PROGRESS REPORT NO. 1

Spring Chinook Salmon Habitat Requirements in the Salmon River, Klamath River Basin, California

by

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and

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Research Work Order NO. 26

December, 1990

We conducted a snorkel census of summer steelhead and spring chinook salmon in the Salmon River in July 1990. During a two day survey, 85 miles of the North Fork, South Fork, and mainstem Salmon River were censused and 169 spring chinook, 48 summer steelhead and 78 "half-pounders" were counted. These numbers indicate record low populations for both species based on trend information gathered since 1980. (For a complete review, see attached report titled; 1990 Adult Spring Chinook and Summer Steelhead Census, Salmon River, California).

Based on census results we decided to concentrate spring chinook salmon spawning studies on the South Fork River. Capturing spring chinook salmon and implanting radio-transmitters began on 30 August and concluded on 11 September. During seven trapping days in this period, 49 salmon (22 females and 27 males) were captured. High frequency (151MHz) radio-transmitters were orally inserted into the gut of 30 salmon (22 females and 8 males). Four salmon were captured in the lower 1-mile reach of the East Fork and the remaining 26 were captured at various locations from 1 mile above Matthews Creek to 0.5 mile above Horseshoe Bend in the Trinity-Alps Wilderness (Approx. 18.5 river miles). Fork length and scale samples were collected on all fish equipped with transmitters. Subsequent locations were used to collect information on summer holding habitat, pre-spawning movements, spawning distribution, spawning habitat, and redd residency time.

Of the initial 30 salmon tagged, 73% (n=22) survived to spawn. Seven mortalities occurred from 10-32 days following capture. In only one case was a complete, intact carcass recovered. In this case, the internal transmitter was in proper position within the stomach and no signs of predation (natural or man-caused) were evident. Most recoveries were characterized by partial carcass remains 100 ft or more upslope from the channel with the radiotransmitter in close proximity. Bear sign (scat, tracks, hair, etc.) was evident at all but one recovery site of the early mortalities and at several post-spawning recoveries. The lack of carcass information made it impossible to determine if improper transmitter placement was a contributing factor to these losses. We suspect one mortality was due to poaching because of the suspicious location of the transmitter and the high visibility of the salmon holding pool from the South Fork road.

Transmitter failure accounted for the eighth missing salmon. Five days following deployment and after three previous relocations, no signal could be received for a female salmon tagged in the Cecil Creek area; however, 35 days later the transmitter was recovered 3.5 miles upstream emitting a weak signal at approximately one-half its normal pulse rate. It is unknown whether this particular female survived to spawn.

Spawning location and time of spawning were obtained from the tagged 22 spawners. Spawning began on 22 September in the upper portion of the study area and progressed until 15 October when the last tagged female spawned. Analysis of redd survey data will provide further information.

Redd physical data (depth, velocity, size, surface fines, substrate composition, etc.) were collected from 22 known spring chinook redds, and 15 redds were permanently marked as potential fry-trapping sites. Data entry is currently underway and analysis will start in late December.

Tissue samples were taken from 18 post-spawn spring chinook and 23 post-spawn fall chinook for electrophoretic analysis and comparison. Tissue samples from 14 fall chinook were also collected from the Scott River, CA to provide an additional comparison and for the purpose of possible stock identification. Tissue samples are currently held at the Humboldt State

University fish genetics lab and test results should be available in May of 1991.

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1990 Adult Spring Chinook and Summer Steelhead Census, Salmon River, California.

by
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1312 Fairlane Road, Yreka CA 96097

Introduction

A complete census of Salmon River adult summer steelhead Oncorhynchus mykiss and spring-run Chinook salmon O. tschawytscha was conducted on July 24 and 25, 1990. This cooperative effort included personnel from the Klamath National Forest, California Department of Fish and Game, U.S. Fish and Wildlife Service (Humboldt State University Cooperative Fishery Research Unit-Arcata and Klamath Field Office-Yreka), and a citizen volunteer.

The objective was to compile a total count of adults for each species in order to compare with previous counts and estimates derived from index reaches. These comparisons show the trend in numbers of adult salmon and steelhead holding in the Salmon River during late July or early August of each year.

Study Area and Methods

The Salmon River, located in the Salmon Subbasin, is tributary to the Klamath River of Northern California. The North Fork, South Fork, and mainstem provide approximately 80-85 miles of salmonid spawning, rearing and holding habitat.

Prior to the census on July 24 and 25, about eighty miles of river to be inventoried was divided into 20 reaches each approximately 4 miles long (Figure 1).

On July 24, 34 divers snorkel-inventoried 24 miles of the North Fork Salmon (Right Hand Fork downstream to Kanaka Gulch) and 26 miles of the South Fork Salmon (Little South Fork downstream to Milepost-21 bridge;Figure 1). Each dive team consisted of a minimum of two people (including a team leader experienced at conducting direct observation inventories and species identification). Each team counted the number of adult Chinook salmon, summer steelhead and "half-pounders" encountered in their assigned reach.

Remaining portions of the North Fork (approx. 8 miles) and South Fork (approx. 6 miles) as well as the mainstem Salmon (18.5 miles from Forks of Salmon to the Klamath River) were inventoried on July 25.

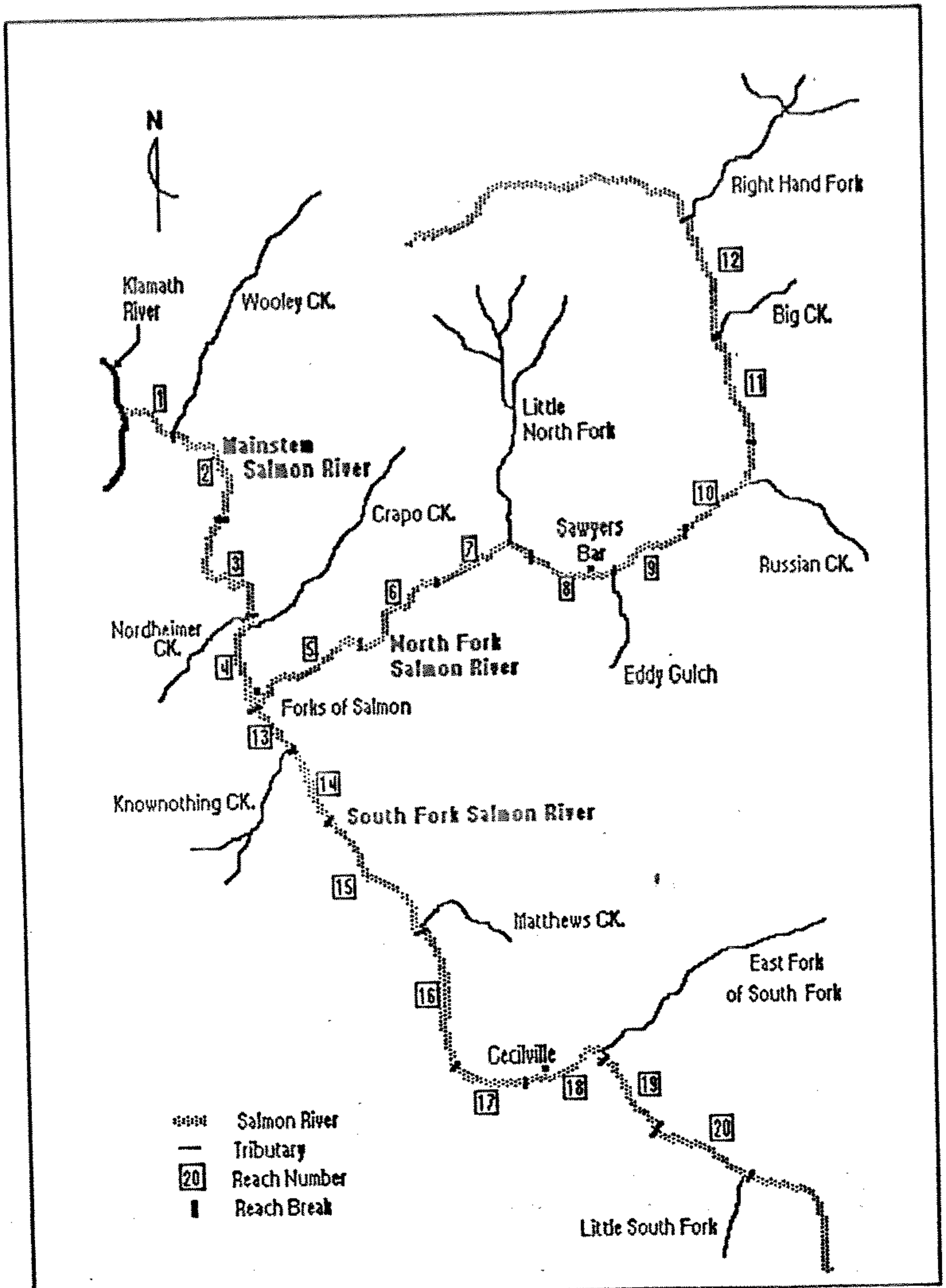

Figure 1. Reaches inventoried in the 1990 Summer Steelhead/Spring Chinook Census of Salmon River, CA.

Adult escapement was estimated from an index reach in each fork for the years when manpower or budget constraints made it impossible to census the entire river. Estimators were calculated for spring chinook and summer steelhead in each fork based on three years of complete census data (1980, 1982, and 1990). Previous estimates were adjusted to reflect correction of the estimator from including 1990 census data.

The formula used for these calculations is:

$$Est_{sppx/Fy} = \frac{\Sigma(IRC_{sppx/Fy} \text{ for 1980, 1982, 1990})}{\Sigma(TC_{sppx/Fy} \text{ for 1980, 1982, 1990})}$$

Where: $Est._{sppx/Fy}$ = Estimator for species X in river fork Y; where X= steelhead or chinook and Y= North or South Fork.

$IRC_{sppx/Fy}$ = Index reach count for species X in river fork Y; and

$TC_{sppx/Fy}$ = Total count for species X in fork Y.

Estimators used were:

North Fork: steelhead=0.2222; salmon=0.2927
South Fork: steelhead=0.1606; salmon=0.0887

Estimates were calculated by dividing the index reach count by the appropriate estimator.

Results

The total count (North Fork, South Fork, and Mainstem Salmon) for the Salmon River system was 169 spring chinook, 48 summer steelhead, and 78 half-pounder steelhead (Table 1). The eight reaches of South Fork Salmon held 58% (n=98) of the spring chinook compared to 9% (n=15) and 33% (n=56) for the North Fork and Mainstem, respectively. South Fork reaches also held the majority (44%;n=21) of the adult summer steelhead in the system.

Significant numbers of American Shad Alosa sapidissima were noted in the lower three mainstem reaches. Reach 1, 2, and 3 held 115, 310, and 1080 shad, respectively. No shad were seen upriver from Tripp Point (RM 11.0). Shad carcasses were common though sea-bright fish were also observed. Forest Service biologists observed shad in the lower Salmon River in October 1989, indicating that they use the habitat for long periods in some years.

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2	Murderers- Butler Flat	12	2	4
3	Butler- Nordheimer Ck.	12	2	1
4	Nordheimer- Forks	32	9	4
	Mainstem Subtotal	56	15	16
North Fork				
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6	Sawpit- Milepost 8.0	7	3	1
7	Milepost 8.0- Kelly Gul.	5	6	8
8	Kelly Gul.- Eddy Gul.	0	0	0
9	Eddy Gul.- Whites Gul.	1	0	9
10	Whites- Mule Bridge	2	1	6
11	Mule Brdg.- Big Ck.	0	0	4
12	Big Ck.- Right Hand Fk.	0	0	2
	North Fork Subtotal	15	12	34
South Fork				
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14	Knownothing- MP-21 Brdg.	0	1	3
15	MP-21- Matthews Ck.	10	2	8
16	Matthews- French Ck.	30	5	6
17	French- Timber Gul.	19	1	4
18	Timber- East Fork	7	2	2
19	East Fk.- Consetti Brdg.	12	1	1
20	Consetti- Ltl. South Fk.	14	4	4
	South Fork Subtotal	98	21	28
	Salmon River Total	169	48	78

Discussion

Trends of adult summer-run steelhead and spring-run Chinook salmon escapement are apparently at record lows in the two Forks of Salmon River when compared with information obtained since 1980 (Figures 2 and 3). Estimates made in this report are not population estimates, but serve only as indices of habitat use trends by adult fish. Mainstem counts, or estimates, were unavailable for most years and therefore not included. Although some temporal variation in sampling occurred during this period, the overall trend appears consistent with other data. Tuss et al. (1990) showed similar trends in spring Chinook escapement on the Trinity River where adult returns increased from 8466 in 1987 to 13,905 in 1988, then fell to 5506 in 1989.

Adult fish of both species, particularly steelhead, were found dispersed throughout the available holding habitat. Spring Chinook concentrations typically seen in highest quality pools on previous surveys were notably absent with several exceptions. Several pools which held concentrations of spring Chinook were isolated from human access/activity or were directly influenced by cold water influx from tributaries. Unfortunately one such thermal refuge was adjacent to the Salmon River road and easily accessible to poachers.

Evidence of poaching (entrails, carcasses with wounds, gaffs, and large treble hooks) was found by several dive teams during the census. Forest Service habitat survey crews have also recovered numerous poaching implements in the past year.

Physical habitat condition appears suitable to hold many more adult fish than observed during this survey. Numerous deep pools, isolated from human activity, were unutilized by adult fish. Roelofs (1983) cites similar findings from Humboldt State University studies of Wooley Creek, New River, and North Fork Trinity River where "...there were no indications...that summer holding habitat was limiting to adult summer steelhead..." in those streams.

Water temperatures observed during this census ranged from a minimum of 13°C on the South Fork to maximum of 24°C on the North Fork (South Fork 13°C-22°C; North Fork 16°C-24°C; mainstem 18°C-20.5°C). Though maximum water temperatures exceed the optimum range for migration of summer chinook (13.9°C-20.0°C; Reiser and Bjornn 1979), mean maximum water temperatures in mainstem and South Fork Salmon were within this range in 1988 and 1989. Mean maximum water temperatures in the North Fork Salmon fell within this range in 1988 (19.1°C) and exceeded it in 1989 (21.6°C; Dix and Cuenca 1989). Historical information suggests that maximum summer water temperatures were a recognized problem as early

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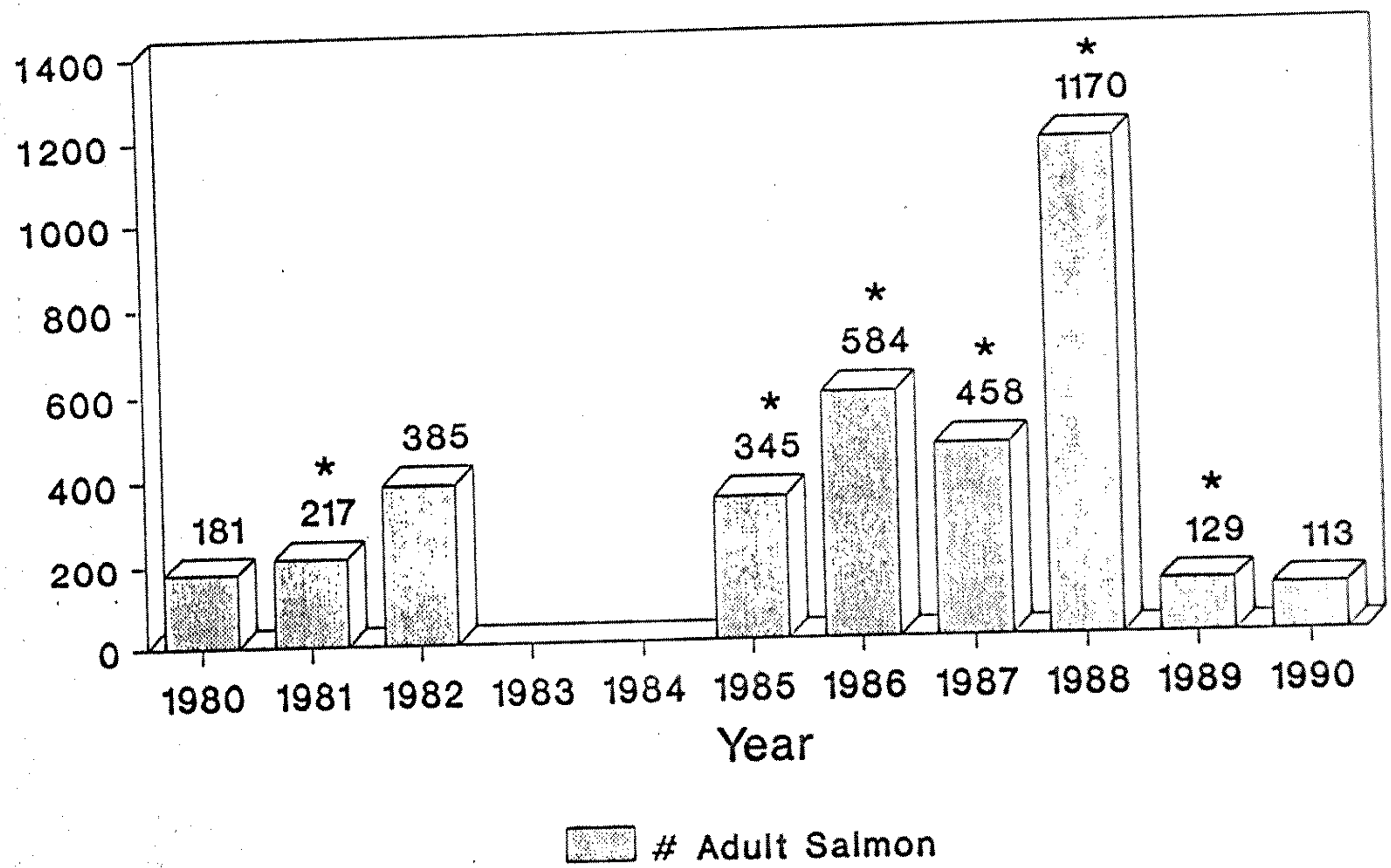

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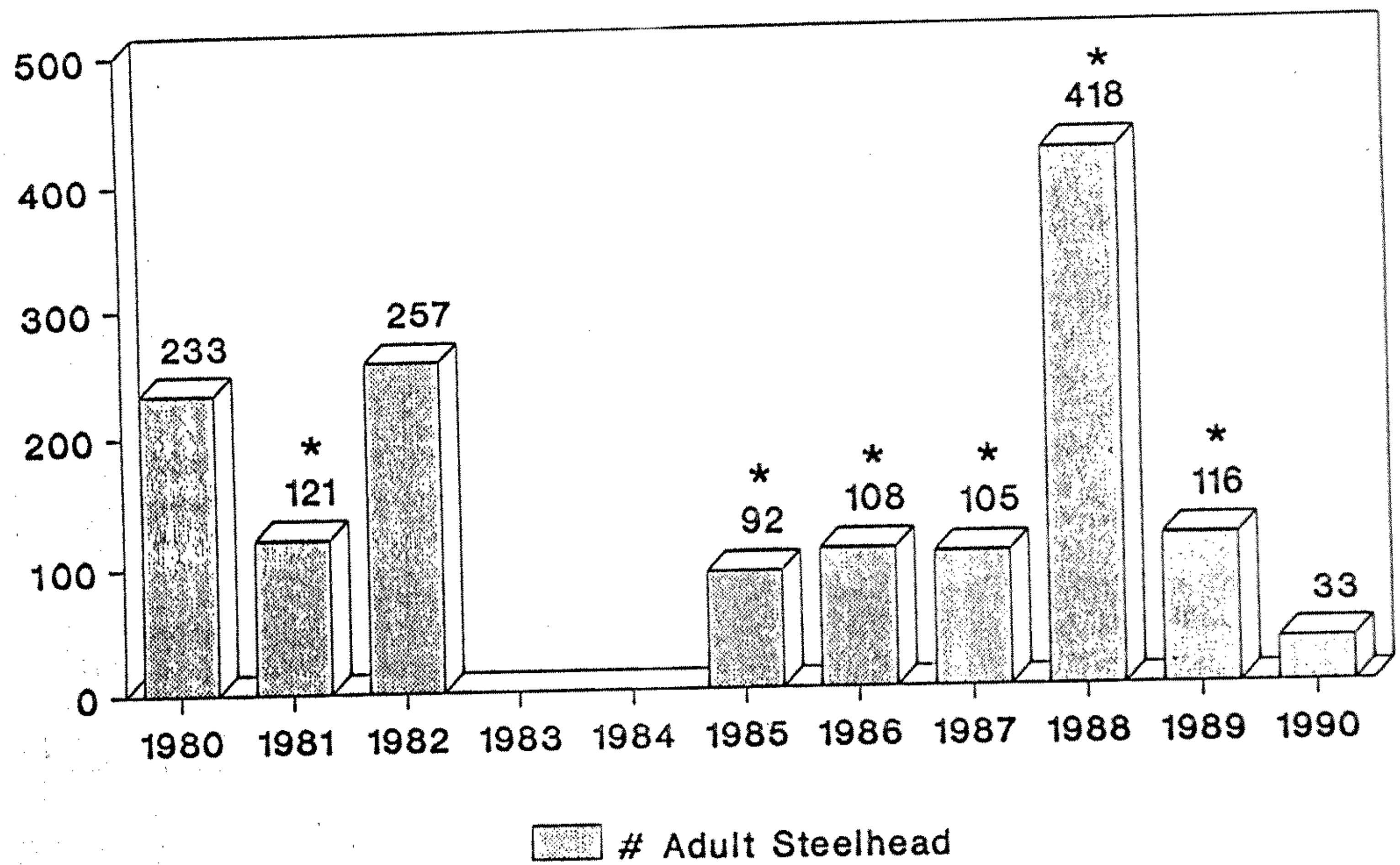

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as 1934 when Taft and Shapovalov (1935) found temperatures of 77.5°F (25.3°C) in the North Fork and 78.5°F (25.8°C) in the South Fork.

Though knowledge of general habitat requirements is widely available, spawning and rearing habitat requirements for local races of spring chinook and summer steelhead are not well understood. Spring chinook spawners use habitats in the upper South Fork and North Fork Salmon, however some information critical to race-specific habitat management (i.e., #redds/female, #males/female, selected spawning habitats, thermal requirements for successful incubation to emergence, juvenile habitat selection, freshwater rearing residence time, etc.) remains unknown. A comprehensive recovery strategy must answer these, and other, questions to be successful. Some of these questions may be answered by a graduate research project currently under contract between USFS, USFWS, and Humboldt State University. Furthermore, habitat condition assessments will be completed in the Salmon River and its Forks by October 1990.

Recommendations

1. Assist California Department of Fish and Game in control of poaching by promoting use of CalTip and assisting with law enforcement efforts.

2. Designate spring-run chinook salmon as a "sensitive species" in Klamath River tributaries above the Trinity River confluence.

3. Identify and maintain essential spawning and rearing habitat in the Salmon River system for spring chinook and summer steelhead.

4. Identify race specific spawning and rearing habitat requirements for spring chinook and summer steelhead in Klamath National Forest tributaries.

5. Reduce summer water temperatures through an aggressive riparian revegetation program.

6. Conduct angler use inventories to determine the extent of potential summer steelhead harvest on the Salmon River.

7. Continue cooperative censuses on the Salmon River annually.

8. Prepare habitat management plans for summer steelhead and spring chinook on each stream identified as essential habitat within the Klamath National Forest jurisdiction.

Acknowledgements

We would like to recognize and thank the following people for their participation in the 1990 census effort. Without their cooperation and expertise, an inventory of this magnitude would not be possible.

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Doug Alcorn
HSU Coop Research Unit-Arcata: Roger Barnhart

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Al Olson	Fran Fericano	Jennifer Johnson
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Mike Journey	Mike Derrig	Carol Petty
Greg DesLaurier	Leah Juarros	Annie Gibson
Colleen Weiser	Mike Hyer	
Keith Ray	Don Korte	

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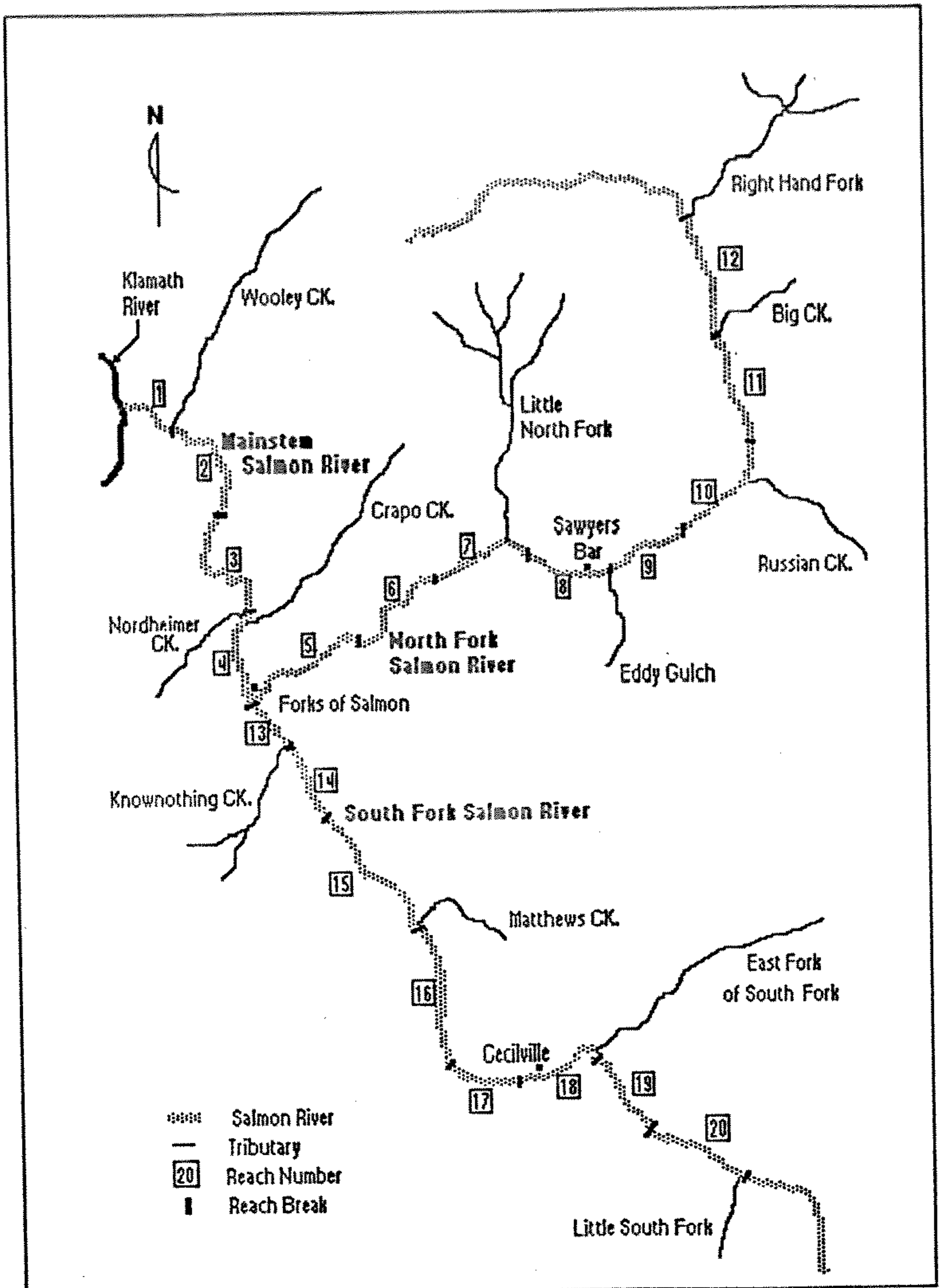

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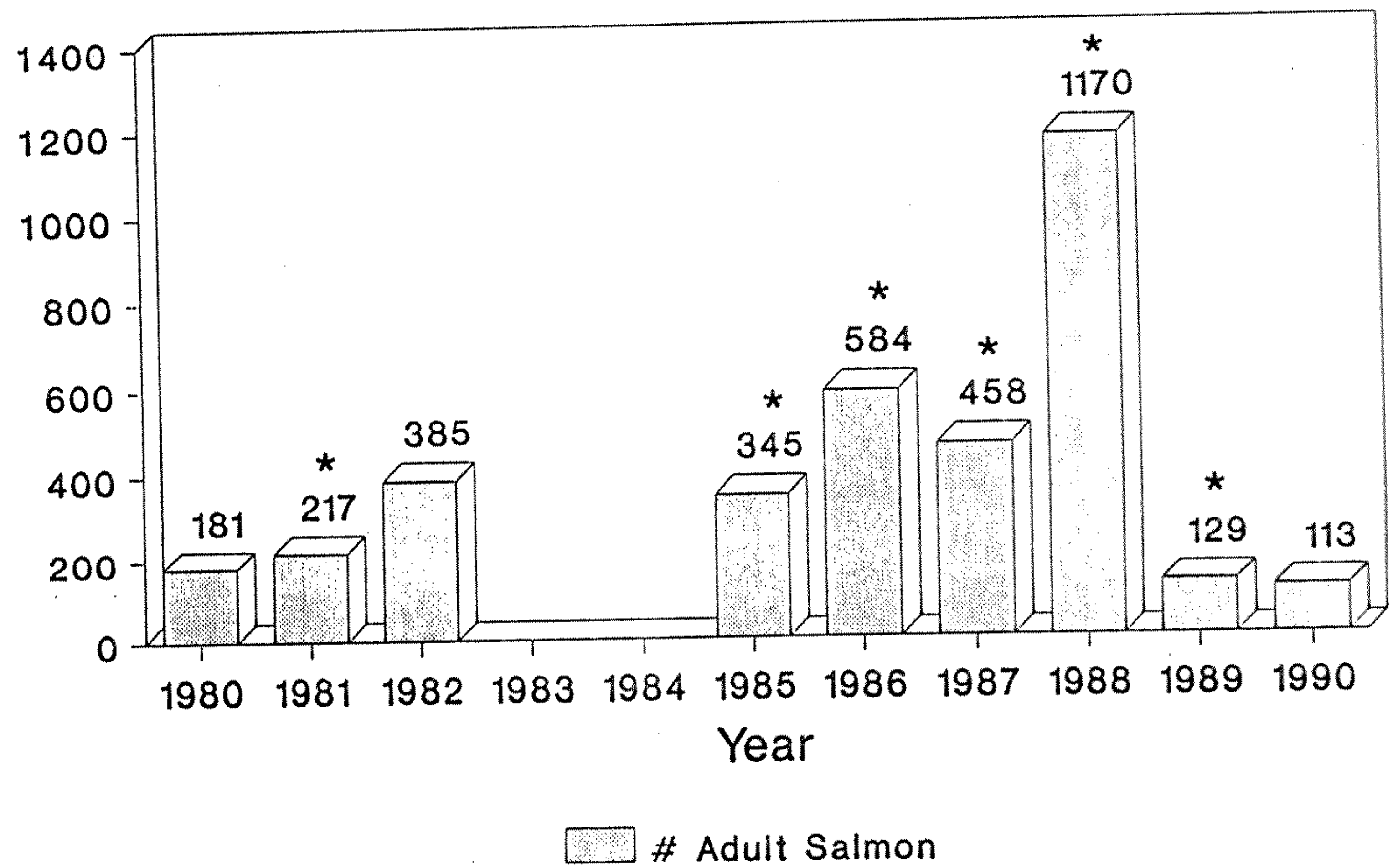

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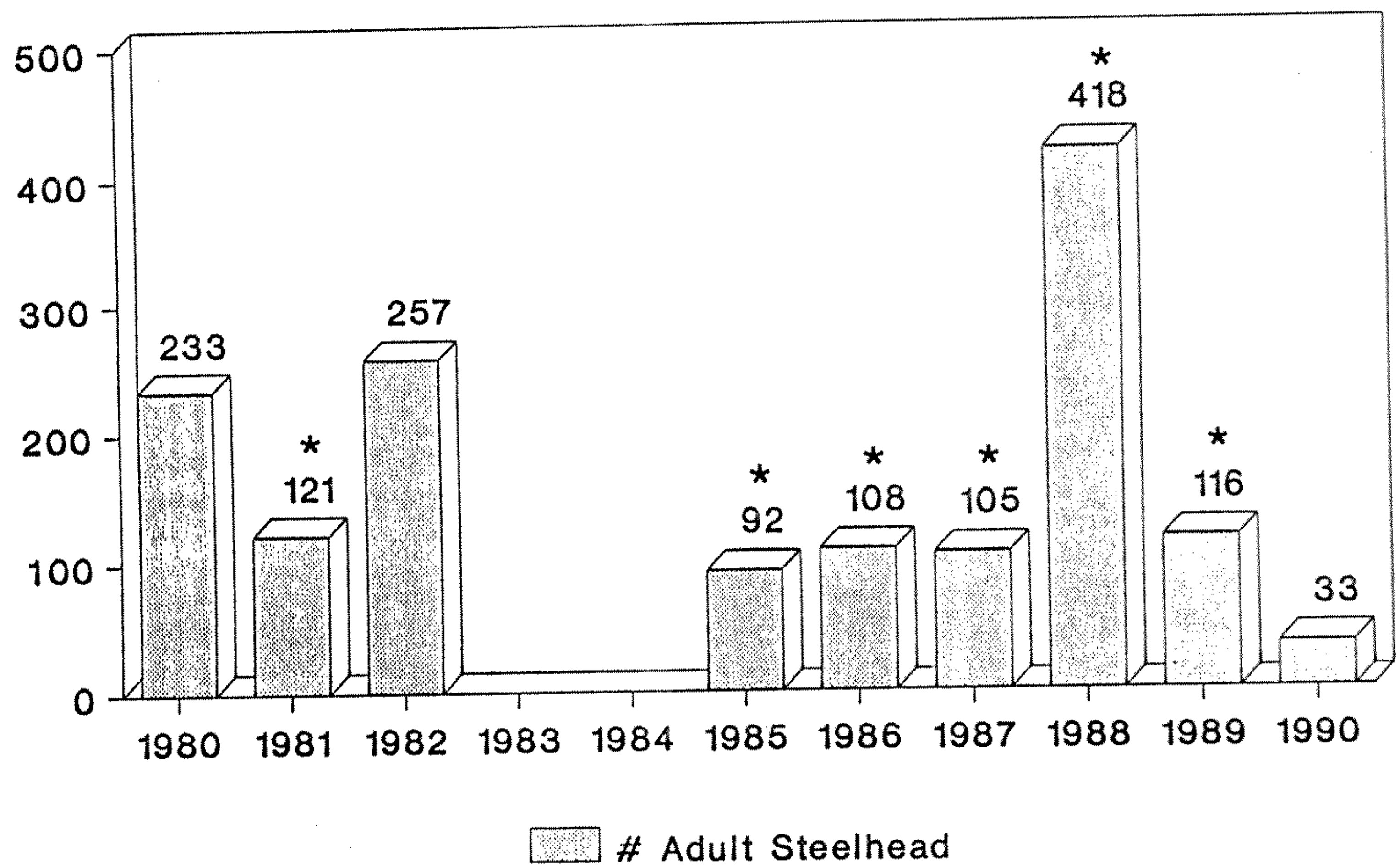

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2. Designate spring-run chinook salmon as a "sensitive species" in Klamath River tributaries above the Trinity River confluence.

3. Identify and maintain essential spawning and rearing habitat in the Salmon River system for spring chinook and summer steelhead.

4. Identify race specific spawning and rearing habitat requirements for spring chinook and summer steelhead in Klamath National Forest tributaries.

5. Reduce summer water temperatures through an aggressive riparian revegetation program.

6. Conduct angler use inventories to determine the extent of potential summer steelhead harvest on the Salmon River.

7. Continue cooperative censuses on the Salmon River annually.

8. Prepare habitat management plans for summer steelhead and spring chinook on each stream identified as essential habitat within the Klamath National Forest jurisdiction.

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Progress Report No. 2

Spring Chinook Salmon Habitat Requirements in the Salmon River, Klamath River Basin, California

by

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Life history and habitat utilization requirements of wild spring chinook salmon in the South Fork Salmon River are being investigated by the California Cooperative Fishery Unit in cooperation with the Klamath National Forest and Humboldt State University. This report summarizes the progress of field work and data analysis for the second portion of project, the natal rearing phase.

Twenty-four spring chinook redds were identified during construction in September and October of 1990. These redds were located in the South Fork Salmon River (upstream from French Creek) and its tributary East Fork. Redd locations were triangulated using two or more reference points on the stream bank for later reference. Water temperatures were monitored and cumulative temperature units used to estimate hatching. Eleven of the 24 marked redds were capped with fry emergent traps modified from Porter (1973) and Field-Dodgson (1983) beginning in mid-February 1991. Chinook fry with large yolk sacs were observed during placement of some redd caps suggesting emergence had not yet begun. A removable live box was secured to the downstream end of the trap to collect and hold emerging fry.

Ten of the 11 redd traps remained functional through the emergence period. Five of the capped redds were constructed by females previously tagged with radio-transmitters. Emergent fry were first captured on March 9, 1991. The last emergent fry was captured on May 22. A total of 5,294 fry were captured from 10 capped redds. Fry totals for individual traps ranged from 31 to 1,432. Trapping mortality was generally quite low when traps operated properly. Nearly all of the fry mortality occurred at one trap location during a single storm flow. Overall, capture mortality was less than 3% of total fry captured.

The redd traps worked well, although they were vulnerable to fine bedload sediment which collected within the cap and vinyl tube connecting the live box. This resulted in frequent trap maintenance during high spring flows. Water depth and velocities encountered during spring runoff often necessitated more than one person to successfully retrieve the fry from the live box. Upon capture, all fry were enumerated and a sub-sample of $\leq$ 25 fry measured to the nearest millimeter fork length. Fry traps were operated until ten successive 'zero catch' days were recorded after peak emergence had concluded.

A quantitative description of substrate composition within and adjacent to a sample of capped redds was undertaken at the conclusion of fry emergence. Three samples were gathered at each of three redd locations on South Fork Salmon River and East Fork using a McNeil core sampler (McNeil and Ahnell 1964).

Monitoring of habitat utilization by juvenile spring chinook was initiated in May 1991 using direct underwater observation. Habitat utilization was assessed on three levels; 1) stream reach (n=4), 2) meso-habitat unit (n=110), and 3) micro-habitat zone. Stations were sampled monthly (May-October) to observe temporal shifts in habitat use. Meso-habitat types were classified as riffle, run, pool, glide, or backwater and a random sample of ≤ seven of each type selected for each reach. The lateral distribution of rearing juveniles within a meso-habitat was stratified by three depth velocity zones.

Outmigrant sampling was conducted concurrent to habitat use assessment to help describe fry movement and emigration timing. In addition, trapping was used to obtain size and scales from outmigrating juveniles. Outmigant pipe traps were located at the upstream and downstream study area limits on South Fork Salmon River, as well lower East Fork. Initial results of juvenile trapping indicate a distinct outmigration pulse during mid-October in both the South Fork and East Fork.

Field data collection for the natal rearing portion of the study has been completed. Compilation and analysis of data are progressing and a draft report of study results scheduled for fall 1992.

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