State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

JUVENILE SPRING-RUN CHINOOK SALMON EMERGENCE, REARING AND OUTMIGRATION PATTERNS IN DEER AND MILL CREEKS, TEHAMA COUNTY, FOR THE 1995 BROOD YEAR

SPORT FISH RESTORATION ANNUAL PROGRESS REPORT

by

Colleen D. Harvey
Associate Fishery Biologist
Inland Fisheries Division

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INTRODUCTION

This annual brood year report documents the length frequency of spring-run chinook salmon smolts emigrating from Mill and Deer creeks and the timing of spring-run yearling outmigration. Juvenile growth patterns are followed from emergence through rearing and emigration. This 1995 brood year (BY) report will cover the 1995 adult spring-run chinook salmon (spring run) population counts, onset and peak of spawning, calculated and actual timing of 95 BY spring-run fry emergence, spring-run juvenile growth rates, spring and fall-run fry emigration and spring-run chinook salmon yearling emigration.

This 95 BY report was funded through the Federal Sport Fish Restoration Act for the purpose of investigating spring-run life history in Mill and Deer creeks. No conclusions will be drawn at this time as to the emigration patterns of spring-run chinook salmon in Mill and Deer creeks.

1995 Adult Population Counts and Spawning Surveys in Mill and Deer Creeks.

An estimated 320 adult spring run entered Mill Creek in 1995. This estimate was derived from electronic and visual counts at Clough Dam, February through June 1995. Spring-run spawning surveys for these adult salmon began in Mill Creek on 23 August (Table 1). The purpose of these spawning surveys is to determine the onset, peak and termination of spawning and to collect tissue samples from carcasses for genetic analysis. Spawning surveys extended from above Hwy-36 bridge crossing downstream to 2 miles below Black Rock. The reaches from Rocky Gulch to Savercool and from 2 miles below Black Rock to Little Mill Creek were not surveyed. The first redds were counted in the Black Rock area on 14 September. Maximum daily water temperatures in the Black Rock area dropped below 57°F on 22 September (Appendix Tables 1-4). Given the limited number of surveys made, the peak and termination of spawning and spawning distribution cannot be determined for Mill Creek.

In Deer Creek, the 1995 adult population was counted by snorkel surveying the adult holding habitat. On 2 August the reach from Upper Falls to approximately 4 miles downstream of Ponderosa Way crossing was surveyed and 1,295 adult salmon were counted. Spring run spawning surveys in Deer Creek began on 22 August. Spawning surveys extending from Upper Deer Creek Falls to Gaithers Camp. Areas not surveyed include the reach from Hwy-23 to Lower Falls, from Wilson Cove to Polk Springs and downstream of Gaither Camp. The first redds were counted the week of 30 August in the Lower Falls area(Table 1). Maximum daily water temperatures at the onset of spawning were 56°F (Appendix Tables 1-4). Of the areas surveyed, Upper Falls to Potato Patch Campground had the highest concentration of redds. The onset of spawning in this reach was the week of 5 September. The week of 12 October appeared to be the peak of spawning activity. On 31 October, live fish were still on redds in the Upper Falls area. In the Lower Falls to A-line reach the peak of spawning was the week of 10 October. No live fish were seen on redds after 23 October in this reach. Spawning data from these two reaches will be used in calculating time of egg hatching and fry emergence.

TABLE 1. August - October 1995 spring-run spawning records in Mill and Deer creeks.
Redd counts are cumulative for the season--all redds are counted in every survey.

Mill Creek spring-run chinook spawning survey counts.

Date	week #	Area	Total Redds	Carcasses	Live
08/23/95	34	Savercool to Black Rock	0	0	0
08/31/95	35	Savercool to Black Rock	0	0	0
09/06/95	36	Savercool to Black Rock	0	0	0
09/13/95	37	Little Hole-in-the-Ground to Hole-in-the-Ground Camp	0	0	0
09/16/95	37	Hwy-36 Bridge	0	0	0
09/14/95	37	Savercool to Black Rock	2	0	0
09/18/95	38	Black Rock to Ranch House	5	0	0
10/03/95	40	Savercool to Black Rock	6	0	4
10/04/95	40	Hole-in-the-Ground to Rocky Gulch	24	2	7
10/11/95	41	Hwy-32 to Hole-in-the-Ground	31	3	7
10/11/95	41	Little Hole-in-the-Ground to Hole-in-the-Ground Camp	35	9	21
10/17/95	42	Hot Springs bridge to Hwy -36	0	0	0
10/30/95	44	Little Hole-in-the-Ground to Hole-in-the-Ground Camp	24	9	0
Electronic counter spring run estimate: 320					

Note: Areas not surveyed: Rocky Gulch to Savercool and Black Rock Ranch House to Little Mill Creek.
Redd counts do not represent total redds since some surveys were made prior to end of spawning season.

Deer Creek spring-run chinook spawning survey counts.

Date	week #	Area	Total Redds	Carcasses	Live
08/22/95	34	Upper Falls area	0	0	0
08/24/95	34	Lower Falls to A-line	0	0	0
08/28/95	35	Upper Falls, Hwy-32	0	0	0
08/29/95	35	Ponderosa Way, Beaver Creek	0	0	0
08/30/95	35	Lower Falls to A-line	5	0	0
09/05/95	36	Upper Falls, Hwy-32	4	0	0
09/15/95	37	Lower Falls to A-line	35	0	6
09/19/95	38	Upper Falls to Potato Patch	84	1	26
09/26/95	39	Upper Falls to Potato Patch	89	17	77
09/27/95	39	Lower Falls to A-line	74	6	21
10/01/95	40	A-line to Wilson Cove	94	4	24
10/04/95	40	Upper Falls to Potato Patch	209	19	68
10/05/95	40	Lower Falls to A-line	94	10	31
10/05/95	40	Polk Spring To Murphy Trail	102	1	5
10/10/95	41	Lower Falls to A-line	111	6	22
10/12/95	41	Upper Falls to Potato Patch	235	15	105
10/16/95	42	Upper Falls to Potato Patch	326	16	56
10/23/95	43	Lower Falls to A-Line	79	1	3
10/26/95	43	Beaver Creek to Gaither Camp	7	1	0
10/26/95	43	Murphy Trail to Beaver Creek	122	0	0
10/30/95	44	Upper Falls to Potato Patch	275	10	6
10/30/95	44	Lower Fall to A-line	- - -	2	0
Snorkel survey spring run estimate: 1,295					

Note: Areas not surveyed: Hwy-32 to Lower Falls and Wilson Cove to Polk Spring.
Redd counts do not represent total redds since some surveys were made prior to end of spawning season.

Egg Incubation, Hatching and Fry Emergence

To calculate fry emergence, daily temperature units (TU) were calculated from the water temperature records on each creek, starting with the onset of spring-run spawning. A TU is defined as the average daily water temperature (in °F) minus 32. From the time of egg fertilization, a cumulative minimum total of 1550 TU's is required for the egg to hatch and the fry to emerge. Based on these criteria, the calculated earliest emergence in Deer Creek at A-line would be 28 November. The expected emergence from the peak date of spawning would be 24 January (Table 2). Between the time fry are first estimated to hatch to the time the peak of hatching could occur is a two-month time period. This gap is further extended by estimating the latest time period fry would be emerging. The termination of spawning at A-line area was 23 October. Estimated emergence of fry from this date would be 13 February. So although the time lapse between the onset and termination of spawning (8/30-10/32) is approximately eight weeks, this can lead to a 11-week lapse between the onset and termination of fry emergence. Weekly sampling for newly emerged fry in Deer Creek began on 18 December 1995. The first fry were observed in the A-line area on 11 January ranging in size from 31-36 mm FL. In the Ponderosa Way area the first fry were observed on 28 December ranging in size from 32-34 mmFL. Fry in this size range continued to be sampled through 3 May (Figure 1).

TABLE 2. Calculated and actual spring run fry emergence times in Deer Creek and Mill Creek based on time of onset and peak of spawning activities.

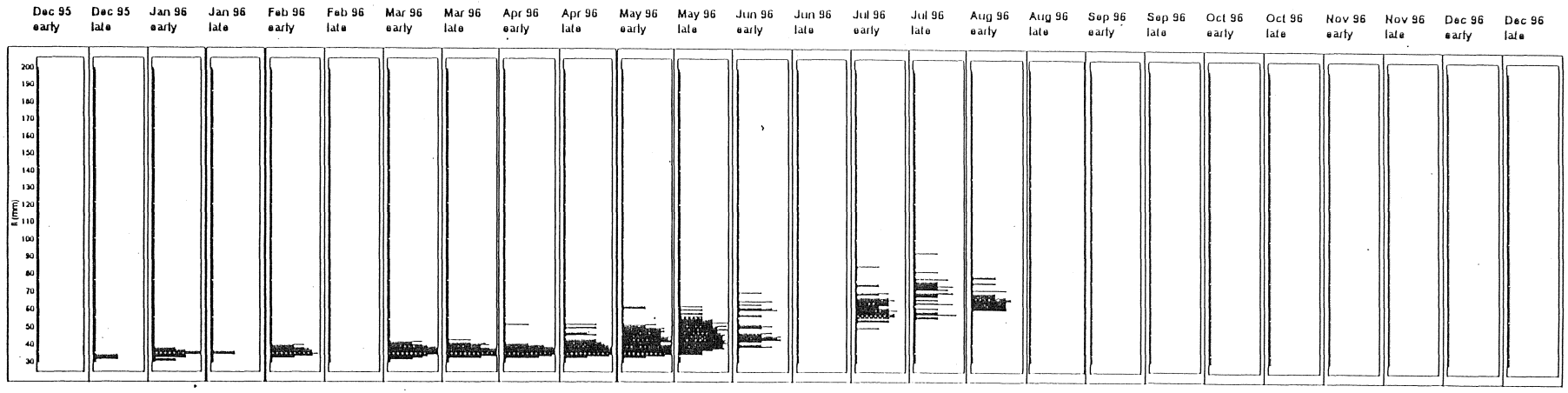
Creek		Spawning Dates	Calculated Emergence	Actual Emergence	Size mm FL
Deer Creek at A-line	(onset)	08/30/95	11/28/95	01/11/96	31-36 mm
	(peak)	10/10/95	01/24/96		
Deer Creek at Ponderosa Way		no surveys		12/28/96	32-34 mm
Mill Creek at Black Rock	(onset)	09/14/95	12/15/96	01/09/96	34-35 mm
	(peak)	no surveys			

In Mill Creek the calculated earliest emergence in the Black Rock area would be 15 December. Weekly surveys began on 9 January. Spring-run fry were captured on this first survey and ranged in size from 34-35 mm FL. No spawning surveys were made in the Black Rock area to determine the peak and termination of spawning. Newly emerged fry in the 33-34 mm FL size range continued to be sampled through 2 May (Figure 2). Due to snow and road closures, Black Rock was the only sampling station accessible during the time of spring-run fry emergence this season.

Juvenile rearing

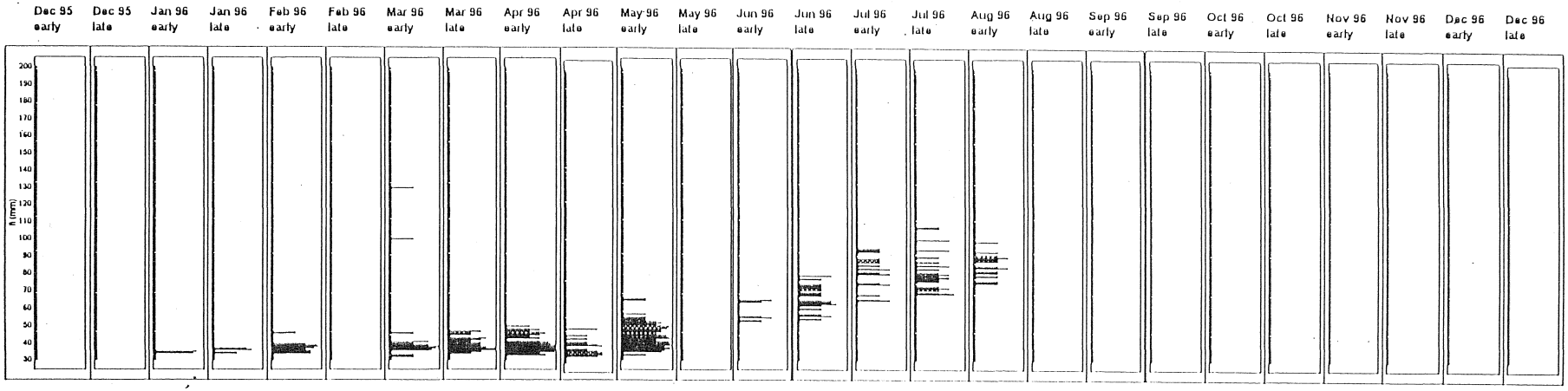
In Deer Creek, 864 juvenile spring-run salmon were sampled from late December 1995 through late August 1996 (Figure 1). By early June, juveniles had moved from the edgewater rearing

Figure 1. Length frequency distribution (mmFL) of spring-run chinook salmon rearing in Deer Creek, December 1995 - December 1996. Sample size = 864 fish.



source: dfg.ifd,redbluff

Figure 2. Length frequency distribution (mmFL) of spring-run chinook salmon rearing in Mill Creek, December 1995 - December 1996. Sample size = 418 fish.



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areas into the riffle and pool areas. From June through August, length frequencies ranged from 39 to 93 mm FL, with the majority of juveniles sampled ranging from 54 to 78 mm FL. No sampling for juveniles rearing in Deer Creek occurred after August 1995. No 95 BY yearlings were sampled during 96 BY rearing studies in 1997.

In Mill Creek, 418 juvenile spring-run salmon were sampled from early January 1996 through early August 1996 (Figure 2). From June through August length frequencies ranged from 53 to 108 mm FL, with the majority of juveniles sampled ranging from 56 to 95 mm FL. No sampling for 95 BY juveniles rearing in Mill Creek occurred after August 1995. No 95 BY yearlings were sampled during 96 BY rearing studies in 1997.

Techniques used to capture juvenile spring run in Mill and Deer creeks (electroshocking and seining) may be biased toward sampling smaller fish. Therefore, this data may not represent all size ranges of juvenile salmon rearing in these creeks.

Fry and Yearling Emigration

Rotary screw traps were placed in Mill and Deer creeks to sample outmigrant spring run and record size range and timing of emigration (Figures 3 and 4, and Tables 3 and 4). In both Mill and Deer creeks these screw traps are placed in fall-run chinook salmon spawning habitat. Since fall-run and spring-run fry emerge during the same time periods, if spring-run fry emigration occurred simultaneously with fall-run fry emigration, we would be unable to distinguish the two runs in the trap catches.

The rotary screw trap in Deer Creek was fished from early December 1995 through December 1996, excluding the months of July, August and September 1996. The first fry was sampled on 1 December 1995 and measured 31 mm FL. Fry in the 32 to 40 mm FL size range continued to be sampled through late April. Maximum size increased each month from 42 mm FL in December to 97 mm FL in May (Figure 3 and Table 3). The first 95 By spring-run yearling outmigrant was trapped on 19 November 1996. One-hundred and three yearlings were captured between 19 November and 5 December ranging in size from 68 to 118 mm FL. Due to high flows, the rotary screw trap was not reinstalled after 5 December 1996.

The rotary screw trap in Mill Creek was fished from December 1995 through December 1996 excluding the months of July, August and September. The first fry was sampled on 9 December measuring 32 mm FL. Fry in the 33 to 40 mm FL size range continued to be sampled through April 1996. Maximum size increased each month from 33 mm FL in December to 101 mm FL in May (Figure 4 and Table 4). The first 95 BY spring-run yearling outmigrant was trapped on 3 November. Ten yearlings were captured between 3 November and 5 December ranging in size from 93 to 117 mm FL.

1994 BY Trapping

Yearling 1994 BY spring run may have been captured during rearing and outmigrant sampling in Mill and Deer Creeks. Figures 2 and 3 show salmon in the 101 to 149 mm FL range occurring in December 1995 through early April 1996 which do not fit the growth patterns of the 95 BY juveniles sampled.

Figure 3. Length frequency distribution (mmFL) of spring-run and fall-run chinook salmon emigration from Deer Creek, December 1995 - December 1996. Sample size = 2994 fish.

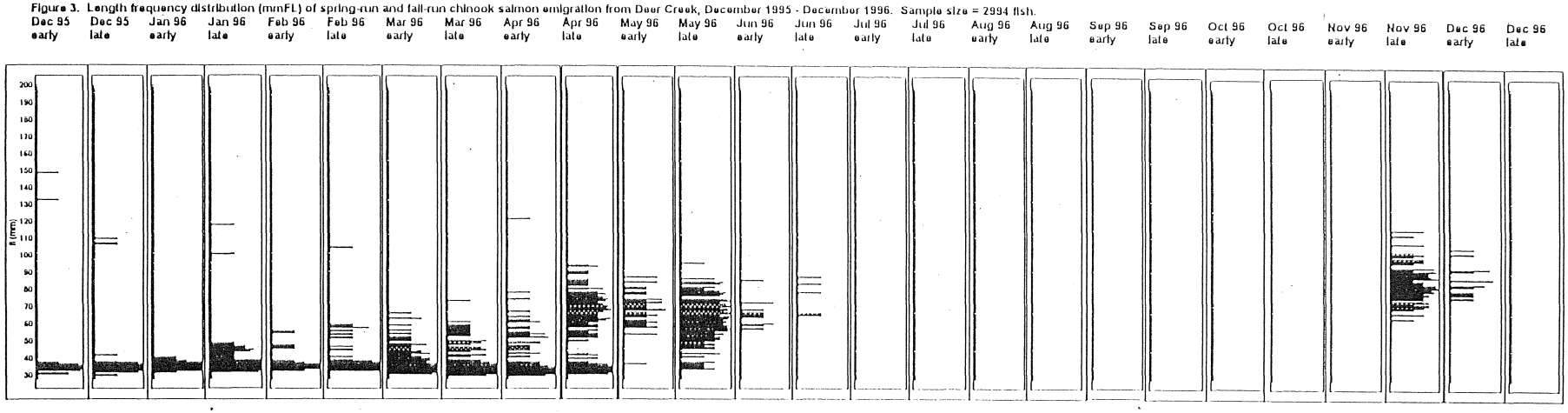

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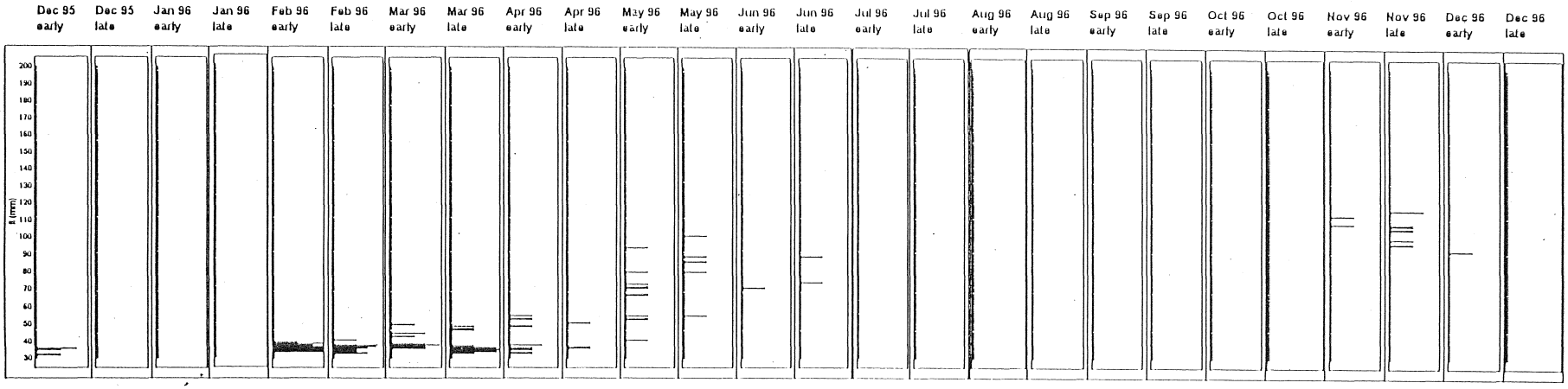
Figure 4. Length frequency distribution (mmFL) of spring-run and fall-run chinook salmon emigration from Mill Creek, December 1995 - December 1996. Sample size = 176 fish.



source: dfg.ifd,redbluff

Table 3. Spring-run and fall-run chinook salmon emigration from Deer Creek December 1995 through December 1996.
Note: 94 BY yearlings are reported in 94 BY Annual Report, and 96 BY fry will be reported in a 96 BY report.

Method: 8' rotary screw trap fished at canyon mouth: T25N, R1W, S22.

YEAR		1995	1996									
MONTH		DEC	JAN	FEB	MAR	APR	MAY	JUN	SEP	OCT	NOV	DEC
DAY	1/											
1		1		156		5	21				0	0 no sampling in spring 1997
2		0	102	51		29	2				0	7
3		0	11	9		16	13	in				3
4		0	3			17	out	2				0
5		1	4	5	in	11					0	7
6		0	2	out	26			6				out
7			2		10						0	
8			4		11	13						
9		0	5		4	7						
10		0	168		11			1			0	
11		0	75		25	104						
12			187		112	17					0	
13		3	94		40							
14		61	84		15			2			0	
15		out	126	in	38	20	in				0	
16		in	550	164	27	30	66			in	0	
17		56	out	66	48	44	30	3			0	
18		33		125	32	42				0	0	
19		25	in	out	40	18					15	
20		24	259		43			4		0	38	
21		12	211		47		7				18	
22		7	89		50		8			0	2	
23		8	141		34		26				3	
24		9	53		75	21	15	0		0	3	
25			40		31	18					2	
26		4	104		17	14		0			9	
27		2	45							0	5	
28		6	40		723		17	0			1	
29		5	88		55	22	5			0	0	
30		8			21	21	out	out		0	7	
31		8	64		4							
# TRAP DAYS		29	28	8	26	31	17	26		15	30	5
# TRAPPED	fry	273	2551	576	1539	469	210	18		—	—	—
	yearling	—	—	—	—	—	—	—		0	103	17
SIZE RANGE MMFL	fry	30-42	32-49	33-60	32-75	32-96	36-97	59-89		—	—	—
	yearling	—	—	—	—	—	—	—			66-118	78-107
AVERAGE MMFL	fry	35	35	36	37	45	66	63		—	—	—
	yearling	—	—	—	—	—	—	—			88	90

1/ no fry trapped prior to Dec 1.

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Table 4. Spring-run and fall-run chinook salmon emigration from Mill Creek December 1995 through December 1996.
Note: 94 BY yearlings are reported in 94 BY Annual Report, and 96 BY fry will be reported in a 96 BY Annual Report

Method: 5' rotary screw trap fished at canyon mouth: T25N, R2W, S1.

YEAR		1995	1996									
MONTH		DEC	JAN	FEB	MAR	APR	MAY	JUN	SEP	OCT	NOV	DEC
DAY												no sampling in spring 1997
1					0	0		no		in		0
2				in	out	6		sampling				0
3				0		0	1	0			2	0
4				out						0		1
5					in	0		0			0	0
6					1		4					out
7				in	1						0	
8		in		16	0	1				0		
9		1		9	1		0					
10		0		3	0			0		0	0	
11		0		13	0	1						
12				10	1	0					0	
13		0		12	4		0	1		0		
14		4		6	9						0	
15		out		5	0	0	3				0	
16				7	1	0	0			0	0	
17				6	0	1	0	1			0	
18				out	0	1				0	0	
19					2	0					4	
20					0	out		0		0	1	
21					0						0	
22						In				0	0	
23					3						1	
24					9	1	1	1		0	0	
25					0	0					0	
26				in		0		0			0	
27				2	1					0	1	
28				1	18		1	0			0	
29				0	0	0				0	0	
30					1	0		out		0	0	
31					0		3					
# TRAP DAYS		6		14	27	27	31	29		30	30	5
# TRAPPED	fry	5		90	52	11	13	3		—	—	—
	yearling	—		—	—	—	—	—		0	9	1
SIZE RANGE MMFL	fry	32-36		33-41	33-50	33-55	41-101	71-89		—	—	—
	yearling	—		—	—	—	—	—			97-117	93
AVERAGE MMFL	fry	35		37	37	42	73	78		—	—	—
	yearling	—		—	—	—	—	—			108	93

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Coded-Wire-Tagging

Juvenile salmon >40 mm FL captured during rearing studies in the spring and yearling salmon captured in the rotary screw traps in the fall were coded-wire tagged with a code unique to each creek. In Deer Creek, 782 spring run were tagged using tag code 0601080408. In Mill Creek 157 salmon were tagged using tag code 0601080409. Juvenile salmon sampling efforts in the Sacramento River and Delta during the fall of 1996 did not recover any Mill or Deer Creek tag codes. Daily sampling sites included rotary screw traps at GCID and Knights Landing, mid-water or Kodiak trawl sited at Sacramento, Mossdale and Chipps Island, and beach seining in the lower Sacramento River, norther Delta, Central Delta and south Delta.

Recommendations

The 1995 BY is the third year that spring-run life history in Mill and Deer Creeks has been monitored from adult migration through juvenile emigration This life-history study is scheduled to continue through four complete brood years. Knowledge of spring-run adult migration timing is used in coordinating instream flows with irrigation demands in Mill and Deer Creeks. The timing of spring-run fry and yearling outmigration timing is used in setting Sacramento-San Joaquin Delta flow standards to protect spring-run smolts. Due to the small sample sizes inherent with such low adult population numbers, coded-wire tagging is an impracticable method to monitor juvenile spring-run salmon movement through the Delta.

APPENDIX TABLE 1. Daily water temperature records for Deer Creek at A-Line: July 1995 - December 1996; The A-line Road crossing area is used by spring-run chinook salmon for adult holding and spawning, egg incubation, fry emergence, and juvenile rearing.

	JUL 95			AUG 95			SEP 95			OCT 95			NOV 95			DEC 95			JAN 96			FEB 96			MAR 96			APR 96			MAY 96			JUN 96			JUL 96			AUG 96			SEP 96			OCT 96			NOV 96			DEC 96		
DAY	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean
1	54.1	59.7	57.4	56.3	61.3	58.8	52.9	57.0	54.8	48.9	51.4	50.1	45.9	47.3	46.6	45.5	47.5	46.8	40.1	42.1	41.1	39.7	41.7	40.8	39.6	42.3	40.9	39.7	46.2	42.8	47.1	53.4	50.6	50.2	57.2	54.1	57.4	62.6	60.1	55.9	60.8	58.3	53.8	57.6	55.6	51.6	54.1	52.8	43.7	45.3	44.4	38.3	40.1	39.0
2	55.0	60.3	58.1	57.0	61.7	59.3	53.2	57.0	55.0	49.6	52.3	50.6	45.0	46.4	45.6	43.5	46.4	45.6	41.4	42.3	42.0	40.5	42.1	41.3	39.4	42.8	41.0	40.3	46.0	42.9	47.7	52.5	50.3	52.3	58.5	55.9	57.0	62.2	59.7	55.2	59.9	57.4	52.9	56.5	54.7	51.4	53.4	52.4	43.2	44.6	44.0	38.5	41.0	39.8
3	55.4	60.3	58.4	57.0	61.7	59.2	53.8	57.0	55.2	49.6	52.0	50.7	43.2	44.6	44.1	43.0	43.9	43.4	40.5	42.3	41.4	40.8	42.1	41.4	41.4	42.4	41.7	41.4	47.3	44.1	44.6	50.2	47.8	52.2	58.5	55.8	56.3	61.2	58.7	54.1	59.9	56.9	52.0	55.4	53.8	51.1	53.4	52.1	43.5	44.8	44.0	40.1	42.3	40.7
4	54.7	60.1	57.8	56.1	61.3	58.7	51.1	54.7	53.0	47.3	49.6	49.0	41.7	43.7	42.6	44.5	46.2	43.9	39.0	40.8	39.8	39.6	42.1	40.9	38.1	41.5	39.9	41.5	47.7	44.6	44.6	50.9	48.0	53.2	59.4	56.8	54.1	60.6	57.4	55.0	60.3	57.5	51.1	54.7	52.9	51.1	53.2	52.1	41.5	43.5	42.3	42.3	42.8	42.6
5	54.7	60.6	58.1	57.2	62.2	59.6	51.1	55.0	53.0	46.4	49.6	47.9	41.9	44.2	43.0	46.2	48.0	47.2	39.7	41.5	40.6	39.6	42.1	40.5	38.1	40.3	38.7	43.2	49.6	46.3	44.6	49.6	47.3	54.1	59.9	57.5	56.5	62.4	59.3	54.7	60.1	57.3	50.4	54.1	52.3	51.1	53.2	52.1	40.3	42.1	41.1	40.3	42.1	41.2
6	56.1	60.1	58.6	57.0	61.3	59.0	52.2	55.9	53.9	46.6	49.3	48.0	42.1	44.1	43.2	46.6	48.0	47.0	40.8	41.7	41.4	40.3	42.6	41.2	37.2	42.3	39.6	43.9	50.7	47.3	44.8	50.9	48.2	54.7	60.8	58.3	58.1	64.0	60.8	55.6	61.0	58.1	50.4	54.5	52.3	51.4	53.6	52.4	41.0	42.8	41.7	40.5	42.1	41.2
7	54.7	59.5	57.7	55.6	60.1	57.7	52.5	56.3	54.4	46.6	48.9	47.8	43.5	45.3	44.4	44.8	46.6	45.9	40.5	41.9	41.2	39.7	42.8	41.0	40.3	43.7	42.0	45.0	51.6	48.3	45.3	51.4	48.8	56.1	61.2	59.3	59.0	63.7	61.3	56.1	61.5	58.7	51.1	55.2	53.1	51.1	53.2	52.2	42.1	43.7	42.7	42.3	44.6	43.1
8	55.2	58.8	56.8	53.6	59.0	56.3	52.9	56.3	54.4	46.6	48.6	47.5	44.2	46.8	45.8	44.1	45.3	44.8	41.4	42.8	42.1	39.7	42.8	41.1	40.6	44.8	42.9	44.4	50.9	47.9	45.5	51.3	49.0	56.1	61.2	59.0	58.5	64.0	61.1	56.5	61.9	59.0	51.1	55.0	53.1	51.3	53.4	52.2	42.6	44.4	43.4	43.7	44.6	44.0
9	54.7	57.9	56.6	54.9	59.5	57.1	52.9	56.3	54.4	46.4	48.9	47.6	46.9	48.9	47.9	43.5	45.0	44.6	41.5	42.8	42.5	40.8	43.5	42.2	42.1	45.1	43.6	43.9	47.3	45.5	45.7	52.0	49.3	54.1	59.0	57.1	59.2	64.4	61.6	57.0	62.2	59.5	51.4	55.2	53.2	51.1	52.9	51.9	43.2	44.8	44.0	42.1	44.4	43.0
10	53.8	57.0	55.7	54.9	58.6	56.6	52.5	56.1	54.3	47.5	50.0	48.7	44.8	47.3	45.9	43.0	44.8	43.8	40.1	41.5	40.8	41.4	43.7	42.7	41.2	43.5	42.1	43.2	47.1	45.1	46.0	53.2	50.2	53.6	59.0	56.8	58.5	63.7	61.0	57.9	61.2	59.5	52.0	55.6	53.5	48.6	50.9	49.9	44.2	45.3	44.6	42.3	44.1	42.9
11	51.8	56.3	54.5	52.9	57.6	55.2	53.2	57.4	55.2	47.3	49.8	48.7	44.2	45.9	45.2	44.8	46.4	45.5	41.2	42.3	41.7	40.3	43.7	41.9	40.6	42.1	41.4	42.4	46.8	44.8	48.4	55.4	52.3	54.1	59.7	57.4	58.6	64.0	61.2	57.9	61.5	59.5	50.9	53.4	52.4	49.6	52.0	50.5	43.7	45.7	44.6	43.5	44.1	43.7
12	51.8	56.3	54.3	53.2	57.9	55.5	54.7	57.9	56.1	47.8	49.5	48.7	45.5	48.0	46.8	44.1	46.6	45.9	40.5	41.9	41.1	40.3	43.7	42.1	39.4	43.2	41.4	43.5	46.8	45.0	50.9	56.5	54.1	54.1	59.9	57.5	60.1	64.4	61.8	58.1	63.0	60.3	50.9	52.0	51.4	49.5	51.1	50.3	45.5	46.6	45.9	42.3	44.1	43.4
13	52.3	57.9	55.4	54.0	57.6	55.9	54.7	58.1	56.3	46.6	49.1	47.8	46.4	47.5	46.9	42.3	43.9	43.0	39.4	40.5	40.2	40.5	43.7	42.1	40.5	44.1	42.3	41.4	48.0	44.9	51.4	55.9	54.2	54.7	60.3	57.9	60.3	66.0	62.7	59.7	64.0	61.5	49.6	53.4	51.5	46.6	49.1	48.0	43.2	45.1	44.0	39.7	42.3	40.6
14	54.7	59.7	57.5	54.5	59.5	56.9	55.6	59.0	57.0	47.1	49.3	48.1	45.5	47.3	46.5	41.0	42.8	42.0	39.4	41.5	40.3	40.3	43.7	41.7	40.8	45.9	43.2	43.9	50.4	47.2	52.3	55.0	53.1	54.7	60.1	57.7	61.2	65.5	63.2	57.9	62.8	60.4	52.2	54.1	53.4	46.2	48.0	47.1	41.4	43.0	42.1	39.6	40.8	40.2
15	56.1	61.2	58.8	55.9	60.6	58.0	54.3	57.4	56.0	47.5	49.5	48.4	45.5	46.9	46.3	40.5	43.2	41.8	41.5	42.3	42.1	40.1	44.4	42.0	41.0	46.6	43.8	45.1	48.0	46.4	49.3	52.2	50.5	53.8	59.4	56.9	58.6	63.7	61.1	57.2	61.9	59.5	49.6	52.2	50.8	44.4	46.2	45.3	40.5	42.3	41.3	39.6	41.7	40.6
16	56.1	61.3	59.1	55.6	57.9	56.8	53.6	56.5	54.9	47.3	49.1	48.2	46.2	48.4	47.2	39.6	40.5	40.0	39.6	42.8	41.6	42.8	44.8	43.8	41.4	46.0	43.8	42.6	45.1	43.8	47.3	49.1	48.3	53.6	58.5	56.2	57.0	62.2	59.6	55.9	60.3	58.0	48.7	51.6	50.1	43.5	45.7	44.6	40.5	43.2	41.5	39.9	42.3	40.8
17	57.2	60.6	59.2	52.9	57.0	54.9	52.5	55.6	54.1	47.8	49.8	48.6	45.9	47.1	46.4	38.5	40.1	39.4	37.8	39.7	38.8	42.1	43.7	43.0	42.1	47.7	44.9	38.7	42.8	41.0	46.6	48.2	47.3	52.0	56.3	54.5	57.7	62.2	59.6	55.2	59.7	57.5	49.1	52.3	50.5	44.1	46.6	45.5	43.5	47.1	45.4	38.3	39.9	39.1
18	57.9	61.9	59.7	52.2	57.0	54.5	53.2	56.3	54.6	47.8	49.8	48.8	46.4	48.6	47.6	39.9	41.5	40.7	35.6	39.6	37.0	41.2	42.8	42.0	42.4	48.0	45.2	38.7	43.2	41.1	45.5	47.3	46.3	51.1	56.5	54.1	53.8	59.7	56.8	54.7	58.5	56.7	49.5	52.9	51.0	43.3	45.7	44.1	46.6	47.3	46.8	37.9	39.6	38.9
19	56.5	59.7	58.0	53.2	58.1	55.6	53.6	56.5	55.0	47.8	49.6	48.7	44.8	46.4	45.5	38.7	40.3	39.6	37.8	39.7	39.1	40.5	41.2	40.8	42.1	48.0	45.1	40.3	42.1	41.1	44.2	50.2	47.1	52.2	57.6	55.3	55.2	61.2	58.0	53.2	57.4	55.3	50.4	53.4	51.7	41.5	43.3	42.3	46.4	47.7	47.0	38.7	39.9	39.3
20	54.7	60.3	57.6	54.7	59.2	56.7	53.8	56.8	55.1	47.1	48.7	48.0	44.6	45.3	44.9	38.1	39.6	38.7	38.7	39.9	39.6	40.3	42.6	41.2	42.4	48.0	45.2	38.7	44.1	41.4	43.9	52.0	47.9	54.0	58.5	56.7	57.0	63.0	59.7	53.2	58.5	55.7	51.1	54.3	52.5	40.8	43.5	42.1	46.6	48.0	47.3	36.3	38.1	37.2
21	55.8	60.8	58.4	55.6	60.1	57.6	53.8	55.8	54.7	45.7	48.2	47.4	44.6	46.4	45.4	37.8	38.3	38.0	37.2	39.4	38.3	38.7	41.0	39.9	41.7	47.3	44.7	41.0	45.0	43.1	46.2	48.6	47.6	54.1	58.3	55.8	58.5	63.7	61.0	54.7	59.5	56.9	52.3	54.7	53.4	41.4	44.8	43.1	44.6	47.7	46.4	37.2	37.9	37.6
22	54.7	59.7	57.4	56.5	59.0	57.5	52.3	54.9	53.5	43.7	45.5	44.7	44.8	46.6	45.5	37.8	38.8	38.5	36.3	37.8	37.2	37.9	40.8	39.5	42.1	45.7	44.2	42.8	48.0	45.4	46.2	52.0	48.8	52.7	58.5	55.6	59.5	61.5	60.7	56.3	61.2	58.4	50.7	53.4	52.2	43.7	46.2	44.8	41.5	44.4	42.9	37.6	39.9	38.7
23	54.1	59.5	57.0	56.1	60.8	58.2	51.3	54.0	52.5	43.2	45.1	44.0	44.2	45.3	44.9	37.2	38.3	37.8	36.1	37.8	36.7	37.8	41.0	39.2	39.6	44.4	41.9	44.8	48.0	46.5	44.6	50.5	47.5	52.9	56.7	55.2	58.6	64.2	61.1	57.0	61.2	59.0	50.7	53.4	52.0	45.3	47.1	46.4	43.5	45.7	44.5	38.3	39.7	38.9
24	54.7	60.1	57.4	55.9	59.0	57.4	51.6	54.0	52.7	42.6	44.4	43.5	43.5	44.8	44.4	36.5	37.4	37.1	37.2	38.8	38.0	37.2	39.6	38.0	40.1	44.8	42.5	46.2	48.4	47.2	44.8	52.7	48.9	52.3	56.1	54.0	59.2	64.4	61.7	57.0	61.9	59.4	51.1	54.0	52.3	41.0	46.0	43.6	43.7	45.1	44.4	37.9	39.7	38.9
25	54.3	59.2	56.9	53.4	57.6	55.5	51.6	53.8	52.6	42.3	44.4	43.2	43.5	46.2	45.0	36.3	37.8	37.2	37.2	38.7	38.0	34.9	38.8	37.0	40.8	43.5	42.4	43.5	52.0	47.8	47.7	54.7	51.2	51.1	53.1	52.0	58.6	63.1	61.0	57.0	60.4	58.7	50.4	52.9	51.7	40.3	42.6	41.2	41.5	43.7	42.6	38.8	40.8	40.2
26	53.2	59.0	56.4	51.6	55.9	53.8	51.4	53.6	52.4	43.5	46.6	45.0	42.1	45.7	43.7	36.7	38.7	37.9	37.8	39.6	38.7	34.9	38.3	36.7	39.9	45.0	42.4	45.7	52.0	49.0	48.9	54.9	52.2	51.1	52.3	51.6	59.5	64.4	61.6	53.8	57.7	55.9	50.9	54.1	52.4	41.7	43.5	42.5	40.5	42.3	41.2	38.7	40.6	39.7
27	54.0	59.5	56.9	51.1	55.2	53.3	51.4	53.6	52.4	45.9	48.0	47.0	41.0	42.6	41.7	38.7	40.3	39.5	37.9	39.6	38.4	36.7	38.7	37.6	42.1	44.1	43.0	44.1	50.0	47.4	50.0	54.7	52.4	50.9	52.0	51.4	59.5	62.8	61.1	54.1	59.0	56.4	51.4	53.8	52.6	42.4	44.1	43.2	40.3	42.3	41.6	40.5	41.5	41.0
28	56.5	61.7	59.1	51.1	55.2	53.1	49.3	51.3	50.6	47.1	48.7	47.7	41.7	44.1	43.1	38.7	40.3	39.6	38.1	40.3	39.2	37.6	38.8	38.2	39.0	43.5	41.3	43.5	49.6	47.0	48.7	54.7	51.7	49.5	56.3	53.1	58.6	63.9	60.9	55.8	60.3	57.8	51.4	54.0	52.6	43.2	44.1	43.8	38.8	40.3	39.7	40.3	42.3	41.2
29	56.5	60.6	58.8	51.3	55.8	53.4	48.0	50.4	49.3	46.9	48.4	47.6	42.8	43.5	43.1	40.3	41.5	41.1	38.7	40.3	39.6	38.7	41.5	40.1	38.7	44.8	41.6	44.6	52.7	48.8	48.7	54.1	51.6	53.1	59.2	56.4	59.5	64.4	61.6	56.5	60.6	58.5	52.3	54.7	53.3	42.3	44.4	43.4	38.8	41.5	39.8	40.1	42.3	41.3
30	60.1	61.0	56.7	51.4	55.9	53.7	48.2	50.9	49.4	46.2	48.0	47.2	42.8	45.7	44.5	41.4	42.1	41.7	38.7	40.3	39.5				40.5	46.4	43.3	46.2	53.6	50.3	48.6	54.1	51.5	55.8	61.7	59.0	59.0	63.7	61.2	55.0	59.0	57.0	51.4	54.0	52.8	42.8	44.4	43.7	40.3	43.0	42.1	40.8	44.1	42.3
31	56.1	61.2	58.6	51.8	56.1	53.8				46.6	48.6	47.6				40.8	42.3	41.4	40.3	42.1	41.0				41.9	46.6	44.3				48.6	55.0	52.2				57.4	62.4	59.9	53.8	57.9	55.8				42.3	44.4	43.3				43.5	44.1	43.8
	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean
	51.8	61.9	57.5	51.1	62.2	56.4	48.0	59.0	53.9	42.3	52.3	47.6	41.0	48.9	45.1	36.3	48.0	41.9	35.6	42.8	39.9	34.9	44.8	40.7	37.2	48.0	42.6	38.7	53.6	45.5	43.9	56.5	49.9	49.5	61.7	56.0	53.8	66.0	60.5	53.2	64.0	58.1	48.7	57.6	52.5	40.3	54.1	47.1	38.8	48.0	43.4	36.3	44.6	40.8

source: Dept Fish and Game, IFD Red Bluff

APPENDIX TABLE 2. Daily water temperature records for Deer Creek at Ponderosa Way: July 1995 - December 1996; The Ponderosa Way area is used by spring-run chinook salmon for adult holding and spawning, egg incubation, fry emergence, and juvenile rearing.

	JUL 95			AUG 95			SEP 95			OCT 95			NOV 95			DEC 95			JAN 96			FEB 96			MAR 96			APR 96			MAY 96			JUN 96			JUL 96			AUG 96			SEP 96			OCT 96			NOV 96			DEC 96		
DAY	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean
1	59.0	64.4	61.5	60.3	66.9	63.5	55.6	61.7	58.6	50.9	55.2	52.9	48.6	50.7	49.7	47.3	49.1	48.2	42.3	44.2	43.3	42.3	44.6	43.4	42.3	45.7	43.7	43.2	48.4	46.5	52.2	55.8	53.8	54.1	59.5	56.9																					
2	59.5	65.1	62.1	60.8	67.3	64.0	56.3	62.1	59.0	51.1	55.8	53.4	47.3	49.1	48.2	47.3	49.6	48.6	43.2	45.1	44.1	43.5	45.3	44.2	42.3	46.0	43.8	42.8	46.8	44.7	52.3	55.6	53.7	57.0	62.2	59.3	thermograph lost in flood January 1, 1997																				
3	59.9	65.5	62.4	61.2	67.3	64.1	56.8	61.9	59.0	52.0	56.3	53.9	45.9	48.6	46.9	45.9	47.3	46.4	43.0	44.6	43.9	42.8	45.5	44.4	44.1	45.3	44.7	44.4	48.0	46.4	49.8	52.5	51.0	57.0	61.9	59.4																					
4	59.5	65.1	61.9	60.4	66.9	63.6	54.9	60.1	57.3	50.5	54.1	52.2	43.7	46.0	45.1	46.0	47.8	47.0	41.4	42.8	42.1	44.8	46.9	46.0	43.0	44.8	44.2	44.8	48.6	47.1	49.1	52.9	50.8	57.9	63.3	60.5																					
5	59.0	65.5	62.1	61.2	67.3	64.1	54.1	59.9	56.8	49.3	53.2	51.1	44.1	46.8	45.2	47.8	50.0	49.0	41.4	43.5	42.5	44.1	45.7	44.8	41.4	43.2	42.6	47.1	50.7	48.9	49.1	51.1	50.0	59.0	64.4	61.3																					
6	60.4	65.7	62.7	61.3	66.9	63.8	54.7	60.6	57.4	48.9	53.2	50.9	43.7	46.6	45.1	48.7	50.0	49.4	42.3	44.2	43.3	44.1	45.5	44.7	40.8	44.6	42.8	48.2	52.0	50.2	48.9	52.9	50.7	59.4	65.3	62.2																					
7	59.2	64.9	61.8	60.1	65.5	62.4	55.6	61.2	58.2	48.6	52.5	50.5				47.7	49.5	48.5	42.3	44.2	43.3	43.3	45.1	44.4	44.1	46.8	45.4	49.6	53.2	51.3	49.6	53.8	51.6	61.0	66.7	63.6																					
8	59.4	63.3	61.0	58.1	64.2	61.0	55.8	61.3	58.4	48.4	52.2	50.2	45.9	49.1	47.7	46.4	48.4	47.4	43.5	44.8	44.2	43.3	45.3	44.5	44.6	48.6	46.5	49.1	52.7	51.1	50.2	54.5	52.0	61.2	66.4	63.4																					
9	58.5	63.9	60.8	58.5	64.6	61.4	56.8	61.2	58.4	48.6	52.3	50.3	48.7	50.7	49.7	46.2	47.5	46.8	44.1	45.1	44.7	44.4	46.4	45.4	45.9	48.6	47.0	48.2	51.1	49.2	50.0	54.7	52.1	59.5	64.4	61.5																					
10	57.0	61.5	59.1	58.8	63.9	61.0	55.8	61.2	58.3	49.1	53.2	51.1	48.2	50.2	49.2	45.3	46.9	46.0	42.1	43.7	43.1	45.5	47.1	46.1	45.0	46.2	45.6	46.6	48.4	47.7	50.7	55.6	53.0	57.9	64.0	60.9																					
11	55.2	59.9	57.6	56.8	62.8	59.5	56.1	61.9	58.9	49.6	52.9	51.3	46.6	49.1	47.9	46.8	49.8	48.0	43.0	44.8	43.8	44.6	46.2	45.4	44.1	45.7	45.1	46.2	48.2	47.4	52.2	58.5	55.3	58.5	64.4	61.4																					
12	54.9	59.0	56.7	56.3	62.8	59.4	57.6	63.1	60.1	49.6	52.9	51.1	47.3	50.0	48.7	47.8	50.7	49.3	42.8	44.6	43.6	45.1	46.8	45.8	43.5	45.7	44.5	46.2	49.8	47.9	55.0	60.6	57.7	58.6	64.6	61.6																					
13	54.9	62.2	58.6	57.2	62.8	59.9	57.9	63.1	60.3	49.3	53.1	50.9	48.2	51.1	49.6	45.1	48.0	46.5	41.2	43.2	42.2	44.8	46.8	45.6	43.3	46.6	44.9	45.1	49.1	47.1	56.1	60.1	58.0	59.2	65.3	62.2																					
14	57.7	64.9	61.2	57.9	64.4	61.0	58.8	63.7	60.9	49.6	53.6	51.4	48.6	50.5	49.4	43.7	46.0	44.7	40.3	42.6	41.7	44.1	46.0	44.9	44.1	47.8	45.8	47.5	51.1	49.4	55.8	59.0	57.4	59.0	65.1	61.9																					
15	59.5	66.6	62.8	59.5	65.5	62.3	57.7	62.8	60.2	49.5	53.2	51.3	48.0	50.0	49.1	44.1	47.3	46.4	42.6	45.0	43.9	43.5	46.0	44.8	44.8	48.6	46.6	48.4	50.5	49.7	52.3	55.6	54.2	58.5	64.4	61.3																					
16	59.9	66.7	63.3	60.1	63.9	61.6	57.4	61.9	59.4	49.5	52.9	51.0	48.7	50.9	49.8	42.1	43.5	42.7	43.2	46.8	45.4	45.9	47.3	46.8	45.1	48.6	46.8	46.0	48.4	47.0	50.7	52.3	51.2	57.9	63.7	60.7																					
17	60.8	66.2	63.4	56.8	61.7	59.1	55.8	60.8	58.1	49.1	53.2	51.1	48.6	50.7	49.7	41.0	42.8	42.1	40.3	43.0	41.6	45.7	47.5	46.6	45.7	49.6	47.6	43.0	46.0	44.5	49.6	51.1	50.3	56.5	61.2	58.7																					
18	61.7	67.6	64.5	55.6	61.9	58.6	55.8	61.3	58.3	49.8	53.6	51.6	49.8	51.1	50.4	42.3	43.5	42.9	40.8	41.9	41.4	44.6	46.0	45.1	46.6	50.0	48.3	41.4	45.7	43.7	48.4	49.6	49.0	54.5	61.0	57.8																					
19	60.6	66.6	63.3	56.5	63.1	59.6	56.5	61.7	59.0	50.5	53.8	51.9	48.0	49.8	49.0	40.8	42.4	41.7	41.4	43.5	42.4	43.5	45.1	44.1	46.6	50.2	48.4	43.0	44.6	44.0	47.3	51.1	49.1	55.6	62.2	59.1																					
20	59.2	65.5	62.3	57.9	64.0	60.8	57.0	62.1	59.3	49.6	52.9	51.2	46.4	48.6	47.7	39.7	41.4	40.6	41.9	43.3	42.6	43.5	46.2	44.6	46.8	49.8	48.2	41.7	45.1	43.4	47.7	52.3	49.9	57.2	63.1	60.3																					
21	59.5	66.2	62.7	59.2	65.1	62.0	57.0	60.8	58.8	49.1	52.0	50.3	46.9	48.6	47.8	39.2	41.2	39.9	40.5	43.5	42.3	43.0	45.7	44.2	45.9	48.9	47.6	44.1	46.6	45.4	49.5	52.3	50.2	57.9	64.2	60.8																					
22	58.6	64.9	61.8	60.1	64.4	62.0	56.3	59.5	58.0	46.0	49.1	47.5	46.9	48.9	48.0	39.2	41.2	40.0	39.6	40.6	40.1	42.3	43.5	42.6	44.4	48.6	47.5	46.0	49.1	47.8	49.3	52.2	50.8	57.0	62.8	59.8																					
23	57.9	64.6	61.0	60.4	66.2	63.0	54.7	59.2	56.8	45.1	48.6	46.7	46.6	48.7	47.6	38.8	40.5	39.8	39.7	40.3	39.9	40.8	42.8	42.0	42.3	46.0	44.0	48.6	49.5	49.0	48.7	51.6	50.2	56.7	61.3	59.2																					
24	58.3	64.9	61.5	60.4	64.9	62.2	54.5	57.9	56.1	44.2	47.7	45.7	46.2	48.2	47.2	37.8	39.4	38.6	40.3	42.8	41.7	40.3	42.3	40.9	42.8	46.6	44.6	49.1	51.1	50.2	48.4	53.2	51.1	56.1	60.8	58.0																					
25	58.3	64.4	61.3	57.6	62.8	60.0	54.5	58.6	56.2	43.7	46.9	45.3	46.6	48.4	47.4	38.1	39.7	38.9	39.9	42.3	40.8	37.9	40.6	39.5	43.5	46.6	44.6	47.3	52.2	50.1	50.9	55.4	53.5	54.7	58.5	56.2																					
26	57.4	63.9	60.7	55.6	61.2	58.3	54.3	58.3	56.1	44.8	48.6	46.7	44.2	47.7	46.2	37.9	40.3	39.4	39.9	42.1	41.0	37.8	39.9	39.0	42.8	46.0	44.2	50.4	53.8	52.0	53.2	56.5	54.9	54.0	55.8	54.7																					
27	57.6	64.4	61.0	54.7	60.4	57.4	54.1	58.1	55.9	46.6	50.4	48.4	42.8	44.4	43.6	39.9	41.9	40.9	40.3	43.5	41.7	39.4	39.9	39.7	44.4	46.6	45.5	48.9	52.0	50.4	54.1	56.8	55.3																					
28	59.5	66.7	63.1	54.5	59.9	57.0	53.2	55.8	54.3	48.2	51.1	49.7	42.6	45.7	44.3	40.8	42.1	41.6	40.3	42.8	41.6	39.7	40.6	40.0	42.6	45.7	44.0	48.2	51.6	49.9	53.2	56.5	54.6																					
29	60.6	65.7	63.1	54.1	60.1	57.0	50.9	55.0	52.8	48.6	51.4	50.0	44.4	46.4	45.3	42.1	44.4	43.2	41.4	43.2	42.3	40.8	44.2	42.6	41.5	44.8	43.3	49.3	53.8	51.5	53.2	56.5	54.7																					
30	59.9	66.2	62.8	54.5	60.6	57.3	50.5	54.7	52.5	48.4	51.1	49.7	45.1	47.7	46.5	44.4	45.3	44.9	42.4	43.7	43.1				43.7	47.3	45.3	51.4	55.2	53.2	53.2	56.5	54.6																					
31	60.6	66.9	63.4	54.7	60.6	57.6				48.9	51.1	50.0				42.8	45.1	44.4	43.0	45.1	44.0				45.3	47.7	46.5				52.9	57.2	55.0																					
	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean
	54.9	67.6	61.7	54.1	67.3	60.8	50.5	63.7	57.8	43.7	56.3	50.3	42.6	51.1	47.6	37.8	50.7	44.3	39.6	46.8	42.6	37.8	47.5	43.9	40.8	50.2	45.5	41.4	55.2	48.2	47.3	60.6	52.8	54.0	66.7	60.1																					

source: Dept Fish and Game, IFD Red Bluff

APPENDIX TABLE 3. Daily water temperature records for Mill Creek at Big Bend: July 1995 - December 1996; The Big Bend area is used by spring-run chinook salmon for adult holding and spawning, egg incubation, fry emergence and juvenile rearing.

	JUL 95			AUG 95			SEP 95			OCT 95			NOV 95			DEC 95		
DAY	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean
1	45.0	56.5	50.2	48.6	61.5	55.0	47.8	57.2	53.2	45.3	51.8	49.0	43.7	48.0	46.1	46.2	47.1	46.5
2	45.9	58.3	51.2	49.1	61.7	55.5	48.0	57.4	53.3	45.5	52.3	49.3	41.9	46.6	44.5	43.7	46.9	44.8
3	46.4	58.5	51.2	48.9	61.3	55.2	49.1	57.4	53.5	46.0	52.3	49.7	39.2	44.8	42.0	40.8	43.5	42.0
4	45.7	58.5	51.1	48.2	61.9	55.2	45.3	54.5	50.9	43.9	50.2	47.2	38.5	42.6	41.0	41.5	45.7	43.4
5	46.0	59.5	51.6	49.8	61.9	56.1	46.4	55.6	51.6	43.5	49.3	46.7	40.3	43.9	42.0	45.3	47.7	46.2
6	46.8	58.1	51.6	49.6	60.6	55.3	47.5	56.1	52.6	43.7	49.5	47.0	39.4	43.7	42.2	44.4	47.7	46.0
7	46.0	58.5	51.4	48.6	59.5	54.1	47.8	56.7	52.9	43.0	49.1	46.6	42.3	46.0	44.0	43.9	46.4	45.1
8	46.8	56.1	50.8	45.6	58.6	52.5	48.0	56.5	53.0	43.0	49.1	46.4	43.2	47.3	44.9	41.7	44.8	43.5
9	47.8	55.6	51.2	48.0	59.5	54.2	48.4	56.3	53.0	43.2	49.3	46.7	46.9	48.4	47.6	42.8	45.3	44.0
10	45.7	55.6	50.1	48.4	58.5	53.6	48.0	56.5	53.0	44.8	50.9	48.0	42.4	46.6	44.5	40.8	43.7	42.5
11	44.2	55.8	49.6	46.4	57.6	52.4	49.5	57.6	54.1	45.0	49.8	47.9	41.5	45.7	43.7	43.5	45.3	44.8
12	44.8	54.7	49.5	46.6	58.1	53.0	50.4	58.5	54.8	43.9	49.8	47.3	45.3	48.6	46.7	42.4	45.3	44.3
13	45.1	58.8	51.5	47.8	57.9	53.5	50.5	58.5	54.9	43.3	49.1	46.3	43.7	47.5	45.9	40.8	43.2	42.0
14	47.1	60.1	53.1	48.9	60.4	55.0	51.3	58.5	55.2	42.8	49.1	46.3	43.0	46.6	45.5	40.1	42.8	41.2
15	47.7	60.8	53.5	50.0	60.6	56.0	49.6	57.2	54.1	44.1	49.8	47.4	43.5	46.6	45.4	36.9	42.6	39.1
16	47.3	61.0	53.6	50.9	57.7	54.5	49.5	56.5	53.4	44.1	49.6	47.3	45.7	47.8	46.8	38.7	40.1	39.3
17	48.2	60.1	53.1	46.8	56.1	52.1	48.2	56.1	52.6	43.7	49.3	47.1	42.8	47.3	45.3	37.2	40.1	38.7
18	49.1	58.5	53.0	46.2	57.7	52.3	49.1	56.5	53.3	44.8	49.8	47.7	45.7	49.6	47.0	39.6	41.5	40.3
19	48.0	57.0	51.9	47.5	59.0	53.8	49.6	56.8	53.7	43.9	49.1	47.1	42.1	46.6	44.3	37.2	40.8	39.0
20	46.9	59.7	52.8	49.3	59.5	55.0	49.6	57.0	53.8	43.7	48.6	46.5	41.5	45.0	43.5	36.5	39.6	38.1
21	47.3	59.5	53.2	50.2	60.4	55.8	49.6	55.0	52.8	43.9	48.2	46.6	43.7	46.0	44.6	36.0	39.0	37.3
22	46.4	59.2	52.6	51.3	57.7	54.9	48.2	54.5	51.9	40.5	45.7	43.2	42.3	45.3	43.8	37.2	38.3	37.7
23	45.9	59.0	52.5	52.2	61.5	56.8	47.1	53.8	51.2	39.7	44.8	42.4	41.4	44.8	43.2	35.6	38.5	37.0
24	46.4	59.5	53.0	50.2	58.6	55.0	48.9	53.8	51.6	39.4	44.2	42.3	42.1	44.4	43.4	34.0	37.2	35.9
25	45.5	58.8	52.4	47.8	57.2	53.1	49.1	54.9	51.7	39.6	44.2	42.2	43.0	46.6	44.1	34.9	37.0	36.1
26	46.0	59.5	52.6	45.9	55.9	51.7	47.7	53.1	50.9	42.3	47.7	44.8	41.5	46.6	43.6	35.4	38.3	36.7
27	45.9	60.3	53.1	45.3	55.4	51.3	48.6	54.1	51.1	43.5	47.8	46.3	38.7	41.2	40.2	37.4	39.6	38.4
28	48.7	62.8	55.4	45.9	55.2	51.2	46.6	51.3	49.2	43.9	48.2	46.5	40.8	44.1	42.3	38.3	39.6	38.8
29	48.7	59.2	54.2	46.0	56.1	51.8	44.1	50.2	47.7	44.1	48.4	46.6	40.6	44.1	42.5	39.4	40.6	39.9
30	48.0	60.6	54.1	46.4	56.1	52.0	44.2	51.1	48.2	43.5	47.8	46.1	42.3	46.0	43.6	40.3	41.9	40.8
31	47.8	61.0	54.4	46.6	56.1	52.3				45.3	49.1	47.1				39.7	41.7	40.9
	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean
	44.2	62.8	52.2	45.3	61.9	53.9	44.1	58.5	52.4	39.4	52.3	46.5	38.5	49.6	44.1	34.0	47.7	41.0

	JAN 96			FEB 96			MAR 96			APR 96			MAY 96			JUN 96		
DAY	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean
1	38.5	42.1	40.0	39.0	41.9	40.3	38.5	42.3	40.1	38.3	46.2	42.0	42.3	54.0	47.8	45.1	57.9	50.9
2	39.0	42.3	40.7	39.0	41.2	40.3	37.2	42.4	39.8	38.7	44.6	41.0	42.6	52.9	47.5	46.6	59.4	52.6
3	39.4	42.3	40.8	38.7	41.5	40.2	39.7	42.8	40.6	39.0	46.6	42.2	40.3	50.5	45.4	46.0	58.8	52.0
4	37.9	41.5	39.6	36.5	40.8	38.8	35.6	40.5	38.5	39.2	47.8	42.9	40.6	51.4	45.7	47.3	59.9	53.0
5	38.7	41.9	40.1	38.3	40.6	39.2	35.4	37.9	36.3	40.1	49.3	44.3	40.6	50.2	45.3	47.7	60.3	53.4
6	39.4	42.1	40.9	38.7	41.5	40.1	34.7	41.5	37.3	40.8	50.5	45.3	41.2	52.0	46.1	47.7	61.0	53.7
7	38.7	42.3	40.6	38.7	42.3	40.1	38.7	42.4	40.5	41.5	52.0	46.4	41.2	52.5	46.7	48.4	61.2	54.1
8	39.9	43.2	41.4	38.7	42.8	40.3	38.7	44.1	41.3	41.2	51.1	46.1	41.5	52.5	46.9	48.4	60.8	54.0
9	41.0	42.8	41.7	39.6	42.8	41.0	39.6	44.8	42.0	40.5	49.5	44.1	40.8	53.1	46.8	46.4	58.8	52.6
10	38.3	40.8	39.5	40.3	43.3	41.4	38.7	43.7	40.6	40.1	46.6	43.2	41.7	54.5	47.8	46.4	59.4	52.6
11	38.7	41.5	40.2	39.0	42.8	40.7	38.3	41.5	39.8	40.3	46.6	43.3	42.8	57.0	49.2	47.3	60.1	53.2
12	38.1	41.5	40.0	38.7	43.3	40.8	37.9	43.2	40.1	40.3	47.3	43.5	44.1	57.2	50.1	47.3	60.1	53.5
13	37.9	41.0	39.6	38.7	43.5	40.9	38.7	43.5	40.9	38.7	49.1	43.2	44.6	55.6	49.6	47.5	60.4	53.8
14	37.4	41.2	39.3	38.7	43.5	40.9	38.3	45.1	41.4	40.8	51.1	45.4	46.6	52.0	48.5	47.7	60.4	54.0
15	41.2	42.1	41.6	38.7	44.1	40.9	38.7	46.0	42.1	42.4	50.0	45.0	45.3	48.7	46.9	46.8	59.4	53.3
16	38.7	42.1	40.7	41.4	43.7	42.4	38.7	45.9	42.2	38.1	43.9	41.1	43.3	46.2	44.6	47.1	58.6	53.2
17	37.2	39.9	38.6	41.4	42.8	41.9	39.4	47.8	43.0	37.0	42.4	39.6	43.2	45.3	43.9	46.2	56.7	51.7
18	31.8	39.6	35.8	40.1	41.5	40.9	39.6	47.8	43.3	35.8	44.1	39.2	42.8	43.9	43.3	44.8	57.6	51.0
19	34.7	39.2	37.4	39.4	40.3	39.7	39.4	48.2	43.5	38.7	42.8	40.2	41.5	48.6	44.3	45.9	58.6	52.4
20	34.5	39.4	38.5	39.2	40.6	39.7	39.9	48.4	43.9	36.9	43.5	39.6	41.2	51.1	45.4	48.4	59.0	54.1
21	33.3	37.6	35.4	37.2	39.6	38.4	38.7	47.8	43.3	38.7	43.5	41.1	44.1	49.1	45.2			
22	34.9	37.9	36.3	36.9	40.1	38.1	41.7	46.9	43.2	40.6	47.8	43.5	42.8	50.7	46.0			
23	34.5	36.9	35.5	36.3	40.1	37.9	37.0	44.4	40.6	41.9	46.4	44.3	41.2	49.8	45.3			
24	32.7	36.9	34.6	34.7	37.9	36.2	37.4	45.3	41.2	43.3	46.9	44.8	42.1	52.5	46.5			
25	35.8	37.9	36.8	33.3	38.3	35.7	39.0	44.6	41.7	40.3	52.0	45.0	44.2	54.7	48.9			
26	36.5	39.0	37.6	33.1	37.9	35.5	37.2	45.3	41.1	41.9	52.2	46.6	44.8	54.1	49.3			
27	31.8	38.7	35.1	35.4	37.9	36.7	40.1	45.1	41.8	40.3	50.2	45.3	45.7	53.8	49.6			
28	35.8	39.6	37.5	35.4	37.4	36.5	37.2	42.8	40.1	40.3	50.0	45.0	43.9	53.8	48.4			
29	37.9	39.7	38.9	36.7	40.8	38.1	36.3	45.3	40.1	40.6	53.8	46.4	44.6	52.9	48.7			
30	36.3	39.2	37.8				38.5	46.6	42.1	41.9	54.1	47.7	44.1	54.0	48.9			
31	38.7	41.4	39.7				39.4	46.6	43.1				44.1	55.0	49.3			
	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean
	31.8	43.2	38.8	33.1	44.1	39.4	34.7	48.4	41.1	35.8	54.1	43.6	40.3	57.2	47.0	44.8	61.2	53.0

	JUL 96			AUG 96			SEP 96			OCT 96			NOV 96			DE	
DAY	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max
1																	
2	thermograph lost in flood January 1, 1997																
3																	
4																	
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	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	ma

source: Dept Fish and Game, IFD Red Bluff

APPENDIX TABLE 4. Daily water temperature records for Mill Creek at Black Rock; July 1995 - December 1996; The Black Rock area is used by spring-run chinook salmon for adult holding and spawning, egg incubation, fry emergence and juvenile rearing.

	JUL 95			AUG 95			SEP 95			OCT 95			NOV 95			DEC 95		
DAY	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean
1	48.9	58.5	53.5	54.5	60.6	58.0	53.8	57.7	55.6	50.0	53.4	51.3	47.5	49.6	48.4	47.3	49.1	48.4
2	49.8	59.0	54.3	55.2	60.8	58.5	54.0	57.9	55.8	50.2	53.8	51.6	46.0	48.0	47.0	45.7	48.6	47.4
3	50.0	59.0	54.5	55.2	60.6	58.3	54.7	57.9	56.0	50.7	54.1	52.0	43.9	46.2	45.1	44.1	44.8	44.4
4	49.6	59.0	54.0	54.7	60.6	58.0	52.0	55.2	53.6	48.6	51.3	49.7	42.6	44.8	43.7	44.2	47.5	45.9
5	49.6	60.1	54.8	56.1	60.6	58.9	52.0	56.1	53.8	46.9	50.9	48.7	43.2	46.0	44.5	47.7	48.9	48.4
6	50.7	58.8	54.9	55.9	60.6	58.5	53.2	57.0	54.8	47.8	51.1	49.2	43.5	45.9	44.6	47.8	49.1	48.3
7	50.0	59.0	54.3	54.3	58.8	57.0	53.8	57.2	55.4	47.5	50.7	48.9	45.0	47.5	46.0	46.0	48.0	47.0
8	50.9	57.2	53.8	52.3	57.2	55.3	53.8	57.2	55.4	47.3	50.5	48.8	46.0	48.9	47.6	45.3	46.8	46.0
9	51.6	57.0	54.3	54.5	58.5	56.8	53.8	57.4	55.4	47.3	50.9	48.9	48.6	50.5	49.4	45.0	46.6	45.8
10	50.0	55.9	53.0	54.5	57.9	56.5	53.8	57.2	55.4	48.7	52.3	50.1	45.7	49.1	47.1	44.2	46.0	45.2
11	48.4	55.8	52.1	52.7	56.3	55.0	54.1	58.6	56.2	48.9	51.6	50.1	45.3	47.8	46.5	46.0	48.2	47.3
12	48.9	54.7	52.2	53.2	57.0	55.6	55.6	59.5	57.2	48.6	50.9	49.4	46.8	50.0	48.3	44.8	48.2	46.6
13	49.6	58.5	54.0	54.7	57.0	56.1	55.6	59.5	57.2	47.3	50.7	48.9	48.2	50.4	49.0	44.1	45.0	44.6
14	52.0	59.9	56.1	55.2	58.8	57.2	56.1	60.1	57.6	48.0	51.1	49.4	47.3	49.6	48.3	42.3	44.8	43.5
15	52.7	60.3	56.8	56.5	59.7	58.5	54.9	58.6	56.6	48.6	51.8	49.9	46.8	49.3	48.1	42.1	45.3	43.6
16	52.2	61.2	56.6	56.5	59.0	57.5	54.7	57.9	56.0	48.6	51.4	49.7	48.0	50.5	49.1	41.2	42.1	41.7
17	52.9	60.6	56.5	52.5	56.3	54.6	53.2	57.0	54.9	48.7	51.8	50.0	47.3	49.3	48.2	40.6	41.5	41.3
18	52.9	59.5	56.4	52.7	56.3	54.6	54.1	57.9	55.7	48.9	52.2	50.2	48.2	50.2	49.0	41.5	43.0	42.3
19	52.0	58.3	55.0	54.3	57.6	56.2	54.7	58.5	56.2	48.9	51.4	49.9	45.9	48.2	47.1	40.3	41.7	41.1
20	51.6	59.7	55.6	55.8	58.8	57.4	54.7	58.5	56.3	48.2	51.1	49.5	45.3	47.8	46.2	39.9	41.2	40.3
21	52.5	59.5	56.4	56.7	59.7	58.3	54.7	57.0	55.7	46.8	50.4	48.9	45.9	48.4	46.9	39.0	40.1	39.6
22	51.6	58.6	55.5	57.0	59.5	58.2	53.2	56.1	54.5	44.4	46.8	45.5	46.0	48.2	46.7	39.0	40.5	39.9
23	51.4	58.5	55.3	57.2	61.3	58.9	52.2	55.8	53.7	43.9	46.6	44.8	45.5	47.3	46.2	38.3	40.1	39.1
24	52.0	58.8	55.9	56.8	59.5	57.9	52.3	55.6	53.7	43.3	46.2	44.5	45.3	47.5	46.1	37.8	38.8	38.2
25	51.8	58.5	55.4	54.1	57.2	55.7	52.5	56.1	53.8	42.8	45.9	44.4	45.7	48.6	46.9	37.9	39.4	38.4
26	51.4	58.5	55.3	52.5	55.8	54.2	52.2	55.0	53.4	44.8	48.6	46.6	42.8	46.9	45.0	37.9	40.5	39.4
27	52.0	59.5	55.8	52.0	55.6	53.8	52.2	55.2	53.3	47.8	50.4	48.9	41.5	43.5	42.4	40.1	41.9	41.0
28	54.3	61.9	58.1	52.0	55.2	53.7	50.5	53.2	51.9	48.0	50.5	49.1	42.8	46.0	44.5	40.1	41.9	41.1
29	54.1	61.9	57.4	52.2	55.9	54.0	48.9	52.3	50.3	48.0	50.7	49.1	44.2	46.0	45.0	41.7	43.5	42.7
30	53.8	59.7	57.1	52.5	56.3	54.4	48.7	52.3	50.5	47.7	50.2	48.8	44.6	47.7	46.3	43.5	44.6	43.9
31	53.8	60.1	57.3	52.5	56.7	54.6				48.0	50.9	49.3				42.8	44.2	43.5
	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean
	48.4	61.9	55.2	52.0	61.3	56.5	48.7	60.1	54.8	42.8	54.1	48.9	41.5	50.5	46.6	37.8	49.1	43.4

	JAN 96			FEB 96			MAR 96			APR 96			MAY 96			JUN 96		
DAY	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean
1	41.5	44.1	42.7	41.5	43.5	42.7	41.0	44.1	42.4	41.7	47.8	44.6	46.8	54.1	50.8	50.0	57.6	53.9
2	43.3	44.2	43.8	42.4	44.1	43.1	41.0	43.5	42.6	42.1	46.4	44.2	46.8	53.2	50.3	51.6	59.0	55.5
3	42.3	43.9	43.2	42.4	44.1	43.2	42.8	43.7	43.3	42.4	47.1	45.1	44.1	50.7	47.8	50.9	58.6	54.9
4	40.8	42.8	41.6	41.9	44.6	43.4	41.0	43.2	42.2	42.8	48.2	45.8	44.6	51.4	48.3	51.8	59.5	55.9
5	41.5	43.5	42.5	42.1	44.1	43.1	40.1	41.5	40.7	44.4	50.0	47.4	44.6	50.4	47.6	52.3	60.1	56.3
6	42.8	44.1	43.2	42.6	44.6	43.5	39.0	43.2	41.3	45.3	50.9	48.5	45.7	51.4	48.6	52.7	61.2	56.8
7	42.4	43.5	43.0	42.1	44.6	43.4	42.4	45.7	44.1	46.0	52.2	49.6	45.3	52.2	49.2	53.2	61.3	57.3
8	43.3	44.6	43.9	42.1	44.8	43.6	42.8	46.6	45.0	45.3	51.4	49.0	46.0	52.2	49.4	53.2	60.4	56.9
9	42.8	44.6	44.1	43.0	45.3	44.3	43.7	46.6	45.4	44.8	49.6	46.8	45.5	52.5	49.4	51.6	58.5	55.3
10	41.2	42.6	42.0	43.9	45.7	44.8	42.4	45.1	43.7	43.5	47.3	45.8	46.2	53.8	50.4	51.6	59.0	55.5
11	42.4	43.7	43.0	42.4	45.0	44.0	42.6	44.2	43.3	43.7	47.8	45.8	47.8	56.7	52.4	52.3	59.5	56.2
12	41.9	43.2	42.5	42.6	45.3	44.1	41.7	45.1	43.4	43.9	47.1	45.9	49.1	57.9	53.4	52.3	59.5	56.3
13	41.4	42.3	41.6	42.4	45.1	44.1	41.9	45.1	43.7	42.6	48.6	45.8	48.7	56.3	52.6	53.2	59.7	56.8
14	40.8	42.4	41.7	42.1	44.8	43.8	42.1	46.6	44.5	45.3	50.4	48.1	50.0	53.2	51.4	53.4	59.5	56.8
15	42.8	44.2	43.7	41.9	46.2	43.9	42.6	47.3	45.2	45.9	50.0	47.3	48.6	50.7	49.4	52.9	58.8	56.2
16	42.1	45.0	44.1	44.8	46.0	45.5	42.6	46.8	45.1	42.6	45.9	44.1	46.2	48.4	47.3	53.2	57.9	55.9
17	40.1	41.5	40.9	44.6	45.3	44.9	43.3	48.7	46.2	40.3	43.7	42.1	45.9	46.9	46.5	51.1	56.1	54.0
18	37.9	41.5	39.4	42.6	44.6	43.7	43.9	48.7	46.6	39.9	45.0	42.7	45.0	46.6	45.9	50.4	56.1	53.6
19	39.4	41.9	41.0	42.3	43.5	42.7	43.5	49.1	46.6	41.2	44.2	42.8	44.2	50.0	47.0	52.0	57.9	55.1
20	40.6	41.9	41.5	42.4	44.1	43.2	44.1	49.1	46.9	40.3	44.6	42.6	44.1	52.0	48.0	54.1	57.9	56.3
21	38.3	40.5	39.6	41.2	43.3	42.1	42.8	48.7	46.1	42.4	45.7	44.0	46.9	50.0	47.7	54.1	57.4	56.0
22	38.5	40.1	39.1	40.5	41.9	41.2	43.5	48.0	45.5	44.1	48.6	46.5	46.0	51.6	48.6	53.2	57.7	55.6
23	37.9	38.8	38.3	39.6	41.9	40.7	40.1	44.8	42.7	45.7	48.4	47.1	44.4	50.7	47.6	53.2	56.5	54.9
24	38.7	41.2	39.9	37.9	40.1	39.2	40.8	45.3	43.5	46.8	49.1	47.8	45.3	53.2	49.3	51.8	55.0	53.7
25	38.7	40.5	39.7	36.5	39.6	38.2	41.9	44.8	43.7	44.1	52.3	48.2	47.8	55.0	51.6	51.3	54.1	52.0
26	39.6	41.2	40.4	36.3	39.2	37.8	41.2	45.1	43.5	46.0	52.2	49.5	48.7	55.0	52.1			
27	38.8	41.0	39.9	37.9	39.6	38.8	43.3	45.3	44.4	44.6	50.5	47.9	49.5	54.1	52.1			
28	39.6	42.1	40.9	38.3	39.6	38.8	41.0	44.6	42.5	44.2	50.0	47.6	48.0	54.3	51.1			
29	41.0	42.4	41.8	39.4	42.4	41.0	39.6	44.6	42.3	45.3	53.2	49.5	48.7	54.1	51.6			
30	41.2	42.1	41.7				41.7	47.3	44.5	46.8	54.1	50.8	48.4	54.1	51.7			
31	41.9	44.1	42.8				43.3	47.8	45.6				48.6	55.4	52.1			
	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean
	37.9	45.0	41.7	36.3	46.2	42.5	39.0	49.1	44.1	39.9	54.1	46.4	44.1	57.9	49.7	50.0	61.3	55.5

	JUL 96			AUG 96			SEP 96			OCT 96			NOV 96			DEC 96		
DAY	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean
1																		
2	thermograph lost in January 1997 flood																	
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31																		
	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean	min	max	mean

source: Dept Fish and Game, IFD Red Bluff