus</i>		111	303		618	291
Sacramento squawfish	<i>Ptychocheilus grandis</i>			10			33
Catostomidae							
Sacramento sucker	<i>Catostomus occidentalis</i>		6	10		4	48
Ictaluridae							
Brown bullhead	<i>Ictalurus nebulosus</i>		2				
Poeciliidae							
Mosquitofish	<i>Gambusia affinis</i>			15			32
Gasterosteidae							
Threespine stickleback	<i>Gasterosteus aculeatus</i>			9			2
Cottidae							
Coastrange sculpin	<i>Cottus aleuticus</i>	15	33	6	19	16	2
Other Vertebrata							
Northwestern salamander	<i>Ambystoma gracile</i>				1		
Bullfrog tadpole	<i>Rana catesbeiana</i>						2

Appendix 4-3-2. Mark West Creek: Total numbers of fish and other vertebrates captured by seine in each index zone, 1995

		Summer 1995			Fall 1995		
		Upper	Middle	Lower	Upper	Middle	Lower
Salmonidae							
Steelhead juvenile	<i>Onchorhynchus mykiss</i>	190	44	3	198	29	1
Cyprinidae							
California roach	<i>Hesperoleucus symmetricus</i>	22	44	341	71	105	129
Catostomidae							
Sacramento sucker	<i>Catostomus occidentalis</i>			45		10	18
Gasterosteidae							
Threespine stickleback	<i>Gasterosteus aculeatus</i>			187			164
Centrarchidae							
Bluegill	<i>Lepomis macrochirus</i>	8	1		2		
Embiotocidae							
Tule perch	<i>Hysterocarpus traski</i>	120	17	6	160	80	
Cottidae							
Coastrange sculpin	<i>Cottus aleuticus</i>	11	4	41	8	2	6
Other Vertebrata							
Bullfrog	<i>Rana catesbeiana</i>	1					
Bullfrog tadpole	<i>Rana catesbeiana</i>				2		

Appendix 4-3-3. Maacama Creek: Total numbers of fish and other vertebrates captured by seine in each index zone, 1995

		Summer 1995			Fall 1995		
		Upper	Middle	Lower	Upper	Middle	Lower
Salmonidae							
Steelhead juvenile	<i>Onchorhynchus mykiss</i>	314	35	44	283	23	71
Cyprinidae							
California roach	<i>Hesperoleucus symmetricus</i>		150	265		95	315
Sacramento squawfish	<i>Ptychocheilus grandis</i>		26	87		37	81
Catostomidae							
Sacramento sucker	<i>Catostomus occidentalis</i>		84	36		60	182
Gasterosteidae							
Threespine stickleback	<i>Gasterosteus aculeatus</i>		460	207		320	401
Centrarchidae							
Bluegill	<i>Lepomis macrochirus</i>	6		6	5		
Cottidae							
Coastrange sculpin	<i>Cottus aleuticus</i>	27	14		15	3	
Other Vertebrata							
Bullfrog tadpole	<i>Rana catesbeiana</i>	1				2	13
Red-legged frog tadpole	<i>Rana aurora</i>						27

Appendix 4-3-4. Green Valley Creek: Total numbers of fish and other vertebrates, and of the California freshwater shrimp, captured by seine, 1995.

		1995	
		Summer	Fall
Petromyzontidae			
Brook lamprey	<i>Lampetra sp.</i>	9	2
Salmonidae			
Coho salmon juvenile	<i>Onchorhynchus kisutch</i>	57	51
Steelhead juvenile	<i>Onchorhynchus mykiss</i>	138	72
Gasterosteidae			
Threespine stickleback	<i>Gasterosteus aculeatus</i>	22	75
Centrarchidae			
Bluegill	<i>Lepomis macrochirus</i>	8	4
Cottidae			
Unidentified sculpin	<i>Cottus sp.</i>	1	
Coastrange sculpin	<i>Cottus aleuticus</i>	36	48
Invertebrates			
California freshwater shrimp	<i>Syncaris pacifica</i>	4	26

Appendix 4-4. Fork length of young-of-the-year steelhead and coho, 1995.

		Young-of-the-year Steelhead							
		Santa Rosa Creek		Mark West Creek		Maacama Creek		Green Valley Creek	
		summer	fall	summer	fall	summer	fall	summer	fall
Upper	Number of fish	154	142	182	189	305	273		
	Fork Length, mm	55.8	66.2	72.7	85.0	64.3	71.3		
	Standard Deviation	11.4	11.8	11.0	10.9	13.5	12.9		
Middle	Number of fish	166	86	310	25	333	20	138	71
	Fork Length, mm	78.2	90.7	81.0	98.4	78.1	103.7	70.8	75.0
	Standard Deviation	13.9	16.0	11.1	11.0	7.7	11.3	13.5	15.8
Lower	Number of fish	0	0	2	1	43	67		
	Fork Length, mm			107.5	63.0	77.5	107.6		
	Standard Deviation			6.4		10.7	14.2		
Total		320	228	494	205	681	367	138	71

		Young-of-the-year Coho Salmon							
		Santa Rosa Creek	Mark West Creek	Maacama Creek	Green Valley Creek				
Upper	Number of fish	18	20	15	10				
	Fork Length, mm	72.9	74.3	70.7	72.0				
	Standard Deviation	10.0	11.1	10.1	10.8				
Middle	Number of fish	10	10	10	10				
	Fork Length, mm								
	Standard Deviation								
Lower	Number of fish								
	Fork Length, mm								
	Standard Deviation								

Appendix 4-5. Summer growth of young-of-the-year steelhead and coho, 1995.

		Steelhead							
		Mean Length, mm		Growth, mm	Summer Date	Fall Date	Days	Growth, mm/Day	
		Summer	Fall	mm	Date	Date			
TOTAL	Santa Rosa Creek	Upper	55.8	66.2	10.4	20-Jul-95	23-Oct-95	95	0.109
		Middle	78.2	90.7	12.5	1-Aug-95	31-Oct-95	91	0.137
		Lower							
TOTAL	Mark West Creek	Upper	72.7	85.0	12.2	24-Jul-95	2-Nov-95	101	0.121
		Middle	81.0	98.4	17.4	31-Jul-95	1-Nov-95	93	0.187
		Lower	0.0	0.0	0.0				
MIDDLE	Maacama Creek	Upper	64.3	71.3	6.9	25-Jul-95	24-Oct-95	91	0.076
		Middle	78.1	103.7	25.5	2-Aug-95	25-Oct-95	84	0.304
		Lower	77.5	107.6	30.1	23-Jul-95	27-Oct-95	96	0.313
TOTAL	Green Valley Creek	Upper	0	0	0				
		Middle	70.8	75	4.2	18-Jul-95	30-Oct-95	104	0.040
		Lower	0	0					

Appendix 4-6. Fork length in fall of young-of-the-year steelhead and coho, 1993-1995.

		Santa Rosa Creek			Mark West Creek			Maacama Creek			Green Valley Creek		
		1993	1994	1995	1993	1994	1995	1993	1994	1995	1993	1994	1995
Upper	Number of fish	75	46	142	32	2	189	126	1	273			
	Fork Length, mm	66.7	63.5	66.2	83.8	83.5	85.0	87.5	80.0	71.3			
	Standard Deviation	10.6	7.0	11.8	12.3	0.7	10.9	7.3		12.9			
Middle	Number of fish	41	24	86	17	56	25	1	0	20	13	4	71
	Fork Length, mm	83.2	77.7	90.7	68.9	62.3	98.4	95		103.7	78.4	75.8	75.0
	Standard Deviation	11.1	6.7	16.0	7.4	8.8	11.0			11.3	14.6	6.2	15.8
Lower	Number of fish	0	0	0	17	2	1	16	0	67			
	Fork Length, mm				86.9	85.0	63.0	98.1		107.6			
	Standard Deviation				8.8	5.7		6.2		14.2			

Upper Santa Rosa Creek				Middle Santa Rosa Creek			
comparison	t	df	sig.	comparison	t	df	sig.
1993 vs. 1994	1.82	119	n.s.	1993 vs. 1994	2.20	63	*
1993 vs. 1995	0.31	215	n.s.	1993 vs. 1995	-2.70	125	**
1994 vs. 1995	-1.47	186	n.s.	1994 vs. 1995	-3.88	108	**

Upper Mark West Creek				Middle Mark West Creek			
comparison	t	df	sig.	comparison	t	df	sig.
1993 vs. 1994	0.03	32	n.s.	1993 vs. 1994	2.8	71	**
1993 vs. 1995	-0.57	219	n.s.	1993 vs. 1995	-9.65	40	**
1994 vs. 1995	-0.19	189	n.s.	1994 vs. 1995	-15.76	79	**

Upper Maacama Creek				Lower Maacama Creek			
comparison	t	df	sig.	comparison	t	df	sig.
1993 vs. 1995	13.15	397	**	1993 vs. 1995	-2.61	81	**

Middle Green Valley Creek			
comparison	t	df	sig.
1993 vs. 1994	0.34	15	n.s.
1993 vs. 1995	0.72	82	n.s.
1994 vs. 1995	0.10	73	n.s.

t = value of t-statistic

df = degrees of freedom

* = significant at 5% level (2-tailed test)

** = significant at 1% level (2-tailed test)