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SUMMARY

Job 1. A Review of Resident and Native Trout Management in Oregon

Objectives for FY 1992

We had three objectives for our review of resident and native trout in fiscal year 1992:

1. Map and analyze spatial distribution of hatchery releases in selected Oregon watersheds from 1925 to the present.

2. Review available literature and summarize current knowledge of the life history, habitat requirements, and distribution of Oregon stocks of coastal cutthroat trout (*Oncorhynchus clarki clarki*).

3. Summarize results of Job 1 in a series of reports concerning the history of trout management and provide recommendations for conservation of native stocks.

Accomplishments in FY 1992

Drafts of reports concerning all objectives under Job 1 are in various stages of completion. Results are not repeated in this progress report, but are or soon will be available in the following documents. Results from Objective 1 above has been summarized in a draft Oregon Department of Fish and Wildlife information report that is undergoing peer review and editing. The report is entitled "Evaluating Spatial Patterns of Fish Management from Historical Records: Release of Hatchery Trout in Four Oregon Drainage Basins." Results of Objective 2 are contained in a status report for anadromous salmonids of Oregon coastal basins (Nickelson et al. 1992). Two drafts of the final reports under Objective 3 also were prepared. The first is an overview of the history of fish management in the United States and Oregon and the implications for future conservation of native fishes. The second report is a history of the 19th-century fish culture movement in the United States and its influence on scientific ideas in fisheries. A third report is in progress. It will summarize the history of trout management in Oregon and provide recommendations for conservation of native stocks. All three reports are scheduled for completion in FY 1993.

Job 2. Determine Diversity Within Oregon's Rainbow Trout Populations

Objectives for FY 1992

1. Determine diversity within Oregon's rainbow trout populations using life history characteristics.

2. Determine diversity within Oregon's rainbow trout populations using biochemical characteristics.

3. Develop homologous (within stock) and heterologous (between stock) populations of native rainbow trout for determination of genetic or environmental control of life history differentiation.

Accomplishments in FY 1992

1. We installed fyke traps and monitored upstream passage of rainbow trout at Link River, Keno, and J.C. Boyle dams during October, November, and December.

2. We installed a trap in Spencer Creek to capture downstream migrant juvenile rainbow trout. The trap was operated October through November and March through May.

3. We used a blocking seine and fyke net to capture and sample rainbow trout spawning in Spring Creek and the Williamson River. Fish on the Williamson were sampled in December and January; those in Spring Creek were sampled those same months and then through May at six-week intervals.

4. We conducted laboratory experiments that determined physiological differences between strains of rainbow trout from a common river basin.

Findings in FY 1992

1. The estimated number (70) of adult Klamath River rainbow trout that passed upstream over J.C. Boyle Dam in 1991 was less than 2% of the number reported one year after construction of the dam. The 1991 number was also the lowest estimated during the four-year span of this project.

2. Spencer Creek again proved to be a major source of recruitment for the upper Klamath River rainbow trout population above J.C. Boyle Dam. Although some marked juveniles were recaptured directly below J.C. Boyle Dam, evidence to date indicates that most Spencer Creek juveniles rear to adulthood in the Keno reach of the Klamath River. Age-0 and age-1+ juvenile rainbow trout tended to move downstream out of Spencer Creek earlier in 1992 than in 1991.

3. Rainbow trout that spawned during December and January in Spring Creek again were larger than those that spawned during the same time at Kirk Springs on the lower Williamson River. Recaptures of tagged rainbow trout indicate that mature fish that spawn in either location return to the same location to spawn in subsequent years. These data support the hypothesis that both populations are reproductively isolated from each other.

4. Laboratory experiments showed that physiological differences existed between strains of rainbow trout although those strains inhabited the same basin. Those differences were reflected in different reactions to acute stress events and changed environmental conditions, and underscore the importance of protecting all strains within a basin.

Job 3. Hatchery Supplementation Effects on Oregon's Rainbow Trout Populations

Objectives for FY 1992

Determine if native Metolius River rainbow trout have introgressed or been otherwise affected adversely by introduced hatchery trout.

Accomplishments in FY 1992

1. We placed thermographs that recorded water temperatures at two sites in Lake Creek and three sites in the Metolius River from May through September.

2. We conducted monthly snorkel surveys of the upper 6.4 km of the Metolius River.

Findings in FY 1992

1. Rainbow trout in the Metolius River began to spawn in November and continued into July. The peak count of new trout redds occurred during December.

2. Age-0 rainbow trout were found at abundances nearly 800% above those observed the previous year. Most age-0 and older juveniles occurred from the source to the Blue Hole, and most disappeared from the study area during winter months.

3. Relatively few wild adult rainbow trout were counted in the upper 6.4 km of the Metolius River. Greater numbers were counted during winter months, which suggests a spawning migration from the lower river. Most wild adults were observed in areas not stocked with hatchery rainbow trout.

4. Hatchery rainbow trout were observed upstream from locations where they were stocked, particularly during times when many wild rainbow trout were spawning.

JOB 2. DETERMINE DIVERSITY WITHIN OREGON'S RAINBOW TROUT POPULATIONS

Introduction

Activities described here reflect the fifth year of a five-year effort described in Goal II of the Native Trout Project Proposal (Buchanan et al. 1988). A complete description of the diversity of Oregon's native trout is beyond the scope of this study. We have chosen to limit efforts primarily to rainbow trout *Oncorhynchus mykiss* in the Deschutes and upper Klamath basins.

Materials and Methods

Life History Characteristics

Fyke traps to capture adult trout that moved upstream were installed in fish ladders at Link River, Keno, and J.C. Boyle dams (Figure 1). Trapping continued from 09 October through 27 December of the reporting period. The traps were operated Monday through Friday during periods when many fish were captured and at least weekly during the winter when fish movement was limited. A downstream weir and trap was installed in Spencer Creek 0.8 km from the mouth, as in previous years (Buchanan et al. 1990, 1991). The downstream trap was operated from 01 October to 27 November 1991 and from 09 March through 20 May 1992. Fry and juvenile trout were initially separated by size. We will analyze their scales to verify this separation. A downstream screw trap (2.4 m in diameter) was also installed in the Klamath River immediately below the J.C. Boyle fish bypass outfall. This screw trap was operated continuously from 01 October to 16 October 1991, when it was removed for repairs. The trap was replaced 30 October and fished continually until 20 December 1991, when it was removed for the winter. This screw trap was again installed at the same site 27 February 1992 and fished continuously until 21 May, when it was permanently removed for additional repairs.

We compared life history characteristics among rainbow trout that spawn in two areas that are in close proximity to one another and not separated by physical barriers. Mature rainbow trout were captured from Spring Creek and from Kirk Springs on the Williamson River (located approximately 10 km upstream from the mouth of Spring Creek). Trout were captured from Kirk Springs on 18 December 1991 and 15 January 1992 and from Spring Creek on 19 December 1991 and 17 January 1992 using the trapping techniques reported in Hemmingsen et al. (1988). Rainbow trout scale samples were also taken from Spring Creek and Kirk Springs trout to determine both age and number of previous spawnings.

Development of Homologous and Heterologous Populations of Rainbow Trout

To produce progeny for tests of genetic differences in disease resistance, performance, and behavior, 15 male and 9 female rainbow trout from Spring Creek were mated with 15 males and 7 females from Deming Creek. Both streams are found in the Upper Klamath Lake Basin. Mature rainbow trout were collected using the techniques and methods reported in Hemmingsen et al. (1988) and Buchanan et al. (1990). Matings were conducted at Klamath Hatchery in a manner that allowed all possible combinations. Eyed eggs were

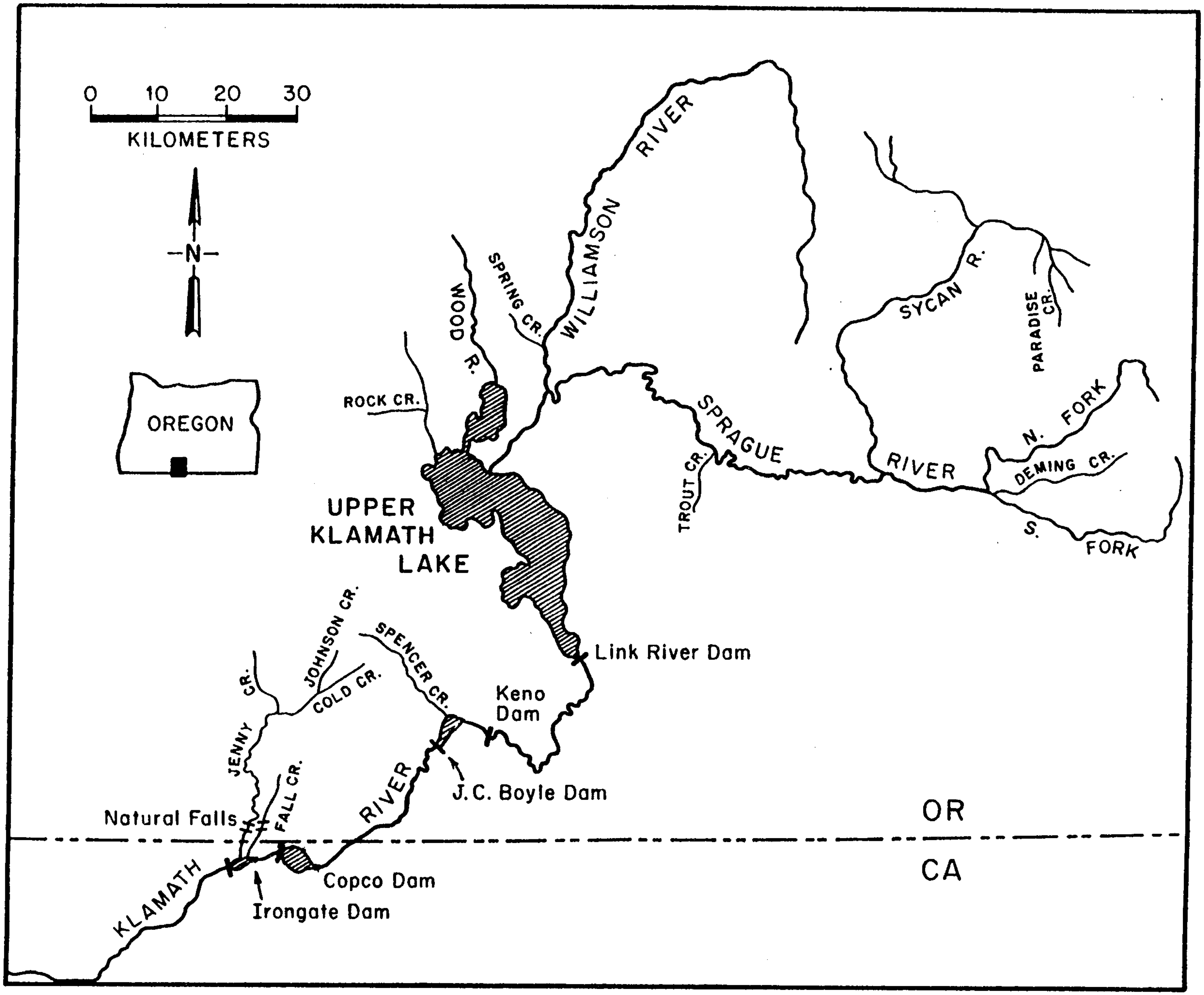

Figure 1. Map of the upper Klamath River Basin.

transferred to Oregon State University where the offspring were subsequently raised.

Differences in the ability to respond to stress events may affect the survival and fitness of fish in the wild. Genetic differences in the stress response in those offspring mentioned above were compared by rearing and testing in a common controlled environment. The response of the two pure strains and a hybrid strain (offspring of Spring Creek dams X Deming sires) was compared after acclimation to three temperatures (14°C, 18°C, and 22°C) using three different measures:

1) Time required for a startled fish to find cover in a standard laboratory stream after two acute stress events an hour apart.

2) Rates of oxygen consumption immediately and 18 hours after an acute stress event.

3) Plasma coritsol levels 18 hours after an acute stress event.

The acute stressor in each case was standardized by netting the fish and suspending it in the air for 30 seconds. Measurements of time required to find cover after multiple stress events were made by putting a stressed fish in a gated, protected portion of the downstream end of an open trough. After giving the fish 60 seconds to adjust, it was startled with bright lights and sound and allowed to swim to the shaded, cobble-filled upstream end of the trough. Measurements of oxygen consumption were made individually in 1.2-1.4 liter static respirometers made from opaque PVC tubing. Measurements of plasma cortisol were made on fish individually enclosed in opaque flow-through respirometers 18 hours after enclosure.

Results and Discussion

Life History Characteristics

The trap at Link River Dam operated 313 hours during October, 169 hours during November, and 392 hours during December 1991 and captured no adult rainbow trout attempting to pass from the Klamath River into Upper Klamath Lake. The trap at Keno Dam operated 975 hours and captured only 13 rainbow trout (Table 1). The trap at J.C. Boyle Dam operated 871 hours and captured only 6 rainbow trout (Table 2). We compared our estimates of monthly trout passage at J.C. Boyle Dam in 1988, 1989, 1990, and 1991 with those reported in 1959 (Hanel and Gerlach 1964; Table 3). The number passed in 1991 was the lowest estimated during the four-year span of this project, and was less than 2% of that reported one year after the construction of J.C. Boyle Dam.

The downstream trap and weir in Spencer Creek operated 1,755 hours and captured 1,210 fry, 11,865 juvenile (yearling and older), and 67 adult rainbow trout (Table 4). Like the previous year, we observed downstream movement of fry during October and November. Similar fry movement began again in May, unlike the previous year when no downstream movement was detected until June (Buchanan et al. 1991). Likewise, preliminary analysis indicates juvenile rainbow trout tended to move downstream out of Spencer Creek in greater

Table 1. Rainbow trout captured in the upstream trap at Keno Dam, October through December 1991.

Date	Number of fish trapped	Number of fish tagged	Hours of trapping
October	7	7	297
November	6	6	283
December	0	--	395
TOTAL	13	13	

Table 2. Rainbow trout captured in the upstream trap at J.C. Boyle Dam, October through December 1991.

Date	Number of fish trapped	Number of fish tagged	Hours of trapping
October	6	6	295
November	0	--	187
December	0	--	389
TOTAL	6	6	

numbers about one month earlier in 1992 than in 1991. The downstream screw trap in the Klamath River below J.C. Boyle Dam operated 3,291 hours and captured 45 unmarked juvenile, 6 marked juvenile (originally captured in the Spencer Creek downstream weir), and 2 adult rainbow trout (Table 5).

We captured and sampled 101 adult rainbow trout from Spring Creek and 141 adult rainbow trout from Kirk Springs on the Williamson River. Similar to results for the spawning populations of the previous year (Buchanan et al. 1991), spawning rainbow trout sampled at Spring Creek were significantly larger (Mann-Whitney test, $P < 0.001$) than spawning rainbow trout sampled at Kirk Springs (Table 6). Preliminary tagging returns indicate that mature rainbows captured in either location return to the same location in subsequent spawning runs (Table 7). To date we have found no Spring Creek spawners that have strayed to Kirk Springs, nor Kirk Springs spawners that have strayed to Spring Creek. This suggests that the two populations are reproductively isolated in spite of the absence of any physical barrier between the two spawning sites.

Table 3. Expanded monthly estimates of upstream passage of rainbow trout at J.C. Boyle Dam in 1959 (Hanel and Gerlach 1964) compared to 1988 through 1991.

Month	1959	1988	1989	1990	1991
January	--	--	0	0	0
February	--	0[a]	0	0	0
March	--	20	5	51	0
April	--	92	135	207	35
May	289[a]	20	64	12	5
June	532	11	15	16	7
July	48	5	2	5	0
August	333	18	46	27	6
September	1,980	67	147	59	2
October	2,252	227	166	33	15
November	95	47	8	2	0
December	0	0	0	0	0
TOTAL	5,529	507	588	412	70

[a] *Estimates were made for the second half of the month only.*

Table 4. Rainbow trout captured in the downstream trap at the Spencer Creek weir, October and November 1991 and March through May 1992.

Date	Number of rainbow trout			Hours trap operated
	Fry	Juveniles	Adults	
10/01-10/15	61	4	0	115
10/16-10/31	377	482	0	407
11/01-11/18	315	108	0	162
11/19-11/30	22	11	0	220
03/01-03/14	0	80	8	95
03/15-03/31	0	499	12	194
04/01-04/14	0	2,618	23	205
04/15-04/30	0	3,716	9	167
05/01-05/14	350	4,265	15	140
05/15-05/21	85	82	0	50
Total	1,210	11,865	67	

Table 5. Rainbow trout captured by a downstream screw trap in the Klamath River immediately below the J.C. Boyle fish bypass from October 1991 through December 1991 and late February through May 1992.

Date	Number of rainbow trout			Hours trap operated
	Juveniles unmarked	Juveniles marked[a]	Adults	
10/01-10/16	0	0	0	116
10/17-10/30	0	0	0	20
11/01-11/14	10	1	0	351
11/15-11/30	6	0	0	314
12/01-12/14	4	0	0	384
12/15-12/20	0	0	0	167
02/27-02/28	3	0	1	71
03/01-03/14	3	0	0	339
03/15-03/31	1	0	0	332
04/01-04/14	5	2	0	333
04/15-04/30	9	3	0	334
05/01-05/14	3	0	0	338
05/15-05/21	1	0	1	192
Total	45	6	2	

[a] *Marked juvenile rainbow trout were wild trout that were originally captured at Spencer Creek and fin marked.*

Table 6. Descriptive statistics for length distributions of spawning rainbow trout sampled in Spring Creek and at Kirk Springs in the Williamson River.

Group	N	Length (cm)				
		Min.	Max.	Mean	Median	St. dev.
1990-91						
Kirk Springs	240	38.8	63.0	50.2	49.5	4.4
Spring Creek	191	37.2	72.5	54.8	54.5	6.7
1991-92						
Kirk Springs	141	32.3	66.5	50.7	51.0	5.8
Spring Creek	101	33.9	70.5	55.5	56.8	7.8

Table 7. Recaptures of spawning adult rainbow trout from Spring Creek (SC) and Kirk Springs (KS). Fork lengths are in cm.

Tag no.	Tagging Site	Tagging Date	Tagging Length	Recapture Site	Recapture Date	Recapture Length	Days to recapture	Length gain
0421	KS	01/15/91	57.4	LRD[a]	12/14/91	--	--	
0580	LRD	05/15/89	35.6	KS	12/18/91	51.0	947	15.4
0922	SC	04/26/89	47.0	SC	04/26/90	50.9	365	3.9
0940	SC	05/03/89	55.0	SC	04/26/90	57.0	358	2.0
0941	SC	05/03/89	48.2	SC	05/10/90	47.8	372	0.0
0949	SC	05/03/89	48.3	SC	05/10/90	50.7	372	2.4
0321	SC	05/10/90	55.3	SC	05/13/91	60.8	368	5.5
0772	SC	12/18/90	57.2	SC	12/19/91	57.6	366	0.4
0855	SC	01/16/91	55.5	SC	12/19/91	57.8	337	2.3
0844	SC	01/16/91	55.5	SC	12/19/91	56.2	337	0.7
0877[b]	SC	01/16/91	46.5	SC	12/19/91	48.0	337	1.5
4543	SC	04/03/91	42.8	SC	12/19/91	47.0	260	4.2
0375	SC	02/27/91	52.0	SC	01/17/92	53.2	324	1.2
0358	SC	02/27/91	62.2	SC	02/26/92	64.0	364	1.8
3358	SC	04/12/90	50.2	SC	02/26/92	51.8	805	1.6
4555	SC	04/03/91	53.2	SC	03/25/92	55.2	356	2.0
2932[c]	SC	05/13/91	60.6	SC	05/19/92	63.0	371	2.4

[a] *The fish recaptured on 12/14/91 was a mortality washed against the trash racks at Link River Dam (LRD).*

[b] *Fish Number 877 was recaptured twice, first on 12/19/91 then again on 12/15/92.*

[c] *Fish Number 2932 was recorded as a male when tagged and as a spawned female when recaptured. All other fish listed were females.*

Development of Homologous and Heterologous Populations of Rainbow Trout

Time-to-Find-Cover

At 14°C, all Spring Creek fish responded to stimuli to find cover after 90 seconds, whereas about 10% of Spring X Deming and 20% of Deming Creek fish did not. Differences in those proportions were significant ($P \leq 0.05$). At 18°C, 35% of Deming Creek fish failed to find cover after 90 seconds whereas only 10-12% of the fish of either Spring Creek or Spring X Deming strains did not. No significant differences could be detected among strains at 22°C; 10-15% of the fish of all strains failed to find cover.

Although only healthy fish were used initially, nearly all fish that failed to find cover died within 48 hours of the experiment. This result suggested that the behavior reflected differences in the ability to compensate for the multiple stress events and was not a behavioral "hiding" response.

Plasma Cortisol Levels

Eighteen hours after an acute stress event at 14°C, only fish of the Spring X Deming strain had plasma cortisol levels significantly ($P \leq 0.05$) elevated above control levels. Eighteen hours after an acute stress event at 18°C, Deming Creek fish had plasma cortisol levels that were significantly higher than those of Spring Creek fish and control (non-stressed) fish. No other among-strain differences were detected. At 22°C however, all strains had plasma cortisol levels that were elevated significantly above control levels. This suggests that recovery from an acute stress event is slower for all fish at higher temperatures, and Deming Creek rainbow trout are less able to recovery immediately at 18°C than are rainbow trout of other strains.

Oxygen Consumption

Significant differences in oxygen consumption rates were detected among strains at all three temperatures immediately and 18 hours after an acute stress event. These differences show a complex pattern of genotype-environment interactions; the same strains responded differently to different environments. Consequently, the relative performance of strains at 14°C does not necessarily reflect the relative performance at 18°C or 22°C. This clearly has management importance. Even within a basin, for example, choice of local brood stocks for supplementation of other streams in the basin must be based on more than just their expected performance under one environmental condition, whether that condition is average or extreme. Furthermore, these results underscore the importance of protecting all strains within a basin against loss of the diversity they provide.

JOB 3. HATCHERY SUPPLEMENTATION EFFECTS ON OREGON'S RAINBOW TROUT POPULATIONS

Introduction

Activities described here reflect the fifth year of a five-year effort we described in Goal III of the Native Trout Project Proposal (Buchanan et al. 1988). Previously, we reported that the infection by *Ceratomyxa shasta* in susceptible hatchery rainbow trout decreased from greater than 90% in Suttle Lake to 0% at the mouth of Lake Creek (Figure 2), and that the parasite would not eliminate holdover catchable rainbow trout in the Metolius River (Buchanan et al. 1991). We attempted to identify environmental factors in the upper Metolius River that may prevent *C. shasta* infection.

Clear water and relatively stable flow in the Metolius River allow observation by snorkel techniques at all months of the year without injury to fish. We conducted snorkel surveys at intervals as close to monthly as practical to gather life history information on wild rainbow trout in the Metolius River. Such information would enable comparison with other rainbow trout populations, particularly those in other large spring-fed streams. In addition, observations of fish distribution may allow us to develop hypotheses about other effects of supplementation with hatchery trout. That is relevent particularly in regard to previously identified genetic consequences of such supplementation (Currens 1987; Buchanan et al. 1991.)

Materials and Methods

In late May 1992, we placed two thermographs in Lake Creek. One was located about 1.6 km below the outlet of Suttle Lake (KM 6.5), and the other was located near the mouth. At the same time, we placed three thermographs in the Metolius River (Figure 2), one near the spring source, one at Gorge Campground, and one at the confluence with Lake Billy Chinook. Thermographs recorded water temperatures hourly throughout the report period.

Snorkeling surveys continued on the upper 6.4 km of the Metolius River from its spring source to Gorge Campground. The 6.4 km of river was divided into 14 reaches (Buchanan et al. 1991) and all were surveyed 11 times during the report period. For consistency of bias, the same two snorkelers conducted the entire set of surveys. Generally, each observed the water column from one river bank to the center of the river, and snorkelers alternated sides of the river on successive surveys. Counts of observations in the following categories were recorded for each river reach on plastic tablets: new trout redds; adult ($\geq$ 20 cm) or juvenile (< 20 cm) bull trout, brown trout, brook trout, and whitefish; wild rainbow trout fry, juveniles 5-9 cm or 10-19 cm, and adults ($\geq$ 20 cm); catchable hatchery rainbow trout; and holdover hatchery rainbow trout. Hatchery rainbow trout were distinguished from wild rainbow trout by the absence of an adipose fin (clipped) or by a deformed dorsal fin.

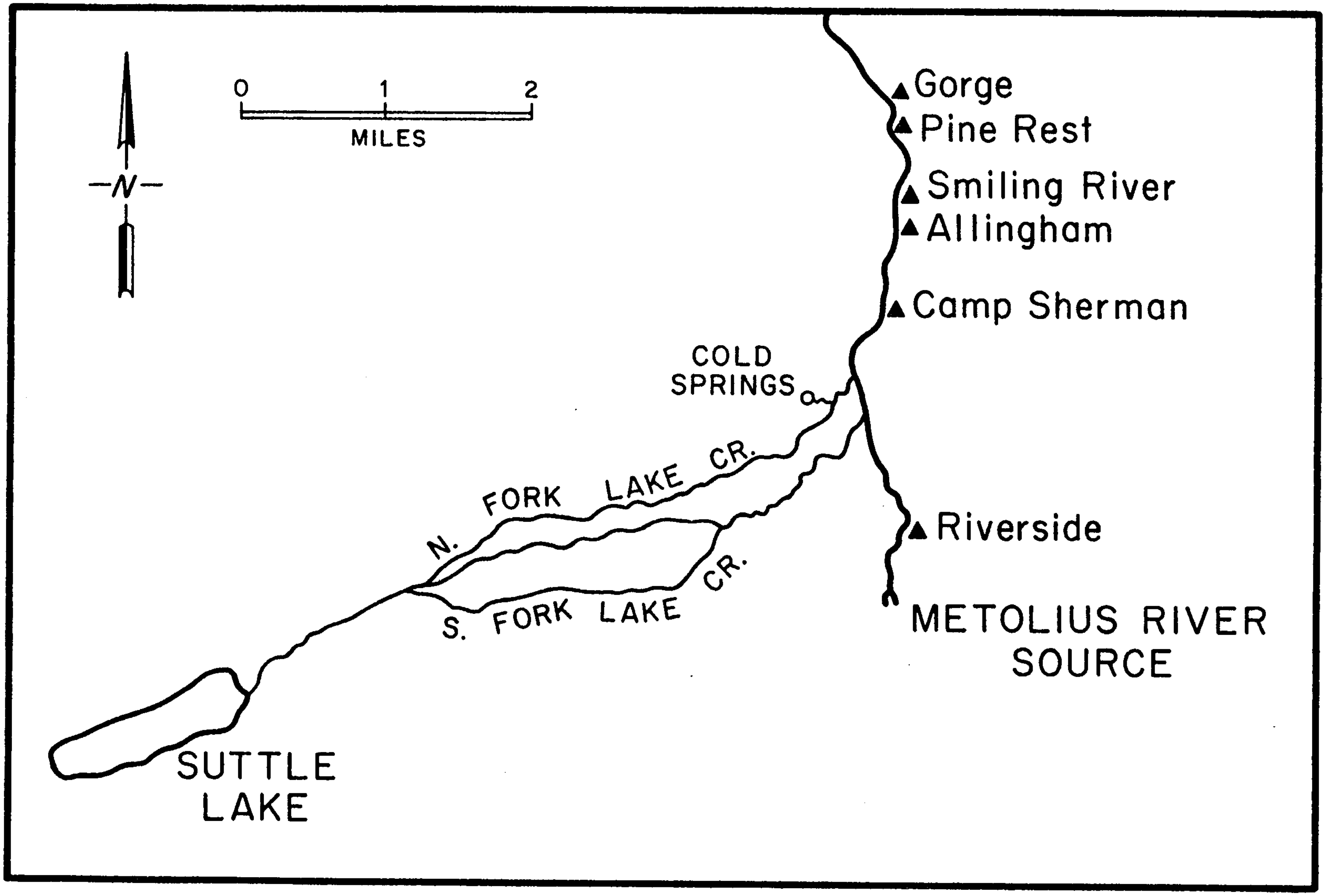

Figure 2. Map of the Lake Creek and Metolius River study areas.

Results and Discussion

Daily maximum temperatures of upper Lake Creek (KM 6.5) were at or in excess of 20°C most of the time from mid-June through mid-August. However, inflow of spring water in lower reaches of the creek helped moderate those temperatures to near 12°C near the mouth (KM 0.1) during that same time period (Figure 3). Minimum daily temperatures near the mouth were near 9-11°C during summer months (Figure 4). It is generally accepted that *C. shasta* becomes active when water temperatures exceed 10°C. Once infected by *C. shasta*, susceptible rainbow trout held at water temperatures between 6.7°C and 20.5°C have little or no ability to overcome the infection (Udey et al. 1975). Therefore, rainbow trout susceptible to infection by *C. shasta* should have died from ceratomyxosis after exposure at the mouth of Lake Creek, but they did not (Buchanan et al. 1991) Presently, the factor(s) that inhibits *C. shasta* infection at the mouth of Lake Creek remains unknown.

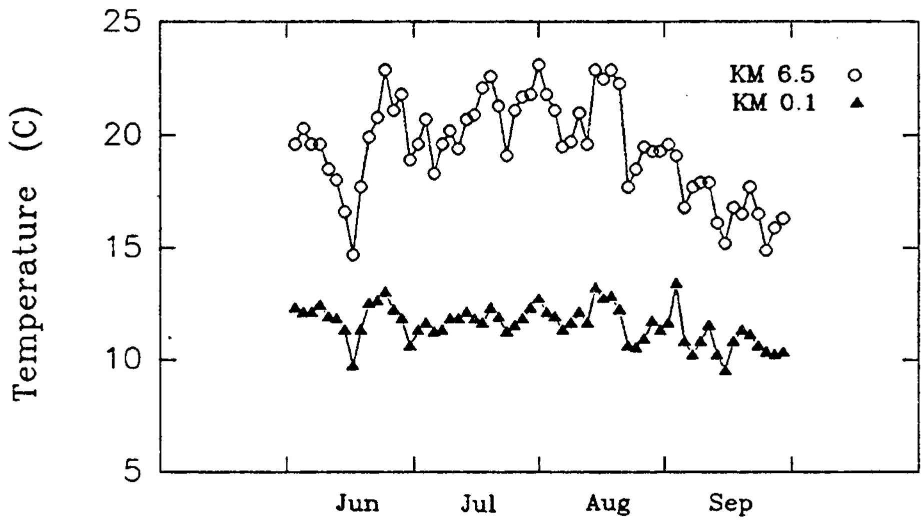

Figure 3. Daily maximum temperatures of Lake Creek in 1992.

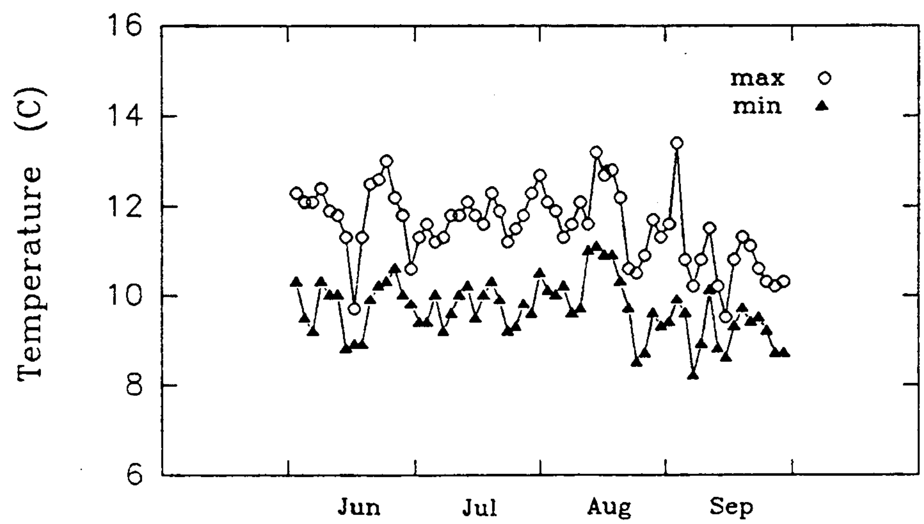

Figure 4. Daily temperatures at the mouth of Lake Creek in 1992.

Most of the summer we measured about 2°C daily variation in the upper Metolius River 0.4 km downstream from the source spring (Figure 5). That contrasts with the constant 8.5°C from February through mid-August reported by Fies and Robart (1988). Daily maximum temperatures at that site generally were cooler than at either downstream location from early June through mid-August. Maximum temperatures at Gorge Campground exceeded 12°C most of the summer (Figure 6). Those temperatures should have permitted *C. shasta* infection in susceptible fish, but we were unable to detect ceratomyxosis in susceptible rainbow trout exposed at two locations between the confluence of Lake Creek and Gorge Campground (Buchanan et al. 1991). Like the situation at the mouth of Lake Creek, the relationship of water temperature in regulating *C. shasta* infection is not clear. Nevertheless, *C. shasta* cannot be expected to eliminate holdover hatchery trout in the Metolius River.

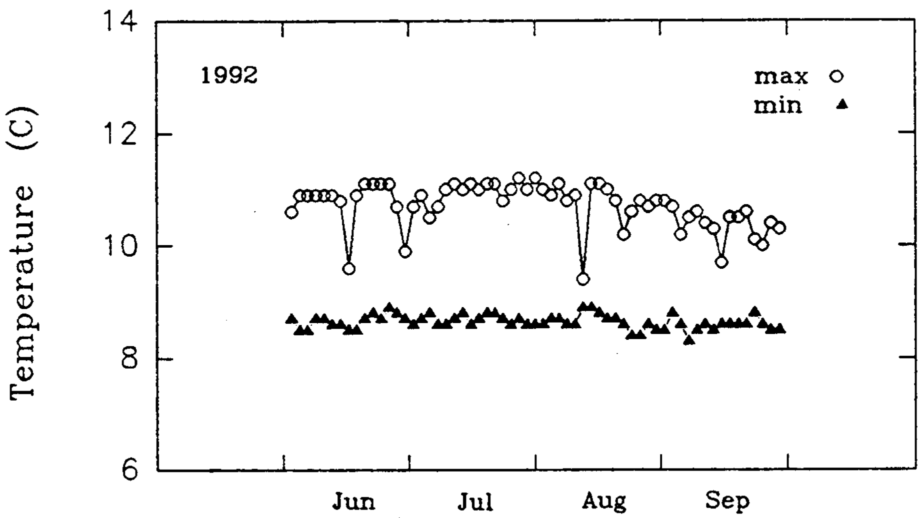

Figure 5. Daily temperatures of the Metolius River measured 0.4 km downstream from the source spring.

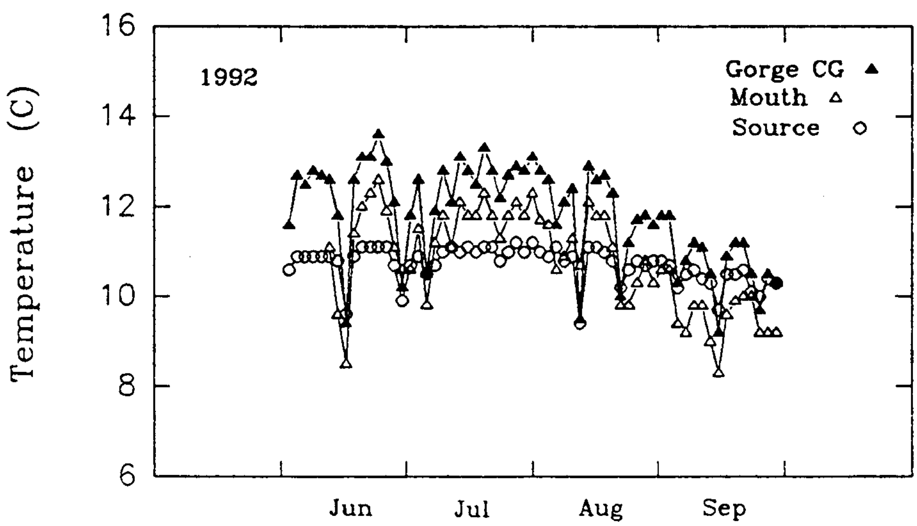

Figure 6. Daily maximum temperatures of the Metolius River measured at three locations.

During FY 1992, we counted 338 trout redds in the upper 6.4 km of the Metolius River. Spawning occurred in all river sections from the source to Gorge Campground, but 86% of the redds were found above the confluence with Lake Creek (Figure 7). Spawning began in November and continued into July. The peak count of new trout redds occurred during December.

The number of juvenile rainbow trout 5-9 cm long in the upper 6.4 km of the Metolius River declined from about 500 in October 1991 to less than 50 by the end of February 1992. The explanation for the decline in abundance is yet unknown, but may be explained by mortality, hiding in the substrate, or migration downstream from the study area. We observed an increase in the number of 5-9 cm juveniles in May, which is consistent with previous observations (Buchanan et al. 1991). We counted 3,000 to 3,600 individuals from July through September. The large difference in counts made in FY 1992 compared to those made earlier is likely due to some undefined population dynamic rather than an increased ability to see fish of that size. Those juveniles were not uniformly distributed throughout the study area, but were much more abundant both years from the source downstream to the Blue Hole (Figure 8). We seldom saw more than 100 individuals from the Camp Sherman bridge to Gorge Campground.

The number of juvenile rainbow trout 10-19 cm long declined similarly from October 1991 through April 1992 from about 500 to 100 in number. By the end of May the number had increased to about 600 individuals, and remained near that number through September. Like smaller rainbow trout, the largest proportion of 10-19 cm fish occurred from the source to the Blue Hole, and many disappeared during winter months (Figure 9). However, a greater proportion of large juveniles inhabitated the river area below Camp Sherman Bridge than did small juveniles.

Counts of wild adult rainbow trout (≥ 20 cm) increased from about 175 in October 1991 to 450 in December. Thereafter, the number decreased to about 125 in late April before increasing to about 250 by the end of September 1992. The peak count in December coincides with the highest count of new redds, and may represent individuals that migrated from the lower Metolius River to spawn in the upper sections. Wild adult rainbow trout were somewhat uniformly distributed from the source downstream to Camp Sherman Bridge, except during winter months. However, there was a marked decline in abundance at all times from Camp Sherman Bridge to Gorge Campground (Figure 10).

Catchable hatchery rainbow trout are stocked each year in the Metolius River from late April through September. Our count of 535 catchables in October 1991 declined to 134 in December and to less than 25 by late March 1992. From May through September 1992 the count ranged from about 500 to 950 individuals, likely depending on the time between stocking and surveying. The uppermost stocking location is currently just downstream from Camp Sherman Bridge, and most hatchery rainbow trout were observed downstream from that location (Figure 11). However, we did observe hatchery rainbow trout that had moved upstream past Camp Sherman Bridge, particularly in November and December. Most of the upstream migrant hatchery trout were found between Camp Sherman Bridge and the Blue Hole.

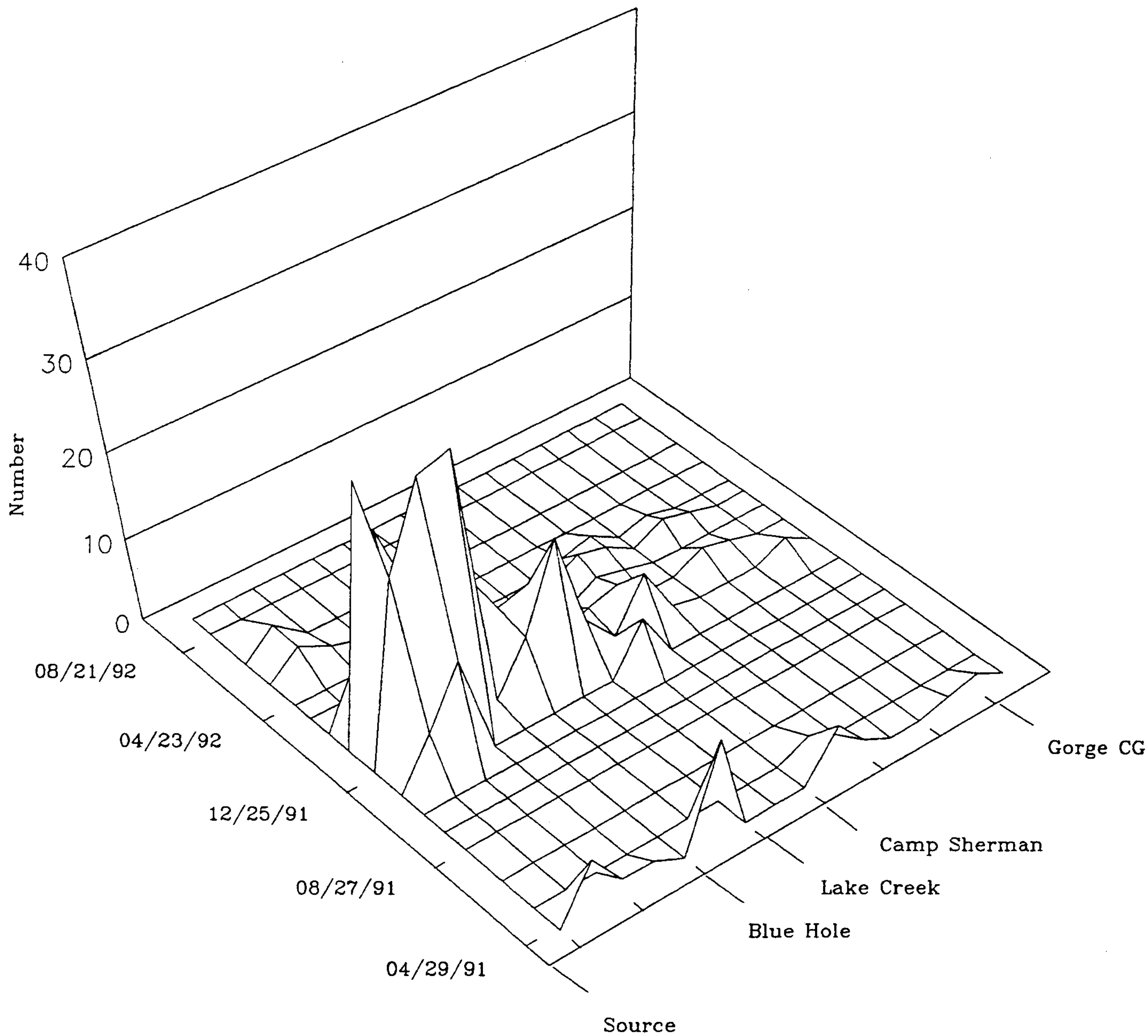

Figure 7. New trout redds counted in the upper 6.4 km of the Metolius River during 1991 and 1992.

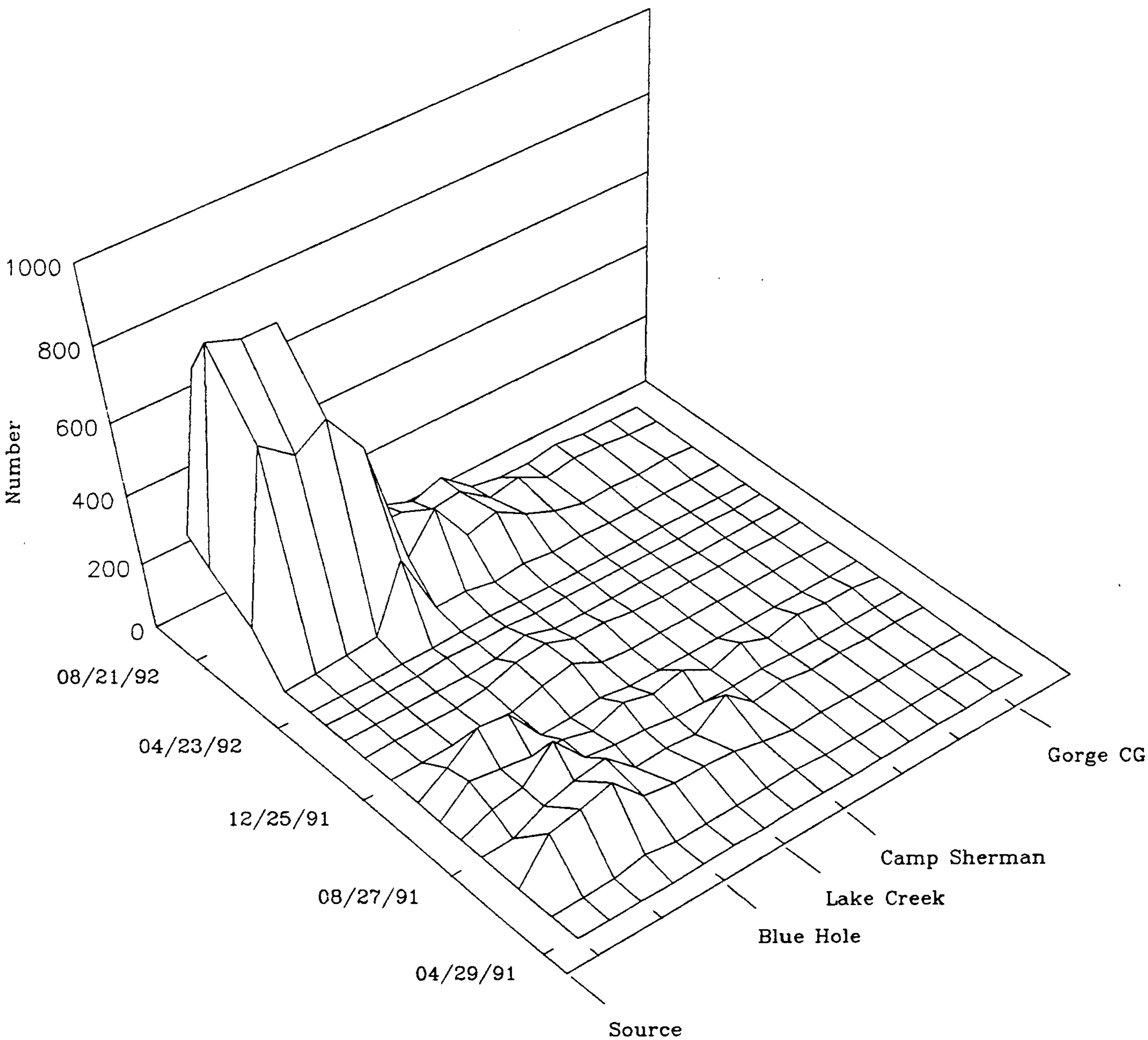

Figure 8. Juvenile rainbow trout (5-9 cm) counted in the upper 6.4 km of the Metolius River during snorkel surveys in 1991 and 1992.

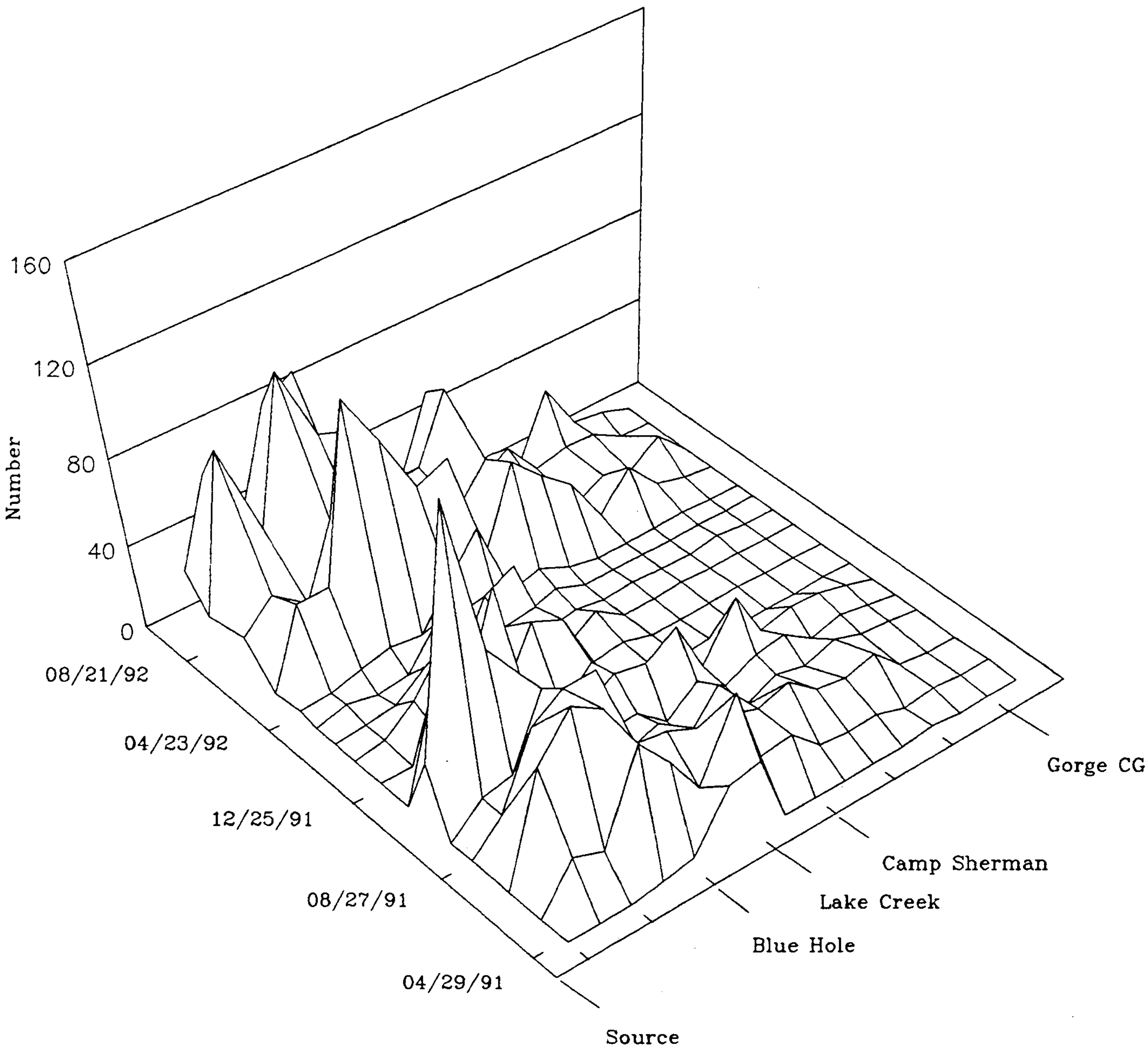

Figure 9. Juvenile rainbow trout (10-19 cm) counted in the upper 6.4 km of the Metolius River during snorkel surveys in 1991 and 1992.

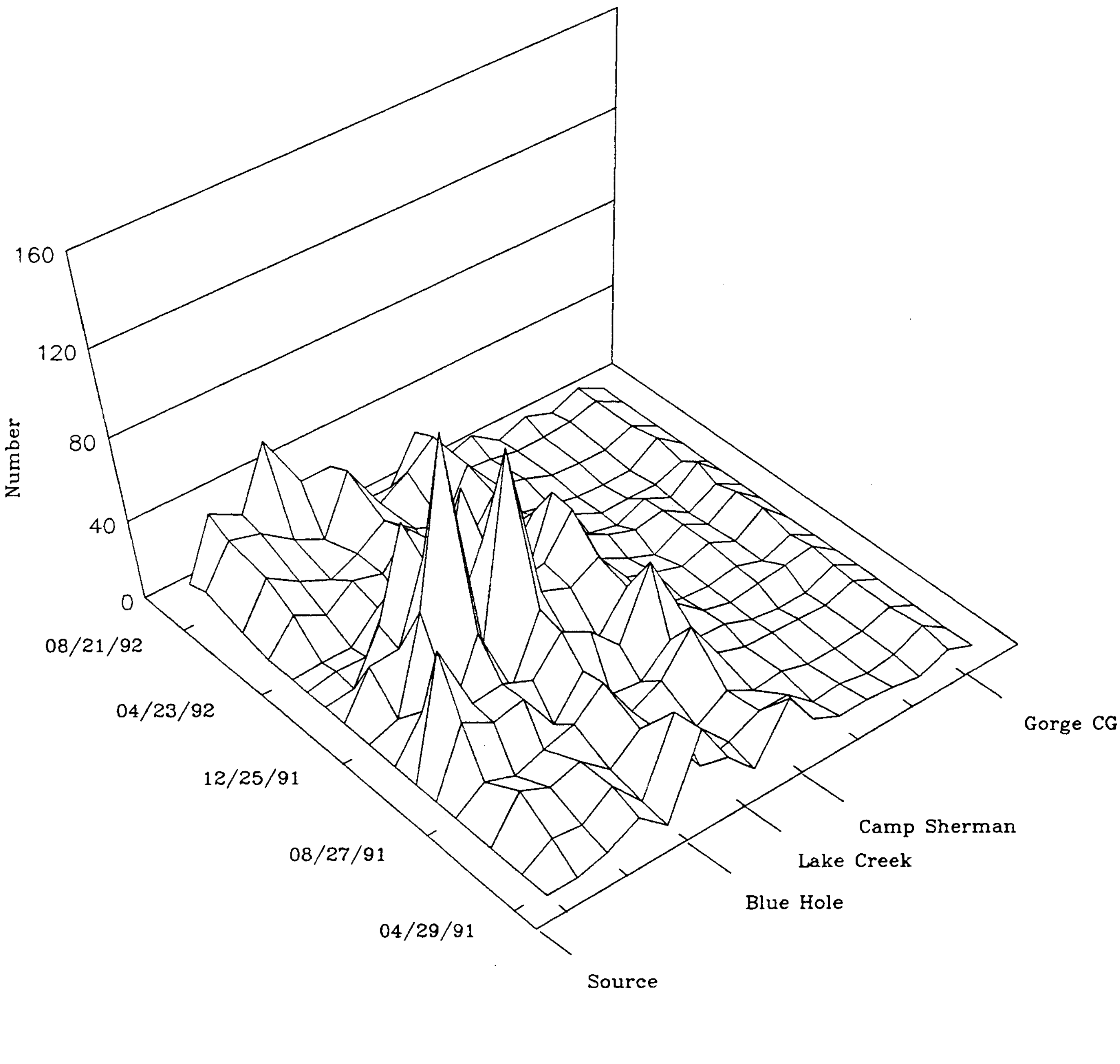

Figure 10. Wild adult rainbow trout counted in the upper 6.4 km of the Metolius River during snorkel surveys in 1991 and 1992.

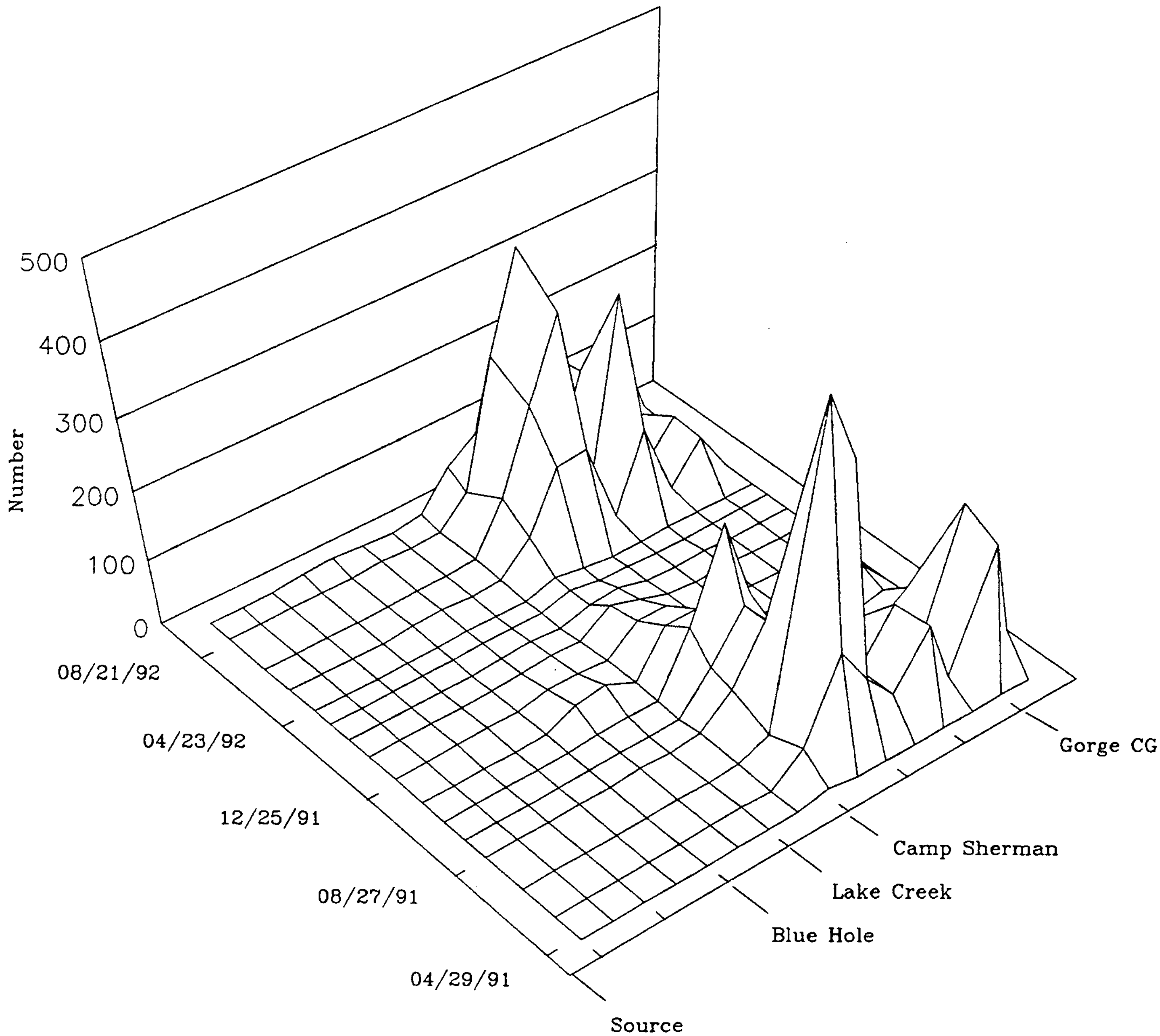

Figure 11. Hatchery rainbow trout counted in the upper 6.4 km of the Metolius River during snorkel surveys in 1991 and 1992. Observations include catchables and adipose-clipped holdovers.

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