ANNUAL
PERFORMANCE REPORT

AGENCY: California Department of Fish and Game

PROJECT (CONTRACT) NO: 1-FG-20-09820 (FG 0414)

PROJECT TITLE: Trinity River Basin Salmon and Steelhead Monitoring Project

PERIOD COVERED: July 1, 1997 through June 30, 1998

INTRODUCTION: This is the tenth in a series of annual reports detailing various monitoring activities (Tasks) conducted by the Department of Fish and Game in the Trinity River basin. This report fulfills requirements set forth under the terms of Cooperative Agreement Number 1-FG-20-09820 between the Department of Fish and Game (Department) and the United States Bureau of Reclamation (USBOR).

Specific Tasks were designed to complement restoration activities authorized by Public Law 98-541 (Trinity River Basin Fish and Wildlife Restoration Act) enacted by Congress in 1984. This law authorized expenditures through Federal fiscal year (FY)1995. Results of Department studies through this authorization are listed in the table below and are available upon request from: California Department of Fish and Game, Inland Fisheries Division, 1416 9th Street, Sacramento, CA 95814.

Task title	Inclusive years
I. Spawner Surveys in the Upper Trinity River Basin	1988-1995
II. Capture and Coded-Wire Tagging of Naturally Produced Chinook Salmon in The Trinity River Basin	1988-1994
III. Life History, Distribution, Run Size and Angler Harvest of Steelhead in the South Fork Trinity River Basin	1988-1994
IV. Annual Run-Size, Harvest, and Spawner Escapement Estimates for Trinity River Basin Chinook and Coho Salmon and Steelhead	1989-1995
V. Survival and Contribution of the Fisheries and Spawner Escapements Made by Chinook and Coho Salmon Produced at Trinity River Hatchery.	1989-1995
VI. Survival and Contributions to the Fisheries and Spawner Escapements Made by Steelhead Produced at Trinity River Hatchery.	1990-1994
VII. Life History, Distribution, Run Size, and Harvest of Spring Chinook	

Salmon in the South Fork Trinity River Basin.	1990-1994
VIII. Special Project: Technical Analysis and Report Preparation	1991-1993

In 1996, with the expiration of P.L. 98-541, Congress passed P.L. 104-143, authorizing expenditures for and additional three years, ending September 30 1998. This report is the third annual report under the new law. Copies of annual reports beginning with FY 1996 are available on request from: California Department of Fish and Game, Region 1, Trinity River Project, 5341 Ericson Way, Arcata, California 95521.

TASK REPORTS:

TASK 1: Annual Run-size, Harvest and Spawner Escapement Estimates for Trinity River Basin Chinook and Coho Salmon and Steelhead

Task Objectives:

1. To determine the size, composition, distribution and timing of adult chinook and coho salmon, and steelhead runs in the Trinity River basin.

2. To determine the angler harvest and spawner escapements of Trinity River chinook and coho salmon, and steelhead.

Procedures:

From June 18, 1997 through September 30, 1997, returning spring-run chinook salmon (spring chinook) were captured and tagged at a temporary weir in the Trinity River near the town of Junction City, California. A second weir, near the town of Willow Creek, California, was operated from August 20, 1997 through November 18, 1997, to capture fall-run chinook salmon (fall chinook), coho salmon (coho) and steelhead. The trapping and tagging methods at the two weirs were the same except that only chinook were tagged at Junction City Weir (JCW), while at Willow Creek Weir (WCW) chinook, coho and steelhead were tagged.

At both weirs, personnel identified all salmon and steelhead captured to species, measured to the nearest cm fork length (FL), examined for hook and gill-net scars and hatchery marks. Chinook captured at JCW and all salmon and steelhead captured at WCW, except those judged to be in poor condition, were tagged with FT-4 spaghetti tags (Project tags). To determine the number of effectively tagged fish, we subtracted from the tagged population all known tagging mortalities and fish from which anglers reported removing the tags and releasing the fish.

Project tags were inscribed with a unique number identifying the individual fish and a return address so anglers could mail the tags to us for processing. Approximately one-half of the chinook salmon and all of the coho and steelhead were tagged with $10 reward tags while the remainder received non reward tags.

We estimated the harvest rate for each species by dividing the number of reward tags returned, by the number of fish effectively reward tagged. Total harvest was then determined by multiplying the harvest rate for each species by their respective run-size estimates.

The length data collected at the weirs and Trinity River Hatchery (TRH) were smoothed with a moving average of five, 1-cm increments to determine the nadir separating grilse (two-year old) and adult (three-year and older) salmon in the runs. All steelhead > 41 cm FL were consider adults, and steelhead $\leq$ 41 cm FL were consider half-pounders.

All salmon and steelhead entering TRH were counted, measured and examined for Project tags and hatchery marks. Run-size estimates, upstream of the weirs, were based on the recovery of Project-tagged and untagged fish entering TRH. In essence, the recovery of tagged and untagged fish at the hatchery gave us the trapping efficiency rate at the weir, which was then applied to the number of fish tagged at the weir. For example, if 10% of the fall chinook entering TRH were Project tagged, this would imply that 10% of the fall chinook run migrating upstream of weir was trapped and tagged at the weir. Run-sizes, upstream of the weir, were estimated with the formula: $N=((M+1)(C+1)/(R+1)$ where ***N*** is the estimated run size, ***M*** is the number of effectively tagged fish, ***C*** is the number of fish examined for tags and ***R*** is the number of Project-marked fish recovered in the hatchery sample. This year, all spring chinook estimates are for fish migrating upstream of the Junction City Weir while all fall chinook, coho and steelhead estimates are for fish migrating upstream of the Willow Creek Weir.

The accuracy of the run-size estimate is dependent not so much on the total number of fish tagged but on the total percentage of the population which is tagged. Clearly, the greater the percentage of the population tagged, the more accurate the estimate. We determine the accuracy of the estimate by applying statistical procedures which bound the estimate within confidence limits. We operated the weir in an attempt to capture enough fish to obtain 95% confidence limits within $\pm$ 10% of the run-size estimates. In other words, we want be 95% sure that our estimate is within 10% of the actual run size. To achieve that level of accuracy, we attempt to capture and tag between 5% and 10% of the population.

The Trinity River supports both spring- and fall-chinook runs. Prior to the construction of Trinity and Lewiston dams these runs were separated both temporally in their run timing and spatially in their spawning location. However, now the runs overlap both in run timing and spawning location. The seasonal trend in run timing is that during the

transition between runs, spring chinook numbers decrease while fall chinook increase.

In order to make independent estimates for the two runs, a means to differentiate the two runs at the weir and hatchery was needed. Coded-wire tag (CWT) analysis was used for this determination. Each year a portion of spring and fall chinook produced at TRH are given adipose-fin clips and CWTs. These CWTs carry a binary code which identifies the origin of the fish carrying it. When the catch of fall CWTed chinook exceeds spring CWTed chinook at the weir that date is chosen as the start of the fall run. All chinook trapped after that date were considered fall chinook while those trapped prior were considered spring chinook.

Results:

Analysis of coded-wire tagged chinook captured at the weirs and returning to Trinity River Hatchery indicates that all chinook captured at JCW and chinook trapped through September 9, 1997 at WCW were spring chinook. Chinook trapped after September 9, 1997 at WCW were considered fall chinook. Length frequency analysis indicated that spring grilse were $\leq$ 49 cm FL, fall grilse were $\leq$ 49 cm FL and coho grilse were $\leq$ 51 cm FL.

Junction City Weir
We installed and began fishing at JCW on June 18, 1997 and continued through September 30, 1997, fishing a total of 67 nights. During this period we caught 1,041 chinook (all spring) and 20 steelhead.

Based on length frequency analysis, the spring chinook trapped at JCW were composed of 11 grilse and 1,030 adults and the 20 steelhead were all adults. Of these, we effectively tagged 1,017 chinook; no steelhead were tagged.

Willow Creek Weir
WCW was installed and began fishing September 20, 1997 and continued through November 18, 1997. This weir had been scheduled to fish through November but high flows, due to a storm event, forced its removal. WCW was fished a total of 63 nights and caught 370 spring and 748 fall chinook, 220 coho and 753 steelhead.

Length frequency analysis indicates our catch at WCW this season was composed of 21 grilse and 349 adult spring chinook, 132 grilse and 616 adult fall chinook, 165 grilse and 55 adult coho and 13 half-pounder and 740 adult steelhead. We effectively tagged 731 fall chinook, 202 coho and 703 steelhead. At WCW, tagged spring chinook are not used to generate estimates as we capture only a small portion of that run.

Trinity River Hatchery
Totals of 5,117 spring chinook, 6,207 fall chinook, 1,759 coho and 430 adult steelhead

entered Trinity River Hatchery this season. Project tags were recovered from 315 (6.2% of the total) spring chinook, 205 (3.3%) fall chinook, 44 (2.5%) coho and 57 (13.3%) adult steelhead.

Run-Size Estimates

This year's spring chinook run-size was estimated to be 20,039 fish composed of 768 grilse and 19,271 adults. Of these, anglers harvested an estimated 1,330 adults (no grilse were reported harvested), leaving 768 grilse and 17,941 adults available to spawn. This spawner escapement was composed of natural spawners (543 grilse and 13,094 adults) and TRH spawners (225 grilse and 4,892 adults). Previous spring chinook run-size estimates have ranged from 2,381 (in 1991) to 62,692 (in 1988) (Appendix 1).

We estimate the fall chinook run size at 21,347 fish composed of 3,767 grilse and 17,580 adults. Anglers harvested an estimated 102 grilse and 686 adults, leaving 3,665 grilse and 16,894 adults available to spawn. This spawner escapement was composed of natural spawners (2,845 grilse and 11,507 adults) and TRH spawners (820 grilse and 5,387 adults). Since 1977, fall chinook run-size estimates have ranged from 9,207 (in 1991) to 147,888 (in 1986) (Appendix 2).

Coho run size was estimated at 7,935 fish composed of 5,951 grilse and 1,984 adults. Anglers harvested 42 (all grilse) leaving 7,893 available to spawn. The spawner escapement was split between natural spawners (5,038 grilse and 1,097 adults) and TRH spawners (871 grilse and 887 adults). Coho run size upstream of WCW has ranged from 852 in 1994 to 59,079 in 1987 (Appendix 3).

All steelhead released from TRH since the 1989 brood year (BY) have been fin-clipped. Recovery of these fin-clipped fish as adults at the weirs and TRH allow us to make independent run-size, spawner-escapement and angler-harvest estimates for hatchery- and naturally produced steelhead in the basin. The steelhead marking program at TRH was discontinued for the 1994 BY. As a result, we were not able to estimate hatchery/wild and natural components as in previous years.

Steelhead run size was estimated at 5,212 adults. Anglers harvested 516 adult steelhead leaving 4,696 to spawn. The spawner escapment was composed of 4,267 natural spawners and 429 TRH hatchery spawners. Steelhead run size upstream of WCW has ranged from 3,046 in 1992 to 37,276 in 1989 (Appendix 4).

Prepared by: Michael R. Lau and Wade Sinnen, California Department of Fish and Game, November 18, 1998.

TASK 2: Survival and Contributions to the Fisheries and Spawner Escapement Made by Chinook and Coho Salmon Produced at Trinity River Hatchery

Task Objectives:

To determine relative return rates and the contribution to spawning escapement and the fisheries made by chinook and coho salmon produced at Trinity River Hatchery, and to

evaluate experimental hatchery management practices aimed at increasing adult returns.

Background:

To achieve Task 2 objective, representative samples from Trinity River Hatchery's (TRH) annual salmon production must be adipose-fin clipped (ad-clipped) and coded-wire tagged (CWT) for subsequent identification as adults. Prior to 1995, the Department was responsible for the coded-wire tagging program at TRH and the results were published as noted in the Introduction. Beginning in 1995, the Department turned over the coded-wire tagging program at TRH to the Hoopa Valley Fisheries Department. Due to the change in responsibilities, the Department will no longer report on the juvenile tagging effort at TRH. Our efforts are directed at the recovery of these coded-wire tagged fish as adults and analyzing the information derived from recovery

Procedures:

We examined all adult salmon entering TRH for fin-clips and Project tags (also part of Tasks 1 and 3). The heads from ad-clipped salmon were retained for later coded-wire tag removal and decoding.

The information needed to estimate the numbers of salmon of a specific CWT group that returned to the Trinity River basin, and contributed to the fisheries and spawner escapement are; 1) run size, 2) the proportion of the run comprised by the various CWT groups, and 3) the harvest rate. Methods to determine the run-size and angler-harvest estimates were presented in Task 1.

To estimate the numbers of the salmon above a specific weir site with a CWT, we used the equation:

$$N_{CWT} = \frac{NW_{ADclip}}{NW} \times \frac{NH_{ADCWT}}{NH_{ADclip}} \times N_{run\text{-}size\ estimate}$$

where, N_{CWT} = estimated number of the specific species of salmon above the weir with a CWT; NW_{ADclip} = number of salmon observed at the weir with an Ad clip; NW = total number of salmon observed at the respective weir; NH_{ADCWT} = number of salmon observed at TRH with an ad clip and a CWT; NH_{ADclip} = total number of Ad-clipped salmon observed at TRH; and $N_{run\text{-}size\ estimate}$ = run-size estimate.

Using the various CWT groups recovered at TRH, we estimated the fraction of the population upstream of the weir with a specific CWT with the equation:

$$NH_{CWT\ group}$$

$$F_{CWT\ group} = \frac{\quad}{NH_{ADCWT}}$$

where, $F_{CWT\ group}$ = fraction of the salmon population with a specific CWT code; and $NH_{CWT\ group}$ = number of salmon observed at TRH with a specific CWT code.

We estimated the total number of chinook salmon upstream of the weir with a specific CWT code with the equation:

$$N_{CWT\ group} = N_{CWT} \times F_{CWT\ group}$$

where, $N_{CWT\ group}$ = estimated total number of salmon of a specific CWT group.

The estimated number of fish from each CWT group caught in the Trinity River sport fishery upstream of the weir was then estimated by the equation:

$$SF_{CWT\ group} = N_{CWT\ group} \times N_{harvest\ rate\ estimate}$$

where, $SF_{CWT\ group}$ = number of salmon of a specific CWT group caught in the Trinity River sport fishery; and $N_{harvest\ rate\ estimate}$ = harvest rate estimate.

We estimated the total number of fish of a specific CWT code group available to the spawner escapement by the equation:

$$N_{CWT\ escapement} = N_{CWT\ group} - SF_{CWT\ group}$$

where, $N_{CWT\ escapement}$ = the total number of salmon of a specific CWT group available to the spawner escapement.

The estimated number of salmon of specific CWT code group available to natural spawner escapement was:

$$N_{CWT\ natural\ escapement} = N_{CWT\ escapement} - NH_{CWT\ group}$$

where, $N_{CWT\ natural\ escapement}$ = the estimated number of a specific CWT group contributing to natural spawning escapement.

As stated above, estimating the total return of individual CWT groups depends on a basin-wide run-size estimate. In 1995, due to funding uncertainties, we were unable to estimate the spring chinook run-size in the Trinity River basin (see last year's annual report).

In evaluating the return of CWTed hatchery chinook, we normally report on the

individual year's return along with a summary of each CWT group throughout their five-year life cycle. Missing the 1995 spring chinook run size has the unfortunate result of making it impossible to summarize the total return of any CWT group returning the river in 1995.

All estimates for spring and fall chinook are for the Trinity River upstream of the Junction City Weir (JCW) (river km [RKM] 137.1) and the Willow Creek Weir (WCW) (RKM 48.4), respectively.

Results:

We recovered 1,555 ad-clipped chinook at TRH this season. These included TRH-produced chinook (633 spring and 919 fall) and 3 naturally produced chinook. The returning spring chinook CWTed fish were composed of ten release groups from the 1992 through 1995 Brood years (BY)s (Appendix 1). The fall chinook CWTs were from twelve groups representing the 1992 through 1995 BYs (Appendix 1). The naturally produced chinook were composed of three CWT groups from the 1993 BY (Appendix 1).

Return rates for spring chinook TRH CWT groups, based on the number released and their estimated run size as adults, ranged from 0.013% for the 1994 BY yearling release, to 0.547% for the 1993 BY yearling release (Appendix 2). Return rates for fall chinook TRH CWT groups ranged from 0.005% (1992 BY yearling, five-year-old) to 0.523% (1994 BY yearlings) (Appendix 3).

Both spring and fall chinook release groups from the 1992 BY had exceptionally high return rates this year for five-year-old fish. For fall chinook returning as five-year-olds in 1996, the return rates was essentially zero.

Prepared by: Michael R. Lau and Wade Sinnen, California Department of Fish and Game, November 20, 1998.

TASK 3: Naturally and Artificially Produced Coho Salmon in the Trinity River Basin

Task Objectives:

To determine, through mass marking of Trinity River Hatchery (TRH) produced coho salmon, the relative return rates and contributions to spawning escapement and the fisheries made by naturally and hatchery-produced coho in the Trinity River basin.

Procedures:

There are two phases involved in this task: marking all TRH-produced coho; and recovering adult coho returning to the basin. The procedures for the marking phase will be discussed in this section, and the adult recovery phase will be covered under Tasks 1 and 2.

Marking coho involved anaesthetizing them with carbon dioxide, removing their right maxillaries, and releasing them into a hatchery pond. To keep count of fish marked, each marking station was equipped with a manual counter to tally each fish.

To determine overall marking accuracy, we examined a sample of the marked coho just prior to their release into the river. These fish were anaesthetized with carbon dioxide, measured to the nearest mm fork length (FL), and checked for quality of the maxillary clip. If more than 3/4 of the bone was excised it was considered a good clip; less than that was considered a poor clip. We estimated the total number of coho effectively marked by multiplying the percent of fish with good clips by the total number marked.

Results:

Staff personnel marked (right maxillary clip) 517,017 juvenile coho, representing the entire 1996 brood year at Trinity River Hatchery. We began clipping December 31, 1997 and finished on February 26, 1998.

On March 2 and 3, 1998, we performed quality control evaluations (QC) on the marked coho just prior to their release from the hatchery. We measured 4,264 coho to the nearest mm (FL), and examined them for marking accuracy.

Fork lengths of the measured coho ranged from 90 to 285, averaging 157 mm. The table below summarizes release estimates based on our observed marking accuracy.

Stratum 1/	Percent in sample 2/	Estimated number released 3/
Incomplete RM	0.49%	2,529

Effective Clip	99.51%	513,663
Totals:	100.00%	516,192

1/ No clip = both maxillary bones completely intact
Incomplete RM = ≥25% and ≤ 100% of the right maxillary bone intact
LM = Left maxillary bone removed, right intact
Effective clip = 100% of right maxillary bone removed
2/ Percent of the total 2,000 coho check from each stratum
3/ Release estimates based on TRH estimates of total released; deducts hatchery mortality estimates from the total tagged.

Prepared by: Teri Moore and Michael Lau, California Department of Fish and Game, November 12, 1998.

TASK 4: Salmon Spawner Surveys in the Upper Trinity River Basin

Task Objectives:

To determine, through a system of spawning ground surveys, the distribution, size, sex

composition, incidence of marked/tagged individuals, and pre-spawning mortality of naturally spawning chinook and coho salmon in the main stem Trinity River.

Procedures:

Our study area included the main stem Trinity River from the upstream limit of anadromous fish migration at Lewiston Dam (river km 180.1) to the confluence of the North Fork Trinity River (river km 116.7). We divided the survey area into seven zones (see Table 1) based on historic use by spawning adult salmon and accessibility to survey crews. This area was surveyed once a week throughout the salmon spawning season by personnel in rafts.

Table 1. Description and lengths of river zones used in the 1997-98 main stem Trinity River spawner survey.

River zone	River km (range)	Length (km)	Zone description
1	180.1-176.9	3.2	Lewiston Dam - Old Lewiston Bridge
2	176.9-169.0	7.9	Old Lewiston Bridge - Browns Mtn. Bridge
3	169.0-158.8	10.2	Browns Mtn. Bridge - Steel Bridge
4	158.8-148.4	10	Steel Bridge - Douglas City Camp
5	148.8-134.8	14	Douglas City Camp - Round House
6	134.8-124.8	10	Round House - Junction City campground
7	124.8-116.7	8.1	Junction City campground - Mouth of the North Fork Trinity River

All salmon carcasses encountered during this survey were examined to determine species, sex, spawning condition of the females, presence of fin clips, presence of spaghetti tags, and general physical condition. Additionally, we measured 30 chinook from each survey zone each week to the nearest centimeter (cm) fork length (FL).

We flagged all chinook and coho carcasses which we believed had died no more than one week prior to the survey as evidenced by at least one clear eye and a relatively firm body. Flags consisted of a piece of 1 ½ by 1 ½ inch colored plastic strip attached to a hog ring which was affixed to the fish's mandible. Recovery of flagged fish in subsequent weeks provided an estimate of the survey's efficiency, which was used to estimate the total number of fish which had died in each survey zone.

We chose a date to separate spring from fall chinook based on the presence of spring and

fall coded-wire tagged (CWT) chinook. The date that the number of fall CWTed chinook exceeded the number of spring CWTed chinook in the survey was the separation date. Chinook recovered prior to that date were considered spring chinook and those recovered on or after that date were considered fall chinook.

We did not conduct carcass surveys on tributaries to the mainstem Trinity River this year. Studies conducted previous years have suggested that the tributaries are relatively unimportant in terms of chinook spawning. The relative importance of tributaries to coho spawning has not been determined.

Results:

We examined 3,897 chinook salmon carcasses during the mainstem spawner survey. These included 58 ad-clipped fish, 101 program-marked fish, 1 which was ad-clipped and program-marked; 126 unmarked condition-one carcasses which we flagged, and 3,611 unmarked condition-two carcasses.

Table 2. Distribution and estimated density of adult chinook salmon spawners during the 1997-98 Trinity River survey.

Zone a/	Number carcasses flagged	Flags recovered	% recovery b/	Total observe d/ c/	Expanded total d/	Per cent distribution	Fish/ km e/
1	38	10	26.3%	1,548	5,882	25.4%	1,838
2	33	11	33.3%	1,010	3,030	13.1%	384
3	18	1	5.6%	386	6,948	30.0%	681
4	7	0	6.8%	271	3,985	17.2%	399
5	11	1	9.1%	134	1,474	6.4%	105
6	13	2	15.4%	207	1,346	5.8%	135
7	1	0	11.5%	54	470	2.0%	58
Total	121	25	20.6%	3,610	23,135	100.0%	365

a/ Zones described in Table 1.
b/ Computed from: total number of flags recovered/total number of carcasses flagged multiplied by 100. The percent recoveries for zones in which no flagged carcasses were recovered were estimated by dividing the sum of flagged carcasses recovered in the two adjacent zones by the sum of total carcasses flagged in those zones and multiplying by 100.
c/ Total adult chinook carcasses examined, excluding flag recoveries.
d/ Computed from: (total unflagged carcasses examined / (% flags recovered/100).
e/ Computed from: expanded total/zone length (km).

We recovered a total of 58 adipose-fin clipped chinook during the main stem survey this season Coded-wire tags were extracted from 49 of these. Fifteen different code groups from 4 brood years were represented (see Table 3). Based on the timing of CWTed fish recovered in the survey, we assume that only spring chinook were recovered through October 31, after which only fall chinook were recovered.

Table 3. Release and recovery data for coded-wire tagged chinook salmon recovered in the 1997-98 Trinity River spawner survey.

CWT a/	Type b/	Brood year	Location c/	Number effectively tagged d/	Number recovered e/
601080402	F-f	1992	Lewiston	9,817	1
601080407	Wild	1992	Sky Ranch	7,993	1
601040107	S-f	1993	TRH	222,056	10
601080212	Wild	1993	Sheridan	9,177	1
601080312	Wild	1993	Sheridan	10,856	1
601080313	Wild	1993	Sheridan	11,699	2
601080502	Wild	1993	Sheridan	11,837	1
65705	F-y	1993	TRH	55,039	10
65706	F-y	1993	TRH	55,297	3
65708	S-y	1993	TRH	53,738	3
65709	S-y	1993	TRH	57,787	8
65021	F-f	1994	TRH	54,723	1
65022	F-f	1994	TRH	53,905	1
65220	S-f	1994	TRH	113,236	1
65221	S-f	1994	TRH	113,411	1
65222	F-y	1994	TRH	113,124	2
601040108	F-f	1994	TRH	107,935	1
601080206	Wild	1995	Lewiston	27,944	1
100000 f/					9
Totals					58

a/ Coded-wire tag number assigned to that group of fish.
b/ S = spring, F = fall, y = yearling, f= fingerling, Wild = Naturally produced
c/ TRH = Trinity River Hatchery; release locations for wild fish (Chapter 2 in past Annual Reports).
d/ Number effectively tagged = (Total number tagged) - (tagging mortalities + estimated shed tags + estimated poor fin-clipped fish).
e/ Adipose fin-clipped recovered fish.
f/ CWTs were either unreadable, shed, or lost while decoding.

Spring chinook females comprised 53.7% of the adults while fall chinook females comprised 54.0% of the total. Females accounted for 53.8% of the of the total (spring

plus fall) adult recovery in the survey.

We observed a female pre-spawning mortality rate of 2.6% for spring chinook, and 5.7% for fall chinook. The overall (spring and fall chinook) pre-spawning mortality rate for adult females was 3.5%. Pre-spawning mortality rates in the Trinity River have ranged from 1.1% (1991) to 44.9% (1988) during prior surveys conducted sporadically since 1955. As noted by the Department in the past, pre-spawning mortality in the Trinity River is directly related to escapement: as escapement increases, so does pre-spawning mortality.

We examined a total of 14 coho salmon carcasses during the mainstem spawner survey. These included 10 which had received a right maxillary clip, and 4 unmarked fish.

Table 4. Adult coho salmon spawner distribution and estimated density by river zone during the 1997-98 Trinity River spawner survey.

Zone a/	Total observed	Observation efficiency b/	Expanded total c/	Percent distribution	Spawner density (fish/km) d/
1	8	26.3%	30	30.8	0.3
2	2	33.3%	6	6.1	0.1
3	3	5.6%	54	54.3	0.5
4	0	6.8%	0	0.0	0.0
5	0	9.1%	0	0.0	0.0
6	0	15.4%	0	0.0	0.0
7	1	11.5%	9	8.8	0.1
Zone a/	Total observed	Observation efficiency b/	Expanded total c/	Percent distribution	Spawner density (fish/km) d/
Total: Mean:	14	20.6%	99	100.0	1.6

Table 4 (cont.).

a/ Zones described in Table 1.
b/ Recovery efficiencies described in Table 2.
c/ Computed from: (total unflagged examined/(% flags recovered/100).
d/ Computed from: expanded total/zone length (km).

Prepared by: Teri Moore and Michael Lau, California Department of Fish and Game, November 6, 1998.

TASK 5: Capture and Coded-wire Tagging of Naturally Produced Chinook Salmon in the Trinity River Basin

Task Objectives:

To capture, mark (adipose fin clip), tag (binary-coded wire) and release representative groups (up to 200,000 fish/group) of naturally produced chinook salmon fry and fingerlings. Releases are into the mainstem Trinity River for subsequent determination of their survival and contribution to ocean and river fisheries and spawning escapement.

Procedures:

Task 5 is composed of three distinct phases: trapping, tagging, and recovery. The trapping and tagging phases take place in the spring following the emergence of juvenile chinook salmon. The recovery phase takes place from two-to-five years later and involves the efforts of several agencies; including the Department of Fish and Game (Department), Hoopa Valley Tribal Fisheries Department, Yurok Tribal Fisheries Department, and the Pacific Fisheries Management Council. This report will be

concerned with the tagging and trapping phases of the Task 5. The recovery phase will be discussed in a future report.

Trapping was conducted in the main stem Trinity River using from one to eight fyke nets per night. The nets were 3.1 m wide x 1.2 m high at the mouth; tapering 7.6 m to a 0.33-m by 0.33-m exit leading into dual live boxes. Each net was attached at the mouth to a 2.5-cm diameter galvanized pipe frame, which was connected by ropes to metal posts driven into the streambed. The nets were normally set at mid-afternoon and recovered at midmorning the next day, when all captured fish were transferred to holding cages and placed in the river.

Tagging was conducted inside a 5.5-m long converted office trailer placed adjacent to the trapping site. A 3.5-KW generator was used to supply the electrical needs of the operation (tagging machines, pumps and lights). Usually, two or three tagging machines were used depending on the availability of fish.

Each fish to be tagged was anesthetized with alka-seltzer gold, its adipose fin removed (ad-clip) and a one-half length coded-wire tag (CWT) injected into its rostrum. Each day, a sample of 100 juvenile chinook from each CWT group was retained for a quality control (QC) check, and the remainder were released downstream of the trapping site. The QC fish were transferred to a live box and placed in the river for a minimum of 24 hours; after which they were examined for mortality, tag retention, and ad-clip quality. Tag retention was verified by passing each fish though an electronic tag detector, and ad-clip quality was verified by direct examination. The number of effectively tagged fish from each day's tagging effort was calculated by subtracting the estimated mortality, tag shedding and poor ad-clips from the daily total tagged.

We measured a sample of 100 juvenile chinook to the nearest mm fork length (FL) at least once a week. We kept track of the number of fish trapped each day by placing each trapping day's fish in a separate holding cage. These fish were counted automatically during the tagging process.

Results:

Our trapping efforts began on March 9 and concluded on May 28, 1998. Total effort during this period was 86 trap nights (one net fished for one night) and total catch was 4,161 chinook, 27 coho and 77 steelhead.

The overall catch-per-unit effort (CPUE[1/]), during the historical peak emigration period

[1/] Catch-per-unit-effort is defined as the average number of fish caught per trap per night fished. For example: if we fished eight nets for one night and caught 800 fish, the CPUE would be 100 fish.

(March 5 through May 27) was 56 this year, the lowest recorded since we began tagging naturally produced juvenile chinook in 1989. The CPUE's recorded during previous years have ranged from 2,343 (1990) to the previous low of 77 recorded during 1997. The low CPUE this year was the result of emergency flow increases from Lewiston dam and El Nino rains. On several occasions, the U.S. Bureau of Reclamation increased releases from Trinity reservoir to reduce the rate of increase in storage and spill rate from Lewiston Dam. The resulting high flows reduced the efficiency of our traps, washed away equipment, and ultimately forced us to discontinue Task 5 operations. Furthermore, high flows prior to March 9 washed fry downstream before we were able to start trapping.

We began coded-wire tagging operations on March 17 and finished on May 28. Project personnel coded-wire tagged 2,633 juvenile chinook this season. After subtracting for tagging mortality, tag shedding and poor fin clips, we effectively tagged a total of 2,376 naturally produced chinook (Table 1). Prior years' effective tagging totals are; 15,704 (1988-89), 112,133 (1989-90), 72,865 (1990-91), 56,610 (1991-92), 44,565 (1992-93), 92,486 (1993-94), 123,610 (1995-96), and 38,263 (1997-98).

Coho CPUE ranged from 0 to 5 with a season average of 0 fish per trap night. Steelhead CPUE ranged from 0 to 2 fish with a season average of 1 fish per trap night.

Chinook trapped throughout the season ranged in fork length (FL) from 35 to 84 mm, averaging 51 mm. The overall average FL of CWTed fish was 51 mm.

Table 1. Summary of coded-wire tagging of naturally produced chinook in the Trinity River basin, 1997-98 season.

Coded-wire tag number	Inclusive tagging dates	Number effectively tagged	Average fork length (mm)
0601080506	Mar 17 - May 28	2,376	51.0
Season Total		2,376	51.0

Prepared by: Teri Moore and Michael R. Lau , California Department of Fish and Game, November 20, 1998.

TASK 6: Life History, Distribution, Run Size and Angler Harvest for South Fork Trinity River Basin Anadromous Salmonid Populations

Task Objectives:

1. To determine the timing, size, composition, distribution, and angler harvest of adult fall chinook and coho salmon runs in the South Fork Trinity River (SFTR) basin.

2. To determine by direct observation methods, the timing, size, composition, and distribution of adult spring chinook and spring (summer) steelhead runs in the SFTR basin.

3. To determine juvenile salmonid emigration timing patterns and assess their rearing areas and residence times in the SFTR basin.

4. To describe age compositions and life-history patterns of adult and juvenile salmonids through scale pattern analysis.

Introduction:

We used several methods to achieve the objectives of Task 6. These methods included snorkel surveys, redd counts, carcass counts, and trapping of juvenile salmon and steelhead.

Procedures:

Snorkel Survey: From August 19-28, 1997, teams of two to three individuals equipped with mask, snorkel, wetsuit, and wading shoes examined a total of 144.1 river km (divided into sixteen adjacent sections) within the SFTR basin. Fourteen sections were located between the E.F. (East Fork) of the SFTR to the confluence with the mainstem Trinity River, and 2 sections were located in lower Hayfork Creek (see attached map). Each section was surveyed once. The surveyors floated or swam downstream; recording the number of adult chinook, grilse chinook, adult steelhead, and half-pound steelhead. They also noted habitat types where adult chinook and steelhead were observed, and any adverse habitat conditions.

Redd survey and carcass recovery:

Personnel surveyed the SFTR from the air three times to determine the onset of spawning and the distribution of spawning activity. Sections which contained the highest concentrations of adult chinook and redds (based on historical data, the August snorkel survey and aerial surveys) were subsequently surveyed on foot by crews of two to three individuals. Each redd was measured (length and width), and its approximate location recorded on a topographical map. Brightly colored flagging was tied to riparian vegetation directly opposite the redd. The date of observation and redd length and width measurements were recorded on the flagging. The run size was calculated from the total number of redds observed multiplied by 2.25, plus live fish counted on the last survey date.

All carcasses recovered during the redd surveys were identified to species, sexed, examined for external tags and fin clips, and measured to the nearest 1 cm fork length (FL). Scales were taken from carcasses in good condition. Spawning success was assessed based on a visual estimate of the percent of eggs or amount of sperm remaining in the carcass. Pectoral fins were collected for the Yurok Tribal Fisheries Department, and organs (heart, liver, gill arch and eye) were collected for the National Marine Fisheries Service for DNA analysis. Adult chinook and redds observed upstream of Hitchcock Creek (River km 57.9) were considered to be spring-run fish.

Juvenile trapping: We captured juvenile salmon and steelhead using fyke nets attached to trap boxes. The nets were constructed of 1.3 cm nylon mesh, and had a 1.2 m by 3 m upstream opening, and extended 10 m to a trap attachment frame at the terminal end. Trap boxes were constructed of plywood and hardware cloth, and measured 0.8 m wide by 1.2 m long and 0.5 m in depth (vertical dimension). We fished the traps overnight once per week (depending on flow and temperature conditions) at 13 locations in the

SFTR basin from April 1997 through December 1997; and from April 1998 to September 30, 1998. We suspended trapping operations at a particular station when morning water temperatures exceeded 68 degrees F. We identified trapped juvenile salmonids to species and measured them to the nearest 1 mm fork length (FL). We collected scales from all juvenile salmon greater than 55 mm (FL) and steelhead greater than 60 mm (FL).

Results:

Adult Salmon Population Monitoring:

Snorkel survey: We counted 647 adult spring run chinook and 95 adult steelhead during the August snorkel survey (see Table 1). The majority were observed holding in pools; and all appeared to be in excellent condition.

Redd and carcass surveys: We conducted redd surveys for spring run chinook salmon during the weeks ending (WE) October 17 and November 7 (see Table 1). The preliminary run size estimate calculated for spring-run chinook salmon was approximately 720 fish. Carcasses recovered and measured during the redd surveys ranged in size from 50 cm (FL) to 97 cm (FL), and no tagged or marked fish were recovered. Pre spawning mortality for spring-run chinook was calculated to be approximately 15%.

Due to dangerous flow conditions, we did not conduct foot or snorkel surveys to count adult fall chinook or redds. Instead, personnel counted redds and live fish from a California Highway Patrol helicopter flying at an altitude of approximately 400 feet over the SFTR. Based on the number of redds and live fish counted in sections downstream of Hitchcock Creek (river km 57.9) to the confluence with the Trinity River, the preliminary run size estimate for fall-run chinook salmon was calculated to be approximately 1,210 fish.

Table 1. Summary of 1997 South Fork Trinity River snorkel and redd counts.

		Snorkel Survey		**Redd survey**	
		Fish counted		Chinook redds counted	
Section	**River km (range)**	Chinook	Steelhead	Spring run	Fall run
A	0-6.5 (East Fork SFTR)	0	0	**	**
B	112.0-117.8	0	0	**	**
C	117.8-111.3	9	1	**	**
D	111.3-102.7	34	2	**	**
E	102.7-89.5	45	5	59	67
F	89.5-77.7	114	22	36	45

G	77.7-68.4	281	8	153	128
H	68.4-57.9	113	5	72	120
I	57.9-49.6	7	7	37	38
J	49.6-40.2	15	11	211	197
K	40.2-31.7	10	6	0	52
L	31.7-22.5	1	8	0	36
M	22.5-13.2	0	0	0	46
N	13.2-2.3	1	1	0	121
Y	0-8.0 (Hayfork Creek)	10	17	83	0
Z	8.0-15.6 (Hayfork Creek)	7	2	**	**
Totals		**647**	**95**	**651**	**850**

** Sections not surveyed.

Juvenile out-migrants monotoring:

Juvenile trappings: Between July and November 1997, juvenile chinook salmon were captured only at the mouth of Hayfork Creek. Juvenile steelhead were captured at all stations. No juvenile coho salmon were captured. Peak catches of juvenile steelhead varied from location to location (see Table 2).

Between April and July, 1998, juvenile chinook were captured at the "Curved Bridge", Forest Glen sites on the SFTR mainstem, and at the mouth of Hayfork Creek. Juvenile steelhead were captured at all stations. No juvenile coho were captured. The peak catches of juvenile steelhead varied from location to location (see Table 2).

Table 2. Total number of juvenile salmon and steelhead caught in fyke traps throughout the South Fork Trinity River (SFTR) basin from July 1997 through June 1998.

			Total captured		
Location	**River (km)**	**Time span**	**Chinook**	**Steelhead**	**Coho**
South Fork Trinity River					
Sandy Bar	2.2	7/1/97 to 7/14/97	0	17	0
Curved Bridge	49.6	7/2/97 to 10/30/97	0	203	0
		4/30/98 to 6/25/98	61	154	0
Forest Glen	89.5	7/9/97	0	3	0

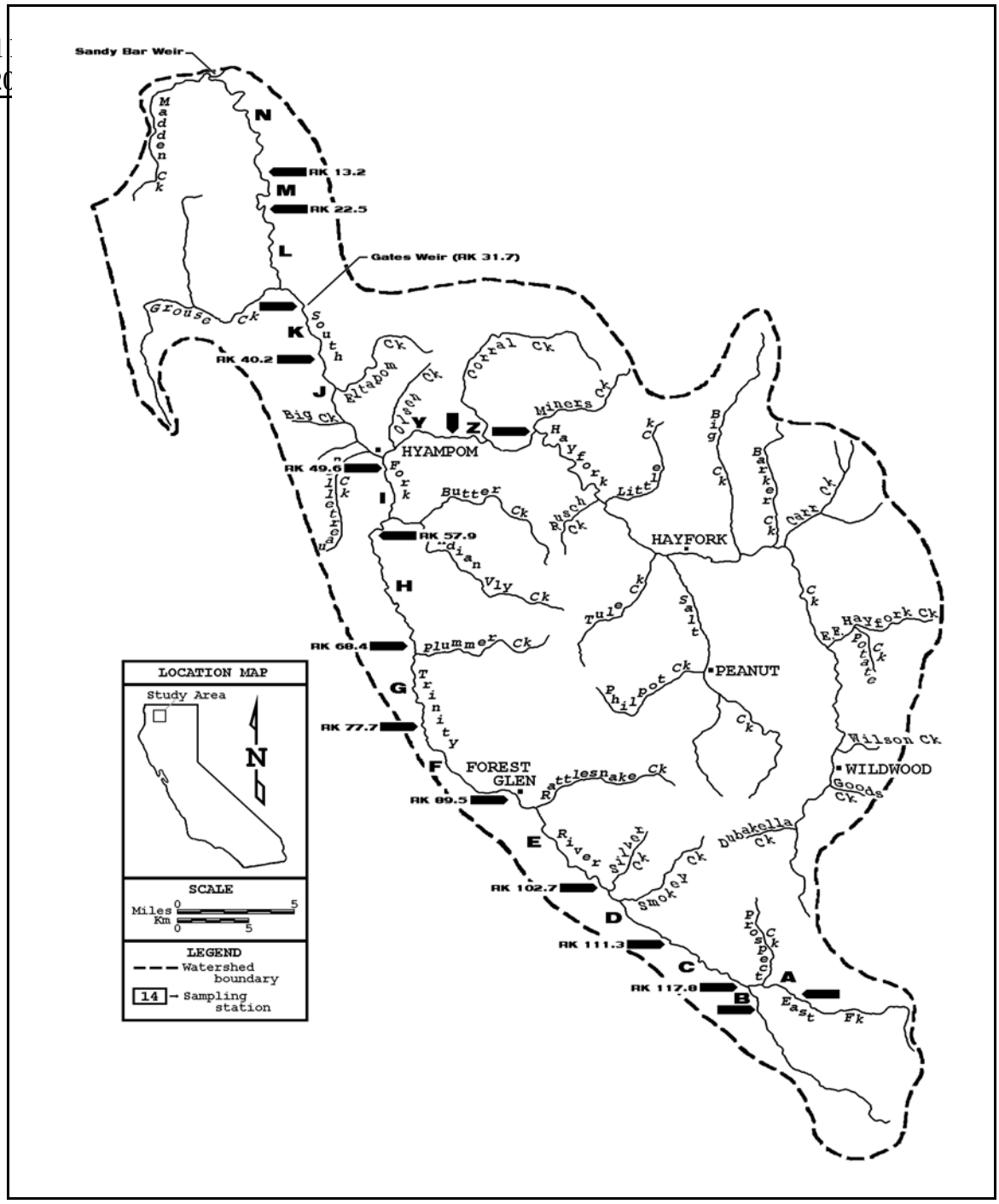
		6/4/98 to 6/25/98	2	42	0
Above E. F. of SFTR	117.8	7/2/97 to 11/13/97	0	201	0
		5/7/98 to 6/23/98	0	90	0
Hayfork Creek					
Mouth	0.1	7/2/97 to 10/30/97	4	799	0
		4/30/98 to 6/25/98	10	357	0
near Big Creek	32.6	7/3/97 to 7/17/97	0	83	0
Wildwood	54.0	7/10/97 to 11/13/97	0	5	0
		4/17/98 to 6/24/98	0	21	0
near Dubakella Creek	58.4	7/10/97 to 11/13/97	0	3	0
		5/13/98 to 6/25/98	0	4	0
Other Tributaries					
			Total captured		
Location	**River (km)**	**Time span**	**Chinook**	**Steelhead**	**Coho**
E. Fk. SFTR	0.1	7/11/97 to 11/13/97	0	73	0
		5/7/98 to 6/23/98	0	68	0
Eltapom Creek	0.1	7/2/97 to 10/14/97	0	179	0
E. Fk. Hayfork Cr.	0.1	7/9/97 to 7/15/97	0	40	0
		4/3/98 to 6/24/98	0	238	0
Pelletreau Creek	0.3	7/2/97 to 7/25/97	0	16	0
Butter Creek	0.2	9/24/97 to 10/14/97	0	32	0
Lower Madden Cr.	0.2	9/30/97 to 10/29/97	0	6	0
Upper Madden Cr.	2.5	10/7/97 to 10/29/97	0	2	031

Table 2., continued

Life history patterns:

Scales collected during field activities are currently being analyzed and results will be reported in the future.

Prepared by: Teri Moore, Michael Lau, and Sara Borok, Department of Fish and Game, November 20, 1998.



Map of the South Fork Trinity River basin depicting the locations of major landmarks and snorkel survey sections examined during August 1997.