

2000 RNSP REDWOOD CREEK SUMMER STEELHEAD TROUT SURVEY

DATES: August 1,2, 3,7, 8, & 9, 2000

LOCATION: Redwood Creek, Humboldt County, California
Mainstem reach from Lacks Creek - river km 45.3 to downstream of Hayes Creek (Redwood National Park) - river km 7.8.

DISTANCE: 38 km (23.6 miles) [35 % of the 108-km (67.1 mile) long Redwood Creek mainstem]

FLOWS: Gaging Station: Orick (California Department of Water Resources)
Start of Survey: 44 cfs End of Survey: 36 cfs (Range: 35 to 44 cfs)

DIVERS: David Anderson¹, Kyle Max¹, Baker Holden², Keith Bensen³, Cara Arguello¹.
(Person with prior summer steelhead diving experience on Redwood Creek¹, other northcoast rivers², ocean free diving³) Terry Hines assisted with notes.

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

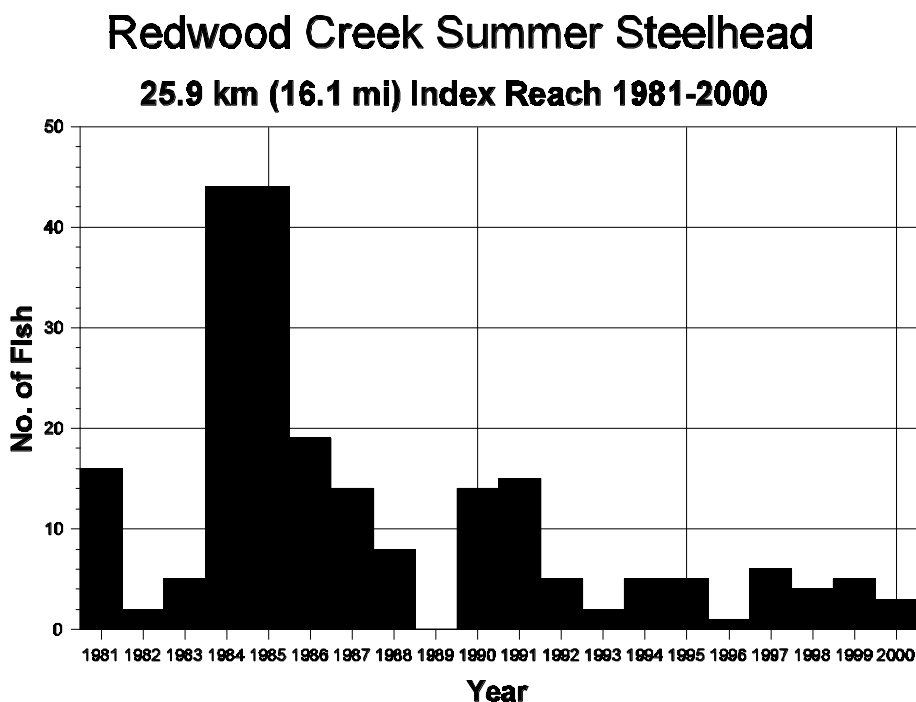
ACCESS: Lacks Creek via Stover Ranch on Redwood Valley Road; Panther Creek at K&K road via Simpson Timber Company; Coyote Creek in via the Bald Hills/Coyote Creek roads and hike along rehabbed road to mouth; hike/snorkel and camp on river two nights between Coyote Creek and Tom McDonald Creek, out via Tall Trees Trail to C-Line parking lot; Tom McDonald in via Tall Trees Trail; Bond Creek in via A-9 road and hike road extension to Redwood Creek trail; and downstream of Hayes Creek out Redwood Creek trail to Redwood Creek lower trailhead parking lot.

ITINERARY:	Date	Survey Reach	Distance	No. SSHD
	8/09	Lacks Creek to Panther Creek <i>Anderson, Bensen, Hines</i>	6.15 km	1
	8/09	Panther Creek to Coyote Creek <i>Holden, Arguello</i>	3.65 km	1
	8/01	Coyote Creek to Copper Creek <i>Anderson, Max, Holden, Bensen</i>	4.50 km	0
	8/02	Copper Creek to upstream of G Creek <i>Anderson, Max, Holden, Bensen</i>	5.45 km	1
	8/03	Upstrm of G Creek to Tom McDonald Creek <i>Anderson, Max, Holden, Bensen</i>	6.15 km	0
	8/07	Tom McDonald Creek to Bond Creek <i>Anderson, Max, Holden, Bensen</i>	4.20 km	0
	8/08	Bond Creek to Hayes Creek <i>Anderson, Max, Holden, Bensen</i>	7.90 km	0

TOTAL NUMBER OF ADULT SUMMER STEELHEAD TROUT OBSERVED IN 2000: 3
(NUMBER OF ADULT SUMMER STEELHEAD TROUT (SSHD) OBSERVED WITHIN THE INDEX SECTION (LACKS CREEK TO TOM McDONALD CREEK - 16.1 miles): 3).
SUMMER STEELHEAD TROUT (*Oncorhynchus mykiss*)

Year 2000 was the 20th consecutive summer steelhead trout survey of Redwood Creek, the first was 1981. Three adult summer steelhead (steelhead ≥ 16.5 inches), seven ‘half-pounder’ steelhead (smaller immature sea-run steelhead returning after less than one year in the ocean), and 95 coastal cutthroat trout (*O. clarki*) were observed in a mainstem survey reach from Lacks Creek to downstream of Hayes Creek (Figure 1 and Table 1). The three adults were observed within the smaller index reach (Lacks Creek to Tom McDonald Creek). The number of adult steelhead within the index reach has declined and the cohort strength of 1984 and 1985 has waned (Figure 2 and Appendix I).

Figure 2. Numbers of summer steelhead observed each summer since 1981 on a 25.9 km (16.1 mile) index reach of Redwood Creek (Lacks Creek to Tom McDonald Creek), Humboldt County, California.



All three adult summer steelhead were observed in pools, two in association with cover and/or structure; bedrock ledges, boulders, and large woody debris and one in the shallows of a pool (Table 2). One was associated with a pool immediately downstream Lacks Creek. Past data from Redwood Creek show the majority of summer steelhead are observed in pools, and pools associated with the inflow of cooler water from tributaries (Anderson 1993).

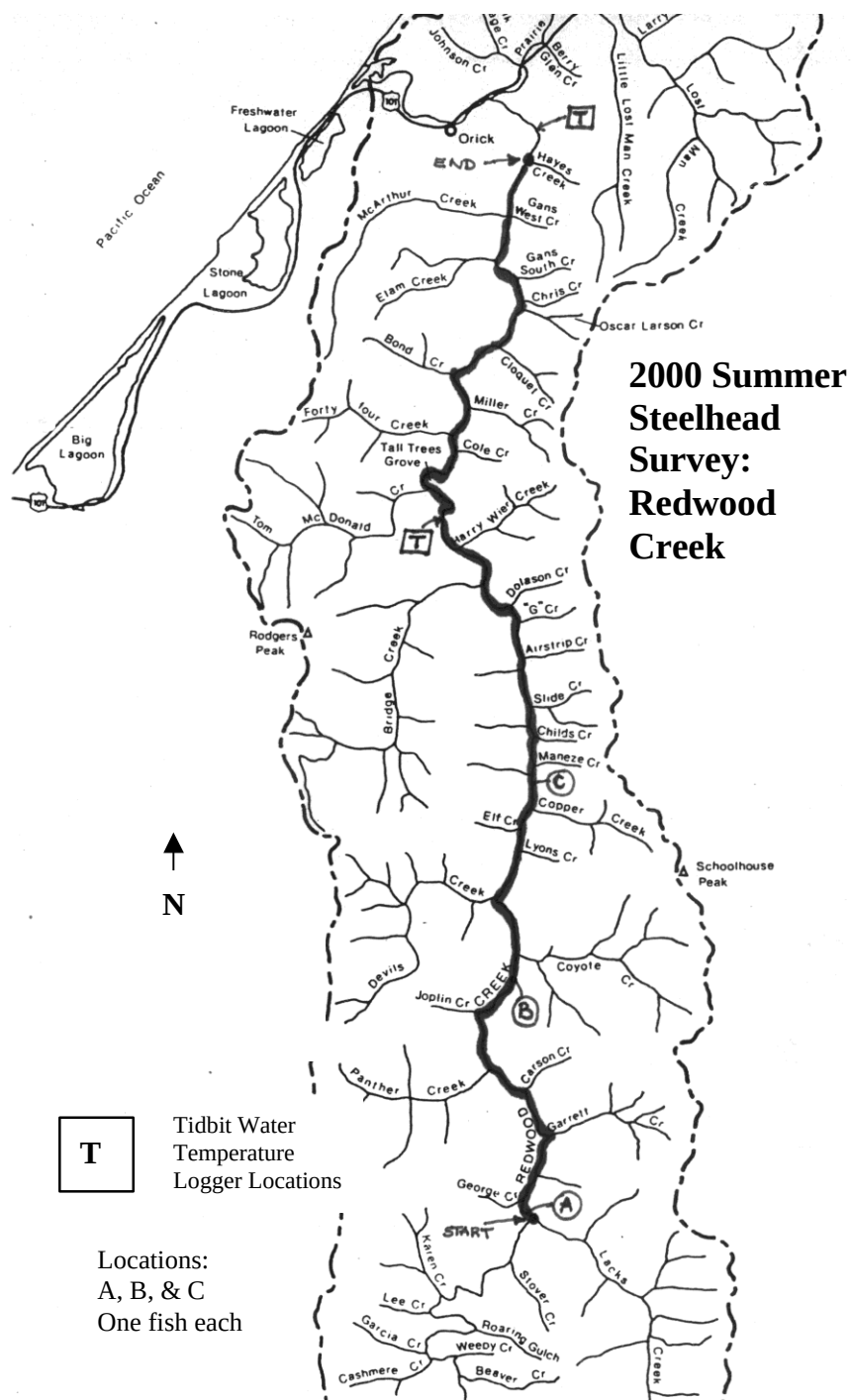


Figure 1. Locations of 3 adult summer steelhead observed during the 2000 snorkel survey of Redwood Creek, Humboldt County, California. Survey was between Lacks Creek and Hayes Creek during August 1-3 and 7-9, 2000.

Table 1. Numbers of adult summer steelhead ($\geq 16.5''$), 'half-pounder' steelhead, coastal cutthroat trout, other fish and wildlife observed, and miscellaneous notes during the 2000 summer steelhead survey of mainstem Redwood Creek, Humboldt County, California. Survey conducted August 1 through 9, 2000 by Redwood National Park and covered 38 km (23.6 miles) [35% of the 108 km (67.1 mile) long Redwood Creek mainstem].

Redwood Creek Mainstem Stream Reach		No. of Summer Steelhead Adults	No. of Half Pounders	No. of Cutthroat Trout	Other Fish and Wildlife Observed
I N D E X R E A C H	Lacks to Panther Creek	1	2	6	Juvenile steelhead and chinook, resident steelhead, three spine stickleback, pacific giant salamander larvae, adult yellow legged frogs, mergansers (15), dippers (10), kingfisher, blue grouse, spotted sandpiper, stellers jay, California sister butterfly, raccoon and deer tracks; and backpackers (3).
	Panther to Coyote Creek	1	2	3	Resident steelhead, sucker, kingfisher, and mergansers (4).
	Coyote to Copper Creek	0	0	4	Juvenile chinook, steelhead, and coho, resident steelhead, sculpin, adult yellow legged frogs, tailed frog larvae, garter snake, dipper (6), river otter; and one low flying helicopter going up stream.
	Copper to Pig Pen Prairie (Slide Cr)	1	0	17	Resident steelhead, pacific giant salamander larvae, mergansers, spotted sandpiper, dipper, bandtailed pigeons, morning doves, and marbled murrelet calls from 0550 to 0720 (at mouth of Copper Creek).
	Pig Pen Prairie (Slide Cr) to Bridge Creek	0	0	10	Adult and juvenile three spine stickleback, mergansers, dippers; and one abandoned yellow aluminum canoe.
	Bridge to Tom McDonald Creek	0	0	8	Juvenile chinook salmon (fewer juvenile salmonids than upstream) and Osprey (near Otter [Kent's] Camp).
	Tom McDonald to Bond Creek	0	2	17	Resident steelhead, suckers, bat, mergansers, mallard ducks (2), dragonfly larvae; and campers (2) and hikers (5). Invertebrates, <i>Juga</i> snails and limniphilid caddisfly larvae along entire Redwood Creek survey)
	Bond Creek to Hayes Creek	0	1	30	Juvenile and resident steelhead, three spine stickleback, osprey, killdeer, great egret, great blue heron, mergansers, spotted sand pipers, dippers, kingfishers, morning doves, band tailed pigeon; and cow elk (12).
Total		3	7	95	

Table 2. Results of the 2000 Redwood Creek summer steelhead survey, including date observed, location on report map, number of steelhead, estimated length of fish (inches), habitat description, and USGS 7.5' topographic and UTM map coordinates.

2000 Date	Map Location	No. of SSHD	Est. Length (inches)	Habitat Description
8/09	A	1	17"	In pool immediately below confluence of Lacks Creek. Fish under rock at 2.5' D. Pool dimensions 20' W x 150' L. Water temperature 20.0°C at ~0930. (T8NR3Esec19, UTM 426680E 4545750N)
8/09	B	1	24"	In tail of pool next to boulder in 6" D of water about 2-4' from shore. Back of fish partially out of water. Pool maximum depth 3'. Water temperature 19.0°C at 1141. (T8NR2Esec2, UTM 423350E 4551000N)
8/02	C	1	16-18"	Was originally at head of pool, but spooked to large woody debris/large rock cover. Pool dimensions 15' D x 40" W x 140' L. Water temperature 20.0°C at 1040 (T9NR2Esec22, UTM 421450E 4556220N)

WATER DISCHARGE

Water flow (measured at Orick gaging station located downstream of the confluence of Prairie Creek at Redwood Creek) during the six day survey ranged from 35 to 44 cfs, beginning at 44 cfs on August 1 and at 36 cfs at the end of the survey on August 9, 2000.

WATER TEMPERATURE

Water temperatures (°C) 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.

Mainstem Redwood Creek - Water temperatures measured during the 2000 survey in Redwood Creek ranged from 18.0°C (8/08 at 0935) to 23.0°C (8/01 from 1619 to 1710) (Appendix II).

Two Onset TidBit recording temperature loggers were placed mid-depth in the current of Redwood Creek within the park. One was located upstream of Tom McDonald Creek/Tall Trees Grove and the other was in lower Redwood Creek upstream of the trailhead (Figure 1). They recorded temperature every 1-hour from June 15 through October 18, 2000 at the site upstream of Tom McDonald Creek and from June 22 through October 19, 2000 at the lower Redwood Creek site. Maximum, minimum and average water temperatures recorded at the upstream location were 24.0°C, 12.4°C, and 18.3°C, respectively. Daily fluctuation ranged from 1 to 5°C. At the lower site, maximum, minimum, and average water temperatures were 22.3°C, 13.1°C, and 17.3°C, respectively. Daily fluctuation ranged from 1 to 6 °C. The lower site had larger daily fluctuations than the upstream site but the upper site was warmer for longer periods of time (Table 3). Redwood Creek water temperatures remained high June through September, and began to decline in October (Table 3 and Figure 3).

Table 3. Percent of time mainstem water temperature (°C) exceeds or equals temperature value at two locations on Redwood Creek, Humboldt County, California, during June through October 2000. Temperatures recorded by Onset Tidbit temperature loggers.

Month YR 2000	Redwood Creek Above Tall Trees Grove										
	Percent of Time Temperature (°C) Exceeds or Equals Value										
	≥14	≥15	≥16	≥17	≥18	≥19	≥20	≥21	≥22	≥23	≥24
June 22-30	100	100	100	98.0	90.1	74.8	52.0	30.7	15.3	5.9	0.5
July 1-31	100	100	99.6	94.0	73.7	46.2	29.3	16.0	4.6	0	0
August 1-31	100	100	100	99.2	85.1	66.9	38.7	16.3	5.6	1.3	0
September 1-30	100	99.4	93.9	70.4	41.7	19.6	5.7	1.0	0	0	0
October 1-19	71.9	36.2	18.3	8.8	2.9	0.2	0	0	0	0	0
Month YR 2000	Lower Redwood Creek										
	Percent of Time Temperature (°C) Exceeds or Equals Value										
	≥14	≥15	≥16	≥17	≥18	≥19	≥20	≥21	≥22	≥23	≥24
June 15-30	100	100	87.6	66.4	45.7	33.1	18.8	4.8	0.5	0	0
July 1-31	100	100	89.4	52.8	30.1	17.7	10.2	3.0	0	0	0
August 1-31	100	99.7	87.2	55.0	30.1	19.4	13.0	5.5	0.3	0	0
September 1-30	100	96.5	71.8	43.6	28.8	18.9	8.3	1.7	0	0	0
October 1-18	93.2	65.6	36.5	17.9	8.5	1.9	0	0	0	0	0

Tributaries - Temperatures of water entering Redwood Creek from the east and westside tributaries during the survey ranged from 13.0°C (seven westside tributaries including four unnamed creeks and Bond, Elam, and McArthur Creeks and two eastside tributaries, Oscar Larson, and Chris Creeks) to 18.0°C (Copper Creek) (Appendix II). Tributary water temperature generally increased with distance upstream. Water temperatures of **all** tributaries were cooler than the corresponding temperature of mainstem Redwood Creek **measured at the same time**.

Westside tributaries were generally cooler than eastside tributaries; a pattern repeated in all past summer steelhead surveys. However, below the Tall Trees Grove, east and westside tributaries were generally the same at 13 to 14°C. The mean water temperature of westside tributaries was 14.1°C (n = 23, std.dev. = 1.1°C) and temperatures ranged from 13 to 16.5°C. The mean water temperature of eastside tributaries was 15.2°C (n = 17, std.dev. = 1.7°C) and temperatures ranged from 13.0 to 18.0°C.

Fishery Effects - The 2000 year 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 are 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. A California Department of Fish and Game (CDFG)

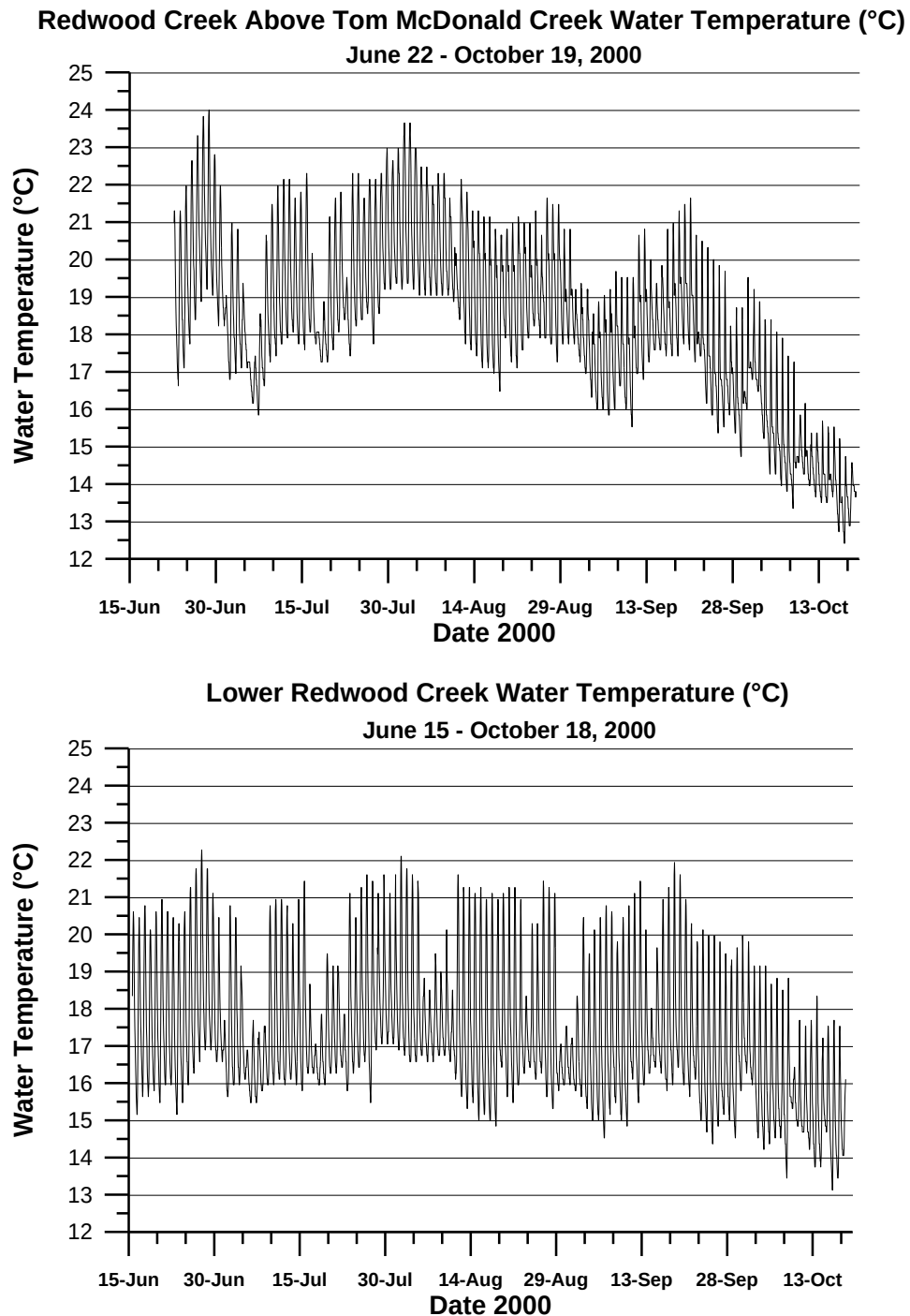


Figure 3. Mainstem Redwood Creek water temperatures (°C) from Onset TidBit temperature loggers located upstream of the lower Redwood Creek trailhead parking lot and upstream of Tom McDonald Creek. The loggers recorded water temperature every 1-hour in the current below the surface of the water from June 15 through October 18, 2000 at the lower Redwood Creek site, and June 22 through October 19, 2000 at the site upstream of Tom McDonald Creek.

funded study (Taylor and Barnhart 1997) of mortality of angler caught and released summer steelhead showed increased summer steelhead mortality with increased water temperature, a 10 percent mortality at 21°C and 35 percent at 24°C. Though only the reach downstream of Bond Creek on Redwood Creek is open to catch-and-release fishing, any incidental post-angling mortality on holding and migrating fish would be significant to the small Redwood Creek summer steelhead population. The CDFG in their 1996 Steelhead Restoration and Management Plan for California (McEwan and Jackson 1996) recommended “adjustment of angling seasons should be considered to limit catch-and-release angling to cooler water periods when hooking mortality is less”. Based on that recommendation, the mainstem of Redwood Creek should be closed to fishing during high water temperature periods. For Redwood Creek summer water temperatures to decrease, the streamside canopy will have to be reestablished, and remaining canopy protected.

Steelhead within the Northern California coastal steelhead ESU (evolutionary significant unit), which includes Redwood Creek, were federally listed by the National Marine Fisheries Service (NMFS) as threatened in June 2000. Originally, according to an agreement with the state of California, steelhead were to remain a candidate species pending the results of comprehensive state recovery activities and management actions, or legal action. However, because the state did not adopt improved forest practice rules, NMFS listed the Northern California steelhead ESU.

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Appendix I. Numbers of Summer Steelhead Trout (SSHD) observed 1981 through 1999 and survey dates in the 25.9 km (16.1 mile) index reach 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
1997	6	8/04 - 07
1998	4	7/27 - 30
1999	5	8/2-10
2000	3	8/1 - 09
^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.		

Appendix II. Water and air temperatures (°C) measured during the 2000 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	2000 DATE	TIME	TEMPERATURE °C	
				WATER	AIR
Redwood Creek (upstream of Lacks Cr.)	REDW	8/09	0910	20.0	16.0
Lacks Creek	E	8/09	0910	16.5	
Redwood Creek (SSHD)	REDW	8/09	---	20.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/09	1005	19.5	
Unnamed Tributary	W	8/09	1005	13.5	
George Creek	W	8/09	---	DRY	
Redwood Creek (upstream of unnamed tributary)	REDW	8/09	1038	19.5	
Unnamed Tributary	W	8/09	1038	13.5	
Redwood Creek (upstream of Garrett Cr.)	REDW	8/09	1310	21.5	18.5
Garrett Creek	E	8/09	1310	17.5	
Redwood Creek	REDW	8/09	--	21.5	
Redwood Creek (upstream of Panther Cr.)	REDW	8/09	1545	22.0	
Panther Creek	W	8/09	1545	15.0	
Redwood Creek (upstream of Panther Cr)	REDW	8/09	0910	19.0	
Panther Creek	W	8/09	0910	13.5	
Redwood Creek (upstream of unnamed tributary)	REDW	8/09	0946	19.0	
Unnamed Tributary	W	8/09	0946	13.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/09	1007	19.0	
Unnamed Tributary	W	8/09	1007	13.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/09	1022	19.5	
Unnamed Tributary	W	8/09	1022	13.0	
Redwood Creek (upstream of Joplin Cr.)	REDW	8/09	1036	19.0	
Joplin Creek	W	8/09	1036	14.0	
Redwood Creek (SSHD)	REDW	8/09	1141	19.0	
Redwood Creek (upstream of Coyote Cr.)	REDW	8/09	1334	21.0	
Coyote Creek	E	8/09	1334	16.0	
Redwood Creek (upstream of Coyote Cr.)	REDW	8/01	1115	19.5	24.0
Coyote Creek	E	8/01	1115	16.5	
Redwood Creek (upstream of unnamed tributary)	REDW	8/01	1218	21.0	
Unnamed Tributary	E	8/01	1218	14.5	
Redwood Creek (upstream of Devils Cr.)	REDW	8/01	1318	20.5	
Devils Creek	W	8/01	1318	14.0	
Redwood Creek (upstream of Lyons Cr.)	REDW	8/01	1520	22.0	
Lyons Creek	E	8/01	1520	17.0	
Redwood Creek (upstream of Elf Cr.)	REDW	8/01	1619	23.0	
Elf Creek	W	8/01	1619	14.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/01	1640	23.0	
Unnamed Tributary	W	8/01	1640	15.0	
Redwood Creek (upstream of Copper Cr.)	REDW	8/01	1710	23.0	
Copper Creek	E	8/01	1710	18.0 [subgravel]	
Redwood Creek (upstream of Copper Cr.)	REDW	8/02	0925	19.5	
Redwood Creek (SSHD)	REDW	8/02	1040	20.0	
Maneze Creek	E	8/02	---	DRY	
Redwood Creek (upstream of unnamed tributary)	REDW	8/02	1400	22.0	
Unnamed Tributary (opposite Pig Pen Prairie)	W	8/02	1400	16.5	
Slide Creek	E	8/02	1419	16.5	
Redwood Creek (upstream of unnamed tributary)	REDW	8/02	1459	23.0	
Unnamed Tributary	W	8/02	1459	16.0	

LOCATION	ALIGN MENT	2000 DATE	TIME	TEMPERATURE °C	
				WATER	AIR
Redwood Creek (upstream of unnamed tributary)	REDW	8/02	1533	22.5	
Unnamed Tributary	W	8/02	1533	15.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/02	1644	22.5	
Unnamed Tributary	E	8/02	1644	16.5	
Redwood Creek (upstream of unnamed tributary)	REDW	8/02	1706	23.0	
Unnamed Tributary	W	8/02	1706	15.0	
Redwood Creek	REDW	8/03	1000	19.5	
G Creek	E	8/03	1026	14.0 [subgravel]	
Dolason Creek	E	8/03	1050	14.5 [subgravel]	
Redwood Creek (upstream of unnamed tributary)	REDW	8/03	1116	20.5	
Unnamed Tributary	W	8/03	1116	14.0	
Redwood Creek (upstream of Bridge Cr.)	REDW	8/03	1143	22.5	
Bridge Creek	W	8/03	1143	15.5	
Redwood Creek (upstream of Emerald Cr.)	REDW	8/03	1243	21.0	
Emerald Creek	E	8/03	1243	16.0 [subgravel]	
Redwood Creek (upstream of Tom McDonald Cr.)	REDW	8/03	1521	22.5	
Tom McDonald Creek	W	8/03	1521	15.5	
Redwood Creek (upstream of Tom McDonald Cr.)	REDW	8/07	1000	19.0	
Tom McDonald Creek	W	8/07	1000	14.0	
Cole Creek	E	8/07	1138	13.5 [subgravel]	
Redwood Creek	REDW	8/07	1142	19.5	
Redwood Creek (upstream of Forty-Four Cr.)	REDW	8/07	1157	20.0	
Forty-Four Creek	W	8/07	1157	13.5	
Redwood Creek (upstream of Miller Cr.)	REDW	8/07	1313	20.5	
Miller Creek	E	8/07	1313	14.0	
Redwood Creek (upstream of Bond Cr.)	REDW	8/07	1357	21.0	
Bond Creek	W	8/07	1357	13.0 [subgravel]	
Redwood Creek (upstream of Bond Cr.)	REDW	8/08	0935	18.0	
Bond Creek	W	8/08	0935	13.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/08	0950	18.0	
Unnamed Tributary	W	8/08	0950	13.0	
Redwood Creek (upstream of Cloquet Cr.)	REDW	8/08	1030	18.0	
Cloquet Creek	E	8/08	1030	13.5	
Redwood Creek (upstream of Oscar Larson Cr.)	REDW	8/08	---	18.5	
Oscar Larson Creek	E	8/08	---	13.0 [subgravel]	
Redwood Creek (upstream of Chris Cr.)	REDW	8/08	1132	18.5	
Chris Creek	E	8/08	1132	13.0	
Redwood Creek (upstream of Gans South Cr.)	REDW	8/08	---	19.5	
Gans South Creek	E	8/08	---	13.5 [subgravel]	
Redwood Creek (upstream of Elam Cr.)	REDW	8/08	1329	19.5	
Elam Creek	W	8/08	1329	13.0	
Redwood Creek (upstream of McArthur Cr.)	REDW	8/08	1422	19.0	
McArthur Creek	W	8/08	1422	13.0	
Redwood Creek (at dry Hayes Creek)	REDW	8/08	1520	19.0	
Hayes Creek	E	8/08	1520	DRY	