

Redwood

National Park

National Park Service
US Department of the Interior



2013 REDWOOD CREEK SUMMER STEELHEAD SURVEY



Fish and Wildlife Branch
September 2015

Cover Photos: (Taken during 2013 survey)
Top Left: Breaking camp: Sealing waterproof bags.
Top Right: River otters on Redwood Creek
Middle Left: Diver with Western Pearlshell mussel at Queens Hole
Middle Right: Creekside fallen old growth redwood with divers for scale
Bottom Left: Pre-dive group picture at Lacks Creek
Bottom Right: Adult Redwood Creek summer steelhead

2013 RNP REDWOOD CREEK SUMMER STEELHEAD SURVEY

DATES: July 29, 30, 31, August 1, (Monday - Thursday) & August 5, 6, 7, 2013 (Monday-Wednesday)

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
Start of Survey: 23 cfs End of Survey: 19 cfs

DIVERS: David Anderson, Terry Hines, Kyle Max, Joanna DiTommaso (All divers with prior summer steelhead diving experience on Redwood Creek). Recorders: Chris Burley and Susannah Manning

METHOD: Visual observation by snorkeling 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; drive/hike to Panther Creek via K& K on Green Diamond Resource Company; hike/snorkel and camp on river four days/three nights to reach Tall Trees summer footbridge downstream of Tom McDonald Creek; footbridge to Redwood Creek trail to 44 horse camp. Drive out C-12/A9-9/West Side Access. Cloquet 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 Reach	Distance km	SSHD No.
	8/7	Lacks Creek to Panther Creek <i>Anderson, Max, DiTommaso (Recorder – Manning)</i>	6.02	1
	7/29	Panther to Below Devil's Cr (33.875km) <i>Anderson, Hines, Max, and DiTommaso</i>	6.62	3
	7/30	Below Devil's Cr to Above Pig Pen (29.75km) <i>Anderson, Hines, Max, and DiTommaso</i>	4.12	1
	7/31	Above Pig Pen to Bridge Creek <i>Anderson, Hines, Max, and DiTommaso</i>	5.23	0
	8/1	Bridge Cr to Tall Trees Summer Bridge (19.25km) <i>Anderson, Hines, Max, and DiTommaso</i>	5.27	1
	8/5	Tall Trees Summer Bridge to Cloquet Cr <i>Anderson, Max, DiTommaso (Recorder – Burley)</i>	4.05	6
	8/6	Cloquet Creek to Dwnstrm of Hayes Creek <i>Anderson, Max, DiTommaso (Recorder – Burley)</i>	7.55	3

TOTAL NUMBER OF ADULT SUMMER STEELHEAD TROUT OBSERVED IN 2013: 15

(Number of Adult Summer Steelhead Trout Observed within the Index Section (Lacks Creek to Tom McDonald Creek - 16.1 miles): 5

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, predators, 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 2006.

Summer 2013 was the 33rd annual 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 km downstream through Green Diamond Resource Company timber lands into Redwood National Park to a location downstream of Hayes Creek. Originally, the survey was from Lacks Creek to Tom McDonald Creek, but was expanded downstream to downstream of Hayes Creek in 1992.

Fifteen (15) adult summer steelhead (steelhead ≥ 16 inches), two (2) 'half-pounder' steelhead (smaller immature sea-run steelhead returning after less than one year in the ocean), and 275 coastal cutthroat trout (*O. clarki*) (cutthroat ≥ 10 inches) were observed in a mainstem survey reach from Lacks Creek to just downstream of Hayes Creek (Table 1). Five of the 15 summer steelhead were observed within the original index reach, Lacks to Tom McDonald Creeks. Most of the coastal cutthroat were in the lower most reach.

All 15 adult summer steelhead were observed in pools (Table 2). Past data from Redwood Creek show the majority of summer steelhead were observed in pools, and pools associated with the inflow of cooler water from tributaries (Anderson 1993). Eight observations were solitary fish, and the other two observations were groups of three and four fish. This was unusual as we usually see solitary fish. Estimated fish length ranged from 17 to 24 inches. Fish lengths were estimated by referring to marked (in inches) leashes that divers used to tow their floating packs when swimming.

In 2013, most fish were found in the lower reaches of the survey, downstream of Tom McDonald Creek (Figure 2). Past surveys have found most summer steelhead above the 'gorge' in the mid to upper reaches of the survey reach.

Summer steelhead numbers over time are presented in Figure 2 and Appendix I. The numbers of fish are low and appear to be cyclic as to year strength.

Western Pearlshell (*Margaritifera falcate*) mussels observed in three locations (Appendix II), 27+ individuals counted. Summer steelhead predators, four river otter were seen. A total of 13 dead Coastal Giant (aka Pacific Giant) Salamanders were observed in mainstem Redwood Creek.

Table 1. Numbers of adult summer steelhead ($\geq 16''$), 'half-pounder' steelhead, and coastal cutthroat trout, and aquatic wildlife noted during the 2013 summer steelhead survey of mainstem Redwood Creek, Humboldt County, California. Survey conducted on seven days, July 29 through August 7, 2013 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 Pounds	No. of Cutthroat Trout ($\geq 10''$)	Aquatic/Wildlife Observed
O R I G I N A L I N D E X R E A C H	Lacks to Panther Creek 8/7/2013	1	1	15	Pacific Giant Salamanders (dead), yellow-legged frogs, <i>Juga</i> snails, Threespine stickleback, Yellow-spotted millipede (<i>Harpaphe haydeniana</i>), Rough-skinned newts.
	Panther to Coyote Creek 7/29/2013	3	0	18	Pacific Giant Salamanders (dead), sculpin, Sacramento suckers, Rough-skinned newt, and garter snake (dead).
	Coyote to Copper Creek 7/29 & 30/2013	0	0	20	Pacific Giant Salamanders (dead), Threespine stickleback, Osprey, Great Blue Heron, Spotted Sandpipers.
	Copper to Pig Pen Prairie (Slide Cr) 7/30 & 31/2013	1	0	20	Pacific Giant Salamander (dead), Yellow-spotted millipedes (dead), Rough-skinned newt, Sacramento sucker, Sacramento suckers, Mallard (hen), Marbled murrelets, beaver scat, Mink.
	Pig Pen Prairie (Slide Cr) to Bridge Creek 7/31/2013	0	1	27	----
	Bridge to Tom McDonald Creek 8/1/2013	0	0	10	Marbled murrelets, Threespine stickleback (dead), Sacramento suckers, and River otter (4).
	Tom McDonald to Bond Creek 8/1 & 5/2013	2	0	36	Great Blue Heron, Spotted sandpiper, American dipper, Bald Eagle (1). Raccoon. Hikers:5, Campsites:1, Campers: 3
	Bond Creek to downstream of Hayes Creek 8/5 & 6/2013	8	0	129	Kingfisher, Common Mergansers (53), Stellars jay, Raven, Pacific Slope Flycatcher, Turkey Vulture, Kinglets, Spotted Sandpipers, Great Blue Heron, Tern, Great Egrets. Horse tracks. Campsites: 2, Campers: 4.
	2013 Total	15	2	275	

Table 2. Date, location (river kilometer and UTM coordinates [NAD83]), number, estimated fork length (inches), and habitat description of adult summer steelhead trout observed in the 2013 snorkel survey of mainstem Redwood Creek, upstream to downstream. (Letters in parentheses in the river km refer to locations on Figure 1 map).

Date 2013	River KM	No. of SSHD	Est. Length (inches)	Habitat Description
SUMMER STEELHEAD				
8/7/2013	44.70 (a)	1	24"	Pool dimension: 75m L x 10m W. Fish in 2 ft depth of water. Redwood Creek water temperature 18.5°C. (UTM 426224E 4546975N)
7/29/2013	39.05 (b)	1	18"	Fish swam upstream by divers. Pool dimension: 300m L x 30m W x 5ft D. (UTM 422860E 4550125N)
7/29/2013	38.50 (c)	1	22"	Spooked twice and found in deep back in a boulder crevice in 4ft of water. Pool dimension: 200m L x 25m W x 6ft D. Redwood Creek water temperature 19.0°C at 14:24. (UTM 423075E 4550510N)
7/29/2013	37.40 (d)	1	23"	Found underside of boulder on edge of stream substrate. Pool dimension: 150m L x 20m W x 6ft D. Redwood Creek water temperature 20.0°C at 15:33. (UTM 423220E 4551515N)
7/30/2013	31.20 (e)	1	21"	Queen's Hole pool with large boulders. Fish found at base of boulder at 15ft depth. Pool dimension: 100m L x 25m W x 18ft D. Water temperature is 18.0°C. (UTM 421325E 4556425N)
8/01/2013	~19.80 (f)	1	20"	Tall Trees area. In middle of creek in a root wad at 2ft depth. Pool dimension: 2000m L x 25m W x 5ft D. (Approximate UTM 415050E 4562700N)
8/05/2013	17.00 (g)	1	24"	Pool dimension: 125m L x 20m W x 9ft D. Water temperature: 19.0°C at 13:23. (UTM 415114E 4564740N)
8/05/2013	16.00 (h)	4	3 @ 20" 1 @ 18"	Pool dimension: 125mL x 25m W x 10ft D. Bond Creek empties into head of pool. Three fish sitting on bottom of pool under boulder. LWD present. Redwood Creek water temperature is 20.5°C at 14:15. (UTM 414479E 4565319N)
8/05/2013	15.75 (i)	1	18"	Pool dimension: 150m L x 20m W x 6ft D. Water temperature is 20.0°C at 15:00. (UTM 414671E 4565588N)
8/06/2013	10.55 (j)	3	17" 20" 21"	In pool under rocks, at 4ft, 5ft, and 6ft depths. Pool dimension: 100m L x 20m W x 6ft D. Redwood Creek water temperature at 14:00 is 18.5°C. (UTM 414035E 4569472N)
Summer Steelhead Total		15		

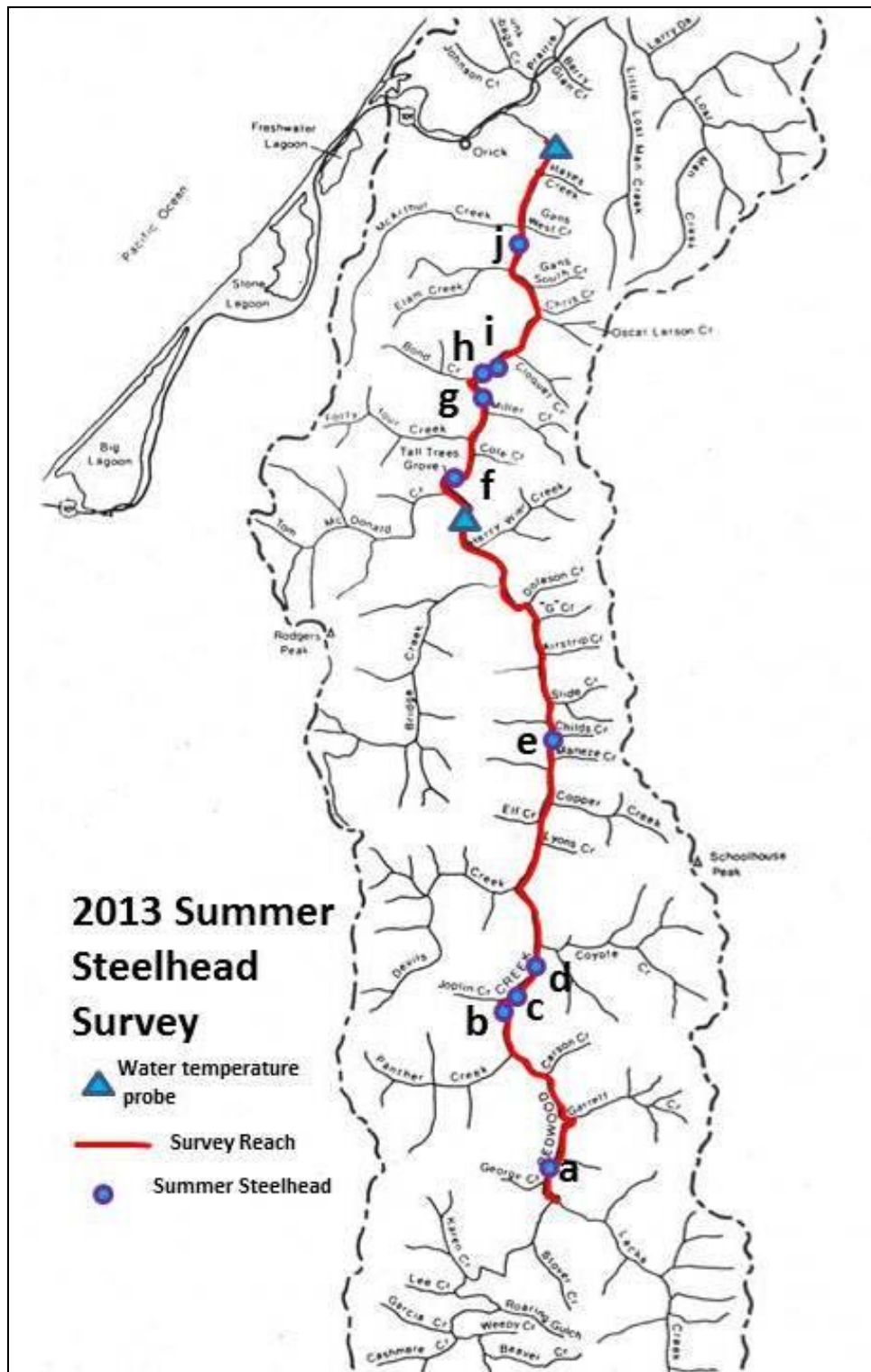


Figure 1. Survey reach and location of the 15 adult summer steelhead observed during the 2013 snorkel survey of Redwood Creek, Humboldt County, California. Survey was between Lacks Creek to downstream of Hayes Creek from July 29 to 31 and August 1, and 5 to 7, 2013.

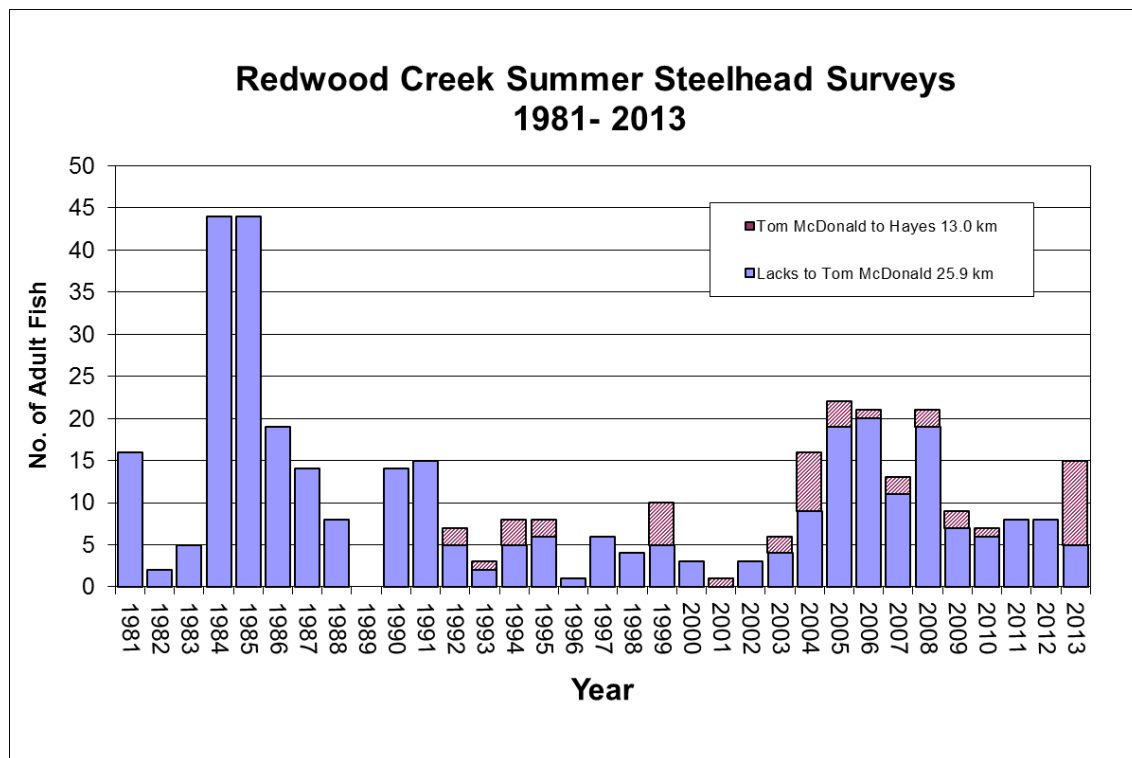


Figure 2. Numbers of summer steelhead observed each summer since 1981 on the original 25.9 km (16.1 mile) index reach Redwood Creek (Lacks Creek to Tom McDonald Creek) and 13.0 km expanded reach (Tom McDonald Creek to downstream of Hayes Creek) Humboldt County, California. The survey was expanded in 1992.

WATER DISCHARGE

Water flow measured at the Orick gaging station located downstream of the confluence of Prairie Creek at Redwood Creek between July 29 and August 7 ranged between 24 and 18 cfs. (This USGS flow data is provisional and subject to revision.)

WATER TEMPERATURE

Temperature loggers continuously recorded Redwood Creek mainstem water temperature (°C) at two sites during the summer. Water temperature of tributaries and mainstem was measured with a hand held thermometer below the water surface during the survey. At each tributary, mainstem Redwood Creek temperature was measured immediately upstream of the tributary confluence.

Mainstem Redwood Creek - Redwood Creek water temperatures hand measured during the 2014 survey ranged from 17.0°C (at 10:34) to 21.5°C (at 14:01) (Appendix II).

Onset Tidbit recording temperature loggers were placed mid-depth in the current of mainstem Redwood Creek at two locations within the park (in the snorkel survey reach). They recorded temperature at one-hour intervals from June to mid October 2013.

A temperature logger (Tidbit S/N 1154750) was located upstream of Tom McDonald Creek/Tall Trees Grove at 22.05 river kilometer (UTM 415936E 4561669N NAD83) between June 1 and October 22. Maximum and minimum water temperatures were 23.9°C and 10.0°C, respectively (Figure 3). The average water temperature was 17.8°C (Std. dev. 3.2°C). For the period July 1 through August 31, the warmer period of the summer, the average water temperature was 19.96°C, the maximum 23.9°C, and the minimum 17.3°C. During the July 1 - August 31 period, the water temperature was at or greater than 18°C 94 percent of the time. Average water temperature in June was 17.4°C; in July, 20.2°C; in August, 19.7°C; in September, 18.0°C; and October 1 to 22, 11.7°C.

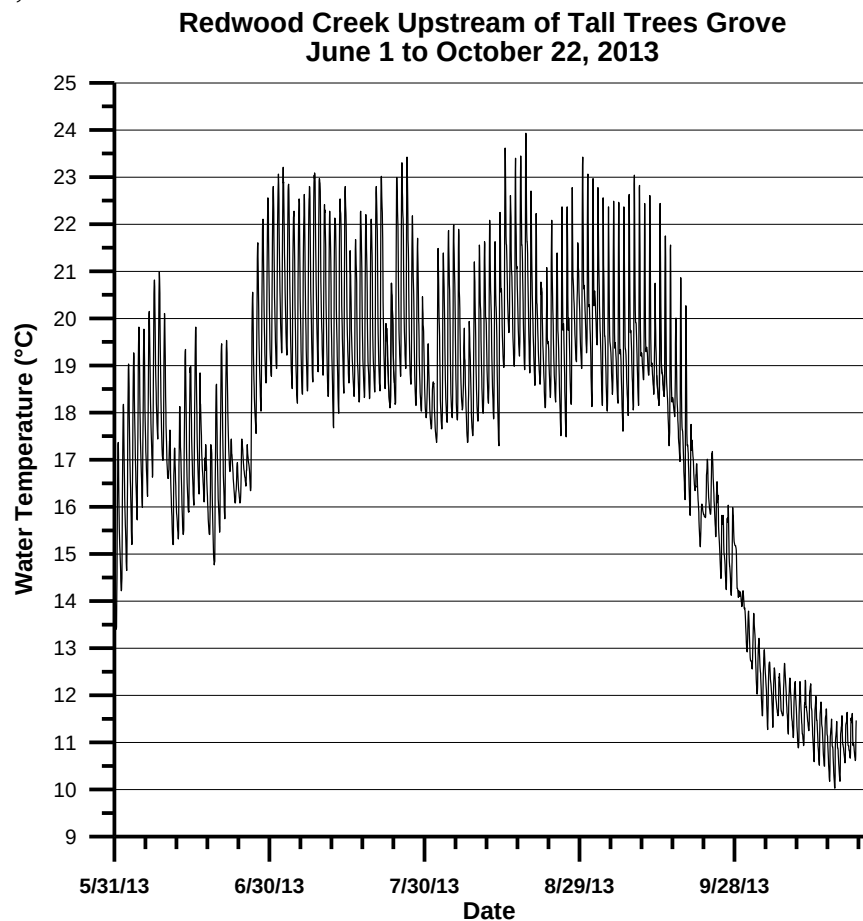


Figure 3. Mainstem Redwood Creek water temperature (°C) from Onset TidBit temperature logger located upstream of Tom McDonald Creek/Tall Trees Grove at 22.05 river km. The logger situated in the current below the surface recorded water temperature every hour from June 1 through October 22, 2013.

The second temperature logger (Tidbit S/N 9759081) was located in lower Redwood Creek at the end of the survey reach upstream of the Redwood Creek trailhead at 7.65 km (UTM 413642E 4572153N NAD83) between June 1 and October 21. Maximum and minimum water temperatures recorded were 22.7°C and 12.1°C, respectively (Figure 4). The average water temperature was 17.0°C (Std. dev. 2.1°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 22.7°C, and the minimum 15.5°C. During the July 1 - August 31 period, the water temperature was at or greater than 18°C 35 percent of the time. For the month of June, average water temperature was 16.8°C; for July, 17.9°C; for August, 17.8°C; for September, 17.6°C; for October 1 to 21, 13.9°C.

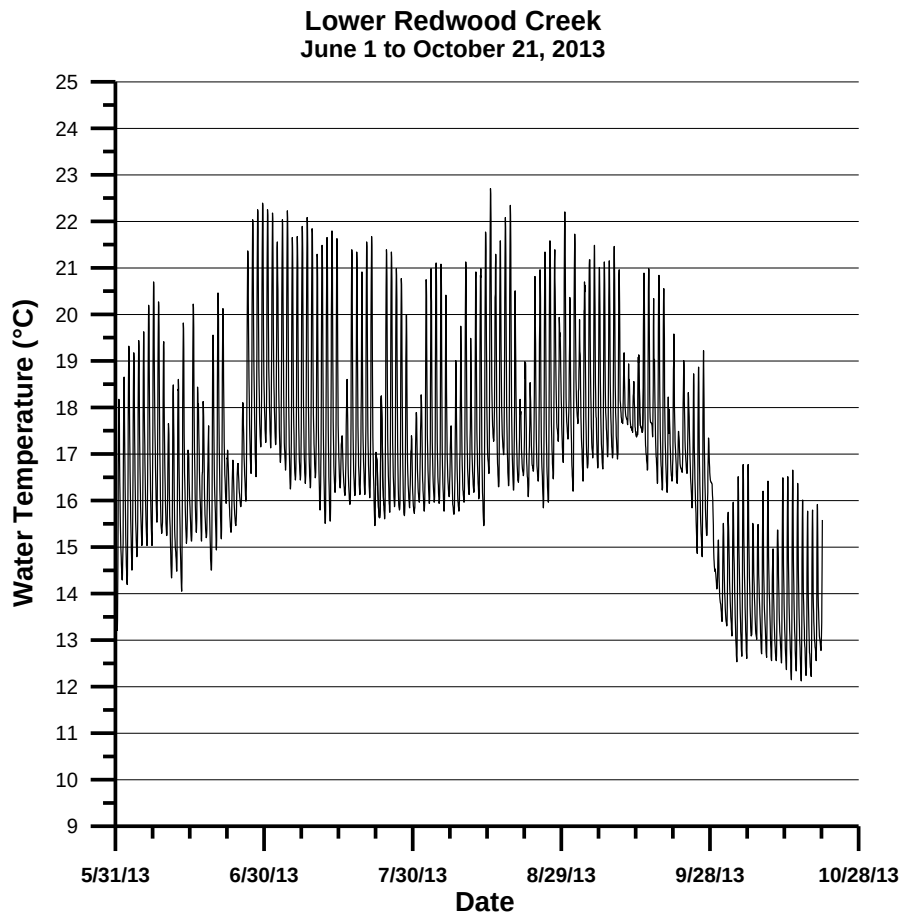


Figure 4. Mainstem Redwood Creek water temperatures (°C) from Onset Tidbit temperature logger located upstream of the lower Redwood Creek trailhead parking lot at 7.65 river km. The logger recorded water temperature every 1-hour in the current below the surface of the water from June 1 through October 21, 2013.

Tributaries - Water temperatures of 53 tributaries, 27 westside and 16 eastside, of Redwood Creek were measured during the survey. Temperatures ranged 12°C (the east side Oscar Larson Creek and three unnamed west side tributaries and Elam and McArthur Creeks) to 15.5°C (east side Coyote Creek) (Appendix II). Water temperatures of all tributaries were colder than the corresponding temperature of mainstem Redwood Creek measured at the same time.

The mean water temperature of west side tributaries was cooler than that of the east side tributaries; a pattern repeated in all past summer steelhead surveys, however the difference was small, 0.6°C.. The mean water temperature of west side tributaries was 13.0°C (std. dev. = 0.6°C) and temperatures ranged from 12.0 °C to 14.0°C. The mean water temperature of east side tributaries was 13.6°C (std. dev. = 0.9°C) and temperatures ranged from 12.0°C to 15.5 °C.

The 2014 year summer water temperatures are similar to temperatures and patterns 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

- Anderson, D.G. 1993. Status of summer steelhead trout in Redwood Creek, Redwood National Park, California. pp. 1-8. In: Proceedings of the Fourth Conference on Research in California's National Parks, eds. S.D. Viers, T.J. Stohlgren, and C. Schonewald-Cox. Transactions and Proceedings NPS/NRUC/NRTP-93/9. U.S.D.I., National Park Service, Denver, Colorado.
- Reiser, D.W., and T.C. Bjornn. 1979. Influence of forest and rangeland management on anadromous fish habitat in western North America: Habitat requirements of anadromous salmonids. USDA, Forest Service General Technical Report. PNW-96. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. 54 pp.
- Roelofs, T.D. 1983. Current status of California summer steelhead (Salmo gairdneri) stocks and habitat, and recommendations for their management. Report to U.S. Department of Agriculture, Forest Service Region. 119 pp.

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Western Pearlshell freshwater mussel in silt covered sand bank of Redwood Creek (RNP 2013)

Appendix I. Numbers of summer steelhead trout observed 1981 through 2013 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.

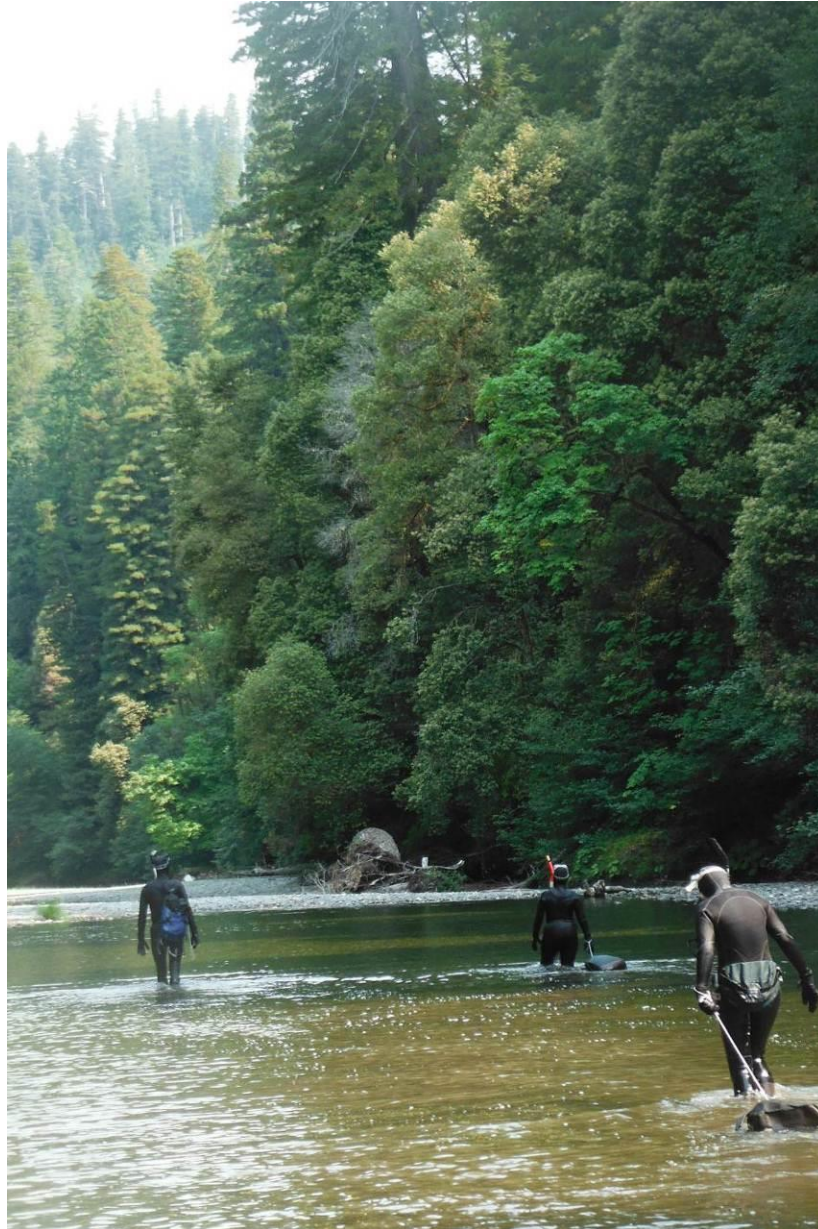
Year	Original Index Reach (Lacks Creek to Tom McDonald Creek) No. of Summer Steelhead	Total Reach Surveyed		Survey Dates
		Total No. of Summer Steelhead	Start to End Points and Distance (km)	
1981	16	16	Beaver Cr to Orick (51.5)	8/10 – 13/81
1982 ^a	2	2	Stover Cr to Emerald Cr (22.5)	10/12 & 14/82
1983	5	7	HWY 299 to Tom McDonald Cr (44.4)	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 Dwnstrm 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	
2009	7	9	Lacks Cr to Downstream of Hayes Cr (38.9)	7/27-30, 8/3-5/2009
2010	6	7	Lacks Cr to Downstream of Hayes Cr (38.9)	7/26 – 29, 8/2-4/2010
2011	8	8	Lacks Cr to Downstream of Hayes Cr (38.9)	7/26, 27, 8/1-4, 8/2011
2012	8 (7 live & 1 dead)	8 (7 live & 1 dead)	Lacks Cr to Downstream of Hayes Cr (38.9)	7/23-26, 30, 31, 8/1/2012
2013	5	15	Lacks Cr to Downstream of Hayes Creek (38.9)	7/29-31, 8/1, 5-7/2013
^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. ^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. Location and number of Western Pearlshell (*Margaritifera falcate*) mussels observed during the 2013 summer steelhead survey of mainstem Redwood Creek.

Date	River Km	Number	Notes
7/30/2013	31.20	7+	At head of Queens Hole pool along rocky bank in sediment between rocks. Persistent population as observed before in previous dives.
8/05/2013	~ 18.0	8	---
8/06/2013	13.5	12	---
Total		27+	



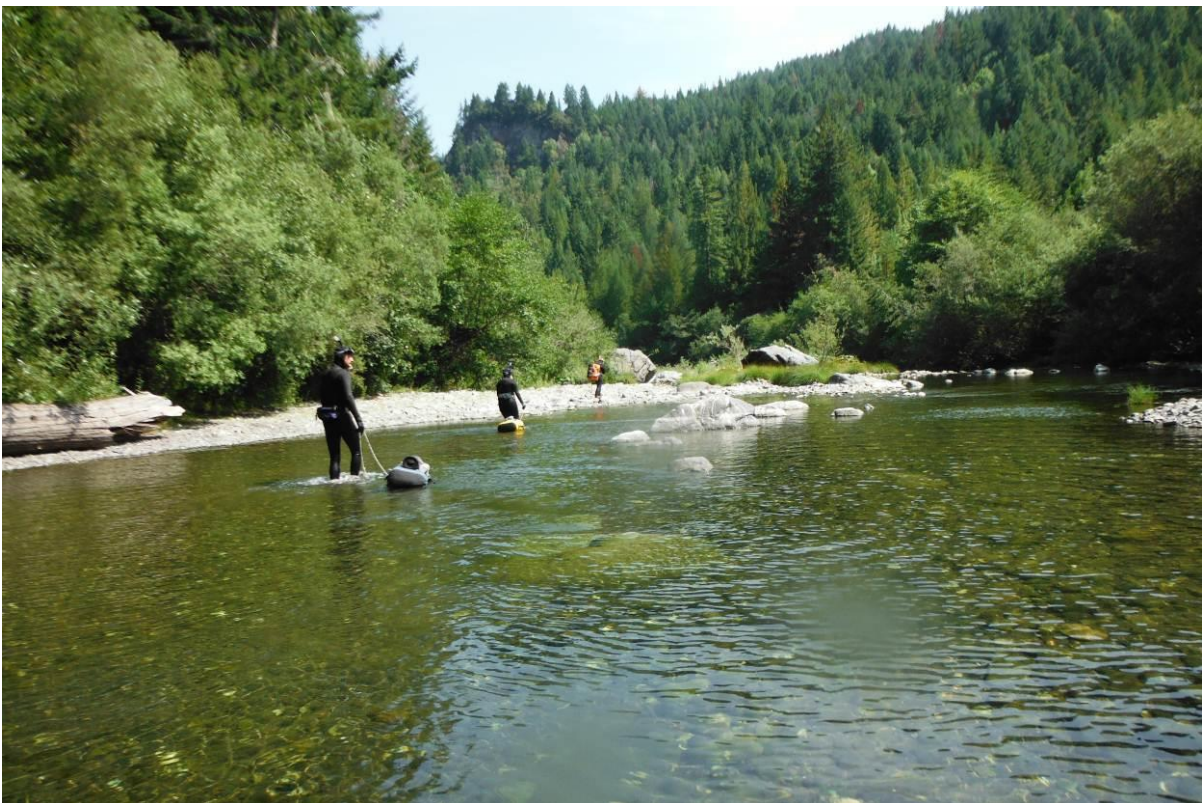
Redwood National Park summer steelhead snorkelers on lower Redwood Creek, 8/2013 (RNP).

Appendix III. Stream water temperatures (°C) measured with a handheld thermometer (0.5°C increments) during the 2013 Redwood Creek summer steelhead trout survey from July 29 to August 7. 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 UN 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 and --- = no data collected. **SSHD** = Water temperature at summer steelhead locations. Confluence connection is whether the tributary flow is connected to mainstem Redwood Creek.

Mainstem and Tributaries	Alignment	Date	Time	Water Temperature (°C)	Confluence Connection
Redwood Creek (upstream)	REDW	8/7/2013	8:44	17.0	
Lacks Creek	East	8/7/2013	8:44	15.0	subsurface 15m
Redwood Creek (upstream)	REDW	8/7/2013	9:11	17.0	
George Creek	West	8/7/2013	9:11	12.5	connected
Redwood Creek 44.70 SSHD	REDW	8/7/2013	---	18.5	
Redwood Creek (upstream)	REDW	8/7/2013	11:28	20.0	
Garrett Creek	East	8/7/2013	11:28	14.5	subsurface 10m
Redwood Creek (upstream)	REDW	8/7/2013	13:46	18.0	
UN ES 42.163	East	8/7/2013	13:46	14.0	---
Redwood Creek (upstream)	REDW	8/7/2013	14:39	19.5	
Carson Creek	East	8/7/2013	14:39	14.5	---
Redwood Creek at Panther	REDW	8/7/2013	15:12	19.5	
Redwood Creek (upstream)	REDW	7/29/2013	10:20	18.5	
Panther Creek	West	7/29/2013	10:20	13.0	connected
Redwood Creek (upstream)	REDW	7/29/2013	11:22	18.5	
UN WS 39.90	West	7/29/2013	11:22	12.0	trickle
Redwood Creek (upstream)	REDW	7/29/2013	11:45	18.5	
UN WS 39.52	West	7/29/2013	11:45	13.5	trickle
Redwood Creek (upstream)	REDW	7/29/2013	12:08	18.5	
UN WS 39.16 km	West	7/29/2013	12:08	13.5	trickle
Redwood Creek (upstream)	REDW	7/29/2013	12:35	18.5	
Joplin Creek	West	7/29/2013	12:35	14.0	Subsurface 10m
Redwood Creek 38.50 SSHD	REDW	7/29/2013	14:24	19.0	
Redwood Creek 37.40 SSHD	REDW	7/29/2013	15:33	20.0	
Redwood Creek (upstream)	REDW	7/29/2013	16:50	19.5	
Coyote Creek	East	7/29/2013	16:50	15.5	connected
Redwood Creek (upstream)	REDW	7/29/2013	18:35	20.0	
Devils Creek	West	7/29/2013	18:35	13.5	connected
Redwood Creek 33.875	REDW	7/30/2013	9:00	17.0	
Redwood Creek (upstream)	REDW	7/30/2013	9:21	17.0	
Lyons Creek	East	7/30/2013	9:21	13.0	connected
Redwood Creek (upstream)	REDW	7/30/2013	10:28	17.0	
Elf Creek	West	7/30/2013	10:28	13.0	connected

Mainstem and Tributaries	Alignment	Date	Time	Water Temperature (°C)	Confluence Connection
UN WS 32.527	West	7/30/2013	10:46	12.5	connected
Redwood Creek (upstream)	REDW	7/30/2013	11:13	17.5	
Copper Creek	East	7/30/2013	11:13	14.0	Subsurface 20m
Redwood Creek 31.20 SSHD	REDW	7/30/2013	14:10	18.0	
Redwood Creek (upstream)	REDW	7/30/2013	15:27	19.0	
UN WS 30.39	West	7/30/2013	15:27	13.5	---
Redwood Creek (upstream)	REDW	7/30/2013	15:42	19.5	
UN WS 30.25	West	7/30/2013	15:42	13.5	seep
Redwood Creek (upstream)	REDW	7/30/2013	16:27	19.5	
UN WS 29.75	West	7/30/2013	16:27	13.5	connected
Redwood Creek 29.75 km	REDW	7/31/2013	8:45	17.0	
Childs Creek	East	7/31/2013	~9:00		Dry >60m
Redwood Creek (upstream)	REDW	7/31/2013	9:46	17.5	
UN WS 29.30	West	7/31/2013	9:46	13.5	---
Redwood Creek (upstream)	REDW	7/31/2013	10:03	17.5	
UN WS 29.066	West	7/31/2013	10:03	13.0	---
Slide Creek	East	7/31/2013	10:13	14.0	connected
Redwood Creek (upstream)	REDW	7/31/2013	12:04	18.0	
UN WS 27.75	West	7/31/2013	12:04	13.0	---
Redwood Creek (upstream)	REDW	7/31/2013	14:47	18.0	
UN WS 28.6861	West	7/31/2013	14:47	13.0	---
Redwood Creek (upstream)	REDW	7/31/2013	15:38	18.5	
Dolason Creek	East	7/31/2013	15:38	13.5	Subsurface 75m
Redwood Creek (upstream)	REDW	7/31/2013	15:30	18.5	
UN WS 25.112	West	7/31/2013	15:30	13.5	---
Redwood Creek (upstream)	REDW	7/31/2013	15:50	18.5	
UN WS 24.90	West	7/31/2013	15:50	13.5	---
Redwood Creek (upstream)	REDW	7/31/2013	16:10	18.5	
Bridge Creek	West	7/31/2013	16:10	13.5	connects
Redwood Creek 24.52	REDW	8/1/2013	8:30	17.0	
Redwood Creek (upstream)	REDW	8/1/2013	10:01	17.5	
Emerald Creek	East	8/1/2013	10:01	13.5	subsurface
Redwood Creek (upstream)	REDW	8/1/2013	10:18	17.5	
UN WS 22.861	West	8/1/2013	10:18	13.0	trickle
Redwood Creek (upstream)	REDW	8/1/2013	12:04	18.0	
Tom McDonald Creek	West	8/1/2013	12:04	13.0	connects
Redwood Creek (Tall Trees summer bridge) 19.20 km	REDW	8/5/2013	9:32	17.0	
Redwood Creek (upstream)	REDW	8/5/2013	10:23	17.0	
UN ES 19.25	East	8/5/2013	10:23	13.0	
Redwood Creek (upstream)	REDW	8/5/2013	10:41	17.0	
Cole Creek	East	8/5/2013	10:41	13.0	
Redwood Creek (upstream)	REDW	8/5/2013	11:23	18.0	
Fortyfour Creek	West	8/5/2013	11:23	12.5	connected
UN ES 17.30	East	8/5/2013	11:46	13.0	---

Mainstem and Tributaries	Alignment	Date	Time	Water Temperature (°C)	Confluence Connection
Redwood Creek 17.00 SSHD	REDW	8/5/2013	13:23	19.0	
Redwood Creek (upstream)	REDW	8/5/2013	14:01	21.5	
Bond Creek	West	8/5/2013	14:01	13.0	connected
Redwood Creek 16.00 SSHD	REDW	8/5/2013	14:15	20.5	
Redwood Creek 15.75 SSHD	REDW	8/5/2013	15:00	20.0	
Redwood Creek 15.2	REDW	8/6/2013	9:42	17.0	
Redwood Creek (upstream)	REDW	8/6/2013	9:55	17.0	
UN WS 14.8775	West	8/6/2013	9:55	12.0	---
Cloquet Creek	East	8/6/2013	10:05	12.5	subgravel
Redwood Creek (upstream)	REDW	8/6/2013	10:34	17.0	
UN WS 13.7492	West	8/6/2013	10:34	12.0	---
Oscar Larson Creek	East	8/06/2013	11:04	12.0	subgravel
Chris Creek	East	8/06/2013	11:04	13.0	---
Redwood Creek (upstream)	REDW	8/06/2013	12:00	20.0	
Elam Creek	West	8/06/2013	12:00	12.0	connected
Redwood Creek 10.55 SSHD	REDW	8/06/2013	14:00	18.5	
Redwood Creek (upstream)	REDW	8/06/2013	14:33	19.5	
McArthur Creek	West	8/06/2013	14:33	12.0	connected



RNP snorkelers trailing their waterproof bags hike on Redwood Creek downstream of Copper Creek. Wildcat Rock is in the background (RNP 2013)