



REF 90460

1996 REDWOOD CREEK SUMMER STEELHEAD TROUT SURVEY

DATES: August 5, 6, 7, 8, 1996

LOCATION: Redwood Creek, Humboldt County, California
Lacks Creek - river km 45.3 downstream to Hayes Creek at 'cold pool' (Redwood National Park)
- river km 7.5

DISTANCE: 37.8 km (23.5 miles) [35% of the 108 km long Redwood Creek mainstem]

FLOWS: Gaging Station: Orick (California Department of Water Resources)
Start of Survey: 53 cfs End of Survey: 50 cfs

DIVERS: David Anderson*, Eddie Childers*, Howard Sakai*, Diona Roja*, Carolyn Meyer* (VIP), Joel Gordon* (RNP RM Support Crew), Bill Falvey, Rick Wallen, David Anthon#, Donald Baldwin, Mike O'Connel (Student Conservation Association), Eric Gerstung# (California Department of Fish and Game)
(* Indicates person with prior Redwood Creek summer steelhead survey experience, # Summer steelhead survey experience on other rivers)

METHOD: Visual observation by diving with mask and snorkel, and full wetsuit or surfsuit (Roelofs 1983). Survey proceeded in the downstream direction.

ACCESS: Lacks Creek at Stover Ranch on Redwood Valley Road; Panther Creek and Coyote Creek at K&K road, Simpson Timber Company; Coyote Creek in via the Bald Hills and Simpson; Copper Creek in via Bald Hills and Maneze Roads and prairie to rehabilitated K&K and 1800 road; Slide Creek/Pig Pen Prairie in via rehabilitated K&K and on flagged trail to primitive trail; Bridge Creek in via West Side Access and M Line to Otter Camp and primitive trail; Tom McDonald in via West Side Access and M Line to mouth; Bond Creek in via Westside Access Road to C-Line and on Forty-four Creek horse trail and Redwood Creek trail, and downstream of Hayes Creek out Redwood Creek trail to Redwood Creek trailhead.

ITINERARY:

8/5	Lacks Creek to Panther Creek	6.15 km
	Childers, Sakai, Roja	
8/5	Panther Creek to Coyote Creek	3.65 km
	Anderson, Gordon, Wallen	
8/6	Coyote Creek to Copper Creek	4.50 km
	Childers, Baldwin, Falvey	
8/6	Copper Creek to Pig Pen Prairie	3.05 km
	Anderson, Anthon, Wallen	
8/7	Pig Pen Prairie to Bridge Creek	4.40 km
	Anderson, Meyer, Gerstung, Anthon, Baldwin	
8/7	Bridge Creek to Tom McDonald Creek	4.15 km
	Childers and Falvey	
8/8	Tom McDonald Creek to Bond Creek	4.20 km
	Childers, Roja, Falvey	
8/8	Bond Creek to downstream Hayes Cr.	7.7 0 km
	Anderson, Gordon, O'Connel	

NUMBER OF ADULT SUMMER STEELHEAD TROUT OBSERVED IN 1996: 1
TOTAL NUMBER OF ADULT SUMMER STEELHEAD TROUT (SSHD) OBSERVED WITHIN THE INDEX SECTION (LACKS CREEK TO TOM MCDONALD CREEK - 16.1 miles): 1

SUMMER STEELHEAD TROUT (*Oncorhynchus mykiss*)

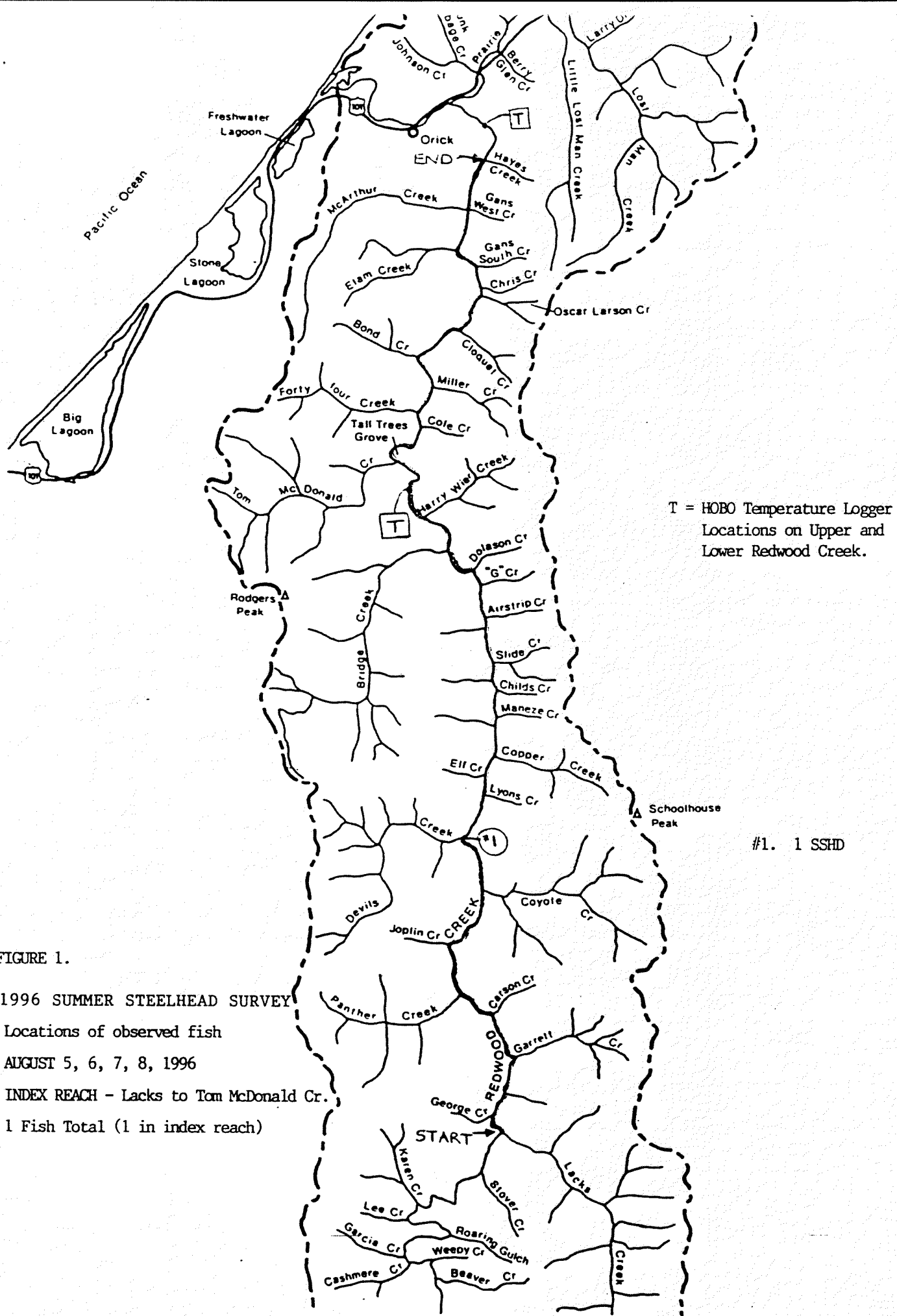
This is the 16th consecutive summer steelhead trout survey of Redwood Creek, the first was in 1981. No adult summer steelhead were observed in this expanded snorkel survey and within the index reach, but one was observed in the Devils Creek confluence pool on August 13 (Figure 1). This year's count in the index section was lower than last year, and appears to be the declining part of the third peak of a decreasing population trend over time (Table 1). The highest peak was in the mid 1980's, followed by a smaller peak in the early 1990s, and even smaller peak in the mid 1990s.

Table 1. Numbers of Summer Steelhead Trout (SSHD) observed 1981 through 1996 in the 16.1 mile index section of Redwood Creek from Lacks Creek to Tom McDonald Creek, Humboldt County, California.

Year	No. of Summer Steelhead	Survey Dates
1981	16	8/10 - 13
1982 ^a	2	10/12 & 14
1983	5	8/22 - 25
1984	44+	8/08 - 10
1985	44+	8/20 - 22, 9/4
1986	19+	8/25 - 27
1987	14	7/14 - 16
1988	8	7/26 - 28
1989 ^b	0	7/31, 8/01 - 02
1990	14	7/31, 8/01 - 03
1991	15	8/05 - 08
1992	5	8/03 - 06, 10
1993	2	8/02 - 05, 09
1994	5	8/01 - 04
1995	5	7/24 - 27
1996	1	8/05 - 08

^a Survey from Stover Creek to Emerald Creek, 14 miles, covering most of index section and best pool habitat.
^b Survey from Lacks to Bridge Creek, minus Garret to Panther Creek, a total of 11.1 miles. Covered best pool habitat.

The one adult summer steelhead was observed on August 13 in the confluence pool associated with cold water entering from Devils Creek, less than a week after the snorkel survey (Table 2). This pool had cover in the way of boulders and depth. Past data from Redwood Creek show the majority of summer steelhead are observed in pools, and where a deep pool and inflow of cooler water from a tributary occur together (Anderson 1993).



T = HOBO Temperature Logger Locations on Upper and Lower Redwood Creek.

#1. 1 SSHD

FIGURE 1.
 1996 SUMMER STEELHEAD SURVEY
 Locations of observed fish
 AUGUST 5, 6, 7, 8, 1996
 INDEX REACH - Lacks to Tom McDonald Cr.
 1 Fish Total (1 in index reach)

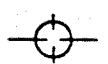


Table 2. Results of the 1996 Redwood Creek summer steelhead survey, including date observed, location on report map, number of steelhead, estimated length of fish (inches), habitat description, and USGS map coordinates.

Date	Map Location	No. of SSHD	Est. Length (inches)	Habitat Description
8/13	1	1	>16.5 - 19"	In mainstem pool at mouth of Devils Creek. Water temperature on 8/06/96 was 18.0°C in middle of pool and 19.0°C at tail of pool. (T9NR2Esec34)

Twenty-six 'half pounder' steelhead (smaller immature sea-run steelhead returning after less than one year in the ocean), and 26 coastal cutthroat trout were observed (Table 3). Juvenile steelhead trout were observed throughout the reach. One dive team noted very few juvenile fish observed in the Bridge to Tom McDonald Creek reach, and even fewer in the Tom McDonald to Bond Creek reach. For the third year in a row, a single crayfish was observed in the lower reach (Bond to Hayes Creek) of Redwood Creek.

Table 3. Numbers of adult summer steelhead (>16.5"), half-pounder steelhead, coastal cutthroat trout, and other fish and wildlife observed during the 1996 summer steelhead survey of the mainstem Redwood Creek., Humboldt County, California.

Redwood Creek Mainstem Stream Reach		No. of Summer Steelhead adults	No. of Half Pounders	No. of Cutthroat Trout	Other Fish and Wildlife Observed
INDEX REACH	Lacks to Panther Creek	0	4	0	Steelhead juveniles
	Panther to Coyote Creek	0	1	1	Steelhead juveniles, suckers, three spine stickleback
	Coyote to Copper Creek	1*	6	1	Steelhead juveniles
	Copper to Pig Pen Prairie	0	2	5	Steelhead juveniles, suckers, three spine stickleback, sculpin
	Pig Pen Prairie to Bridge Creek	0	8	5	Steelhead juveniles, suckers
	Bridge to Tom McDonald Creek	0	1	0	Steelhead juveniles, suckers, otters
	Tom McDonald to Bond Creek	0	3	0	Steelhead juveniles
	Bond Creek to Hayes Creek	0	1	14	Steelhead juveniles, suckers, crayfish
Total		1	26	26	
* Summer steelhead was observed in Devils Creek confluence pool on August 13, 1996					

WATER DISCHARGE

Water flow (at Orick gaging station) during the survey was 53 cfs (starting) and 50 cfs (ending). This was almost a third of last years flow.

WATER TEMPERATURE

Mainstem Redwood Creek - Water temperatures were measured with a hand held thermometer below the water surface in the main current of Redwood Creek and tributaries. At each tributary, the mainstem Redwood Creek temperature was measured upstream of the tributary. Water temperatures measured in Redwood Creek ranged from 17.5 °C (at 1050) to 22.5°C (at 1600) during the 1996 survey (Table 4).

Two HOBO recording temperature loggers were placed mid-depth in the current of Redwood Creek, one upstream of Tom McDonald Creek and one in lower Redwood Creek upstream of the Redwood Creek trailhead. They recorded water temperatures every 48 minutes from July 9 to September 5, 1996 on Redwood Creek upstream of Tom McDonald Creek, and from July 2 to October 25, 1996 at lower Redwood Creek (Figure 2). Water temperatures at the upper and lower locations paralleled the same trend. Maximum and minimum water temperatures recorded at the upstream location were 23.1°C and 17.0°C, and at the lower location, 23.6°C and 11.1°C. Daily fluctuations were on the order of 6 °C at the lower site and 3 °C at the upper site. Water temperatures during the evening remained higher at the upper site than those at the lower site. Average temperature for the period July 9 through September 9 was 19.9°C at the upper site and 18.3°C at the lower site. Redwood Creek high water temperatures slowly declined after mid-August, but did not approach acceptable levels until the first rains in late October.

Tributaries - Temperatures of water entering Redwood Creek from the east and westside tributaries during the survey ranged from 11.5°C (an unnamed westside tributary) to 22.0°C (the eastside tributary Copper Creek). Water temperatures of **all** tributaries were cooler than the corresponding temperature of mainstem Redwood Creek measured at the same time. Westside tributaries were usually cooler than eastside tributaries, a pattern repeated in past surveys. The mean water temperatures of westside temperatures was 13.8°C (n = 32, std. dev. = 1.1°C, and range 11.5 to 17.0°C), and the mean water temperature of eastside tributaries was 15.1°C (n = 13, std. dev. = 2.5°C, and range 13.0 to 22.0°C).

Water temperatures from Prairie Creek, a relatively undisturbed watershed in the Redwood Creek basin were recorded every 48 minutes with a HOBO temperature logger from March 3 to October 25, 1996. Prairie Creek, the largest eastside tributary, enters lower Redwood Creek north of the town of Orick. Prairie Creek water temperatures were lower than both Redwood Creek locations, and ranged from 9.1 to 16.6°C between July 2 and October 25, 1996 (Figure 3). For comparison, its highest temperatures approached lower Redwood Creek's coldest temperatures, and were considerably cooler than the upper Redwood Creek location.

Table 4. Water and Air temperatures (°C) measured during the 1996 Redwood Creek summer steelhead trout survey. Locations are listed south to north. Alignment refers to tributary watershed position: E = eastside, W = westside, and REDW = mainstem Redwood Creek.

LOCATION	ALIGNMENT	1996 DATE	TIME	TEMPERATURE °C	
				WATER	AIR
Redwood Creek (upstream of Lacks Cr.)	REDW	8/05	0900	19.5	
Lacks Creek	E	8/05	0900	16.0	
Redwood Creek (downstream of Lacks Cr.)	REDW	8/05	0900	19.0	
Redwood Creek (upstream of George Cr.)	REDW	8/05		19.0	
George Creek	W	8/05		15.5	
Redwood Creek (downstream of George Cr.)	REDW	8/05		18.5	
Redwood Creek (upstream of unnamed tributary)	REDW	8/05		18.5	
Unnamed Tributary	W	8/05		15.0	
Redwood Creek (downstream of unnamed tributary)	REDW	8/05		18.5	
Redwood Creek (upstream of unnamed tributary)	REDW	8/05		19.0	
Unnamed Tributary	E	8/05		14.0	
Redwood Creek (downstream of unnamed tributary)	REDW	8/05		19.0	
Redwood Creek	REDW	8/05	1230	20.5	
Redwood Creek (upstream of Garrett Cr.)	REDW	8/05	1300	21.5	
Garrett Creek	E	8/05	1300	16.5	
Redwood Creek (downstream of Garrett Cr.)	REDW	8/05	1300	21.5	
Redwood Creek (upstream of unnamed tributary)	REDW	8/05		22.5	
Unnamed tributary	E	8/05		15.0	
Redwood Creek (downstream of unnamed tributary)	REDW	8/05		22.5	
Redwood Creek (upstream of Panther Cr.)	REDW	8/05	1700	22.5	
Panther Creek	W	8/05	1700	14.5	
Redwood Creek (downstream of Panther Cr.)	REDW	8/05	1700	22.5	
Redwood Creek (upstream of Panther Cr.)	REDW	8/05	0920	18.0	19.0
Panther Creek	W	8/05	0920	13.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/05	1045	19.0	
Unnamed tributary	W	8/05	1045	11.5	
Redwood Creek (upstream of unnamed tributary)	REDW	8/05	1133	19.0	
Unnamed tributary	W	8/05	1133	13.5	

LOCATION	ALIGNMENT	1996 DATE	TIME	TEMPERATURE °C	
				WATER	AIR
Redwood Creek (upstream of unnamed tributary)	REDW	8/05	1155	19.5	
Unnamed tributary	W	8/05	1155	13.0	
Redwood Creek (upstream of Joplin Cr.)	REDW	8/05	1300	20.5	
Joplin Creek	W	8/05	1300	13.5	
Redwood Creek (upstream of Coyote)	REDW	8/05	1555	21.0	
Coyote Creek	E	8/05	1555	16.0	
Redwood Creek (upstream of Coyote Cr.)	REDW	8/06	1050	17.5	17.5
Coyote Creek	E	8/06	1050	14.0	
Redwood Creek (downstream of Coyote Cr.)	REDW	8/06	1050	17.5	
Redwood Creek (upstream of Devils Cr.)	REDW	8/06		20.0	
Devils Creek	W	8/06		14.0	
Redwood Creek (downstream of Devils Cr.)	REDW	8/06		pool middle 18.0 tail 19.0	
Elf Creek	W	8/06	~1530	14.5	
Redwood Creek (upstream of Copper Cr.)	REDW	8/06	1700	22.5	
Copper Creek	E	8/06	1700	22.0	
Redwood Creek (upstream of Copper Cr.)	REDW	8/06	1239	19.0	27.5
Copper Creek	E	8/06	1239	17.0	
Redwood Creek (upstream of unnamed trib)	REDW	8/06	1545	22.0	
Unnamed tributary	W	8/06	1545	14.0	
Redwood Creek (upstream of unnamed trib)	REDW	8/06	1640	21.0	
Unnamed tributary	W	8/06	1640	15.0	
Redwood Creek (at Pig Pen Prairie)	REDW	8/06	1740	21.0	
Redwood Creek (at Pig Pen Prairie)	REDW	8/07	1115	19.0	21.5
Slide Creek	E	8/07	1134	14.0	
Unnamed tributary	W	8/07	1210	14.0	
Redwood Creek (upstream of unnamed trib)	REDW	8/07	1247	20.0	
Unnamed tributary	W	8/07	1247	14.0	
Redwood Creek (upstream of unnamed trib)	REDW	8/07	1440	20.5	
Unnamed tributary	W	8/07	1440	13.5	
Redwood Creek	REDW	8/07	1532	21.5	
Redwood Creek (upstream of unnamed trib)	REDW	8/07	1540	21.0	

LOCATION	ALIGNMENT	1996 DATE	TIME	TEMPERATURE °C	
				WATER	AIR
Unnamed tributary	W	8/07	1540	14.5	
Redwood Creek (upstream of unnamed tributary)	REDW	8/07	1605	20.5	
Unnamed Tributary	W	8/07	1605	14.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/07	1636	21.0	
Unnamed Tributary	W	8/07	1636	14.0	
Dolason Creek	E	8/07	1647	16.5	
Redwood Creek (upstream of unnamed trib)	REDW	8/07	1715	22.0	
Unnamed tributary	W	8/07	1715	14.0	
Redwood Creek (upstream of Bridge Cr.)	REDW	8/07	1736	21.5	
Bridge Creek	W	8/07	1736	15.0	
Redwood Creek (upstream of Bridge Cr.)	REDW	8/07	1130	20.0	
Bridge Creek	W	8/07	1130	14.0	
Redwood Creek (downstream of Bridge Cr.)	REDW	8/07	1130	19.0	
Redwood Creek	REDW	8/07	1245	21.5	
Redwood Creek (upstream of Emerald Cr.)	REDW	8/07		20.5	
Emerald Creek	E	8/07		14.0	
Redwood Creek (downstream of Emerald Cr.)	REDW	8/07		20.5	
Redwood Creek (upstream of unnamed tributary)	REDW	8/07		20.5	
Unnamed Tributary	W	8/07		14.5	
Redwood Creek (downstream of unnamed tributary)	REDW	8/07		21.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/07		21.0	
Unnamed Tributary (below Otter Camp)	W	8/07		13.0	
Redwood Creek (downstream of unnamed tributary)	REDW	8/07		21.5	
Redwood Creek (upstream of Tom McDonald Cr.)	REDW	8/07	1600	22.5	
Tom McDonald Creek	W	8/07	1600	14.5	
Redwood Creek (upstream of Tom McDonald Cr.)	REDW	8/08	1050	19.5	
Tom McDonald Creek	W	8/08	1050	13.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/08		20.0	
Unnamed tributary	W	8/08		13.0	
Redwood Creek (downstream of unnamed tributary)	REDW	8/08		19.5	
Redwood Creek (upstream of Cole Cr.)	REDW	8/08	~1300	21.5	
Cole Creek	E	8/08	~1300	13.5	

LOCATION	ALIGNMENT	1996 DATE	TIME	TEMPERATURE °C	
				WATER	AIR
Redwood Creek (upstream of unnamed tributary)	REDW	8/08		22.5	
Unnamed Tributary	W	8/08		17.0	
Redwood Creek (upstream of Forty Four Cr.)	REDW	8/08		22.0	
Forty Four Creek	W	8/08		13.5	
Redwood Creek (downstream of Forty Four Cr.)	REDW	8/08		21.5	
Redwood Creek (upstream of unnamed trib)	REDW	8/08		22.5	
Unnamed tributary	W	8/08		12.0	
Redwood Creek (downstream of unnamed trib)	REDW	8/08		22.0	
Redwood Creek (upstream of Miller Cr.)	REDW	8/08		22.5	
Miller Creek	E	8/08		DRY	
Redwood Creek (downstream of Miller Cr.)	REDW	8/08		22.5	
Redwood Creek (upstream of Bond Cr.)	REDW	8/08	1600	22.0	
Bond Creek	W	8/08	1600	13.0	
Redwood Creek (downstream of Bond Cr.)	REDW	8/08	1600	22.0	
Redwood Creek (upstream of Bond Cr.)	REDW	8/08	1022	17.5	16.0
Bond Creek	W	8/08	1022	12.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/08	1053	18.0	
Unnamed tributary	W	8/08	1053	12.5	
Unnamed tributary	W	8/08	1143	13.0	
Redwood Creek (upstream of Cloquet Cr.)	REDW	8/08	1205	19.0	
Cloquet Creek	E	8/08	1205	13.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/08	1335	21.0	
Unnamed tributary	W	8/08	1335	13.0	
Redwood Creek (upstream of Oscar Larson Cr.)	REDW	8/08	1415	21.5	
Oscar Larson Creek	E	8/08	1415	13.0	
Chris Creek	E	8/08	1433	13.0	
Redwood Creek (upstream of Elam Cr.)	REDW	8/08	1540	22.0	
Elam Creek	W	8/08	1540	12.5	
Redwood Creek (upstream of McArthur Cr.)	REDW	8/08	1630	21.0	
McArthur Creek	W	8/08	1630	12.5	
Redwood Creek (upstream of Hayes Cr. pool)	REDW	8/08	1745	20.0	

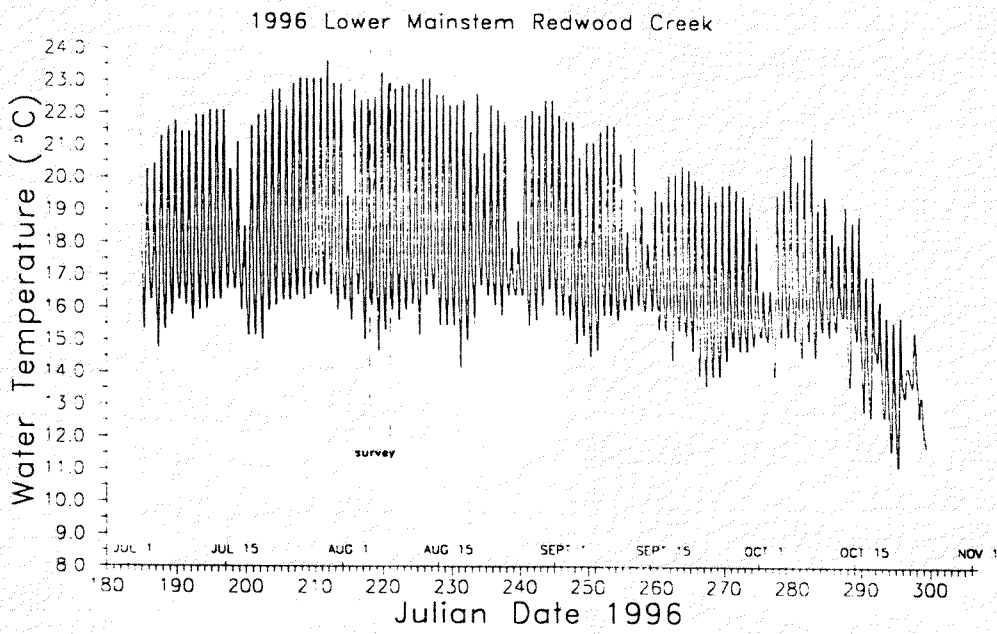
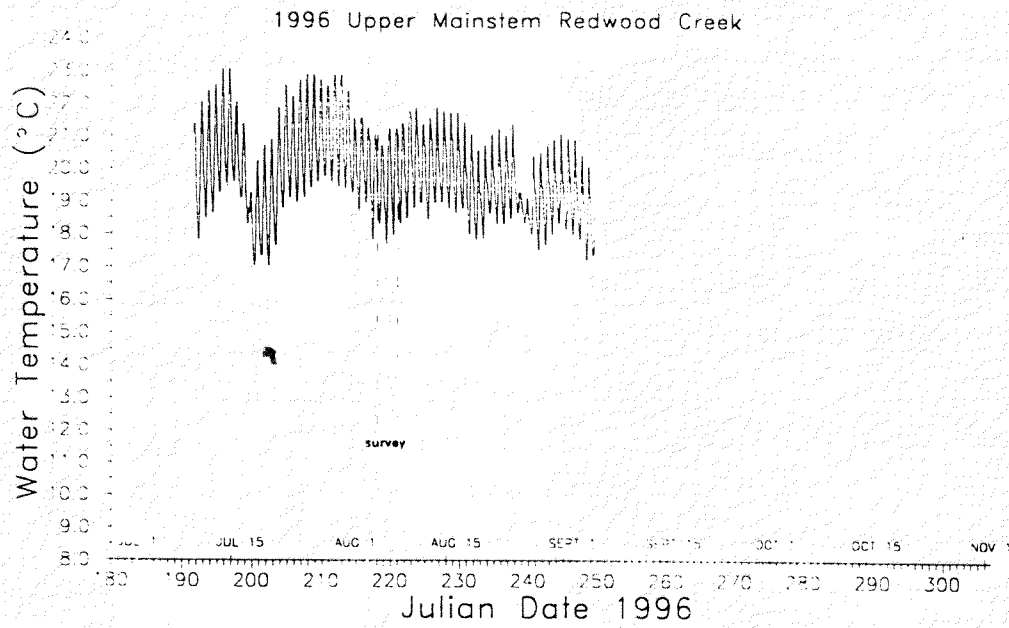


Figure 2. Mainstem Redwood Creek water temperatures (°C) from HOBO temperature loggers located upstream of Tom McDonald Creek and upstream of the lower Redwood Creek trailhead parking lot. Temperature loggers recorded water temperature every 48 minutes in the current below the surface of the water from July 9 through September 5, 1996 at the upper site, and July 2 through October 25, 1996 at the lower site.

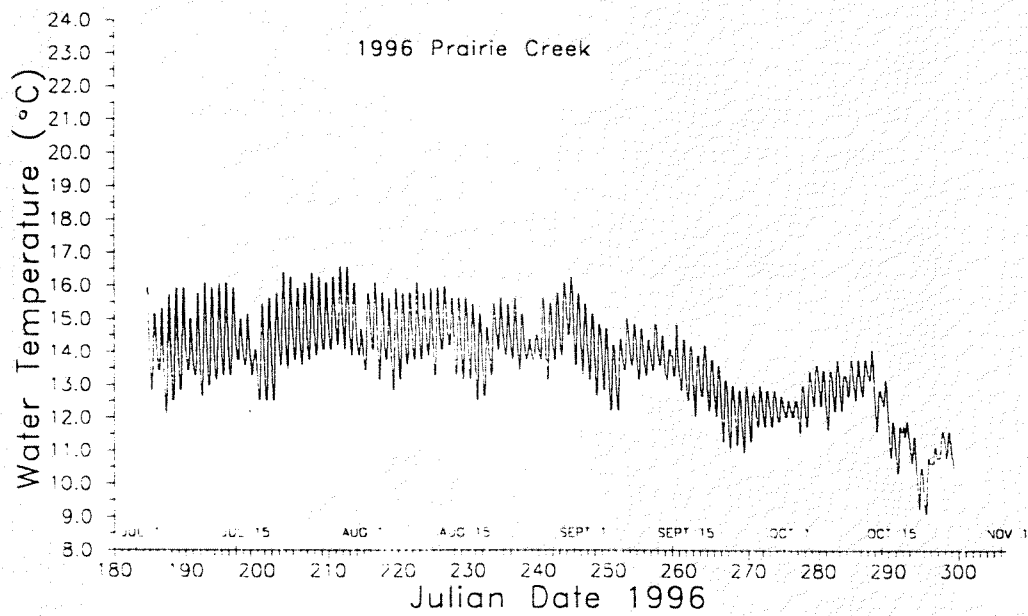


Figure 3. Prairie Creek water temperatures (°C) from July 2 through October 25, 1996. A HOBO temperature logger located at the Wolf Creek bridge recorded temperatures every 48 minutes in the current below the surface of the water.

Fishery Effects - The 1996 summer water temperatures are not an anomaly, similar temperatures and trends have been recorded in past summer steelhead surveys and temperature monitoring. Water temperatures in Redwood Creek were high for salmonid fish, above the preferred temperature range reported by Reiser and Bjornn (1979) for steelhead of 7.3 to 14.6°C. Yoshiyama et. al (1993) reports summer steelhead are found in water temperatures ranging from 10 to 15°C, "with a sustained upper limit of 20°C", and that they can occur in temperatures as high as 27°C for short periods of time. The occurrence of summer steelhead in Redwood Creek in pools associated with or close to tributary cold water sources may indicate that the mainstem as a whole is too warm, and it is these cooler water refugia that are the only suitable habitat for adult summer steelhead holding over the summer in Redwood Creek. For Redwood Creek summer water temperatures to decrease, the canopy will have to be reestablished, and remaining canopy protected.

The Northern California coastal steelhead ESU (evolutionary significant unit) which includes Redwood Creek has been proposed for federal threatened listing (NMFS 1996). The National Marine Fisheries Service concluded the Northern California steelhead ESU is not presently in danger of extinction, but is likely to become endangered in the foreseeable future. They noted summer steelhead abundance is very low and estimated a -3.0% per year trend in total escapement for Redwood Creek summer steelhead (Busby, et al. 1996). A listing decision is due August of 1997.

Literature Cited

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