

Redwood

National Park

National Park Service
US Department of the Interior

2008 REDWOOD CREEK SUMMER STEELHEAD SURVEY



Fish and Wildlife Branch
September 2015

Cover Photos: (Taken During 2008 Summer Steelhead Survey)
Top Left: Rocky Gap in Gorge of Redwood Creek
Top Right: NPS Snorkelers
Middle Right: Coastal Cutthroat Trout
Bottom Left: NPS Snorkelers
Bottom Right: Snorkeler and Recorder

2008 RNSP REDWOOD CREEK SUMMER STEELHEAD SURVEY

DATES: July 28, 29, 30, 31 (Monday - Thursday) and August 4, 5, 6 (Monday - Tuesday), 2008

LOCATION: Redwood Creek, Humboldt County, California
Mainstem reach from Lacks Creek - river km 46.514 to downstream of Hayes Creek (Redwood National and State Parks) - river km 7.65.

DISTANCE: 38.9 km (24.1 miles) [36 % of the 108-km (67.1-mile) long Redwood Creek mainstem]

FLOWS: Gaging Station: Orick [ORK] (<http://waterdata.usgs.gov/> [daily mean values])
Start of Survey: 40 cfs End of Survey: 33 cfs

DIVERS: David Anderson¹, Terry Hines¹, Kyle Max¹, Gallen Reid, and Kelley Breen¹, (¹Person with prior summer steelhead diving experience on Redwood Creek). Recorder: Heather Brown and T. Hines.

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

ACCESS: Lacks Creek via Stover Ranch on Redwood Valley Road; Panther Creek via Green Diamond Resource Company K&K road at Korbel; hike/snorkel and camp on river four days/three nights to reach summer bridge downstream of Tall Trees Grove; Summer bridge and trail via 44 horse camp. Drive out C-12/A9-9/West Side Access roads; Bond Creek in or out via A-9 road and hike road extension to Redwood Creek trail; and downstream of Hayes Creek intercept Redwood Creek trail and hike to lower trailhead parking lot.

ITINERARY:	Date	Survey Reaches	Distance	SSHD No.
	8/06	Lacks Creek to Panther Creek <i>Anderson, Hines, Max, Recorder -Brown</i>	6.02 km	2
	7/28	Panther Creek to upstream of Devils Creek <i>Anderson, Hines, Max, and Reid</i>	5.25 km	3
	7/29	Upstream of Devils Cr to Childs Creek <i>Anderson, Hines, Max, and Reid</i>	5.48 km	12
	7/30	Childs Creek to dwnstrm of Bridge Cr <i>Anderson, Hines, Max, and Reid</i>	6.27 km	2
	7/31	Dwstrm of Bridge Cr to upstrm of Miller Cr <i>Anderson, Hines, Max, and Reid</i>	5.95 km	0
	8/04	Upstrm of Miller Cr to Oscar Larson Cr <i>Anderson, Max, Breen, Recorder - Brown</i>	4.32 km	2
	8/05	Oscar Larson Cr to downstrm of Hayes Creek <i>Anderson, Max, Breen, Recorder - Hines</i>	5.58 km	0

TOTAL NUMBER OF ADULT SUMMER STEELHEAD TROUT OBSERVED IN 2008: 21
(Number of Adult Summer Steelhead Trout Observed within the Original Index Section – Lacks Creek to Tom McDonald Creek – 16.1 miles: 19)

SUMMER STEELHEAD TROUT

Summer steelhead (*Oncorhynchus mykiss*) are an anadromous race of rainbow trout. Their life cycle differs from that of the more numerous winter-run steelhead. Adult summer steelhead ascend the rivers in spring, hold over in deep pools in the summer, and then spawn in winter. Because adult summer steelhead hold in freshwater 8 - 10 months (Roelofs 1983), they are vulnerable to detrimental environmental and human-caused factors including higher water temperatures, low summer flows, decreasing pool depths, and poaching. Steelhead within the Northern California coastal steelhead ESU (evolutionary significant unit), which includes Redwood Creek, were federally listed by NOAA Fisheries as threatened in June 2000 and relisted in January 2006.

Summer 2008 was the 28th consecutive summer steelhead trout survey of Redwood Creek, the first being 1981. The survey reach began at Lacks Creek at Stover Ranch and proceeded 38.9 kilometers downstream through Green Diamond Resource Company timber lands into Redwood National Park at a location downstream of Hayes Creek.

Twenty-one adult summer steelhead (steelhead ≥ 16 inches), 10 'half-pounder' steelhead (smaller immature sea-run steelhead returning after less than one year in the ocean), and 96 coastal cutthroat trout (*O. clarki*) (cutthroat ≥ 10 inches) were observed in the mainstem survey reach (Table 1). Nineteen of the 21 summer steelhead were observed within the original index reach, Lacks to Tom McDonald Creeks.

The 21 adult summer steelhead were observed in 13 pools (Table 2). One of the pools was associated with the westside tributary Devils Creeks. Past data from Redwood Creek show the majority of summer steelhead are observed in pools (Anderson 1993). Nine were solitary fish observations, with three observations of two fish each, and one of six fish. Estimated fish lengths ranged from 16 to 26 inches.

Most fish were found in the mid to upper reaches of the survey. Downstream of G Creek, only three summer steelhead were observed, and that was before Bond Creek (Figure 1).

Summer steelhead numbers over time are presented in Figures 2 and Appendix I.

California Trout and the USFWS surveyed Redwood Creek upstream of Lacks Creek, from the Chezem Road Bridge, river kilometer 71.85 to Stover Creek, river kilometer 47.988, a distance of 23.9 km. Over the three day survey, July 28 to 30, the two snorkelers saw 38 summer steelhead and 14 half pounder-steelhead (Appendix II). No coastal cutthroat were observed. Together the two surveys covered 62.75 km, 58 percent of mainstem Redwood Creek.

Table 1. Numbers of adult summer steelhead ($\geq 16''$), 'half-pounder' steelhead, and coastal cutthroat trout, and aquatic and other wildlife observed during the 2008 summer steelhead survey of mainstem Redwood Creek, Humboldt County, California. Survey conducted on seven days, July 28 through August 6, 2008 from Lacks Creek to downstream of Hayes Creek and covered 38.9 km (24.1 miles) of Redwood Creek mainstem. (Stream reaches are broken out to reflect past reported reaches. These original reaches were based on access points, the majority of which are no longer accessible by vehicle.)

Redwood Creek Mainstem Stream Reach		No. of Summer Steelhead Adults ($\geq 16''$)	No. of Steelhead Half Pounders	No. of Cutthroat Trout ($\geq 10''$)	Aquatic and Other Wildlife Observed
O R I G I N A L I N D E X R E A C H	Lacks to Panther Creek 8/06/2008	2	5	7	Suckers, Sculpin, Fish Redds, Rough-Skinned Newt, Yellow-legged Frogs, Pacific Giant Salamanders (1 dead), Garter Snake, Racer (1 dead), Damsel Fly; Deer, Elk, and Raccoon Tracks, and Bear and Beaver Scat
	Panther to Coyote Creek 7/28/2008	2	2	5	Threespine Stickleback, Sculpin, Juvenile Steelhead and Chinook Salmon, Resident Steelhead, Sacramento Suckers, Lamprey Redds, Yellow-legged Frog, Garter Snake, <i>Juga</i> Snails, Limniphilidae stone case Nymphs, Pteronarcys Nymphs, American Dipper, and Otters (3)
	Coyote to Copper Creek 7/28 & 29/2008	7	2	5	Resident Steelhead, Beaver scat and bank lodge, and Marbled Murrelets (2 at 5:45 am)
	Copper to Pig Pen Prairie (Slide Cr) 7/29 & 30/1008	6	0	4	Mallard, Spotted Sandpiper, American Dipper, Common Raven, Stellars Jay, Belted Kingfisher, and Barred Owl (hooting at 5:40 am)
	Pig Pen Prairie (Slide Cr) to Bridge Creek 7/30/2008	1	0	8	Sucker, Mergansers (8) and Camper (1)
	Bridge to Tom McDonald Creek 7/30 & 31/2008	1	0	3	Freshwater Mussel, Sacramento Suckers, Marbled Murrelets, Piliated, and Woodpecker,
	Tom McDonald to Bond Creek 8/04/2008	2	1	24	Coho Juvenile (2), Sacramento Suckers, Elk (3 bull elk), a Fishing Lure, Camper (1), and Camps (3)
	Bond Creek to downstream of Hayes Creek 8/04 & 05/2008	0	0	40	Resident Steelhead; Juvenile Coho, Chinook, and Steelhead; Otters (4), Vauxs Swift, Osprey, Belted Kingfisher, Spotted Sandpiper, Common Raven, Turkey Vulture, Stellars Jay, Common Mergansers (4), American Robin, Barn Swallow, Rough-wing Swallows, Violet Green Swallow, Sparrow sp., Mallard (14), Great Blue Heron, and Limniphilidae Nymphs
Total		21	10	96	

Table 2. Date, location (river kilometer and UTM coordinates [NAD83]), number and estimated fork length (inches) and habitat description of adult summer steelhead trout observed in the 2008 snorkel survey of mainstem Redwood Creek. (Numbers in parentheses in the river km refer to locations on map of Figure 1).

Date	River KM	No. of SSHD	Est. Length (inches)	Habitat Description
8/06/2008	45.60 (a)	2	18" 22"	Smaller fish spooked to under rock in 3.5ft depth. Larger fish under rock at 6ft depth 50m downstream. Pool dimensions: 100m L x 15m W x 6ft D. Redwood Creek water temperature 17.0°C at 9:25 am. (UTM 426130E 4546375N)
7/28/2008	37.4 (b)	1	20"	Fish swimming in pool with boulders. Pool dimensions: 80yd L x 40 ft W x 7ft D. Redwood Creek water temperature 20.0°C at 3:30pm. (UTM 423225E 4551510N)
7/28/2008	37.10 (c)	1	17"	Fish swimming in pool with rocks. Pool dimensions: 150yd L x 20yd W x 6ft D. Redwood Creek water temperature 20.0°C at 3:50pm. (UTM 423125E 4551760N)
7/28/2008	36.25 (d)	1	16"	Fish hiding between and under rocks at 18inches of depth. Pool dimensions: 80m L x 10m W x 3ft D. Redwood Creek water temperature 20.0°C at 5:24 pm. (UTM 422815E 4552490N)
7/29/2008	34.95 (e)	2	19" 20"	Fish at base of boulder in pool with rock and large woody debris. Pool dimensions: 150yd L x 25yd W x 14ft D. Redwood Creek water temperature 17.0°C at 9:40 am. (UTM 421870E 4553165N)
7/29/2008	34.92 (f)	2	21" 26"	At persistent pool at confluence of Devils Creek. First fish found on pool bottom in open and second fish found under a rock. Pool dimensions: 50yd L x 15yd W x 7ft D. Redwood Creek water temperature 17.0°C and Devils Creek at 12.0°C at 10:00 am. (UTM 421845E 4553175N)
7/29/2008	33.55 (g)	1	18"	In pool with rocks and boulders. Pool dimensions: 50yd L x 12yd W x 7ft D. Redwood Creek water temperature 18.0°C at 11:45 am. (UTM 421845E 4554460N)
7/29/2008	32.52 (h)	1	18"	Fish hiding under rock and wood in alcove. Pool dimensions: 150yd L x 25yd W x 10ft D. Redwood Creek water temperature 21.0°C at 2:32 pm. (UTM 421600E 4555400N)
7/29/2008	31.20 (i)	6	16" 25" 24" 22" 21" 20"	In 'Queens Hole', a persistent L-shaped pool with large undercut boulders and large woody debris. Fish first in open, spooked to rocks, then corralled at end of pool before swimming past snorkelers. Pool dimensions: 130yd L x 25kyd W x 18ft D. Redwood Creek water temperature 21.0°C at 4:00 pm. (UTM 421315E 4556325N)

Date	River KM	No. of SSHD	Est. Length (inches)	Habitat Description
7/30/2008	27.0 (j)	1	18"	Fish swimming in open and spooked to under rock. Pool dimension: 12ft D. Redwood Creek water temperature 21.0°C at 2:50 pm. (UTM 419325E 4559600N)
7/30/2008	23.65 (k)	1	16"	Fish swam alongside snorkeler and then upstream. Pool with large wood debris along banks. Long pool with 6ft D. Redwood Creek water temperature 21.5°C at 5:50 pm. (UTM 417105E 4561175N)
8/04/2008	17.40 (l)	1	18"	Fish at base of bedrock outcrop. Pool dimensions: 125m L x 20m W x 8ft D. Redwood Creek water temperature 17.5°C at 9:58 am. (UTM 415260E 4564445N)
8/04/2008	17.05 (m)	1	24"	Fish under large woody debris at 2ft depth. Pool dimensions: 70m L x 10m W x 6ft D. Redwood Creek water temperature 17.5°C at 10:36 am. (UTM 415200E 4564780N)
Summer Steelhead Total		21		



Summer Steelhead at base of large rock (RNP 2008)

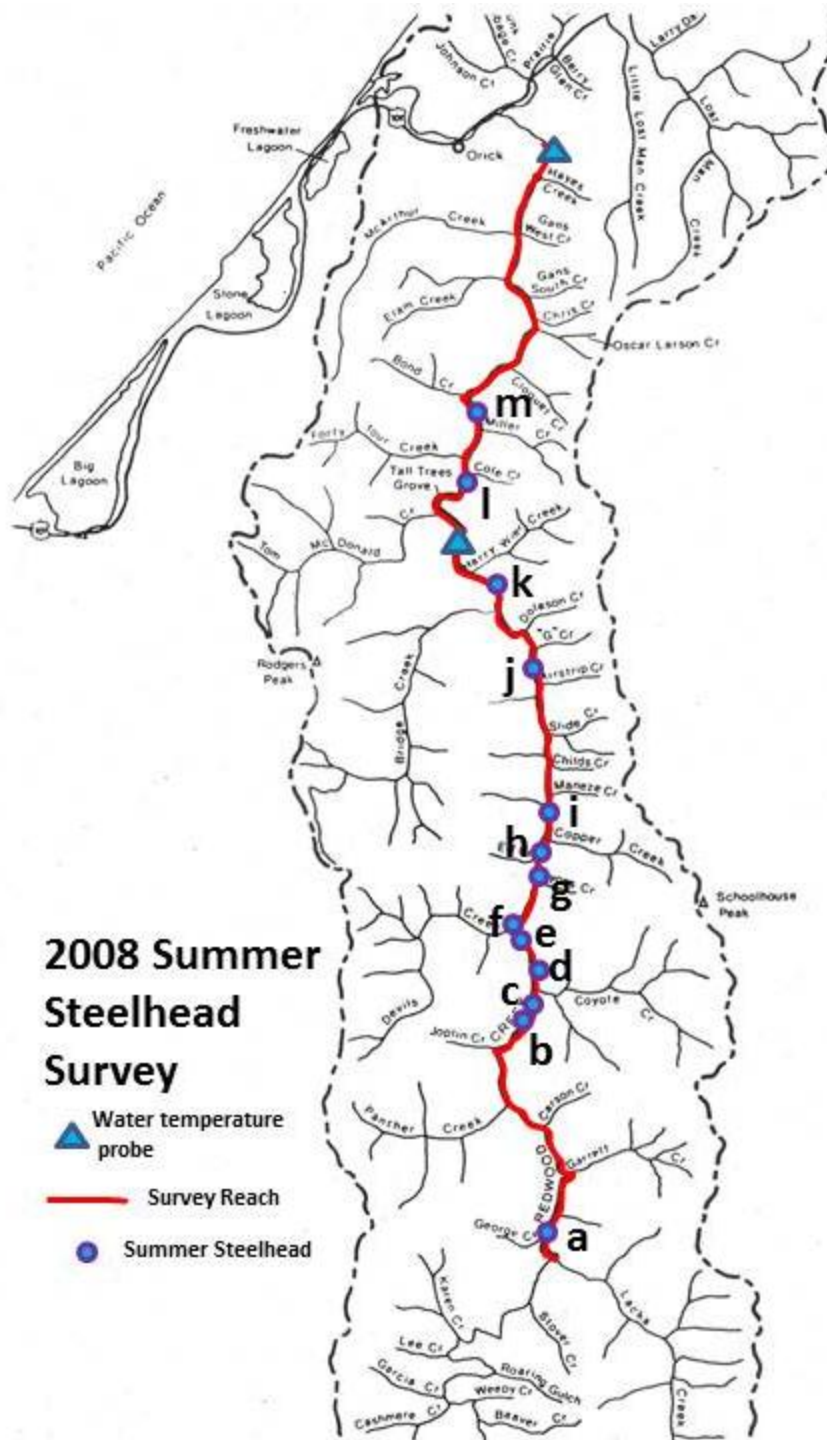


Figure 1. Location of the 21 adult summer steelhead observed during the 2008 snorkel survey of Redwood Creek, Humboldt County, California. Survey was between Lacks Creek to downstream of Hayes Creek from July 28 to 31 and August 4 to 6, 2008.

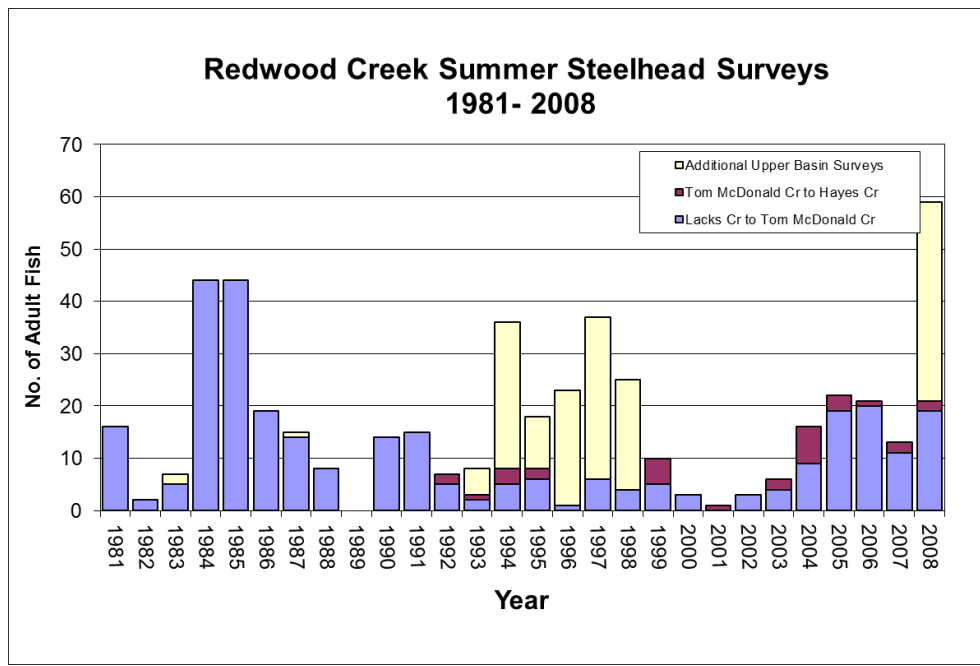


Figure 2. . Numbers of summer steelhead observed each summer since 1981 on the 25.9 km index reach of Redwood Creek (Lacks Creek to Tom McDonald Creek), Humboldt County, California and expanded 13.0 km downstream reach (Tom McDonald Creek to downstream of Hayes Creek.) The survey reach was expanded in 1992. The yellow bars are additional surveys done upstream of the park surveys.

WATER DISCHARGE

Water flow measured at the Orick gaging station located downstream of the confluence of Prairie Creek at Redwood Creek between July 28 and August 6 ranged between 40 and 33 cfs . It did not rain during the survey.

WATER TEMPERATURE

Water temperature (°C) was 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 confluence. Temperature loggers also recorded Redwood Creek mainstem water temperature at two sites.

Mainstem Redwood Creek - Redwood Creek water temperatures measured during the 2008 survey ranged from 16.0°C at 9:00 am to 21.5°C at 5:50 pm (Appendix II).

Onset™ recording temperature loggers were placed mid-depth in the current of mainstem Redwood Creek within the park (and the snorkel survey reach) at two locations. They recorded temperature at one-hour intervals from June to October 2008.

A temperature logger (Tidbit S/N 542048) was located upstream of Tom McDonald Creek/Tall Trees Grove at river kilometer 22.0 (UTM 416034E 4561455N) between June 1 and October 8.

Maximum and minimum water temperatures were 23.6°C and 11.7°C, respectively (Figure 3). The average water temperature was 17.9°C (Std. dev. 2.2°C). For the period July 1 through August 31, the warmer period of the summer, the average water temperature was 19.4°C, the maximum 23.6°C, and the minimum 16.6°C. During the July 1 - August 31 period, the water temperature was at or greater than 18°C 85.9 percent of the time. The average water temperature for June was 16.3°C; for July, 19.5°C; for August, 19.4°C; for September, 16.8°C; and October (1-8), 15.5°C.

The second temperature logger (TempPro S/N 1150635) was located in lower Redwood Creek at 7.65 km (UTM 413686E 4571963N) upstream of the Redwood Creek trailhead between June 2 and October 8. Maximum and minimum water temperatures recorded between June 2 and October 8 were 22.5°C and 12.3°C, respectively (Figure 4). The average water temperature was 17.2°C (Std. dev. 1.8°C). For the period July 1 through August 31, the warmer period of the summer, the average water temperature was 17.8°C, the maximum 22.5°C, and the minimum 15.1°C. During the July 1 - August 31 period, the water temperature was at or greater than 18°C 35.5 percent of the time. The average water temperature for June (2 – 30) was 15.9°C; for July, 17.6°C; for August, 18.1°C; for September, 17.3°C; and for October (1-8), 16.4°C.

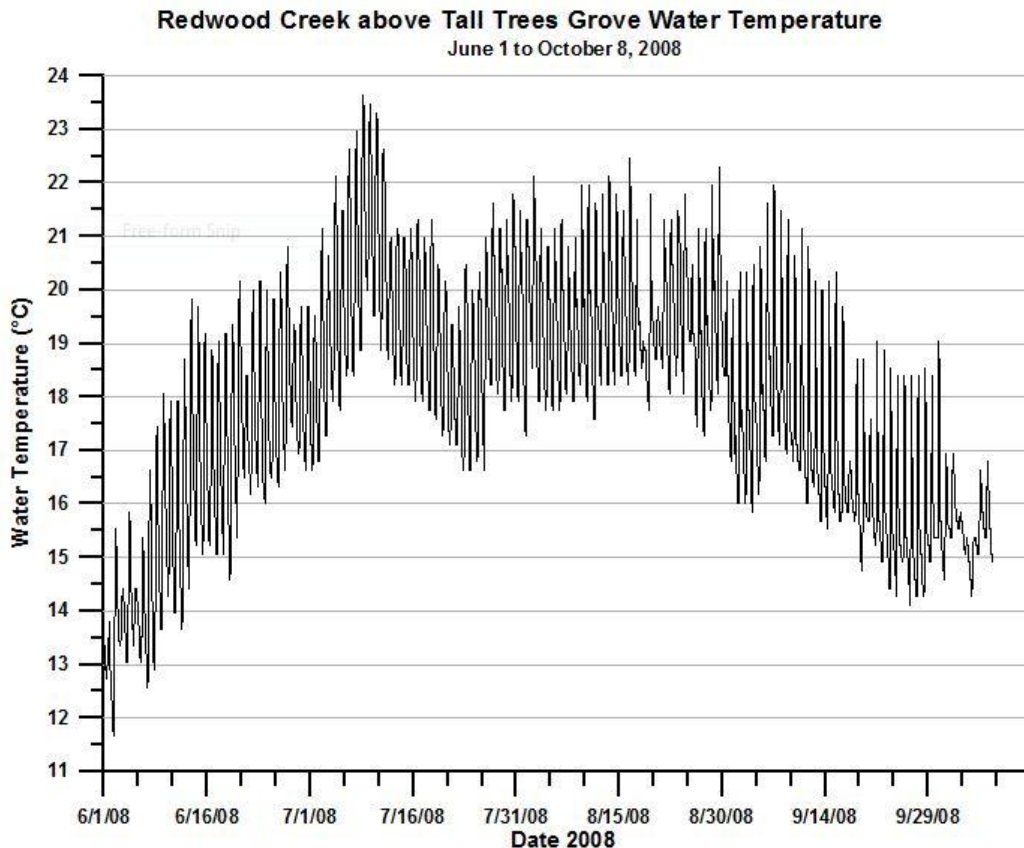


Figure 3. Mainstem Redwood Creek water temperatures (°C) from Onset TidBit temperature logger located upstream of Tom McDonald Creek/Tall Trees Grove at 22.05 river km. The logger recorded water temperature every 1-hour in the current below the surface of the water from June 1 through October 8, 2008.

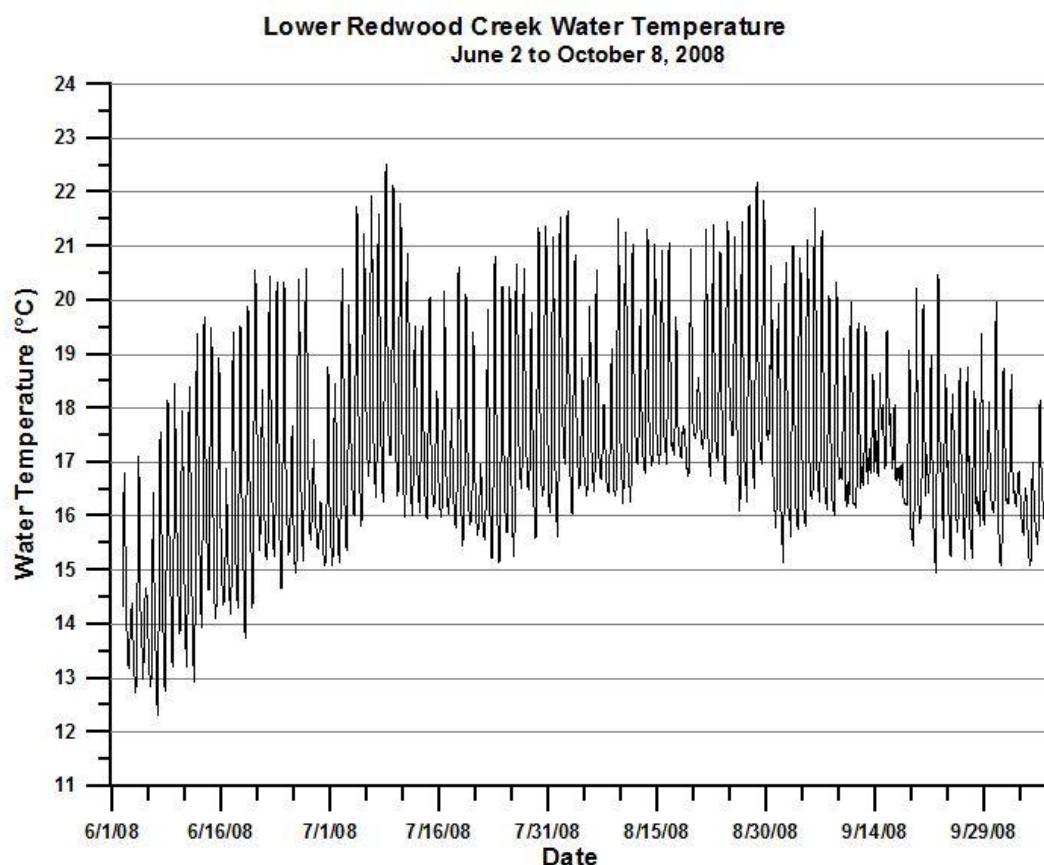


Figure 4. Mainstem Redwood Creek water temperatures (°C) from Onset TempPro temperature logger located upstream of the lower Redwood Creek trailhead parking lot at 7.65 river km. The logger recorded water temperature every 1-hour in the current below the surface of the water from June 2 through October 8, 2008.

Tributaries - Water temperatures of 48 east and westside tributaries entering Redwood Creek measured during the survey ranged from 11.0°C to 15.0°C (Appendix III). 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. The mean water temperature of westside tributaries was 12.6°C ($n = 30$, std. dev. = 0.8°C) and temperatures ranged from 11.0°C (one UNWS 45.65 tributary) to 15.0°C (Bridge Creek). The mean water temperature of eastside tributaries was 13.5°C ($n = 18$, std. dev. = 1.2°C) and temperatures ranged from 12.0°C (Oscar Larson, Miller, and Child Creeks, and UNES 44.381 and UNES 43.8699) to 15.0°C (Coyote, Copper, Maneze, and Dolason Creeks).

The 2008 year summer water temperatures are similar to temperatures and patterns have been recorded in all past summer steelhead surveys. Water temperatures in mainstem Redwood Creek

are high for salmonid fish, above the preferred temperature range reported by Reiser and Bjornn (1979) for steelhead of 7.3°C to 14.6°C.

REFERENCES

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Appendix I. Numbers of summer steelhead trout observed 1981 through 2008 and annual survey dates in the 25.9-km (16.1-mile) index reach (Lacks Creek to Tom McDonald Creek) and expanded survey reaches of Redwood Creek, Humboldt County, California by Redwood National and State Parks personnel and others.

Year	Original Index Reach (Lacks Creek to Tom McDonald Creek) No. of Summer Steelhead	Total Reach Surveyed		Survey Dates
		Total No. of Summer Steelhead	Start to End Points and Distance (km)	
1981	16	16	Beaver Cr to Orick (51.5)	8/10 – 13/81
1982 ^a	2	2	Stover Cr to Emerald Cr (22.5)	10/12 & 14/82
1983	5	7	HWY 299 to Tom McDonald Cr	8/22 – 25/83
1984	44+	44+	Index Reach (25.9)	8/08 – 10/84
1985	44+	44+	Index Reach (25.9)	8/20 - 22, 9/4/85
1986	19	19	Index Reach (25.9)	8/25 – 27/86
1987	14	15	1mile downstream of Snow Camp Cr to Tom McDonald Cr (72.7)	7/14 – 16/87
1988	8	8 & (6 Spring Chinook)	Index Reach (25.9)	7/26 – 28/88
1989 ^b	0	0	Lacks Cr to Bridge Cr (17.9)	7/31, 8/01 – 02/89
1990	14	14	Index Reach (25.9)	7/31, 8/01-03/90
1991	15	15	Index Reach (25.9)	8/05 – 08/91
1992	5 (4 & 1 carcass)	7 (6 & 1 carcass)	Lacks Cr to Hayes Cr (37.8)	8/03 - 06, 10/92
1993	2	3	Lacks Cr to Hayes Cr (37.8)	8/02 - 05, 09/93
		2 ^c	Chezem Rd to Stover Cr (24.75)	8/18, 20, 27/93
		3 ^d	Ayres Cabin to Chezem Rd (14.3)	8/28 & 30/93
		8 Total	76.9 km	
1994	5	8	Lacks Cr to Hayes Cr (37.8)	8/01 – 04/94
		16 ^c	Chezem Rd to Stover Cr (24.8)	8/04-06/94
		3 ^e	HWY299 to Chezem Rd (2.0)	8/15/94
		9 ^d	Bradford Cr to HWY 299 (20.1)	8/13-14/94
		36 Total	84.7 km	

Year (cont.)	Index Reach (Lacks Creek to Tom McDonald Creek) No. of Summer Steelhead	Total Reach Surveyed		Survey Dates
		Total No. of Summer Steelhead in total reach	Begin to End Creeks and Distance (km)	
1995	6 (5 & 1 carcass)	8 (7 & 1 carcass) 8 ^c	Lacks Cr to Hayes Cr (37.8) Chezem Rd to Bair Rd (7.6)	7/24 – 27/95 8/28/95
		2 ^d	Bradford Cr to Ayres Cabin (7.85)	9/02/95
		18 Total	53.25 km	
1996	1	1 21 ^c 1 ^d	Lacks Cr to Hayes Cr (37.8) Chezem Rd to Stover Cr (24.8) Bradford Cr to Chezem Rd (22.1)	8/05 – 08/96 7/31, 8/1, 22/96 8/10-12/96
		23 Total	84.7 km	
1997	6	6 16 ^c 15 ^d	Lacks Cr to Hayes Cr (37.8) Chezem Rd to Stover Cr (24.8) Bradford Cr to Chezem Rd (22.1)	8/04 - 07/97 8/06 – 08/97 8/17, 24, 30/97
		37 Total	84.7 km	
1998	4	4 21 ^d	Lacks Cr to Hayes Cr (37.8) Bradford Cr to Stover Cr (46.9)	7/27 – 30/98 8/24-27, 31/98
		25 Total	84.7 km	
1999	5	10	Lacks Cr to Hayes Cr (38)	8/02-05, 09-10/99
2000	3	3	Lacks Cr to Hayes Cr (38)	8/01-03, 07-09/2000
2001	0	1	Lacks Cr to Hayes Cr (38.1)	7/31, 8/01-02, 07/2001
2002	3	3	Lacks Cr to Hayes Cr (38.1)	7/29-31, 8/ 1, 5, 7/2002
2003	4	6	Lacks Cr to Downstream of Hayes Cr (38.8)	7/29-31, 8/4-6/2003
2004	8 (+ 1 dead)	15 (+ 1 dead)	Lacks Cr to Downstream of Hayes Cr (39.0)	7/27-29, 8/3-5/2004
2005	19	22 (1 Sockeye Salmon)	Lacks Cr to Downstream of Hayes Cr (38.9)	7/26-28, 8/2-4/2005

2006	19 (+ 1 dead)	20 (+ 1 dead)	Lacks Cr to Downstream of Hayes Cr (38.9)	7/25-27 & 31, 8/1-2/2006
2007	11	13 (1 Sockeye Salmon)	Lacks Cr to Downstream of Hayes Cr (38.9)	7/24-26, 30, 31, 8/1/2007
2008	19	21	Lacks to Downstream of Hayes (38.9)	7/28-31, 8/4-6/2008
		9 ^f	Chezem Rd Bridge to Bair Rd Bridge (7.65)	7/28/2008
		6 ^f	Bair Rd Bridge to Beaver Cr (7.4)	7/29/2008
		23 ^f	Beaver Cr to Stover Cr (8.8)	7/30/2008
		59 Total	62.75 km	

^aSurvey 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.

^c Tom Weseloh – California Trout

^d Matt Smith –North Coast Fisheries Restoration

^e Kirk Cohune

^f Tom Weseloh,- California Trout and Tom Shaw – USFWS-Arcata Office

Appendix II. Results of summer steelhead survey of mainstem Redwood Creek from Chezem Road Bridge to Stover Creek, July 28, 29, 30, 2008.

DRAFT
8/07/2008 VERSION

2008 REDWOOD CREEK SUMMER STEELHEAD SURVEY

DATES: July 28, 29 and 30, 2008.

LOCATION: Redwood Creek, Humboldt County, California. Chezem Road Bridge downstream to Stover Creek.

DISTANCE: 15 miles

CREW: Thomas J. Weseloh*, Tom Shaw. Asterisk (*) denotes prior Redwood Creek summer steelhead survey experience. Both divers have 20+ years of experience conducting dive surveys.

METHOD: Mask and snorkel (visual observation). Surveys proceeded in a downstream direction.

ITINERARY:

7/28-Chezem Road Bridge to Bair Road Bridge (9 adult Summer Steelhead and 1 half-pounder)

7/29-Bair Road Bridge to Beaver Creek (6 adult Summer Steelhead and 4 half-pounders)

7/30-Beaver Creek to Stover Creek (23 adult Summer Steelhead and 9 half-pounders)

TOTAL NUMBER OF ADULT (OVER 16") SUMMER STEELHEAD OBSERVED: 38

TOTAL NUMBER OF HALF POUNDERS (12"-16") STEELHEAD OBSERVED: 14

LOCATIONS OF ADULT (OVER 16") SUMMER STEELHEAD:

Date	# of adult Steelhead	Length in inches	Map Location	Description
7-28-08	5	24,19,18, 18,17	1	Corner pool 6-8 ft deep with lots of boulder with cold seeps on right bank. Fish all free swimming.
7-28-08	1	20	2	Fish tucked against boulder in riffle <3 feet deep
7-28-08	1	18	3	In boulder scour pool 4 feet deep free swimming
7-28-08	1	16	4	Hiding under boulder 4 feet deep
7-28-08	1	18	5	Hiding under bridge abutment undercut cement

7-29-08	1	19	6	Hiding under willow cover in water 3 feet deep
7-29-08	1	20	7	In very head of riffle against alder <2 feet deep
7-29-08	1	17	8	Under willow branch at head of pool 4 feet deep
7-29-08	3	24,23,18	9	Free swimming in large complex pool at DFG DSM site
7-30-08	1	21	10	Free swimming in pool 5 feet deep
7-30-08	2	20,18	11	One tucked against bedrock ledge, one free swimming in 3 feet deep
7-30-08	1	22	12	Free swimming in pool 6 feet deep
7-30-08	1	19	13	Free swimming in pool 7 feet deep
7-30-08	2	18,17	14	Free swimming in pool 3 feet deep
7-30-08	2	18,17	15	Free swimming in pool 5 feet deep
7-30-08	1	18	16	In riffle hiding under log 2 feet deep
7-30-08	1	19	17	Free swimming in long pool 4 feet deep
7-30-08	1	17	18	Free swimming in shallow pool
7-30-08	1	18	19	Free swimming in shallow pool
7-30-08	1	19	20	Hiding under boulder 4 feet deep – cold seeps
7-30-08	1	17	21	Free swimming in boulder filled run
7-30-08	1	17	22	In bubble curtain at head of riffle 2 feet deep
7-30-08	1	19	23	Free swimming in pool 5 feet deep lots of boulder cover
7-30-08	1	21	24	Free swimming 5 feet deep
7-30-08	2	20,18	25	Free swimming and hid under ledge 6 feet deep
7-30-08	1	19	26	On bottom of pool along bedrock 7 feet deep
7-30-08	1	21	27	Under boulder in riffle 3 feet deep
7-30-08	1	19	28	Free swimming in pool 6 feet deep

Water temperatures (°F) measured during the 2008 Redwood Creek summer steelhead survey. Locations are listed south to north. Alignment refers to tributary watershed position: E = east side; W = west side; REDW = main stem Redwood Creek. Mainstem Redwood Creek water temperatures taken above tributaries.

LOCATION	ALIGNMENT	DATE	TIME	TEMPERATURE °F
Redwood Cr (Chezem Rd Br)	REDW	7-28-08	1000	64
Captains Cr	E	7-28-08	1030	dry
Sweathouse Cr	E	7-28-08		dry
Greenpoint Cr	W	7-28-08	1300	56
Redwood Cr	REDW	7-28-08	1300	67
Santa Fe Cr	W	7-28-08	1355	59
Redwood Cr	REDW	7-28-08	1355	70
Loin Cr	W	7-28-08		dry

Minor Cr	E	7-28-08	1630	65
Redwood Cr	REDW	7-28-08	1630	71
Redwood Cr	REDW	7-29-08	0930	63
Wiregrass Cr	W	7-29-08	1000	57
Redwood Cr	REDW	7-29-08	1000	64
Moon Cr	E	7-29-08		dry
Toss-up Cr	W	7-29-08	1120	57
Redwood Cr	REDW	7-29-08	1120	67
Molasses Cr	E	7-29-08		dry
Mill Cr	E	7-29-08	1345	59
Redwood Cr	REDW	7-29-08	1345	71
Pilchuck Cr	W	7-29-08	1355	58
Redwood Cr	REDW	7-29-08	1355	71
Beaver Cr	E	7-29-08	1510	60
Redwood Cr	REDW	7-29-08	1510	73
Beaver Cr	E	7-30-08	0905	55
Redwood Cr	REDW	7-30-08	0905	62
Cashmere Cr	W	7-30-08	1015	54
Redwood Cr	REDW	7-30-08	1015	63
Garcia Cr	W	7-30-08	1035	55
Redwood Cr	REDW	7-30-08	1035	63
Roaring Gulch	E	7-30-08	1200	58
Redwood Cr	REDW	7-30-08	1200	66
Lee Cr	W	7-30-08	1335	56
Redwood Cr	REDW	7-30-08	1335	67
Karen Cr	W	7-30-08	1410	56
Redwood Cr	REDW	7-30-08	1410	67
Redwood Cr	REDW	7-30-08	1610	71

Notes: Only fish over 16" fork length were counted as adults (38 total). A total of eighteen (14) fish between 12" and 16" were observed. Visibility was approximately 20-30 feet. The bottom was visible at all times but downstream distance was occasionally reduced by shadows. The predominant cover consisted of riffles and boulders with occasional large wood debris (LWD) generally of small diameter and/or willow/alder material including roots. Very few conifers contributed to LWD. Average pool depths were 3-6 feet with a maximum depth of 12 feet. Cold seeps were fairly common in pools with boulders along the outside bends and often felt along bottom of fine substrate due to subsurface flow. Flow volumes were noticeably higher in bedrock areas and lower in highly aggraded reaches.

Juvenile chinook observed throughout survey reach. Juvenile coho salmon observed directly downstream of Department of Fish and Game trap site and consistently present to lower boundary of survey. Juvenile steelhead were abundant with no clearly visible size class distinction (except for very abundant young of the year) and most often seen near bubble curtains, cool water sources (stratified areas, tributaries and seeps), and cover (LWD, large

boulders).

Presence of cows (tracks, grazing and defecation) in the riparian zone and in the creek observed from just above Sweathouse Creek to Beaver Creek.

No signs of fishing (line, lures, etc.) were observed although a fishing rod was found on the bank.

A total of eight water intakes were observed (one below Captain Creek, one at Minor Creek, four by Adventist Camp, two by Adventist Camp).

Species observed included: Suckers, stickleback, pacific lamprey (live and spawning), rough skinned newts, Pacific Giant Salamander (1 – dead), garter snakes, frogs, ouzels, blue and green herons, egrets, kingfishers, mergansers, mallards, wood ducks, various hawks, and pileated woodpeckers. Species not sighted (but does not definitively absent): coastal cutthroat trout, crayfish, turtles, and freshwater mussels.

Future Recommendations: In order to maintain and improve conditions for summer steelhead a list of future recommendations has been developed.

1. Continue adult summer steelhead surveys in the entire accessible anadromous reach of Redwood Creek on an annual basis. Collect more specific information regarding habitat in holding areas (temperatures, depth, cover, etc.) to determine preferred habitat. Monitor half-pounders and juveniles also.
2. Map cold water seeps, springs and stratified areas.
3. Improve data collection of ancillary information to make it more useful.
4. Photo document habitat conditions and adult summer steelhead holding locations.
5. Secure additional surveyors to allow for recommendations 1, 2, 3 & 4.
6. Standardize survey protocols and data collection for all reaches.
7. Utilize information from recommendations to develop a restoration plan for summer steelhead (there should be both short term and long range goals for implementation strategies).
8. Encourage regulatory agencies and private landowners to review land use practices as related to upslope and instream habitat.

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Appendix III. Water temperatures (°C) measured during the 2008 Redwood Creek summer steelhead trout survey from July 28 to August 6. Locations are listed south to north. Redwood Creek (upstream) refers to water temperature measurement taken immediately upstream of the tributary confluence listed below. UN ES or WS refers to unnamed eastside or westside tributary, and the number refers to river kilometer (measured from the mouth of Redwood Creek). Alignment refers to tributary watershed position: East = Eastside, West = Westside, and REDW = mainstem Redwood Creek.

Location	Alignment	Date	Time	Water Temperature (°C)
Redwood Creek (upstream)	REDW	8/6/2008	8:31 AM	16.5
Lacks Creek	East	8/6/2008	8:33 AM	14.5
Redwood Creek (upstream)	REDW	8/6/2008	9:10 AM	17.0
George Creek	West	8/6/2008	9:10 AM	11.5
Redwood Creek (upstream)	REDW	8/6/2008	9:19 AM	16.5
UN WS 45.65	West	8/6/2008	9:19 AM	11.0
Redwood Creek 45.60 km	REDW	8/6/2008	9:25 AM	17.0
Redwood Creek (upstream)	REDW	8/6/2008	10:28 AM	17.0
UN WS 44.70	West	8/6/2008	10:28 AM	12.5 (subgravel)
Redwood Creek (upstream)	REDW	8/6/2008	10:47 AM	17.5
UN ES 44.381	East	8/6/2008	10:47 AM	12.0
Redwood Creek (upstream)	REDW	8/6/2008	10:58 AM	17.5
UN WS 44.2514	West	8/6/2008	10:58 AM	13.5
Redwood Creek (upstream)	REDW	8/6/2008	11:11 AM	17.5
UN ES 43.8699	East	8/6/2008	11:11 AM	12.0
Redwood Creek (upstream)	REDW	8/6/2008	11:50 AM	18.5
Garrett Creek	East	8/6/2008	11:50 AM	14.0 (subgravel)
Redwood Creek (upstream)	REDW	8/6/2008	2:55 PM	21.0
UN WS 41.372	West	8/6/2008	2:55 PM	13.0
Redwood Creek (upstream)	REDW	8/6/2008	3:31 PM	20.0
Panther Creek	West	8/6/2008	3:31 PM	13.5
Redwood Creek (upstream)	REDW	7/28/2008	10:35 AM	18.0
Panther Creek	West	7/28/2008	10:35 AM	12.0
Redwood Creek (upstream)	REDW	7/28/2008	11:38 AM	18.5
UN WS 39.90	West	7/28/2008	11:38 AM	12.0
Redwood Creek (upstream)	REDW	7/28/2008	11:55 AM	18.0
UN WS 39.52	West	7/28/2008	11:55 AM	13.0
Redwood Creek (upstream)	REDW	7/28/2008	12:17 AM	19.0
UN WS 39.16	West	7/28/2008	12:17 AM	13.0
Redwood Creek 37.4 km	REDW	7/28/2008	3:30 PM	20.0
Redwood Creek 37.1 km	REDW	7/28/2008	3:50 PM	20.0
Redwood Creek (upstream)	REDW	7/28/2008	4:23 PM	19.5
Coyote Creek	East	7/28/2008	4:23 PM	15.0
Redwood Creek 36.25 km	REDW	7/28/2008	5:24 PM	20.0
Redwood Creek	REDW	7/28/2008	5:37 PM	20.0
Redwood Creek (upstream)	REDW	7/28/2008	5:45 PM	20.0
UN ES 35.714	East	7/28/2008	5:45 PM	14.0

Location	Alignment	Date	Time	Water Temperature (°C)
Redwood Creek 35.25 km	REDW	7/29/2008	8:45 AM	17.0
Redwood Creek 34.95 km	REDW	7/29/2008	9:40 AM	17.0
Redwood Creek (upstream)	REDW	7/29/2008	10:00 AM	17.0
Devils Creek	West	7/29/2008	10:00 AM	12.0
Redwood Creek (upstream)	REDW	7/29/2008	11:38 AM	18.0
Lyons Creek	East	7/29/2008	11:38 AM	13.0
Redwood Creek 33.55 km	REDW	7/29/2008	11:45 AM	18.0
Redwood Creek (upstream)	REDW	7/29/2008	12:45 PM	18.0
Elf Creek	West	7/29/2008	12:45 PM	12.0
Redwood Creek (upstream)	REDW	7/29/2008	2:15 PM	20.0
UN WS 32.527	West	7/29/2008	2:15 PM	13.0
Redwood Creek 32. 50 km	REDW	7/29/2008	2:32 PM	21.0
Redwood Creek (upstream)	REDW	7/29/2008	2:45 PM	20.5
Copper Creek	East	7/29/2008	2:45 PM	15.0 (subgravel)
Redwood Creek 31.20 km	REDW	7/29/2008	4:00 PPM	21.0
Redwood Creek (upstream)	REDW	7/29/2008	4:52 PM	20.5
Maneze Creek	East	7/29/2008	4:52 PM	15.0
Redwood Creek (upstream)	REDW	7/29/2008	5:15 PM	20.5
UN WS 30.60	West	7/29/2008	5:15 PM	13.5
Redwood Creek (upstream)	REDW	7/30/2008	9:12 AM	17.0
Childs Creek	East	7/30/2008	9:12 AM	12.0
Redwood Creek (upstream)	REDW	7/30/2008	9:57 AM	18.0
UN WS 29.066	West	7/30/2008	9:57 AM	13.0
Slide Creek	East	7/30/2008	10:08 AM	14.0
Redwood Creek (upstream)	REDW	7/30/2008	11:04 AM	18.5
UN WS 28.243	West	7/30/2008	11:04 AM	13.5
Redwood Creek (upstream)	REDW	7/30/2008	2:26 PM	20.5
UN ES	East	7/30/2008	2:26 PM	14.0
UN WS 26.912	West	7/30/2008	2:57 PM	13.0
Redwood Creek 27.0 km	REDW	7/30/2008	2:50 PM	21.0
Redwood Creek (upstream)	REDW	7/30/2008	3:25 PM	21.0
UN WS 26.68	West	7/30/2008	3:25 PM	13.5
Dolason Creek	East	7/30/2008	---	15.0 (subgravel)
Bridge Creek	West	7/30/2008	5:00 PM	15.0
Redwood Creek 23.65 km	REDW	7/30/2008	5:50 PM	21.5
Redwood Creek 23.50 km	REDW	7/31/2008	9:00 AM	16.0
Redwood Creek (upstream)	REDW	7/31/2008	9:30 AM	17.0
Emerald Creek	East	7/31/2008	9:30 AM	13.5
Redwood Creek (upstream)	REDW	7/31/2008	9:53 AM	17.5
UN WS 22.861	West	7/31/2008	9:53 AM	12.0
Redwood Creek (upstream)	REDW	7/31/2008	11:29 AM	18.5
Tom McDonald Creek	West	7/31/2008	11:29 AM	12.5
Redwood Creek (upstream)	REDW	7/31/2008	1:10 PM	19.0
Fortyfour Creek	West	7/31/2008	1:10 PM	12.5
Redwood Creek 17.55 km	REDW	8/4/2008	9:58 AM	17.5
Redwood Creek 17.40 km	REDW	8/4/2008	10:11 AM	17.5

Location	Alignment	Date	Time	Water Temperature (°C)
Miller Creek	East	8/4/2008	10:23 AM	12.0
Redwood Creek 17.05 km	REDW	8/4/2008	10:36 AM	17.5
Redwood Creek (upstream)	REDW	8/4/2008	11:00 AM	17.5
UN WS 16.85	West	8/4/2008	11:00 AM	12.0
Redwood Creek (upstream)	REDW	8/4/2008	11:11 AM	17.0
UN WS 16.55	West	8/4/2008	11:11 AM	12.0
Redwood Creek	REDW	8/4/2008	11:21 AM	18.0
Redwood Creek (upstream)	REDW	8/4/2008	11:30 AM	17.0
Bond Creek	West	8/4/2008	11:30 AM	11.5
Redwood Creek 15.75 km	REDW	8/4/2008	1:10 PM	19.5
Redwood Creek (upstream)	REDW	8/4/2008	1:49 PM	19.0
UN WS 14.80	West	8/4/2008	1:49 PM	12.5
Redwood Creek (upstream)	REDW	8/4/2008	2:05 PM	19.0
Cloquet Creek	East	8/4/2008	2:05 PM	13.5 (subgravel)
Redwood Creek (upstream)	REDW	8/4/2008	2:41 PM	20.0
UN WS 13.85	West	8/4/2008	2:41 PM	12.5 (subgravel)
Redwood Creek (upstream)	REDW	8/4/2008	2:45 PM	20.0
UN WS 13.806	West	8/4/2008	2:45 PM	12.0
Redwood Creek (upstream)	REDW	8/4/2008	3:10 PM	20.0
Oscar Larson Creek	East	8/4/2008	3:10 PM	12.0
Redwood Creek 13.10 km	REDW	8/5/2008	10:17 AM	17.0
Chris Creek	East	8/5/2008	10:27 AM	12.5
Redwood Creek (upstream)	REDW	8/5/2008	11:20 AM	17.5
UN WS 11.717	West	8/5/2008	11:20 AM	12.0
Redwood Creek (upstream)	REDW	8/5/2008	11:51 AM	17.5
Elam Creek	West	8/5/2008	11:51 AM	12.0
Redwood Creek (upstream)	REDW	8/5/2008	12:20 PM	19.0
McArthur Creek	West	8/5/2008	12:20 PM	12.0
Redwood Creek 7.65 km	REDW	8/5/2008	~2:45 PM	18.5