

1999 RNSP REDWOOD CREEK SUMMER STEELHEAD TROUT SURVEY

DATES: August 2, 3, 4, 5, 9, & 10, 1999

LOCATION: Redwood Creek, Humboldt County, California
Mainstem from Lacks Creek - river km 45.3 to downstream of Hayes Creek (Redwood National Park) - river km 7.3

DISTANCE: 38.0 km (23.6 miles) [35% of the 108 km long Redwood Creek mainstem]

FLOWS: Gaging Station: Orick (California Department of Water Resources)
Start of Survey: 25 cfs End of Survey: 25 cfs (Range: 22 to 32 cfs)

DIVERS: David Anderson¹, Bill Falvey¹, Cara Arguello¹, Kyle Max³, Tom Heinz², Frank Kemp, and Richard Max³ (volunteer).
(Person with prior summer steelhead experience on Redwood Creek¹, other northcoast rivers², ocean free diving³)

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

ACCESS: Lacks Creek at 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 Simpson 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 West Side Access road and M Line to Redwood Creek; 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 lower trailhead parking lot.

ITINERARY:	Date	Survey Reach	Distance	No. SSHD
	8/10	Lacks Creek to Panther Creek <i>Anderson, Falvey</i>	6.15 km	3
	8/10	Panther Creek to Coyote Creek <i>Max, Arguello</i>	3.65 km	0
	8/02	Coyote Creek to Copper Creek <i>Anderson, K. Max, Heinz, Kemp</i>	4.50 km	0
	8/03	Copper Creek to upstream of G Creek <i>Anderson, K. Max, Heinz, Kemp</i>	5.75 km	1
	8/04	Upstrm of G Creek to Tom McDonald Creek <i>Anderson, K. Max, Heinz, Kemp</i>	5.85 km	1
	8/05	Tom McDonald Creek to Bond Creek <i>Anderson, K. Max</i>	4.20 km	0
	8/09	Bond Creek to downstream of Hayes Cr. <i>Anderson, K. Max, R.. Max</i>	7.90 km	5

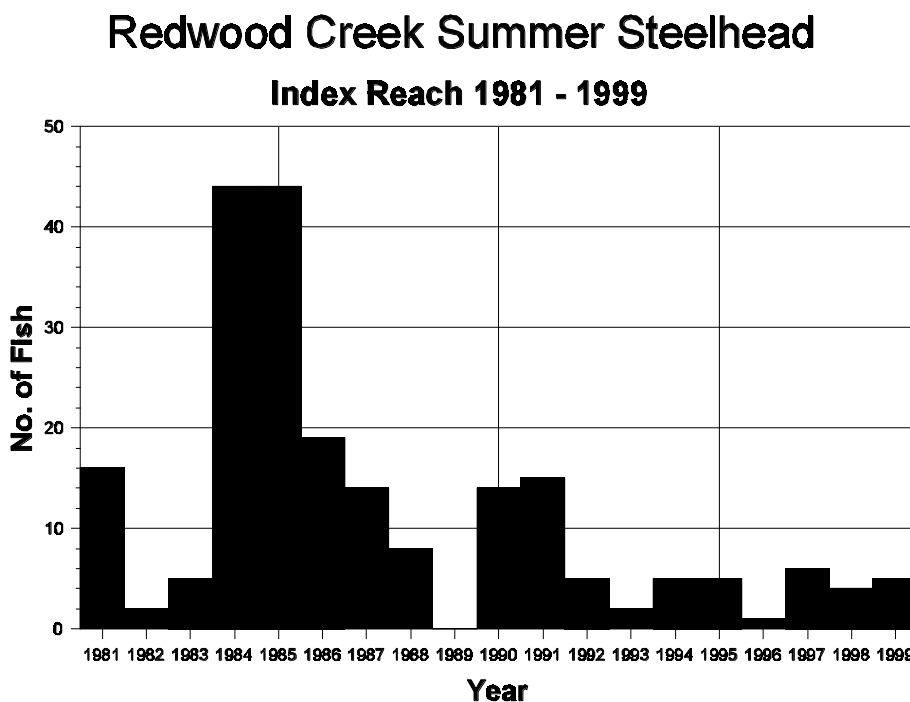
TOTAL NUMBER OF ADULT SUMMER STEELHEAD TROUT OBSERVED IN 1999: 10

(NUMBER OF ADULT SUMMER STEELHEAD TROUT (SSHD) OBSERVED WITHIN THE INDEX SECTION (LACKS CREEK TO TOM McDONALD CREEK - 16.1 miles): 5)

SUMMER STEELHEAD TROUT (*Oncorhynchus mykiss*)

1999 was the 19th consecutive summer steelhead trout survey of Redwood Creek, the first was 1981. The 10 adult summer steelhead (steelhead ≥ 16.5 inches) and 5 half-pounder steelhead were observed in a mainstem survey reach from Lacks Creek to downstream of Hayes Creek (Figure 1). This year's summer steelhead count in the index reach (Lacks Creek to Tom McDonald Creek) was 5. The population is declining 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 index reach of Redwood Creek (Lacks Creek to Tom McDonald Creek), Humboldt County, California.



All adult fish were observed in pools in association with cover and/or structure; bedrock ledges, boulders, and large woody debris (LWD) (Table 1). Five 'half pounder' steelhead (smaller immature sea-run steelhead returning after less than one year in the ocean) and 47 coastal cutthroat trout were also observed (Table 2). All summer steelhead were observed in pools and two were associated with pools immediately downstream of tributaries (Lacks and Garrett Creeks). 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). Seven of the 10 adult summer steelhead were solitary fish, and three were together in one LWD structure. Five of the 10 fish were observed downstream of Bond Creek, the reach of Redwood Creek open to fishing year round.

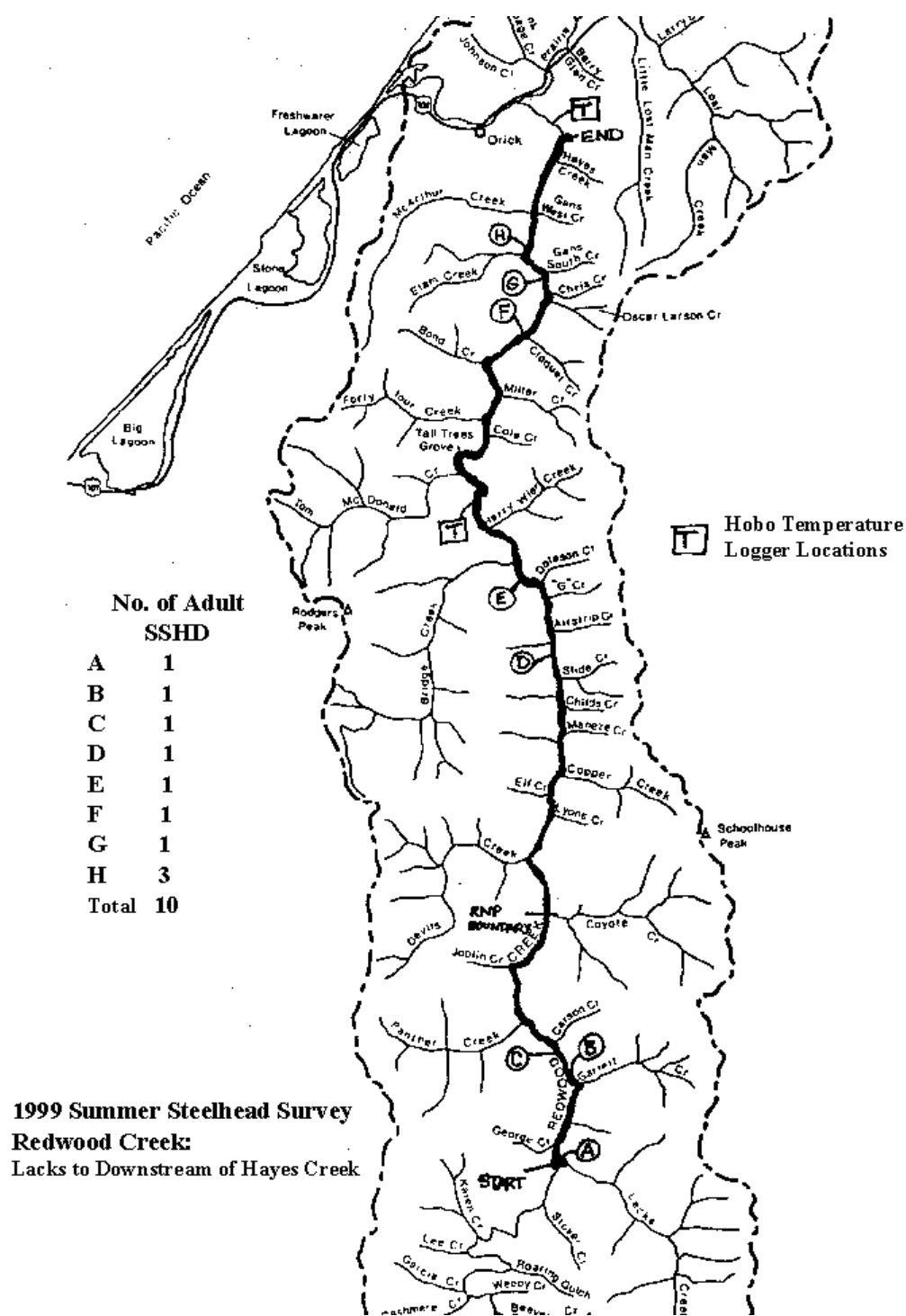


Figure 1. Locations of 10 adult summer steelhead observed during the 1999 snorkel survey of Redwood Creek between Lacks Creek and downstream of Hayes Creek during August 2-5 and 9-10, 1999.

Table 1. Results of the 1999 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.

Date	Map Location	No. of SSHD	Est. Length (inches)	Habitat Description
8/10	A	1	18-20"	Under rock in first pool below Lacks Creek at 3' D. Dimensions of pool: 70'L x 20'W x 3'D. Water temperature was 18.5°C at 0936. (T8NR3Esec19 UTM 426600E 4545750N)
8/10	B	1	16-18"	In first pool below Garrett Creek in pool/riffle. At head of pool and edge of bubble curtain. Pool 5'D. Water temperature of pool 21.0°C. (T8NR3Esec18 UTM 426120E 4547900N)
8/10	C	1	24"	In pool under the overhang at the base of large boulder (garage size) at 10' depth. Pool had large woody debris and other boulders. Pool dimensions 100'L x 40'W x 10'D. (T8NR2Esec13 UTM 425050E 4548650N)
8/03	D	1	18"	In pool under ledge at 4' depth. Part of a series of two pool with large boulders. (T9NR2Esec16 UTM 420190E 4558370N)
8/04	E	1	>16.5" (only saw glimpse of tail)	In pool at 10' depth in large woody debris and larger sized boulder. Water temperature 19.0°C. (T9NR2Esec8 UTM 418070E 4560180N)
8/09	F	1	20"	In pool resting next to large woody debris in 4' depth. Pool size 60'L x 40'W x 5'D. Water temperature 17.5°C. Also present were 5 cutthroat ranging from 10 to 14". (T10NR1Esec13 UTM 415330E 4566330N)
8/09	G	1	20+"	First seen against bank and spooked into fallen alder of shallow pool. In water 2.5' D. Water temperature 17.5°C at 1212. (T10NR1Esec12 UTM 415000E 4568150N)
8/09	H	3	1 @ 18" 1 @ 20" 1 @ 22"	In pool 8' depth under large woody debris and alder overhead cover. Two spooked and darted out while the third remained. Water temperature 17.0°C at 1614. (T10NR1E UTM 414220E 4568510N)

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 22 and 32 cfs, beginning at 25 cfs on August 2 and at 25 cfs at the end of the survey, August 10, 1999.

Table 2. Numbers of adult summer steelhead ($\geq 16.5''$), half-pounder steelhead, coastal cutthroat trout, and other fish and wildlife observed during the 1999 summer steelhead survey of the mainstem Redwood Creek, Humboldt County, California. Survey was conducted August 2 through 10, 1999 by Redwood National Park and covered 38 km (23.6 miles) [35% of the 108 km 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
INDEX REACH	Lacks to Panther Creek	3	2	1	Juvenile steelhead, sculpin, kingfisher, yellow legged frogs, lamprey and salmonid redds, water ouzel
	Panther to Coyote Creek	0	2	4	Tailed frog tadpole in Redwood Creek, kingfisher
	Coyote to Copper Creek	0	0	2	Resident trout (~10"), sculpin, juvenile steelhead, pacific giant salamander, beaver, kingfisher, marbled murrelet detections at Copper Creek.
	Copper to Pig Pen Prairie (Slide Cr)	0	0	9	Sculpin, yellow-legged frogs, unidentified tadpoles, Redtail hawk, Coopers Hawk, Great Blue Heron, Turkey vulture, kingfisher, and a Spotted Owl (4 note call)
	Pig Pen Prairie(Slide Cr) to Bridge Creek	2	0	7	
	Bridge to Tom McDonald Creek	0	0	0	Threespine stickleback and 1 dead sucker
	Tom McDonald to Bond Creek	0	1	8	Sculpin, threespine stickleback, toad, Great Blue Heron, mergansers, and few juvenile steelhead
	Bond Creek to Hayes Creek	5	0	16	Mallards, kingfisher, Great Blue Heron, killdeer, and sandpipers
Total		10	5	47	

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°C (on 8/09/99 @ 1414) to 21°C (8/2, 3, & 10/99) during the 1999 survey (Table 3). Overcast conditions on 8/09/99 lowered mainstem temperatures to 17°C.

Two HOBO 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. They recorded temperature every 1-hour from June 28 through October 25, 1999 at the site upstream of Tom McDonald Creek, and from May 27 through October 18, 1999 at the lower Redwood Creek site. Maximum, minimum and average water temperatures recorded at the upstream location were 22.7°C, 10.5°C, and 17.1°C, respectively. Daily fluctuation ranged from 1 to 4°C. At the lower site, maximum, minimum, and average water temperatures were 21.7°C, 10.9°C, and 16.4°C. Daily fluctuation ranged from 1 to 6°C. Redwood Creek water temperatures peaked during July and August and declined into the fall (Figure 3).

Again, of interest was the absence of algal blooms that have been associated with the warm water temperatures. One reason for this absence may have been the large numbers of aquatic snails (*Juga* sp.) and caddisfly larvae (Limniphilidae) that covered the substrate and submerged boulders. It is these grazers that probably crop any filamentous algae.

Tributaries - Temperatures of water entering Redwood Creek from the east and westside tributaries during the survey ranged from 11.5°C (unnamed tributary) to 18.0°C (Garrett and Copper Creeks) (Table 3). Tributary water temperature increased with distance inland and 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 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 13.3°C (n = 19, std.dev. = 0.8°C) and temperatures ranged from 11.5 to 15.0°C. The mean water temperature of eastside tributaries was 15.0°C (n = 14, std.dev. = 1.6°C) and temperatures ranged from 13 to 18°C.

Fishery Effects - The 1999 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. A Department of Fish and Game 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 20°C and 35 percent at 24°C. Though the numbers of adult summer steelhead holding below

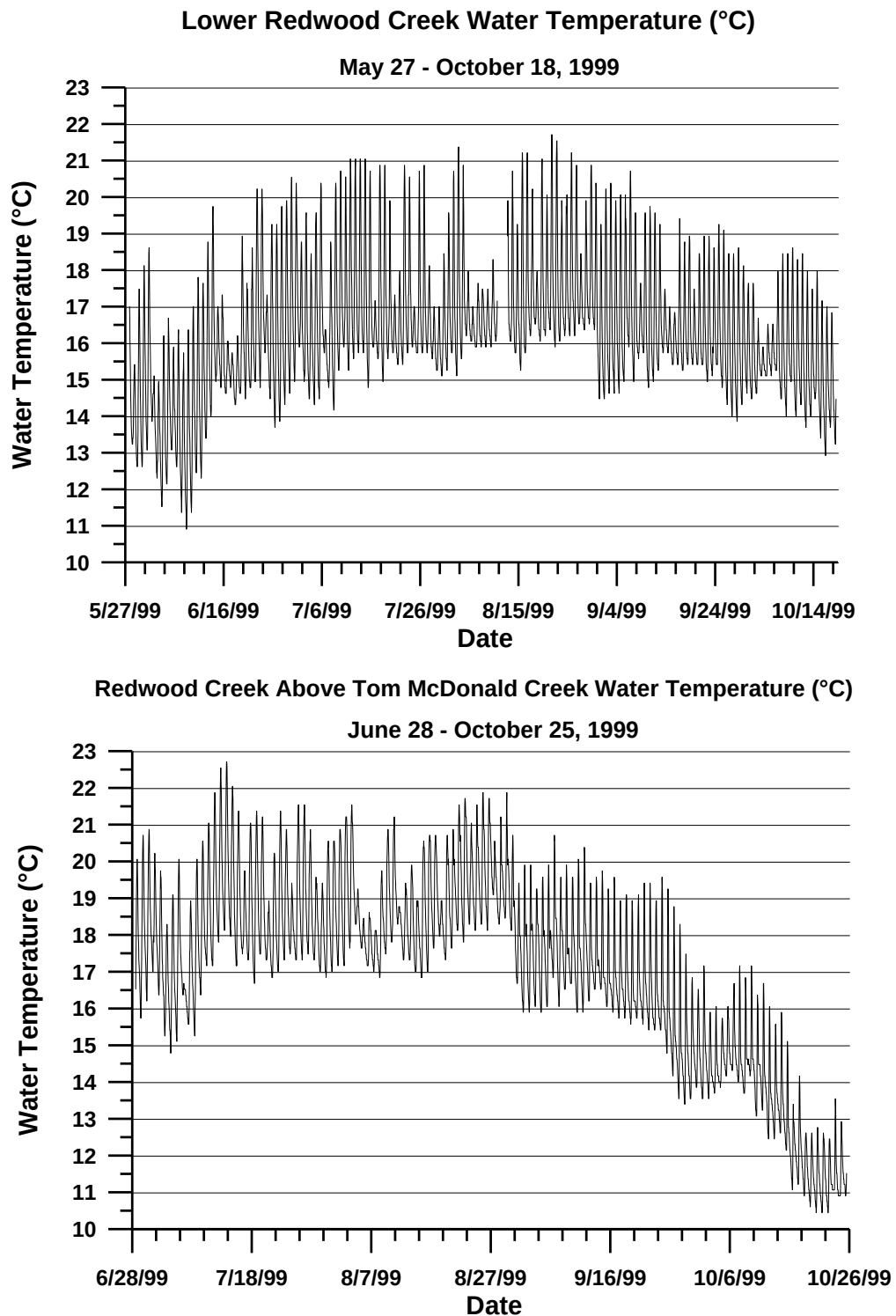


Figure 3. Mainstem Redwood Creek water temperatures (°C) from HOBO temperature loggers located upstream of the lower Redwood Creek trailhead parking lot and upstream of Tom McDonald Creek. The loggers recorded water temperature every 1-hour in the current below the surface of the water from May 27 through October 10, 1999 at the

lower Redwood Creek site, and June 28 through October 25, 1999 at the site upstream of Tom McDonald Creek.

Bond Creek are low, the overall numbers observed during the survey are equally low, 10 fish. Therefore, any incidental angling mortality on holding and migrating fish is significant to the summer steelhead population. The DFG in their 1996 Steelhead Restoration and Management Plan for California 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.

The occurrence of summer steelhead in Redwood Creek 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 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 are a candidate for federal threatened listing. In an agreement with the state of California, it will remain a candidate species pending the results of comprehensive state recovery activities and management actions, or legal action.

Matt Smith of Northcoast Fisheries Restoration, who has surveyed Redwood Creek in past years, did not survey the upper reach of Redwood Creek this year. He reported access to the creek was denied in several areas.

Table 3. Water and air temperatures (EC) measured during the 1999 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	ALIGN MENT	1999 DATE	TIME	TEMPERATURE °C	
				WATER	AIR
Redwood Creek (upstream of Lacks Cr.)	REDW	8/10	0919	18.5	
Lacks Creek	E	8/10	0919	16.0	
Redwood Creek (SSHD)	REDW	8/10	0936	18.5	
Redwood Creek (upstream of unnamed tributary)	REDW	8/10	1024	19.0	
Unnamed Tributary	W	8/10	1024	13.5	
George Creek	W	8/10	1035	13.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/10	1213	19.5	
Unnamed Tributary	E	8/10	1213	14.0	
Redwood Creek (upstream of Garrett Cr.)	REDW	8/10	1400	21.0	
Garrett Creek	E	8/10	1400	18.0	
Redwood Creek (SSHD)	REDW	8/10	~1415	21.0	
Redwood Creek	REDW	8/10	1521	21.0	
Redwood Creek (SSHD)	REDW	8/10	1609	21.0	
Redwood Creek (upstream of Panther Cr.)	REDW	8/10	1645	21.0	
Panther Creek	W	8/10	1645	14.5	
Redwood Creek (upstream of Panther Cr)	REDW	8/10	0923	19.0	
Panther Creek	W	8/10	0923	13.5	
Redwood Creek	REDW	8/10	1000	18.7	
Redwood Creek (upstream of unnamed tributary)	REDW	8/10	1015	18.7	
Unnamed Tributary	W	8/10	1015	11.5	
Redwood Creek (upstream of unnamed tributary)	REDW	8/10	1035	19.0	
Unnamed Tributary	W	8/10	1035	12.5	
Redwood Creek (upstream of unnamed tributary)	REDW	8/10	1100	19.0	
Unnamed Tributary	W	8/10	1100	13.0	
Redwood Creek (upstream of Joplin Cr.)	REDW	8/10	1120	19.0	
Joplin Creek	W	8/10	1120	DRY at least 40 yd up stream	
Redwood Creek (upstream of Coyote Cr.)	REDW	8/10	1355	21.0	
Coyote Creek	E	8/10	1355	16.5	
Redwood Creek (upstream of Coyote Cr.)	REDW	8/02	1330	20.0	26.5
Coyote Creek	E	8/02	1330	16.0	
Redwood Creek (upstream of Devils Cr.)	REDW	8/02	1607	21.0	
Devils Creek	W	8/02	1607	13.5	
Redwood Creek (upstream of Lyons Cr.)	REDW	8/02	1732	20.5	
Lyons Creek	E	8/02	1732	15.0	
Redwood Creek (upstream of Elf Cr.)	REDW	8/02	1834	20.0	
Elf Creek	W	8/02	1834	13.0	
Redwood Creek (upstream of Copper Cr.)	REDW	8/02	1855	20.0	
Copper Creek	E	8/02	1855	18.0	
Redwood Creek (upstream of Copper Cr.)	REDW	8/03	0930	18.0	
Copper Creek	E	8/03	0930	15.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/03	1121	19.0	
Unnamed Tributary	W	8/03	1112	13.0	
Redwood Creek (upstream of Slide Cr.)	REDW	8/03	1400	21.0	
Slide Creek	E	8/03	1400	15.0	
Redwood Creek (SSHD)	REDW	8/03	1434	21.0	
Unnamed Tributary	W	8/03	1447	14.5	

LOCATION	ALIGN MENT	1999 DATE	TIME	TEMPERATURE °C	
				WATER	AIR
Redwood Creek (upstream of unnamed tributary)	REDW	8/03	1700	21.0	
Unnamed Tributary	E	8/03	1700	14.5	
Redwood Creek	REDW	8/04	1030	19.0	
G Creek	E	8/04	~1045	Dry at mouth	
Dolason Creek	E	8/04	1100	Dry at mouth 14.5 upstream	
Redwood Creek (SSHD)	REDW	8/04	1135	19.0	
Redwood Creek (upstream of Bridge Cr.)	REDW	8/04	1150	19.0	
Bridge Creek	W	8/04	1150	15.0	
Redwood Creek (upstream of Emerald Cr.)	REDW	8/04	1235	19.0	
Emerald Creek	E	8/04	1235	14.0	
Redwood Creek (upstream of unnamed tributary)	REDW	8/04	1250	19.0	
Unnamed Tributary	W	8/04	1250	14.0	
Redwood Creek (upstream of Tom McDonald Cr.)	REDW	8/04	1447	19.0	
Tom McDonald Creek	W	8/04	1447	14.0	
Redwood Creek (upstream of Tom McDonald Cr.)	REDW	8/05	1100	18.0	
Tom McDonald Creek	W	8/05	1100	13.0	
Redwood Creek (upstream of Forty-Four Cr.)	REDW	8/05	1240	18.0	
Forty-Four Creek	W	8/05	1240	13.0	
Redwood Creek (upstream of Miller Cr.)	REDW	8/05	1410	18.0	
Miller Creek	E	8/05	1410	14.0	
Redwood Creek (upstream of Bond Cr.)	REDW	8/05	1451	18.0	
Bond Creek	W	8/05	1451	12.0	
Redwood Creek (upstream of Bond Cr.)	REDW	8/09	0935	17.5	
Bond Creek	W	8/09	0935	13.0	
Unnamed Tributary	W	8/09	1000	13.5	
Redwood Creek (upstream of unnamed tributary)	REDW	8/09	1020	17.5	
Unnamed Tributary	E	8/09	1020	13.0	
Redwood Creek (SSHD)	REDW	8/09	~1045	17.5	
Unnamed Tributary	W	8/09	1121	13.0	
Oscar Larson Creek	E	8/09	1148	14.0	
Chris Creek	E	8/09	1155	13.0	
Redwood Creek (SSHD)	REDW	8/09	1212	17.5	
Redwood Creek (upstream of Elam Cr.)	REDW	8/09	1254	17.5	
Elam Creek	W	8/09	1254	12.5 (cold pool)	
Redwood Creek (SSHD)	REDW	8/09	1414	17.0	
Redwood Creek (upstream of McArthur Cr.)	REDW	8/09	1445	17.5	
McArthur Creek	W	8/09	1445	13.0	
Redwood Creek (downstream of Hayes Creek)	REDW	8/09	1545	18.0	

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Report Prepared by: David G. Anderson - NPS Fishery Biologist,
(707) 464-6101 x 5271
Redwood National and State Parks, Orick, California.
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Appendix I. Numbers of Summer Steelhead Trout (SSHD) observed 1981 through 1999 and survey dates 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
1997	6	8/04 - 07
1998	4	7/27 - 30
1999	5	8/2-10
^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.		