

Redwood

National Park

National Park Service
US Department of the Interior

2011 REDWOOD CREEK SUMMER STEELHEAD SURVEY



Fish and Wildlife Branch
September 2015

Cover Photos from 2011 summer steelhead survey:
Top Left: Summer Steelhead Snorkeler
Top Right: Redwood Creek Summer Steelhead
Middle Left: School of Sacramento Suckers
Middle Right: Redwood Creek Snorkelers
Bottom Left: Redwood Creek Coastal Cutthroat Trout
Bottom Right: Western Toad sitting on mask in creek

2011 RNP REDWOOD CREEK SUMMER STEELHEAD SURVEY

DATES: July 26, 27 (Tuesday, Wednesday) and August 1, 2, 3, 4 (Monday-Thursday), and 8 (Monday) 2011

LOCATION: Redwood Creek, Humboldt County, California
Mainstem reach from Lacks Creek - river km 46.514 to downstream of Hayes Creek (Redwood National Park) - river km 7.63.

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: 101 cfs End of Survey: 74 cfs

DIVERS: David Anderson, Terry Hines, Kyle Max, Galen Reid (All divers with prior summer steelhead diving experience on Redwood Creek). Recorder: Heather Brown.

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 via Big Lagoon; hike/snorkel and camp on river four days/three nights to reach footbridge downstream of Tall Trees Grove/Tom McDonald Creek and trail to 44 horse camp. Drive out C-12/A9-9/West Side Access; 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:	<i>Date</i>	<i>Survey Reach</i>	<i>Distance</i>	<i>SSHD No.</i>
	8/8	Lacks Creek to Panther Creek..... <i>Anderson, Hines, Max, and Reid</i>	6.02	3
	8/1	Panther to Below Devils Cr 33.875 km <i>Hines, Max, and Reid</i>	6.62	2
	8/2	Below Devils Cr to above Pig Pen Prairie 29.75 km <i>Hines, Max, and Reid</i>	4.13	3
	8/3	Above Pig Pen Prairie to Emerald Creek 23.1 km <i>Hines, Max, and Reid</i>	6.65	0
	8/4	Emerald Creek to Tall Trees Summer Bridge 19.25 km .. <i>Hines, Max, and Reid</i>	3.85	0
	7/26	Tall Trees Summer Bridge to Cloquet Cr <i>Anderson, Max, and Reid (Recorder- Brown)</i>	4.05	0
	7/27	Cloquet Creek to Downstrm of Hayes Creek <i>Hines, Max, and Reid (Recorder – Brown)</i>	7.55	0

TOTAL NUMBER OF ADULT SUMMER STEELHEAD TROUT OBSERVED IN 2011: 8

(Number of Adult Summer Steelhead Trout Observed within the Index Section (Lacks Creek to Tom McDonald Creek - 16.1 miles): 8

SUMMER STEELHEAD

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 2006.

Summer 2011 was the 31st 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 downstream of Hayes Creek. The order of the survey reaches and dates surveyed were changed in 2011. Road culvert replacement on the K&K road at Green Diamond blocked vehicle access to Panther Creek, the starting point of the 4-day survey downstream to Tall Trees Grove. Other reaches within the park were done first until the K&K was passable.

Eight adult summer steelhead (steelhead ≥ 16 inches), five 'half-pounder' steelhead (smaller immature sea-run steelhead returning after less than one year in the ocean), and 107 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). All eight summer steelhead were observed within the index reach, Lacks to Tom McDonald Creeks. One coho juvenile was found at the confluence of an unnamed westside tributary at river km 15.77.

The adult summer steelhead were all observed in pools (Table 2). One of the pools was associated with a coldwater source, a westside tributary. 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). Four fish were solitary fish observations, and the other two observations were groups of two fish. Estimated fish length ranged from 16 to 28 inches. Fish fork lengths were estimated by referring to graduated (in inches) leashes that were attached to the divers and their floating packs.

All fish were found in the mid to upper reaches of the survey above the gorge area upstream of Childs Creek (Figure 1).

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

Western Pearlshell (*Margaritifera falcata*) freshwater mussels were observed at 14 mainstem Redwood Creek locations during the 2011 summer steelhead survey of mainstem Redwood Creek (Appendix II). They ranged in size from less than 1 inch to 7 inches and totaled 69+ individuals.

Table 1. Numbers of adult summer steelhead ($\geq 16''$), 'half-pounder' steelhead, and coastal cutthroat trout, and aquatic wildlife observed during the 2011 summer steelhead survey of mainstem Redwood Creek, Humboldt County, California. Survey conducted on seven days, July 26 through August 8, 2011 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 Wildlife Observed
O R I G I N A L I N D E X R E A C H	Lacks to Panther Creek 8/8/2011	3	4	12	Resident trout, Juvenile Chinook Salmon, Cutthroat Trout (4-6' size range), Threespine Stickleback, Sacramento suckers, Caddisfly larvae, Yellow-legged frogs, Stellars Jay, Spotted Sandpiper, Beavers (2 juveniles), Pacific Giant Salamanders (3 dead) .
	Panther to Coyote Creek 8/1/2011	2	0	9	Threespine Stickleback, Juvenile Steelhead, Rough-skinned newt, Caddisfly larvae, Belted Kingfisher, American Dipper, Damselfly larvae, Butterflies (California Sister, Louriquin Admiral, Rubyspot, Western Swallowtail)
	Coyote to Copper Creek 8/1 & 2/2011	1	0	9	Sculpin, Juvenile Chinook Salmon, Mergansers, Stellars Jays, Marbled Murrelets (heard 8/2/2011 am), Turkey Vultures, Osprey.
	Copper to Pig Pen Prairie (Slide Cr) 8/2 & 3/2011	2	0	8	Freshwater Mussels, Rough-skinned Newt, Marbled Murrelets (8/3 am, 15 seen, many heard before 0630), Sculpin (dead), Otter tracks.
	Pig Pen Prairie (Slide Cr) to Bridge Creek 8/3/ 2011	0	0	11	Freshwater Mussels, Sacramento Suckers, River Otters (3), Mallards.
	Bridge to Tom McDonald Creek 8/3 & 4/2011	0	1	12	Resident Trout, Sacramento Suckers, Freshwater Mussels, Marbled Murrelets (heard until 0645), Belted Kingfisher, Ravens, Stellar Jays, Mergansers (15), Campsites:2, Campers:2+ and dog
	Tom McDonald to Bond Creek 8/3/2011 & 7/26/2011	0	0	0	Sacramento Suckers (300+), Sculpin, Threespine Stickleback, Pacific Giant Salamander (dead), Freshwater Mussels, Caddisfly Larvae, Damselfly larvae, Butterfly(Rubyspot), Deer (buck and doe), Campsites:1.
	Bond Creek to downstream of Hayes Creek 7/26 & 27/2011	0	0	36	Coho juvenile at UNWS 15.77 tributary, Threespine Stickleback, Sacramento Suckers, Sculpin, Freshwater Mussels, Caddisfly larvae, Beaver sign, Fishermen (3) and a dog.
Total		8	5	107	

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 2011 snorkel survey of mainstem Redwood Creek. (Letters in parentheses refer to locations on map of Figure 1).

Date	River KM	No. of SSHD	Est. Length (inches)	Habitat Description
SUMMER STEELHEAD				
8/08/2011	43.30 (a)	1	16"	Fish under long rock ledge. First pool below Garrett Creek pool. Pool dimensions: 125m L x 15 m W x 5ft D. Redwood Creek water temperature 19.0°C. (UTM: 426010E 4548100N)
8/08/2011	42.30 (b)	2	21" 16"	Fish under rock in woody debris. Pool dimensions: 75m L x 15m W x 8ft D. Redwood Creek water temperature 19.0°C. (UTM: 425296E 4548566N)
8/01/2011	38.00 (c)	1	24"	Fish at 4 foot depth. Pool dimensions: 50m L x 10m W x 5ft D. Redwood Creek water temperature 20.0°C at 1330. (UTM: 4423080E 550892N)
8/01/2011	37.50 (d)	1	20"	In deep pool under large rock and big woody debris (tree trunk). Pool dimensions: 250m L x 20m W x 12ft D. Redwood Creek water temperature 21.0°C at 1533. (UTM: 423250E 4551420N)
8/02/2011	33.50 (e)	1	16"	Fish under big boulder shelf. Pool dimensions: 125m L x 20m W x 6ft D. Redwood Creek water temperature 18.0°C at 0935. (UTM: 421840E 4554510N)
8/02/2011	30.30 (f)	2	22" 28"	Fish in hole under shelf of large woody debris. Pool dimension: 75m L x 30m W x 14ft D. UN WS 30.39 tributary entering at head of pool at 12.5°C. Redwood Creek water temperature 20.5°C at 1524. (UTM: 420965E 4557062N)
Summer Steelhead Total		8		

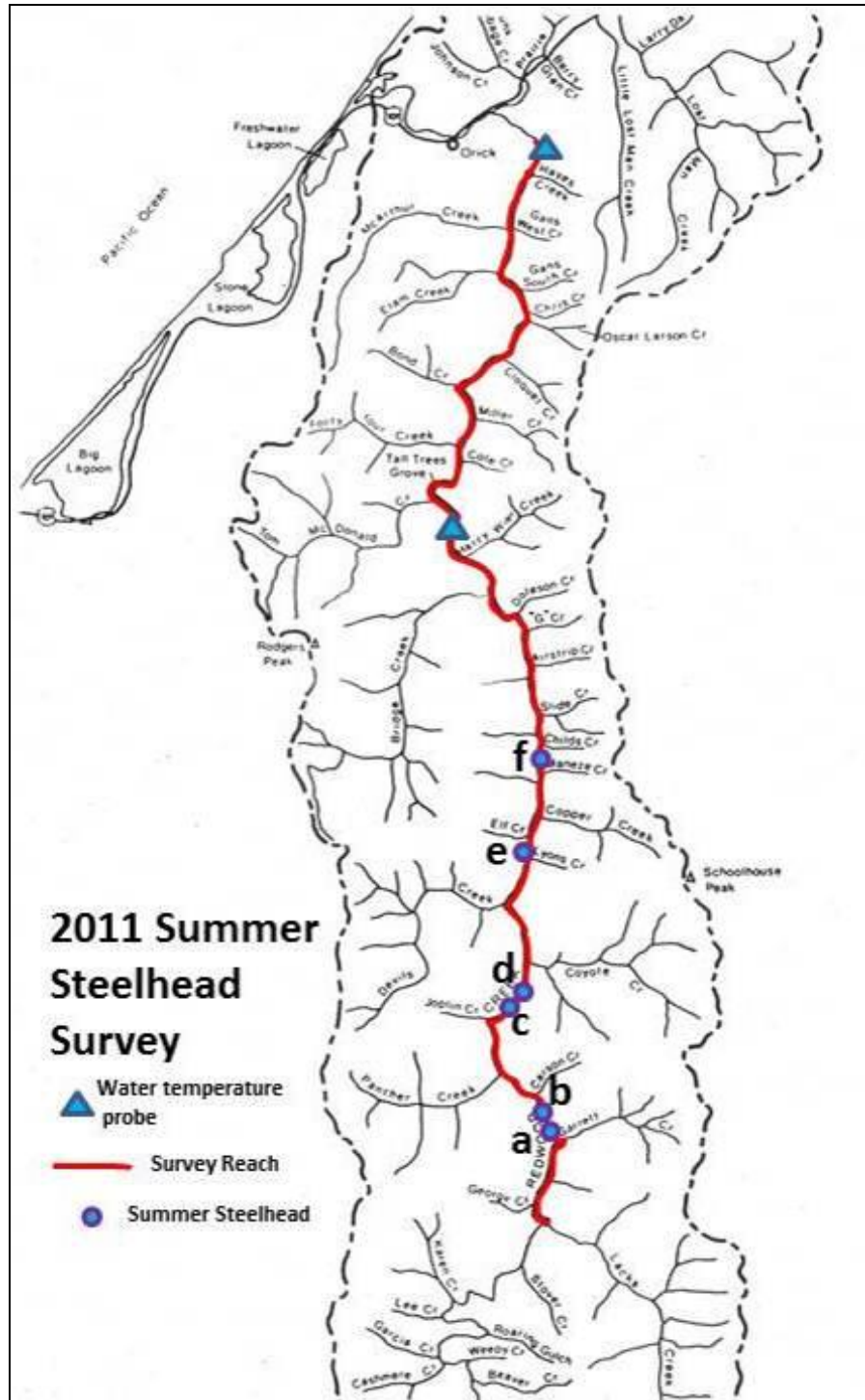


Figure 1. Location of the eight adult summer steelhead observed during the 2011 snorkel survey of Redwood Creek, Humboldt County, California. Survey was between Lacks Creek to downstream of Hayes Creek from July 26 and 27 and August 1 to 4 and 8, 2011.

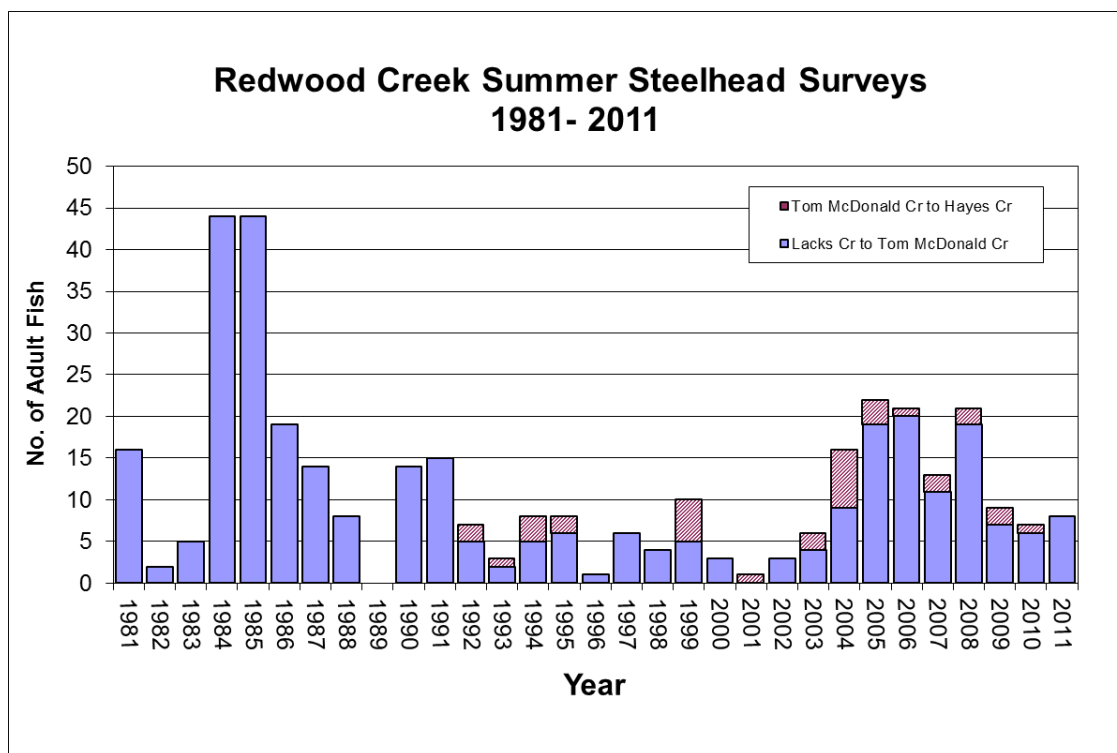


Figure 2. Numbers of summer steelhead observed each summer since 1981 on the 25.9 km index reach of Redwood Creek (Lacks Creek to Tom McDonald Creek), and expanded 13.0 km downstream reach (Tom McDonald Creek to downstream of Hayes Creek), Humboldt County, California. The survey was expanded in 1992.

WATER DISCHARGE

Water flow measured at the Orick gaging station located downstream of the confluence of Prairie Creek at Redwood Creek between July 26 and August 8 ranged between 101 and 73 cfs. (This USGS flow data is provisional and subject to revision.).

WATER TEMPERATURE

Temperature loggers recorded Redwood Creek mainstem water temperature (°C) at two sites during the summer. Water temperature of tributaries 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 2011 survey ranged from 17.0°C (at 08:40) to 21.0°C (at 14:25) (Appendix III).

Onset Tidbit recording temperature loggers were placed mid-depth in the current of mainstem Redwood Creek at two locations within the park (and the snorkel survey reach). They recorded temperature at one-hour intervals from June to October 2011.

A temperature logger (Tidbit S/N 1154750) was located upstream of Tom McDonald Creek/Tall Trees Grove (UTM 415907E 4566155N) between June 15 and October 3. Maximum and minimum water temperatures were 22.7°C and 13.8°C, respectively (Figure 3). The average water temperature was 18.2°C (Std. dev. 1.7°C). For the period July 1 through August 31, the warmer period of the summer, the average water temperature was 19.0°C, the maximum 22.7°C, and the minimum 15.0°C. During the July 1 - August 31 period, the water temperature was at or greater than 18°C 75 percent of the time. Average water temperature for June 15 to 30 was 16.3°C; for July, 18.5°C; for August, 19.8°C; and for September, 17.6°C; and for October 1 to 3, 16.6°C.

The second temperature logger (Tidbit S/N 2401072) was located in lower Redwood Creek upstream of the Redwood Creek trailhead (UTM 413642E 4572147N) between June 20 and October 3. Maximum and minimum water temperatures recorded between June and October were 22.1°C and 13.9°C, respectively (Figure 4). The average water temperature was 17.4°C (Std. dev. 1.7°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 22.1°C, and the minimum 14.2°C. During the July 1 - August 31 period, the water temperature was at or greater than 18°C 35.3 percent of the time. Average water temperature for June 20 to 30 was 16.3°C; for July, 17.6°C; for August, 18.0°C; and for September, 17.1°C.

Tributaries - Water temperatures of 68 eastside and westside tributaries of Redwood Creek measured during the survey. Temperatures ranged from 11.0°C (unnamed westside tributary at 39.9 river km) to 17.5°C (unnamed eastside tributary at 7.75 river km) (Appendix III). Water temperatures of all tributaries were colder 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 13.3°C (n = 38, std. dev. = 0.86°C) and temperatures ranged from 11.0°C to 15.0°C. The mean water temperature of eastside tributaries was 13.95°C (n = 30, std. dev. = 1.2°C) and temperatures ranged from 12.5°C to 17.5°C.

The 2011 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.

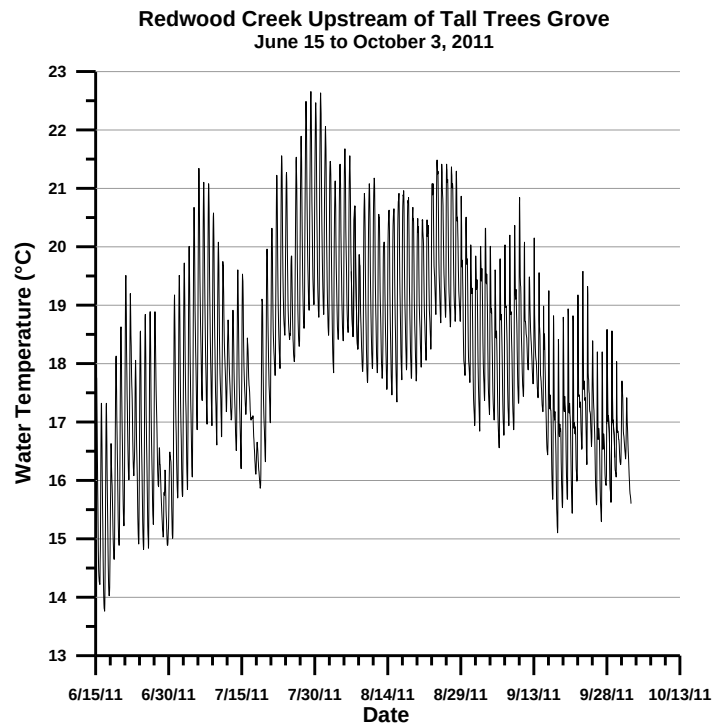


Figure 3. Redwood Creek water temperatures (°C) upstream of Tom McDonald Creek/Tall Trees Grove at 22.05 river km. A temperature logger recorded water temperature every 1-hour in the current below the surface of the water from June 15 through October 3, 2011.

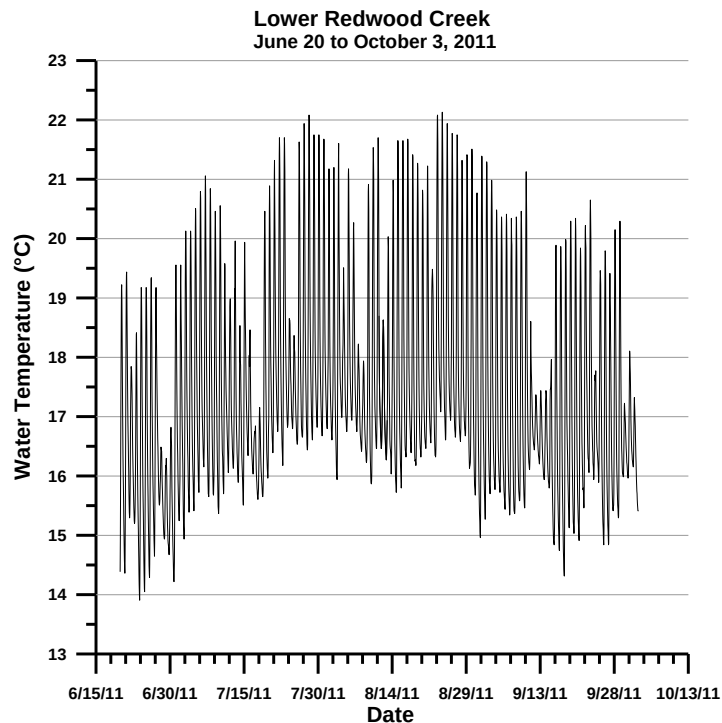


Figure 4. Lower Redwood Creek water temperatures (°C) upstream of the lower Redwood Creek trailhead parking lot at 7.65 river km. A temperature logger recorded water temperature every 1-hour in the current below the surface of the water from June 20 through October 3, 2011.

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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*Beaver (Castor canadensis) scat on Redwood Creek river bottom with Juga snails grazing on it.
(RNP 2011)*

Appendix I. Numbers of summer steelhead trout observed 1981 through 2011 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 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	
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
^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. River location (km), number, and sizes if noted of Western Pearlshell (*Margaritifera falcata*) mussels observed during the 2011 summer steelhead survey of mainstem Redwood Creek.

Date	River Km	Number	Sizes	Notes
8/02/2011	31.30	5		Queens Hole
8/03/2011	29.25	6	2"	"Medium size"
8/03/2011	28.90	2	1 – 2"	Downstream of Slide Creek
8/03/2011	26.52	2	< 1"	
8/03/2011	26.50	2	< 1"	Downstream of Rocky Gap
8/03/2011	25.75	5		First pool downstream of Dolason Creek
8/03/2011	~25.45	13	6 > 3"	Downstream of Dolason Creek
8/03/2011	~24.50	2		Downstream of Bridge Creek
8/03/2011	23.75	2		Downstream of Bridge Creek
8/04/2011	~21.35	2		
8/04/2011	~20.0	1		Downstream of Tom McDonald Creek
7/26/2011	19.05	18+		
7/27/2011	14.35	1	"large"	Downstream of Cloquet Creek UTM 415305E 456660N
7/27/2011	13.73	8	"7 large, 1 small"	Upstream of Oscar Larson Creek UTM 415231E 4567212N
Total Observed		69+		



Redwood Creek Summer Steelhead (RNP 2011)

Appendix III. Water temperatures (°C) measured during the 2011 Redwood Creek summer steelhead trout survey from July 26 to August 8. 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. (Handheld thermometer with 0.5°C increments) SSHD = temperature at summer steelhead locations.

Location	Alignment	Date	Time	Water Temperature (°C)	Confluence Connection
Redwood Creek (upstream)	REDW	8/08/2011	0850	18.0	
Lacks Creek	East	8/08/2011		14.5	
Redwood Creek (upstream)	REDW	8/08/2011		18.0	
George Creek	West	8/08/2011		14.5	
Redwood Creek (upstream)	REDW	8/08/2011		18.0	
UN ES 44.381	East	8/08/2011		14.0	
Redwood Creek (upstream)	REDW	8/08/2011		18.0	
Garrett Creek	East	8/08/2011		15.0	subgravel
Redwood Creek 43.30 SSHD	REDW	8/08/2011		19.0	
Redwood Creek 42.0 SSHD	REDW	8/08/2011		19.0	
UN ES 42.163	East	8/08/2011		14.5	
Redwood Creek (upstream)	REDW	8/08/2011		20.5	
Carson Creek	East	8/08/2011		14.0	
Redwood Creek (upstream)	REDW	8/08/2011	1555	20.0	
Panther Creek	West	8/08/2011	1555	14.0	
Redwood Creek (upstream)	REDW	8/01/2011	1045	19.0	
Panther Creek	West	8/01/2011	1045	14.0	
Redwood Creek (upstream)	REDW	8/01/2011		19.0	
UN WS 39.9	West	8/01/2011		11.0	
UN WS 39.35	West	8/01/2011		14.0	
Redwood Creek (upstream)	REDW	8/01/2011		19.0	
UN WS 39.10 km	West	8/01/2011		14.0	
Redwood Creek (upstream)	REDW	8/01/2011		19.0	
Joplin Creek	West	8/01/2011		14.5	
Redwood Creek 38.00 SSHD	REDW	8/01/2011	1315	20.0	
Redwood Creek 37.50 SSHD	REDW	8/01/2011	1533	21.0	
Redwood Creek (upstream)	REDW	8/01/2011		21.0	
Coyote Creek	East	8/01/2011		16.0	
Redwood Creek (upstream)	REDW	8/01/2011	1650	21.0	
UN ES 35.7384	East	8/01/2011	1650	15.0	
Redwood Creek (upstream)	REDW	8/01/2011	1741	21.0	
Devils Creek	West	8/01/2011	1741	14.0	
Redwood Creek (upstream)	REDW	8/01/2011	1815	21.0	
UN WS 34.11	West	8/01/2011	1815	15.0	
Redwood Creek 33.95 km	REDW	8/02/2011	0845	18.5	

Location	Alignment	Date	Time	Water Temperature (°C)	Confluence Connection
Redwood Creek 33.50 SSHD	REDW	8/02/2011	0935	18.0	
Redwood Creek (upstream)	REDW	8/02/2011		18.0	
Elf Creek	West	8/02/2011		14.5	
Redwood Creek (upstream)	REDW	8/02/2011		18.0	
Copper Creek	East	8/02/2011		14.5	
Redwood Creek (upstream) 30.30 SSHD	REDW	8/02/2011	1524	20.5	
UN WS 30.39	West	8/02/2011	1524	12.5	
Redwood Creek 29.75 km	REDW	8/03/2011	0840	17.0	
Redwood Creek (upstream)	REDW	8/03/2011		17.0	
UN WS 29.70	West	8/03/2011		12.5	
UN WS 29.20	West	8/03/2011		13.0	
Redwood Creek (upstream)	REDW	8/03/2011		17.5	
UN WS 29.066	West	8/03/2011		12.5	
Redwood Creek (upstream)	REDW	8/03/2011	1004	17.5	
Slide Creek	East	8/03/2011	1004	13.0	
Redwood Creek (upstream)	REDW	8/03/2011		17.5	
UN WS 28.80	West	8/03/2011		12.0	
Redwood Creek (upstream)	REDW	8/03/2011	1113	18.0	
UN WS 28.50	West	8/03/2011	1113	14.0	
Redwood Creek (upstream)	REDW	8/03/2011		19.0	
UN WS 26.912	West	8/03/2011		13.0	
Redwood Creek (upstream)	REDW	8/03/2011	1551	20.5	
G Creek	East	8/03/2011	1551	16.5	
Redwood Creek (upstream)	REDW	8/03/2011		20.5	
Dolason Creek	East	8/03/2011		15.0	subgravel
Redwood Creek (upstream)	REDW	8/03/2011		20.5	
UN WS 25.112	West	8/03/2011		14.0	
Redwood Creek (upstream)	REDW	8/03/2011		20.5	
UN WS 25.05	West	8/03/2011		14.5	
Redwood Creek (upstream)	REDW	8/03/2011		20.0	
Bridge Creek	West	8/03/2011		14.0	
Redwood Creek 23.75 km	REDW	8/03/2011		20.0	
Redwood Creek (upstream)	REDW	8/03/2011	1845	20.0	
Emerald Creek	East	8/03/2011	1845	14.5	
Redwood Creek 23.10 km	REDW	8/04/2011	0841	17.0	
Redwood Creek (upstream)	REDW	8/04/2011		17.0	
UN WS 22.861	West	8/04/2011		12.5	
Redwood Creek 22.10 km	REDW	8/04/2011	0942	18.0	
Redwood Creek (upstream)	REDW	8/04/2011	1022	18.0	
UN ES 21.3844	East	8/04/2011	1022	13.0	
Redwood Creek (upstream)	REDW	8/04/2011		19.0	
Tom McDonald Creek	West	8/04/2011		13.5	
Redwood Creek 19.25 km	REDW	7/26/2011	1006	18.5	
Redwood Creek (upstream)	REDW	7/26/2011	1010	18.5	

Location	Alignment	Date	Time	Water Temperature (°C)	Confluence Connection
UN ES 19.20	East	7/26/2011	1010	14.0	
Redwood Creek (upstream)	REDW	7/26/2011	1027	18.5	
UN ES 18.9974	East	7/26/2011	1027	13.5	subgravel
Redwood Creek (upstream)	REDW	7/26/2011	1043	18.0	
Cole Creek	East	7/26/2011	1043	13.5	
Redwood Creek (upstream)	REDW	7/26/2011	1052	18.0	
UN ES 18.50	East	7/26/2011	1052	14.0	
Redwood Creek (upstream)	REDW	7/26/2011	1111	18.5	
Fortyfour Creek	West	7/26/2011	1111	13.0	
Redwood Creek (upstream)	REDW	7/26/2011	1132	18.5	
UN WS 17.60	West	7/26/2011	1132	13.0	
Redwood Creek (upstream)	REDW	7/26/2011	1148	18.5	
Miller Creek	East	7/26/2011	1148	13.0	
Redwood Creek (upstream)	REDW	7/26/2011	1159	18.5	
UN ES 17.053	East	7/26/2011	1159	13.0	
Redwood Creek (upstream)	REDW	7/26/2011	1206	18.5	
UN ES 16.9172	East	7/26/2011	1206	13.5	
Redwood Creek (upstream)	REDW	7/26/2011	1220	18.5	
UN WS 16.45	West	7/26/2011	1220	14.0	subgravel
Redwood Creek (upstream)	REDW	7/26/2011	1222	18.5	
UN WS 16.43	West	7/26/2011	1222	13.0	subgravel
Redwood Creek (upstream)	REDW	7/26/2011	1232	18.5	
UN WS 16.35	West	7/26/2011	1232	12.5	subgravel
Redwood Creek (upstream)	REDW	7/26/2011	1337	20.0	
UN WS 16.30	West	7/26/2011	1337	14.0	subgravel
Redwood Creek (upstream)	REDW	7/26/2011	1341	20.0	
Bond Creek	West	7/26/2011	1341	13.5	
Redwood Creek (upstream)	REDW	7/26/2011	1358	20.0	
UN WS 15.77	West	7/26/2011	1358	13.5	
Redwood Creek (upstream)	REDW	7/26/2011	1406	20.0	
UN WS 15.57	West	7/26/2011	1406	13.5	
Redwood Creek (upstream)	REDW	7/26/2011	1413	20.0	
UN ES15.5468	East	7/26/2011	1413	13.0	subgravel
Redwood Creek (upstream)	REDW	7/26/2011	1425	21.0	
UN WS 15.20	West	7/26/2011	1425	13.0	subgravel
Redwood Creek (upstream)	REDW	7/26/2011	1434	21.0	
UN WS 15.05	West	7/26/2011	1434	14.0	subgravel
Redwood Creek (upstream)	REDW	7/26/2011	1449	21.0	
UN WS 14.65	West	7/26/2011	1449	13.5	
Redwood Creek (upstream)	REDW	7/26/2011	1455	21.0	
Cloquet Creek	East	7/26/2011	1455	13.5	connected
Redwood Creek 14.5 km	REDW	7/27/2011	0947	17.5	
Redwood Creek (upstream)	REDW	7/27/2011	1017	17.0	
UN ES 13.90	East	7/27/2011	1017	13.5	

Location	Alignment	Date	Time	Water Temperature (°C)	Confluence Connection
Redwood Creek (upstream)	REDW	7/27/2011	1020	17.0	
UN WS 13.806	West	7/27/2011	1020	13.0	
Redwood Creek (upstream)	REDW	7/27/2011	1048	17.0	
Oscar Larson Creek	East	7/27/2011	1048	12.5	
Redwood Creek (upstream)	REDW	7/27/2011	1100	17.5	
Chris Creek	East	7/27/2011	1100	13.0	
Redwood Creek (upstream)	REDW	7/27/2011	1128	18.0	
Gans South Creek	East	7/27/2011	1128	13.5	subgravel
Redwood Creek (upstream)	REDW	7/27/2011	1141	18.0	
UN ES 12.289	East	7/27/2011	1141	13.0	
Redwood Creek (upstream)	REDW	7/27/2011	1152	18.0	
UN WS 11.717	West	7/27/2011	1152	12.5	
Redwood Creek (upstream)	REDW	7/27/2011	1212	19.0	
Elam Creek	West	7/27/2011	1212	12.0	
Redwood Creek (upstream)	REDW	7/27/2011	1346	18.5	
UN ES 10.7445	East	7/27/2011	1346	12.5	
Redwood Creek (upstream)	REDW	7/27/2011	1403	20.0	
UN ES 10.19	East	7/27/2011	1403	12.5	
Redwood Creek (upstream)	REDW	7/27/2011	1408	20.0	
McArthur Creek	West	7/27/2011	1408	12.5	connected
Redwood Creek (upstream)	REDW	7/27/2011	1416	20.0	
UN WS 9.90	West	7/27/2011	1416	13.0	
Redwood Creek (upstream)	REDW	7/27/2011	1425	20.5	
Gans West Creek	East	7/27/2011	1425	dry	
Redwood Creek (upstream)	REDW	7/27/2011	1526	21.0	
UN ES 7.75	East	7/27/2011	1526	17.5	
Redwood Creek 7.63km	REDW	7/27/2011	1532	21.0	



Juvenile Redwood Creek chinook salmon (RNP 2011).