

REDWOOD NATIONAL PARK

2006 – 2012
REDWOOD CREEK
ESTUARY MONITORING

FISH DATA RELEASE

Fish and Wildlife Branch

September 2016

2006 - 2012 Redwood Creek Estuary Monitoring Fish Data Release

Introduction

This fish data release summarizes 2006 to 2012 Redwood National Park Fish and Wildlife Branch fish monitoring in the Redwood Creek estuary. Monitoring has occurred in the Redwood Creek estuary since 1980. The purpose of the estuary monitoring is to estimate fish population numbers and growth; record estuary water quality and water elevations; document breaching incidents; and determine cross section changes.

Location

Redwood Creek estuary is located 2.5 miles west of Orick, California at the confluence of Redwood Creek with the Pacific Ocean (Figures 1a, b, and c). Redwood Creek is 108 km long and the watershed is 720 km² in area. The U.S. Army Corps of Engineers completed construction of 3.4 miles of flood control levees in 1968 on lower Redwood Creek. The levees bisect and terminate in the estuary. The estuary consists of the north and south sloughs, and the embayment. The south slough was historically the last meander of Redwood Creek. It was cut off by the south levee. Gated culverts through the south levee connect the slough and creek when the gates are open.

Methods

Fish Monitoring

Population Estimates - The Peterson mark and recapture method (Youngs and Robson 1978) was used to estimate numbers of juvenile salmonid fish in the Redwood Creek estuary embayment. Fish were seined with a 150-foot long, 16-foot wide, quarter inch knotless mesh beach seine net deployed off the bow of a 16-foot boat powered by a 15 hp outboard motor. Seining occurred downstream of the south levee culverts in the embayment along the sand banks and berm and north and south levee rip rap. A blue mark was applied to the upper, middle, or lower caudal fin or anal fin of MS-222 anesthetized fish using a Panjet needleless injector and Alcian Blue dye. Mark appearance ranged from a blue dot to a pigment streak along a fin ray. Seined fish were marked the first two days, allowed to mix the third day, and seined on the fourth day to determine the ratio of marked to unmarked fish. Population and 95 percent confidence interval (95% CI) estimates are rounded off to the nearest 10. Four population estimates are usually conducted, one each in June, July, August, and September during summer.

Growth Estimates – Fish fork lengths were measured to the nearest 1 mm. Though not always possible, 200 fork lengths each of chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*O. mykiss*), and wet weight (g) from 30 juveniles of each species were measured. Two electronic balances were used, a 200 g $\pm$ 0.01g capacity balance for smaller fish, and a 5,000 g $\pm$ 2g capacity balance for larger fish. Fish weights were rounded off to the nearest 0.1g for the smaller capacity balance. Other salmonid species, coastal cutthroat trout (*O. clarki*) and coho salmon (*O. kisutch*), though not as numerous, were measured and weighed. Non-salmonids were also measured (total length). Growth estimates were conducted in conjunction with the population estimates and additional one-day growth estimates added.



February 7, 2006



June 8, 2006

Figure 1a. Redwood Creek Estuary, Humboldt County, California, including the embayment, north and south sloughs, levees, south levee gated culverts, and channel to ocean (Google Earth February 7 and June 8, 2006).



May 24, 2009



April 24, 2010

Figure 1b. Redwood Creek Estuary, Humboldt County, California, including the embayment, north and south sloughs, levees, south levee gated culverts, and channel to ocean (Google Earth May 24, 2009 and April 24, 2010).



May 17, 2011



June 11, 2011

Figure 1c. Redwood Creek Estuary, Humboldt County, California, including the embayment, north and south sloughs, levees, south levee gated culverts, and channel to ocean (Google Earth May 17 and June 11, 2011).

Condition Factor (K') - Condition factor, a measure of fish 'fatness' was calculated for salmonid species measured and weighed. Because of the wide range of fish lengths, condition factor (K') was calculated as: $K' = (100 \times \text{Weight}_{(g)}) / \text{Fork Length}_{(cm)}^b$ (Bagenal and Tesch 1978). Slope (b) was calculated as: $\log_{10} \text{Weight}_{(g)} = \log_{10} a + b \log_{10} \text{Fork Length}_{(cm)}$.

Fish Monitoring

Seines and Fish Handled - The total number of estuary seine hauls in 2006 was 107. The numbers of salmonid fish processed during estuary monitoring were 3,964 juvenile chinook (37 incidental mortalities, 0.93%), 3,211 steelhead (6 incidental mortality, 0.19%), 340 coho smolts (1 incidental mortality, 0.29%), and 107 coastal cutthroat (0 incidental mortality) for a total of 7,622 fish and 44 incidental mortalities (0.58%).

In addition to the juvenile salmonids and adult cutthroat captured, eight additional fish species were captured; Night and Surf Smelt, Prickly and Staghorn Sculpin, Sacramento Sucker, Shiner Surfperch, Starry Flounder, and Threespine Stickleback.

Seined Species		2006 Date (Week of)					
Common Name	Scientific Name	June 5	June 21	July 10	Aug 21	Sept 25	Oct 23
Salmonid Fish							
Chinook Salmon *	<i>Oncorhynchus tshawytscha</i>						
Coastal Cutthroat Trout	<i>Oncorhynchus clarki</i>						
Coho Salmon *	<i>Oncorhynchus kisutch</i>						
Steelhead Trout *	<i>Oncorhynchus mykiss</i>						
Other Fish							
Night Smelt	<i>Spirinchus starksi</i>						
Prickly Sculpin	<i>Cottus asper</i>						
Sacramento Sucker	<i>Catostomus occidentalis</i>						
Shiner Surf perch	<i>Cymatogaster aggregata</i>						
Staghorn Sculpin	<i>Leptocottus armatus</i>						
Starry Flounder	<i>Platichthys stellatus</i>						
Surf Smelt	<i>Hypomesus pretiosus</i>						
Threespine Stickleback	<i>Gasterosteus aculeatus</i>						

* = Federally listed as Threatened
Shading denotes presence.

Table 2006.1 Population estimates and 95 percent confidence intervals for juvenile chinook and coho salmon, juvenile steelhead trout, and coastal cutthroat trout seined in the Redwood Creek estuary embayment, Humboldt County, California, summer 2006. Mouth of creek denotes if Redwood Creek mouth was open or closed to the Pacific Ocean during the estimate.

2006 DATE	Mouth of Creek (Open or Closed)	Chinook Salmon		Coho Salmon	
		Population Estimate	95% Confidence Interval	Population Estimate	95% Confidence Interval
6/5, 6, 8	OPEN	1,870	86 ^a – 5,460	3,350	530 – 6,180
7/10, 11, 13	CLOSED	18,090	14,390 – 21,780	1 ^b	---
8/21, 22, 24	CLOSED	14 ^b	---	None caught	---
9/25, 26, 28	CLOSED	2,430	1,720 – 3,140	None caught	---
		Steelhead Trout		Cutthroat Trout	
6/5, 6, 8	OPEN	20,630	6,620 – 34,650	12 ^b	---
7/10, 11, 13	CLOSED	24,220	10,830 – 37,610	13 ^b	---
8/21, 22, 24	CLOSED	1,630	600 – 2,660	97	50 - 140
9/25, 26, 28	CLOSED	1,720	1,350 – 2,090	11 ^b	---
a. Actual minimum count, calculated 95% lower confidence interval was below what was actually caught					
b. Actual number of fish captured in seine net hauls. No marked fish were recaptured.					

Table 2006.2. Mean fork length (mm), mean weight (g), standard deviation, range, dates, and numbers sampled of juvenile chinook and coho salmon; and steelhead, coastal cutthroat, and half-pounder trout seined in the Redwood Creek estuary embayment, Humboldt County, California, during summer/fall of 2006 from June 05 to October 23. Mouth denotes if Redwood Creek mouth was open or closed to the ocean.

Growth - Redwood Creek Estuary – Summer/Fall 2006									
2006 DATE	MOUTH	FORK LENGTH (mm)				WEIGHT (g)			
		No. Measured	Mean	Std. Dev	Range	No. Weighed	Mean	Std. Dev.	Range
JUVENILE CHINOOK SALMON									
6/5, 6, 8	OPEN	87	79	9.3	47 – 98	30	4.7	1.9	0.5 – 7.5
6/21	OPEN	206	88	6.7	70 – 105	30	7.2	1.8	3.6 – 12.0
7/10,13	CLOSED	210	85	5.4	66 – 99	36	6.1	1.3	4.2 – 9.3
8/21, 22, 24	CLOSED	14	92	2.3	87 – 95	14	8.5	0.9	7.2 – 10.7
9/25, 28	CLOSED	204	103	5.7	90 – 138	31	11.6	1.5	8.8 – 14.6
10/23	CLOSED	252	110	5.7	93 - 139	30	14.3	1.7	11.3 – 18.8
JUVENILE COHO SALMON									
6/5, 6, 8	OPEN	205	118	7.9	93 – 140	30	18.2	3.8	12.2 – 28.1
6/21	OPEN	77	118	7.2	99 – 133	30	18.7	3.2	12.7 – 25.7
7/11	CLOSED	1	103	-	-	1	12.9	-	-
8/21, 22, 24	CLOSED	None Caught	-	-	-	-	-	-	-
9/25, 26, 28	CLOSED	None Caught	-	-	-	-	-	-	-
10/23	CLOSED	None Caught	-	-	-	-	-	-	-

Growth – Redwood Creek Estuary – Summer/Fall 2006 (cont.)									
2006 DATE	MOUTH	FORK LENGTH (mm)				WEIGHT (g)			
		No. Measured	Mean	Std. Dev	Range	No. Weighed	Mean	Std. Dev	Range
JUVENILE STEELHEAD TROUT									
6/5, 6	OPEN	201	117	19.9	50 – 173	30	17.0	7.7	2.2 – 40.1
6/21	OPEN	205	117	16.1	78 – 175	30	17.1	7.2	6.5 – 34.0
7/10, 11, 13	CLOSED	208	123	23.8	56 – 189	32	20.7	8.0	9.1 – 44.4
8/21, 22	CLOSED	229	140	21.4	74 – 235	30	20.4	16.1	4.4 – 55.3
9/25, 28	CLOSED	207	142	17.5	89 – 190	32	28.6	11.8	9.7 – 59.4
10/23	CLOSED	141	146	17.8	101 - 217	29	31.6	11.7	15.0 – 62.9
CUTTHROAT TROUT									
6/5, 6, 8	OPEN	12	249	88.0	160 – 417	12	241	265.7	34.8 – 820
6/21	OPEN	3	221	25.7	205 – 251	3	112	48.7	77.7 - 168
7/10, 11, 13	CLOSED	13	239	17.7	200 – 266	13	161	41.1	80.0 – 228
8/21, 22, 24	CLOSED	58	246	35.0	126 – 312	57	191	75.6	84.0 – 398
9/25, 26, 28	CLOSED	11	253	17.4	234 - 288	11	174	41.1	126 - 258
10/23	CLOSED	1	240	-	-	1	152	-	-

Table 2006.3. Mean condition factor (K'), sample size, standard deviation, minimum and maximum values of captured salmonids measured (fork length cm) and weighed (g) from the Redwood Creek embayment, Humboldt County, California, during the summer and fall of 2006. Condition factor is calculated as: $K' = 100W_{(g)} / FKL_{(cm)}^b$. Slope (b) was calculated as: $\log_{10} \text{Weight}_{(g)} = \log_{10} a + b \log_{10} \text{Fork Length}_{(cm)}$.

Condition Factor (K') - Redwood Creek Estuary 2006							
Date (week of)	6/5/2006	6/21/2006	7/10/2006	8/21/2006	9/25/2006	10/23/2006	Summer/ Fall 2006
Chinook Salmon (b = 2.9401)							
Mean	1.2263	1.2199	1.1887	1.2588	1.1825	1.2140	1.2098
Count	30	30	36	14	31	30	171
Standard Deviation	0.1587	0.1299	0.1601	0.1210	0.1424	0.0540	0.1347
Minimum	0.5283	0.5806	0.7020	1.0905	0.5076	1.0697	0.5076
Maximum	1.4744	1.3506	1.6251	1.5693	1.2907	1.3027	1.6251
Coho Salmon (b = 2.9017)							
Mean	1.3703	1.3811	1.4848	---	---	---	1.3775
Count	30	30	1	---	---	---	61
Standard Deviation	0.1033	0.0888	---	---	---	---	0.0959
Minimum	1.0199	1.0617	---	---	---	---	1.0199
Maximum	1.5426	1.5465	---	---	---	---	1.5465
Steelhead Trout (b = 2.8214)							
Mean	1.7038	1.6298	1.5925	1.6162	1.5900	1.6399	1.6280
Count	30	30	31	30	32	29	182
Standard Deviation	0.1578	0.0856	0.0802	0.1517	0.1163	0.0587	0.1193
Minimum	1.3842	1.4375	1.4107	1.3782	1.2612	1.5323	1.2612
Maximum	2.2619	1.8130	1.7515	2.0537	1.8121	1.7491	2.2619
Cutthroat Trout (b = 2.7297)							
Mean	2.5036	2.2955	2.7284	3.0092	2.5308	2.5961	2.8284
Count	12	3	13	57	11	1	97
Standard Deviation	0.5336	0.2494	0.4184	1.3762	0.2019	---	1.1038
Minimum	1.7977	2.0406	1.8800	2.0608	2.1862	2.5961	1.7977
Maximum	3.4639	2.5389	3.6585	12.3258	2.8703	2.5961	12.3258

Fish Monitoring

Seines and Fish Handled - The total number of estuary seine hauls in 2007 was 64. The numbers of salmonid fish processed during estuary monitoring were 2,137 juvenile chinook (21 incidental mortalities, 0.98%), 4,790 steelhead (9 incidental mortality, 0.19%), 41 coho smolts (0 incidental mortality), and 76 coastal cutthroat (0 incidental mortality) for a total of 7,044 fish and 30 incidental mortalities (0.43%).

In addition to the salmonids captured, 11 additional fish species were captured; Prickly, Staghorn, and Coastrange Sculpin, Bay Pipefish, Northern Anchovy, Pacific Herring, Pacific Lamprey, Shiner Surfperch, Starry Flounder, Surf Smelt, and Threespine Stickleback.

Species		2007 Date (Week of)					
Common Name	Scientific Name	June 11	July 9	Aug 6	Aug 30	Sept 17	Oct 23
Salmonid Fish							
Chinook Salmon *	<i>Oncorhynchus tshawytscha</i>						
Coastal Cutthroat Trout	<i>Oncorhynchus clarki</i>						
Coho Salmon *	<i>Oncorhynchus kisutch</i>						
Steelhead Trout *	<i>Oncorhynchus mykiss</i>						
Other Fish							
Bay Pipefish	<i>Syngnathus leptorhynchus</i>						
Coastrange Sculpin	<i>Cottus aleuticus</i>						
Northern Anchovy	<i>Engraulis mordax</i>						
Pacific Herring	<i>Clupea pallasii</i>						
Pacific Lamprey (Ammocoete)	<i>Entosphenus tridentatus</i>						
Prickly Sculpin	<i>Cottus asper</i>						
Shiner Surfperch	<i>Cymatogaster aggregata</i>						
Staghorn Sculpin	<i>Leptocottus armatus</i>						
Starry Flounder	<i>Platichthys stellatus</i>						
Surf Smelt	<i>Hypomesus pretiosus</i>						
Threespine Stickleback	<i>Gasterosteus aculeatus</i>						

* = Federally listed as Threatened
Shading denotes presence.

Table 2007.1. Population estimates and 95 percent confidence intervals for juvenile chinook and coho salmon, juvenile steelhead trout, and coastal cutthroat trout seined in the Redwood Creek estuary embayment, Humboldt County, California, summer 2007. Mouth of creek denotes if Redwood Creek mouth was open or closed to the Pacific Ocean during the estimate.

2007 DATE	Mouth of Creek (Open or Closed)	Chinook Salmon		Coho Salmon	
		Population Estimate	95% Confidence Interval	Population Estimate	95% Confidence Interval
6/11, 12, 14	OPEN	22,870	9,020 – 36,720	350	38 ^b – 1,000
7/9, 10, 12	OPEN	12,790	6,760 – 18,820	2 ^a	---
8/6, 7, 9	CLOSED	210	65 ^b - 370	None caught	---
9/17, 18, 20	CLOSED	170	26 ^b - 480	None caught	---
		Steelhead Trout		Cutthroat Trout	
6/11, 12, 14	OPEN	28,730	6,070 – 51,380	34 ^a	---
7/9, 10, 12	OPEN	16,830	10,850 – 22,810	154	24 ^b - 430
8/6, 7, 9	CLOSED	4,990	4,270 – 5,700	4 ^a	---
9/17, 18, 20	CLOSED	2,580	1,770 – 3,390	11 ^a	---
a. Actual number of fish captured in seine net hauls. No marked fish were recaptured.					
b. Actual minimum count, calculated 95% lower confidence interval was below what was actually caught					

Table 2007.2a. Mean fork length (mm), mean weight (g), standard deviation, range, dates, and numbers sampled of juvenile chinook and coho salmon; and steelhead, coastal cutthroat seined in the Redwood Creek estuary embayment, Humboldt County, California, during summer/fall of 2007. Mouth denotes if Redwood Creek mouth was open or closed to the ocean.

Growth - Redwood Creek Estuary – Summer/Fall 2007									
2007 DATE	MOUTH	FORK LENGTH (mm)				WEIGHT (g)			
		No. Measured	Mean	Std. Dev	Range	No. Weighed	Mean	Std. Dev.	Range
JUVENILE CHINOOK SALMON									
6/11	OPEN	206	70	9.3	48 – 95	33	4.2	1.6	1.2 – 8.1
7/9, 12	OPEN	215	82	5.9	64 – 101	36	6.3	1.1	3.5 – 8.1
8/6, 7, 9	CLOSED	66	89	6.3	73 – 107	31	7.9	1.4	4.7 – 11.5
8/30	CLOSED	4	92	10.7	77 – 100	4	8.6	2.5	5.2 – 10.8
9/17, 18, 20	CLOSED	26	99	5.2	87 – 108	26	10.4	1.5	7.5 – 12.8
10/23	OPEN	None caught	---	---	---	---	---	---	---
JUVENILE COHO SALMON									
6/11, 12, 14	OPEN	38	109	12.6	55 – 129	38	13.9	3.9	1.6 – 22.9
7/9	OPEN	2	103	2.1	101 – 104	2	11.2	1.3	10.2 – 12.1
8/6, 7, 9	CLOSED	None caught	---	---	---	---	---	---	---
8/30	CLOSED	None caught	---	---	---	---	---	---	---
9/17, 18, 20	CLOSED	None caught	---	---	---	---	---	---	---
10/23	OPEN	None caught	---	---	---	---	---	---	---
JUVENILE STEELHEAD TROUT									
6/11, 12, 14	OPEN	206	120	22.7	52 – 173	32	19.2	9.0	6.7 – 45.9
7/9	OPEN	205	140	20.1	72 – 207	30	34.1	17.3	15.6 – 82.3
8/6, 7, 9	CLOSED	208	155	17.3	82 – 196	33	42.4	15.9	8.7 – 84.9
8/30	CLOSED	237	167	18.7	81 – 208	30	50.4	16.5	6.1 – 79.8
9/17, 18	CLOSED	215	122	30.1	80 – 200	33	24.4	19.7	6.9 – 63.9
10/23	OPEN	2	73	8.5	67 – 79	2	6.2	4.0	3.3 – 9.0

Growth - Redwood Creek Estuary – Summer/Fall 2007 (cont.)

2007 DATE	MOUTH	FORK LENGTH (mm)				WEIGHT (g)			
		No. Measured	Mean	Std. Dev	Range	No. Weighed	Mean	Std. Dev.	Range
CUTTHROAT TROUT									
6/11, 12, 14	OPEN	34	186	36.0	110 – 309	34	74.6	54.4	14.5 - 284
7/9, 10, 12	OPEN	24	223	39.2	168 – 379	24	123.7	89.2	43.7 - 518
8/6, 9	CLOSED	4	232	39.6	174 – 262	4	144.8	65.7	49.0 - 194
8/30	CLOSED	2	323	10.6	315 – 330	2	440	25.5	422 - 458
9/17, 18, 20	CLOSED	11	298	39.3	220 – 367	11	308.2	155.5	106.0 - 674
10/23	OPEN	None caught	---	---	---	---	---	---	---

Table 2007.2b. Mean total length (mm), standard deviation, range, dates, and numbers sampled of non-salmonid fish captured in the Redwood Creek estuary embayment, Humboldt County, California, during summer 2007. Mouth denotes if Redwood Creek mouth was open or closed to the ocean.

Growth - Redwood Creek Estuary – Summer/Fall 2007					
2007 DATE	MOUTH	TOTAL LENGTH (mm)			
		No. Measured	Mean	Std. Dev	Range
JUVENILE STARRY FLOUNDER					
8/6, 9	CLOSED	33	40	6.6	31 - 55
8/30	CLOSED	73	60	11.9	31 - 85
9/17	CLOSED	30	57	11.5	41 - 105
10/23	OPEN	23	73	17.6	40 - 102
SHINER SURFPERCH					
6/14	OPEN	8	105	10.9	93 - 124
7/9, 10	OPEN	48	109	8.8	95 - 133
8/6, 7, 9	CLOSED	22	72	32.7	41 - 116
SURF SMELT					
7/9	OPEN	1	210	---	---
PACIFIC HERRING					
7/12	OPEN	7	169	9.2	155 – 181
BAY PIPEFISH					
8/7	CLOSED	1	223	---	---

Table 2007.3. Mean condition factor (K'), sample size, standard deviation, minimum and maximum values of captured salmonids measured (fork length cm) and weighed (g) from the Redwood Creek embayment, Humboldt County, California, during the summer and fall of 2007. Condition factor is calculated as: $K' = 100W_{(g)} / FKL_{(cm)}^b$. Slope (b) was calculated as: $\log_{10} \text{Weight}_{(g)} = \log_{10} a + b \log_{10} \text{Fork Length}_{(cm)}$.

Date (week of)	6/11/2007	7/9/2007	8/6/2007	8/30/2007	9/17/2007	10/23/2007	Summer/ Fall 2007
Chinook Salmon (b = 2.9303)							
Mean	1.2418	1.2626	1.3192	1.2763	1.2660	---	1.2719
Count	33	36	31	4	26	---	130
Standard Deviation	0.1538	0.0662	0.0823	0.0585	0.0631	---	0.1014
Minimum	0.7499	1.1210	1.1763	1.1971	1.1432	---	0.7499
Maximum	1.6991	1.3699	1.5689	1.3269	1.3793	---	1.6991
Coho Salmon (b = 2.8395)							
Mean	1.5291	1.5112	---	---	---	---	1.5282
Count	38	2	---	---	---	---	40
Standard Deviation	0.0914	0.2699	---	---	---	---	0.0990
Minimum	1.2643	1.3204	---	---	---	---	1.2643
Maximum	1.7331	1.7021	---	---	---	---	1.7331
Steelhead Trout (b = 2.8318)							
Mean	1.6483	1.7588	1.7932	1.7376	2.0529	1.2826	1.7964
Count	30	30	33	30	33	2	158
Standard Deviation	0.1398	0.1471	0.2395	0.1297	2.2854	0.3228	1.0536
Minimum	1.3677	1.4798	1.4817	1.2229	1.3891	1.0543	1.0543
Maximum	2.0024	2.0594	2.8989	1.9376	14.7687	1.5108	14.7687
Cutthroat Trout (b = 3.2656)							
Mean	0.4715	0.4468	0.4640	0.5218	0.4824	---	0.4662
Count	34	24	4	2	11	---	75
Standard Deviation	0.0440	0.0453	0.0455	0.0258	0.0423	---	0.0457
Minimum	0.3870	0.3624	0.4204	0.5036	0.4381	---	0.3624
Maximum	0.5763	0.5556	0.5213	0.5401	0.5527	---	0.5763

2008 Results

Fish Monitoring

Sampling Dates – The Redwood Creek estuary embayment was sampled four weeks during the summer of 2008 for concurrent population and growth estimates. Sample dates were June 9, 10, and 12; July 7, 8, and 10; August 11, 12, and 14; and September 15, 16, and 18, 2008. An additional growth estimate was conducted on October 16.

Seines and Fish Handled - The total number of estuary seine hauls in 2008 was 50. The numbers of salmonid fish processed during estuary monitoring were 12,676 juvenile chinook (113 incidental mortalities, 0.89%), 1,794 steelhead (3 incidental mortality, 0.17%), 68 coho smolts (0 incidental mortality), and 3 coastal cutthroat (0 incidental mortality) for a total of 14,541 fish and 116 incidental mortalities (0.80%).

Fish Presence – During the summer/fall of 2008 four salmonid species were seined in the Redwood Creek embayment; chinook and coho salmon, and steelhead and coastal cutthroat trout. Juvenile chinook and steelhead were present on all sample weeks between June 9 and October 16. Coho salmon were captured on all three days in June and one fish on July 10. Coastal cutthroat were captured in June and August.

In addition to the juvenile salmonids and adult cutthroat captured, nine additional fish species were captured; Coastrange, Prickly, and Staghorn Sculpin, Pacific Herring, Saddleback Gunnel, Shiner Surfperch, Starry Flounder, Surf Smelt, and Threespine Stickleback.

Seined Species		2008 Date (Week of)				
Common Name	Scientific Name	June 9	July 7	August 11	September 15	October 16
Salmonid Fish						
Chinook Salmon *	<i>Oncorhynchus tshawytscha</i>					
Coastal Cutthroat Trout	<i>Oncorhynchus clarki</i>					
Coho Salmon *	<i>Oncorhynchus kisutch</i>					
Steelhead Trout *	<i>Oncorhynchus mykiss</i>					
Other Fish						
Coastrange Sculpin	<i>Cottus aleuticus</i>					
Pacific Herring	<i>Clupea pallasii</i>					
Prickly Sculpin	<i>Cottus asper</i>					
Saddleback Gunnel	<i>Pholis ornata</i>					
Shiner Surfperch	<i>Cymatogaster aggregata</i>					
Staghorn Sculpin	<i>Leptocottus armatus</i>					
Starry Flounder	<i>Platichthys stellatus</i>					
Surf Smelt	<i>Hypomesus pretiosus</i>					
Threespine Stickleback	<i>Gasterosteus aculeatus</i>					
* = Federally listed as Threatened Shading denotes presence.						

Table 2008.1. Population estimates and 95 percent confidence intervals for juvenile chinook and coho salmon, juvenile steelhead trout, and coastal cutthroat trout seined in the Redwood Creek estuary embayment, Humboldt County, California, summer 2008 Mouth of creek denotes if Redwood Creek mouth was open or closed to the Pacific Ocean during the estimate.

2008 DATE	Mouth of Creek (Open or Closed)	Chinook Salmon		Coho Salmon	
		Population Estimate	95% Confidence Interval	Population Estimate	95% Confidence Interval
6/9,10,12	OPEN	11,170	9,480 – 12,860	340	61 ^a - 775
7/7, 8, 10	OPEN	209,420	134, 090 – 284,740	1 ^a	---
8/11,12,14	CLOSED	63,110	35,950 – 90,280	None caught	None caught
9/15,16,18	CLOSED	21,560	16,230 – 26,290	None caught	None caught
		Steelhead Trout		Cutthroat Trout	
6/9,10,12	OPEN	8,860	5,340 – 12,380	2 ^a	---
7/7, 8, 10	OPEN	22,310	298 ^b – 65,740	None caught	---
8/11,12,14	CLOSED	64 ^a	---	1 ^a	---
9/15,16,18	CLOSED	1,000	660 – 1,340	None caught	None caught
a. Actual number of fish captured in seine net hauls. No marked fish were recaptured.					
b. Actual minimum count, calculated 95% lower confidence interval was below what was actually caught					

Table 2008.2. Mean fork length (mm), mean weight (g), standard deviation, range, dates, and numbers sampled of juvenile chinook and coho salmon; and steelhead, coastal cutthroat seined in the Redwood Creek estuary embayment, Humboldt County, California, during summer/fall of 2008. Mouth denotes if Redwood Creek mouth was open or closed to the ocean.

Growth - Redwood Creek Estuary – Summer/Fall 2008									
2008 DATE	MOUTH	FORK LENGTH (mm)				WEIGHT (g)			
		No. Measured	Mean	Std. Dev	Range	No. Weighed	Mean	Std. Dev.	Range
JUVENILE CHINOOK SALMON									
6/9, 12	OPEN	206	76	7.1	49 – 95	31	4.6	1.7	1.1 – 8.0
7/7, 10	OPEN	206	78	7.0	59 – 101	31	5.1	1.3	2.8 – 8.0
8/11,12	CLOSED	213	84	5.9	67 – 100	31	6.1	1.2	4.3 – 9.3
9/15, 16, 18	CLOSED	210	87	6.4	74 - 133	34	6.3	0.9	4.5 – 8.1
10/16	CLOSED	205	91	5.1	74 - 109	30	7.4	1.3	4.8 – 10.3
JUVENILE COHO SALMON									
6/9, 10, 12	OPEN	61	115	10.0	89 – 138	49	16.8	4.0	7.5 - 26.6
7/10	OPEN	1	99	---	---	1	10.1	---	---
8/11, 12, 14	CLOSED	None caught	---	---	---	---	---	---	---
9/15, 16, 18	CLOSED	None caught	---	---	---	---	---	---	---
10/16	CLOSED	None caught	---	---	---	---	---	---	---
JUVENILE STEELHEAD TROUT									
6/9	OPEN	205	127	19.6	90 - 255	30	25.9	12.6	8.5 – 56.4
7/7, 8, 10	OPEN	182	94	29.2	57 – 168	30	9.6	9.0	2.3 – 39.0
8/11, 12, 14	CLOSED	64	104	33.3	63 – 175	30	15.3	13.7	2.7 – 47.2
9/15, 16, 18	CLOSED	229	116	31.6	55 – 229	30	21.1	21.8	5.1 – 114.0
10/16	CLOSED	212	122	32.5	66 – 207	30	19.5	12.2	3.3 – 43.8
9/15, 16, 18	CLOSED	None caught	---	---	---	---	---	---	---
10/16	CLOSED	None caught	---	---	---	---	---	---	---

Growth - Redwood Creek Estuary – Summer/Fall 2008 (cont.)

2008 DATE	MOUTH	FORK LENGTH (mm)				WEIGHT (g)			
		No. Measured	Mean	Std. Dev	Range	No. Weighed	Mean	Std. Dev.	Range
CUTTHROAT TROUT									
6/9	OPEN	2	219	6.4	214 – 223	2	115.0	21.2	100.0 – 130.0
7/7, 8, 10	OPEN	None caught	---	---	---	---	---	---	---
8/14	CLOSED	1	208	---	---	1	58.3	---	---
9/15, 16, 18	CLOSED	None caught	---	---	---	---	---	---	---
10/16	CLOSED	None caught	---	---	---	---	---	---	---
HALF POUNDER STEELHEAD									
9/18	CLOSED	1	359	---	---	1	562	---	---

Table 2008.2b. Mean total length (mm), standard deviation, range, dates, and numbers sampled of non-salmonid fish captured in the Redwood Creek estuary embayment, Humboldt County, California, during summer 2008. Mouth denotes if Redwood Creek mouth was open or closed to the ocean.

Growth - Redwood Creek Estuary – Summer/Fall 2008					
2008 DATE	MOUTH	TOTAL LENGTH (mm)			
		No. Measured	Mean	Std. Dev	Range
JUVENILE STARRY FLOUNDER					
6/9/10/12	OPEN	34	121	26.4	35 - 170
7/7, 8, 10	OPEN	57	48	28.8	31 - 172
8/11, 14	CLOSED	86	72	26.7	48 - 224
9/16, 18	CLOSED	5	75	8.3	64 - 84
10/16	CLOSED	32	77	11.0	57 - 101
SHINER SURFPERCH					
6/9	OPEN	3	91	2.6	89 – 94
SURF SMELT					
7/7, 8, 10	OPEN	9	139	19.9	87 - 152
8/11	CLOSED	1	126	---	---
9/15	CLOSED	1	162	---	---
PACIFIC HERRING					
7/8	OPEN	1	144	---	---

Table 2008.3. Mean condition factor (K'), sample size, standard deviation, minimum and maximum values of captured salmonids measured (fork length cm) and weighed (g) from the Redwood Creek embayment, Humboldt County, California, during the summer and fall of 2008. Condition factor is calculated as: $K' = 100W_{(g)} / FKL_{(cm)}^b$. Slope (b) was calculated as: $\log_{10} \text{Weight}_{(g)} = \log_{10} a + b \log_{10} \text{Fork Length}_{(cm)}$.

Condition Factor (K') - Redwood Creek Estuary 2008						
Date (week of)	6/9/2009	7/7/2008	8/11/2008	9/15/2008	10/16/2008	Summer/ Fall 2008
Chinook Salmon (b = 2.8190)						
Mean	1.4906	1.5549	1.4709	1.4225	1.5228	1.4908
Count	31	31	31	34	30	157
Standard Deviation	0.1321	0.1792	0.1281	0.1261	0.1022	0.1418
Minimum	1.1260	0.7293	1.2356	0.9935	1.1514	0.7293
Maximum	1.8961	1.7683	1.7848	1.6335	1.7018	1.8961
Coho Salmon (b =2.8395)						
Mean	1.5881	1.5038	---	---	---	1.5864
Count	49	1	---	---	---	50
Standard Deviation	0.1114	---	---	---	---	0.1109
Minimum	1.1659	---	---	---	---	1.1659
Maximum	1.8006	---	---	---	---	1.8006
Steelhead Trout (b =2.9458)						
Mean	1.3116	1.1393	1.2044	1.1159	1.1873	1.1917
Count	30	30	30	30	30	150
Standard Deviation	0.5653	0.0901	0.1514	0.0931	0.1243	0.2785
Minimum	1.0038	1.0124	0.9421	0.8081	1.0062	0.8081
Maximum	4.2778	1.3485	1.6198	1.2931	1.7752	4.2778
Cutthroat Trout (b =3)						
Mean	1.0963	---	0.6479	---	---	0.9468
Count	2	---	1	---	---	3
Standard Deviation	0.1074	---	---	---	---	0.2698
Minimum	1.0204	---	0.6479	---	---	0.6479
Maximum	1.1723	---	0.6479	---	---	1.1723

Fish Monitoring

Seines and Fish Handled - The total number of estuary seine hauls in 2009 was 63. The numbers of salmonid fish processed during estuary monitoring were 9,212 juvenile chinook (65 incidental mortalities, 0.71%), 1,947 steelhead (5 incidental mortality, 0.26%), 184 coho smolts (0 incidental mortality), and 9 coastal cutthroat (0 incidental mortality) for a total of 11,352 fish and 70 incidental mortalities (0.62%). Authorization for handling threatened fish was under Redwood National Park's 4(d) NOAA/CDFW permit #13739 and CDFW Scientific Collecting Permit #SC-10028.

In addition to the juvenile salmonids and adult cutthroat captured, seven additional fish species were captured; Prickly and Staghorn Sculpin, Saddleback Gunnel, Shiner Surfperch, Starry Flounder, Surf Smelt, and Threespine Stickleback.

Seined Species		2009 Date (Week of)				
Common Name	Scientific Name	June 8	July 6	August 10	September 14	October 15
Salmonid Fish						
Chinook Salmon *	<i>Oncorhynchus tshawytscha</i>					
Coastal Cutthroat Trout	<i>Oncorhynchus clarki</i>					
Coho Salmon *	<i>Oncorhynchus kisutch</i>					
Steelhead Trout *	<i>Oncorhynchus mykiss</i>					
Other Fish						
Prickly Sculpin	<i>Cottus asper</i>					
Saddleback Gunnel	<i>Pholis ornata</i>					
Shiner Surfperch	<i>Cymatogaster aggregata</i>					
Staghorn Sculpin	<i>Leptocottus armatus</i>					
Starry Flounder	<i>Platichthys stellatus</i>					
Surf Smelt	<i>Hypomesus pretiosus</i>					
Threespine Stickleback	<i>Gasterosteus aculeatus</i>					
* = Federally listed as Threatened Shading denotes presence.						

Table 2009.1. Population estimates and 95 percent confidence intervals for juvenile chinook and coho salmon, juvenile steelhead trout, and coastal cutthroat trout seined in the Redwood Creek estuary embayment, Humboldt County, California, summer 2009. Mouth of creek denotes if Redwood Creek mouth was open or closed to the Pacific Ocean during the estimate.

2009 DATE	Mouth of Creek (Open or Closed)	Chinook Salmon		Coho Salmon	
		Population Estimate	95% Confidence Interval	Population Estimate	95% Confidence Interval
6/8, 9, 11	OPEN	9,600	8,450 – 10,760	1,250	320 – 2,190
7/6, 7, 9	OPEN	23,820	18,660 – 28,980	2 ^a	---
8/10, 11, 13	CLOSED	31,240	18,290 – 44,190	None caught	---
9/14, 15, 17	CLOSED	11,160	8,040 – 14,270	None caught	---
		Steelhead Trout		Cutthroat Trout	
6/8, 9, 11	OPEN	1,530	1,150 – 1,910	None caught	---
7/6, 7, 9	OPEN	44 ^a	---	None caught	---
8/10, 11, 13	CLOSED	6,960	3,910 – 10,020	3 ^a	---
9/14, 15, 17	CLOSED	2,990	1,650 – 4,330	4 ^a	---
a. Actual number of fish captured in seine net hauls. No marked fish were recaptured.					

Table 2009.2. Mean fork length (mm), mean weight (g), standard deviation, range, dates, and numbers sampled of juvenile chinook and coho salmon; and steelhead, coastal cutthroat seined in the Redwood Creek estuary embayment, Humboldt County, California, during summer/fall of 2009. Mouth denotes if Redwood Creek mouth was open or closed to the ocean.

Growth - Redwood Creek Estuary – Summer/Fall 2009									
2009 DATE	MOUTH	FORK LENGTH (mm)				WEIGHT (g)			
		No. Measured	Mean	Std. Dev	Range	No. Weighed	Mean	Std. Dev.	Range
JUVENILE CHINOOK SALMON									
6/8, 11	OPEN	238	66	7.1	48 – 83	32	2.9	0.9	1.3 – 5.0
7/6	OPEN	206	73	6.5	55 – 89	31	4.2	1.0	1.8 – 5.4
8/10	CLOSED	205	89	4.9	72 – 100	30	7.0	0.9	4.8 – 8.6
9/14, 15, 17	CLOSED	216	99	5.7	82 – 118	34	11.0	2.1	6.1 – 15.5
10/15	CLOSED	238	105	5.2	89 – 122	32	12.4	1.8	7.9 – 15.6
JUVENILE COHO SALMON									
6/8, 9, 11	OPEN	174	105	8.4	79 – 133	30	11.4	3.2	8.3 – 22.1
7/8	OPEN	2	110	1.4	109 – 111	2	13.5	0.1	13.4 – 13.5
8/10, 11, 13	CLOSED	None caught	---	---	---	---	---	---	---
9/14, 15, 17	CLOSED	None caught	---	---	---	---	---	---	---
10/15	CLOSED	None caught	---	---	---	---	---	---	---
JUVENILE STEELHEAD TROUT									
6/8, 9	OPEN	200	111	13.9	78 – 157	30	14.1	5.4	5.4 – 25.6
7/6, 7, 9	OPEN	44	118	14.7	79 – 147	30	17.6	7.1	5.1 – 33.4
8/10, 11, 13	CLOSED	214	136	14.7	79 -171	31	30.2	8.0	10.4 – 51.6
9/14	CLOSED	213	147	17.4	95 – 197	30	35.9	12.0	15.7 – 62.5
10/15	CLOSED	167	157	15.1	116 – 220	30	43.2	7.6	27.3 – 61.6

Growth - Redwood Creek Estuary – Summer/Fall 2009 (cont.)

2009 DATE	MOUTH	FORK LENGTH (mm)				WEIGHT (g)			
		No. Measured	Mean	Std. Dev	Range	No. Weighed	Mean	Std. Dev.	Range
CUTTHROAT TROUT									
6/8, 9, 11	OPEN	None caught	---	---	---	---	---	---	---
7/6,7, 9	OPEN	None caught	---	---	---	---	---	---	---
8/11, 13	CLOSED	3	233	61.6	163 – 278	3	171.1	113.3	41.3 - 250
9/14, 17	CLOSED	4	255	30.9	214 – 289	4	171.9	73.7	83.7 - 264
10/15	CLOSED	2	288	21.2	273 – 303	2	267.0	46.7	234 - 300
HALF POUNDER STEELHEAD									
9/17	CLOSED	1	283	---	---	1	276	---	---

Table 2009.3. Mean condition factor (K'), sample size, standard deviation, minimum and maximum values of captured salmonids measured (fork length cm) and weighed (g) from the Redwood Creek embayment, Humboldt County, California, during the summer and fall of 2009. Condition factor is calculated as: $K' = 100W_{(g)} / FKL_{(cm)}^b$. Slope (b) was calculated as: $\log_{10} \text{Weight}_{(g)} = \log_{10} a + b \log_{10} \text{Fork Length}_{(cm)}$.

Condition Factor (K') - Redwood Creek Estuary 2009						
Date (week of)	6/8/2009	7/6/2009	8/10/2009	9/14/2009	10/15/2009	Summer/ Fall 2009
Chinook Salmon (b = 3.0547)						
Mean	0.9617	0.9201	0.9088	0.9674	0.9583	0.9441
Count	32	31	30	34	32	159
Standard Deviation	0.0620	0.0480	0.0364	0.0643	0.0657	0.0609
Minimum	0.8218	0.8152	0.8469	0.8534	0.7935	0.7935
Maximum	1.0981	1.0519	0.9714	1.1803	1.1205	1.1803
Coho Salmon (b = 2.6700)						
Mean	2.2141	2.2299	---	---	---	2.2151
Count	30	2	---	---	---	32
Standard Deviation	0.1536	0.0648	---	---	---	0.1491
Minimum	1.9285	2.1841	---	---	---	1.9285
Maximum	2.6700	2.2758	---	---	---	2.6700
Steelhead Trout (b = 2.9658)						
Mean	1.1590	1.1363	1.1912	1.1912	1.1634	1.1684
Count	30	30	31	30	30	151
Standard Deviation	0.0792	0.0656	0.0683	0.0620	0.0783	0.0731
Minimum	1.0153	0.9963	1.0064	0.9820	0.9049	0.9049
Maximum	1.3156	1.2611	1.3215	1.2923	1.2959	1.3215
Cutthroat Trout (b = 3.3656)						
Mean	---	---	0.3592	0.2985	0.3266	0.3250
Count	---	---	3	4	2	9
Standard Deviation	---	---	0.0257	0.0168	0.0236	0.0336
Minimum	---	---	0.3438	0.2787	0.3099	0.2787
Maximum	---	---	0.3889	0.3198	0.3433	0.3889

Fish Monitoring

Seines and Fish Handled - The total number of estuary seine hauls in 2010 was 93. The numbers of salmonid fish processed during estuary monitoring were 3,017 juvenile chinook (9 incidental mortalities, 0.30%), 1,778 steelhead (2 incidental mortality, 0.11%), 22 coho smolts (0 incidental mortality), and 115 coastal cutthroat (0 incidental mortality) for a total of 4,932 fish and 11 incidental mortalities (0.22%). Authorization for handling threatened fish was under Redwood National Park's 4(d) NOAA/CDFW permit #14992 and CDFW Scientific Collecting Permit #SC-10028.

In addition to the salmonids, eight additional fish species were captured; Pacific Lamprey, Prickly Sculpin, Sacramento Sucker, Shiner Surfperch, Staghorn Sculpin, Starry Flounder, Surf Smelt, and Threespine Stickleback.

Seined Species		2010 Date (Week of)				
Common Name	Scientific Name	June 21	July 12	Aug 16	Sept 13	Oct 19
Salmonid Fish						
Chinook Salmon *	<i>Oncorhynchus tshawytscha</i>					
Coastal Cutthroat Trout	<i>Oncorhynchus clarki</i>					
Coho Salmon *	<i>Oncorhynchus kisutch</i>					
Steelhead Trout *	<i>Oncorhynchus mykiss</i>					
Other Fish						
Lamprey (Amocoete)	<i>Entosphenus tridentatus</i>					
Prickly Sculpin	<i>Cottus asper</i>					
Sacramento Sucker	<i>Catostomus occidentalis</i>					
Shiner Surfperch	<i>Cymatogaster aggregata</i>					
Staghorn Sculpin	<i>Leptocottus armatus</i>					
Starry Flounder	<i>Platichthys stellatus</i>					
Surf Smelt	<i>Hypomesus pretiosus</i>					
Threespine Stickleback	<i>Gasterosteus aculeatus</i>					
* = Federally listed as Threatened Shading denotes presence.						

Table 2010.1. Population estimates and 95 percent confidence intervals for juvenile chinook and coho salmon, juvenile steelhead trout, and coastal cutthroat trout seined in the Redwood Creek estuary embayment, Humboldt County, California, summer 2010. Mouth of creek denotes if Redwood Creek mouth was open or closed to the Pacific Ocean during the estimate.

2010 DATE	Mouth of Creek (Open or Closed)	Chinook Salmon		Coho Salmon	
		Population Estimate	95% Confidence Interval	Population Estimate	95% Confidence Interval
6/21, 22, 24	OPEN	256 ^a	---	22 ^a	---
7/12, 13, 15	OPEN	25,730	6,990 – 44,480	None caught	---
8/16, 17, 19	OPEN	5,770	3,690 – 7,860	None caught	---
9/13, 14, 16	CLOSED	3,980	2,550 – 5,410	None caught	---
		Steelhead Trout		Cutthroat Trout	
6/21, 22, 24	OPEN	5,000	770 – 9,230	19 ^a	---
7/12, 13, 15	OPEN	3,420	236 ^b – 6,650	150	36 ^b - 330
8/16, 17, 19	OPEN	4,270	2,240 – 6,310	18 ^a	---
9/13, 14, 16	CLOSED	5,620	2,600 – 8,650	195	27 ^b - 550
a. Actual number of fish captured in seine net hauls. No marked fish were recaptured.					
b. Actual minimum count, calculated 95% lower confidence interval was below what was actually caught					

Table 2010.2a. Mean fork length (mm), mean weight (g), standard deviation, range, dates, and numbers sampled of juvenile chinook and coho salmon, steelhead and coastal cutthroat trout seined in the Redwood Creek estuary embayment, Humboldt County, California, during summer/fall of 2010 from June 21 to October 19. Mouth denotes if Redwood Creek mouth was open or closed to the ocean.

Fish Growth - Redwood Creek Estuary – Summer/Fall 2010									
2010 DATE	MOUTH	FORK LENGTH (mm)				WEIGHT (g)			
		No. Measured	Mean	Std. Dev	Range	No. Weighed	Mean	Std. Dev.	Range
JUVENILE CHINOOK SALMON									
6/21, 22	OPEN	200	66	10.0	49 - 106	30	3.3	1.5	1.7 – 8.1
7/12	OPEN	204	74	7.1	55 - 88	31	5.0	1.3	2.1 – 7.8
8/16	OPEN	205	88	6.8	70 - 110	30	7.8	1.7	5.1 – 11.0
9/13, 14, 16	CLOSED	206	94	4.7	83 - 108	32	9.5	1.3	6.9 – 12.3
10/19	CLOSED	312	107	4.6	89 - 122	30	13.7	2.2	9.8 – 19.7
JUVENILE COHO SALMON									
6/21, 22, 24	OPEN	22	108	8.7	94 - 129	22	14.1	3.5	8.5 – 24.1
7/12, 13, 15	OPEN	None caught	---	---	---	---	---	---	---
8/ 16, 17, 19	OPEN	None caught	---	---	---	---	---	---	---
9/13, 14, 16	CLOSED	None caught	---	---	---	---	---	---	---
10/19	CLOSED	None caught	---	---	---	---	---	---	---

Growth - Redwood Creek Estuary – Summer/Fall 2010 (cont.)

2010 DATE	MOUTH	FORK LENGTH (mm)				WEIGHT (g)			
		No. Measured	Mean	Std. Dev	Range	No. Weighed	Mean	Std. Dev.	Range
JUVENILE STEELHEAD TROUT									
6/21, 22	OPEN	200	120	16.4	85 - 173	30	19.2	9.1	8.4 – 55.0
7/12, 13, 15	OPEN	204	130	17.7	81 - 174	30	22.1	8.7	10.2 – 41.7
8/16, 17	OPEN	206	139	23.3	77 - 186	30	34.1	16.1	6.6 – 72.0
9/13, 14, 16	CLOSED	207	144	16.6	77 - 189	32	35.9	11.1	20.0 – 75.8
10/19	CLOSED	194	152	18.3	94 - 196	30	41.3	10.7	26.4 – 69.9
COASTAL CUTTHROAT TROUT									
6/21, 22, 24	OPEN	19	190	38.5	138 - 299	19	84.0	71.6	30.4 - 326
7/12, 13, 15	OPEN	36	236	68.8	154 - 393	36	170.8	169.2	35.3 - 740
8/16, 17, 19	OPEN	18	261	57.9	168 - 385	18	238.2	180.2	52.0 - 688
9/13, 14, 16	CLOSED	27	246	32.2	184 - 326	27	169.6	81.9	67.1 - 438
10/19	CLOSED	6	242	22.8	227 - 286	6	173.2	71.2	116.9 - 284

Table 2010.2b. Mean total length (mm), standard deviation, range, dates, and numbers sampled of non-salmonid fish captured in the Redwood Creek estuary embayment, Humboldt County, California, during summer 2010. Mouth denotes if Redwood Creek mouth was open or closed to the ocean.

Growth - Redwood Creek Estuary – Summer/Fall 2010					
2010 DATE	MOUTH	TOTAL LENGTH (mm)			
		No. Measured	Mean	Std. Dev	Range
JUVENILE STARRY FLOUNDER					
6/21, 22, 24	OPEN	17	126	19.4	90 - 161
7/12, 13, 15	OPEN	5	125	17.3	115 - 155
8/16, 17	OPEN	1	201	---	---
9/16	CLOSED	1	154	---	---
SHINER SURFPERCH					
6/24	OPEN	1	126	---	---
7/15	OPEN	1	95	---	---

Table 2010.3. Mean condition factor (K'), sample size, standard deviation, minimum and maximum values of captured salmonids measured (fork length cm) and weighed (g) from the Redwood Creek embayment, Humboldt County, California, during the summer and fall of 2010. Condition factor is calculated as: $K' = 100W_{(g)} / FKL_{(cm)}^b$. Slope (b) was calculated as: $\log_{10} \text{Weight}_{(g)} = \log_{10} a + b \log_{10} \text{Fork Length}_{(cm)}$.

Condition Factor (K') - Redwood Creek Estuary 2010						
Date (week of)	6/21/2010	7/12/2010	8/16/2010	9/13/2010	10/19/2010	Summer/ Fall 2010
Chinook Salmon (b = 2.811)						
Mean	1.662	1.766	1.756	1.709	1.705	1.720
Count	30	31	30	32	30	153
Standard Deviation	0.240	0.100	0.089	0.092	0.078	0.137
Minimum	1.096	1.591	1.609	1.570	1.535	1.096
Maximum	2.276	2.138	2.004	1.931	1.906	2.276
Coho Salmon (b = 2.606)						
Mean	2.803	---	---	---	---	---
Count	22	---	---	---	---	---
Standard Deviation	0.345	---	---	---	---	---
Minimum	1.976	---	---	---	---	---
Maximum	3.720	---	---	---	---	---
Steelhead Trout (b = 2.872)						
Mean	1.432	1.592	1.559	1.511	1.516	1.522
Count	30	30	30	32	30	152
Standard Deviation	0.141	0.744	0.078	0.079	0.082	0.342
Minimum	1.047	1.287	1.412	1.378	1.357	1.047
Maximum	1.749	5.500	1.685	1.713	1.667	5.500
Cutthroat Trout (b = 3.142)						
Mean	0.687	0.652	0.716	0.681	0.757	0.682
Count	19	36	18	27	6	106
Standard Deviation	0.056	0.098	0.049	0.061	0.211	0.089
Minimum	0.604	0.390	0.609	0.588	0.616	0.390
Maximum	0.802	0.835	0.788	0.805	1.180	1.180

2011 Results

Fish Monitoring

Sampling Dates – The Redwood Creek estuary embayment was sampled four weeks during the summer of 2011 for population and growth estimates. Sample dates were June 13, 14, and 16; July 11, 12, and 14; August 22, 23, and 25; and September 12, 13, and 15, 2011. An October growth estimate was cancelled when early October rains opened the estuary on October 5, 2011.

Seines and Fish Handled - The total number of estuary seine hauls in 2006 was 103. The numbers of salmonid fish processed during estuary monitoring were 3,170 juvenile chinook (34 incidental mortalities, 1.07%), 1,422 steelhead (2 incidental mortality, 0.14%), 227 coho smolts (0 incidental mortality), and 111 coastal cutthroat (0 incidental mortality) for a total of 4,930 fish and 36 incidental mortalities (0.73%). Authorization for handling threatened fish was under Redwood National Park's 4(d) NOAA/CDFW permit #16795 and CDFW Scientific Collecting Permit #SC-10028.

Salmonid Fish Presence – During the summer of 2011 four salmonid species were seined in the Redwood Creek embayment; chinook and coho salmon, and steelhead and coastal cutthroat trout. Juvenile chinook and steelhead and coastal cutthroat trout were present on all sample dates between June 13 and September 15. Coho salmon were captured on all three days in June and none the rest of the summer.

In addition to the salmonids captured, eight additional fish species were captured; Pacific Lamprey, Prickly Sculpin, Sacramento Sucker, Shiner Surfperch, Staghorn Sculpin, Starry Flounder, Surf Smelt, and Threespine Stickleback. Surf smelt presence, a marine species, was due to the mouth of the creek being open to the ocean.

Seined Species		2011 Date (Week of)			
Common Name	Scientific Name	June 13	July 11	August 22	September 12
Salmonid Fish					
Chinook Salmon *	<i>Oncorhynchus tshawytscha</i>				
Coastal Cutthroat Trout	<i>Oncorhynchus clarki</i>				
Coho Salmon *	<i>Oncorhynchus kisutch</i>				
Steelhead Trout *	<i>Oncorhynchus mykiss</i>				
Other Fish					
Pacific Lamprey	<i>Entosphenus tridentatus</i>				
Prickly Sculpin	<i>Cottus asper</i>				
Sacramento Sucker	<i>Catostomus occidentalis</i>				
Shiner Surfperch	<i>Cymatogaster aggregata</i>				
Staghorn Sculpin	<i>Leptocottus armatus</i>				
Starry Flounder	<i>Platichthys stellatus</i>				
Surf Smelt	<i>Hypomesus pretiosus</i>				
Threespine Stickleback	<i>Gasterosteus aculeatus</i>				
* = Federally listed as Threatened Shading denotes presence.					

Table 2011.1. Population estimates and 95 percent confidence intervals for juvenile chinook and coho salmon, juvenile steelhead trout, and coastal cutthroat trout seined in the Redwood Creek estuary embayment, Humboldt County, California, summer 2011. Mouth of creek denotes if Redwood Creek mouth was open or closed to the Pacific Ocean during the estimate.

2011 DATE	Mouth of Creek (Open or Closed)	Chinook Salmon		Coho Salmon	
		Population Estimate	95% Confidence Interval	Population Estimate	95% Confidence Interval
06/13, 14, 16	OPEN	670	150 - 1,200	970	510 - 1,440
07/11,12, 14	OPEN	142,750	37,750 – 247,750	None caught	---
08/22, 23, 25	CLOSED	9,900	3,960 – 15,830	None caught	---
09/12, 13, 15	CLOSED	333 ^a	---	None caught	---
		Steelhead Trout		Cutthroat Trout	
06/13, 14, 16	OPEN	490	370 - 660	90	37 ^b - 150
07/11,12, 14	OPEN	354 ^a	----	29 ^a	---
08/22, 23, 25	CLOSED	1,210	220 – 2,210	14 ^a	---
09/12, 13, 15	CLOSED	2,680	1,840 – 3,520	24 ^a	---
a. Actual number of fish captured in seine net hauls. No marked fish were recaptured.					
b. Actual minimum count, calculated 95% lower confidence interval was below what was actually caught					

Table 2011.2a. Mean fork length (mm), mean weight (g), standard deviation, range, dates, and numbers sampled of juvenile chinook and coho salmon; and steelhead, coastal cutthroat seined in the Redwood Creek estuary embayment, Humboldt County, California, during summer of 2012. Mouth denotes if Redwood Creek mouth was open or closed to the ocean.

Growth - Redwood Creek Estuary – Summer 2011									
2011 DATE	MOUTH	FORK LENGTH (mm)				WEIGHT (g)			
		No. Measured	Mean	Std. Dev	Range	No. Weighed	Mean	Std. Dev.	Range
JUVENILE CHINOOK SALMON									
6/13, 14, 16	OPEN	140	67	10.1	47 - 95	30	2.5	1.0	1.0 – 4.4
7/11	OPEN	205	79	7.0	59 - 105	30	5.7	1.4	3.2 – 8.1
8/22, 23	CLOSED	205	83	6.0	67 - 99	30	6.7	1.3	4.9 – 9.5
9/12, 13, 15	CLOSED	205	91	5.7	75 - 109	30	8.1	1.1	5.8 – 11.3
JUVENILE COHO SALMON									
6/13, 14, 16	OPEN	212	125	8.8	97 - 154	112	21.1	3.7	12.7 – 34.3
7/11, 12, 14	OPEN	None caught	---	---	---	---	---	---	---
8/22, 23, 25	CLOSED	None caught	---	---	---	---	---	---	---
9/12, 13, 15	CLOSED	None caught	---	----	----	----	----	----	---
JUVENILE STEELHEAD TROUT									
6/13, 14, 16	OPEN	213	123	16.7	88 - 179	30	22.1	9.1	7.8 – 43.6
7/11, 12, 14	OPEN	215	118	26.3	54 - 197	30	16.4	10.7	2.5 – 47.7
8/22, 23, 25	CLOSED	153	132	37.3	62 - 257	30	44.4	34.6	4.0 - 186
9/12	CLOSED	205	145	26.1	70 - 205	30	38.3	14.3	20.5 – 85.2
CUTTHROAT TROUT									
6/13, 14, 16	OPEN	37	185	34.6	136 - 295	37	73.9	50.9	26.7 - 270
7/11, 12, 14	OPEN	29	225	48.5	169 - 363	29	140.1	118.4	45.1 - 550
8/22, 23, 25	CLOSED	14	234	41.8	200 - 370	14	159.9	134.4	87.0 - 616
9/12, 13, 15	CLOSED	24	264	46.6	197 - 376	24	240.1	148.6	84.0 - 630

Table 2011.2b. Mean fork length or total length (mm), standard deviation, range, dates, and numbers sampled of non-salmonid fish seined in the Redwood Creek estuary embayment, Humboldt County, California, during summer of 2011. Mouth denotes if Redwood Creek mouth was open or closed to the ocean.

2011 DATE	MOUTH	LENGTH (mm)			
		No. Measured	Mean	Std. Dev	Range
STARRY FLOUNDER (Total Length)					
7/12	OPEN	1	36	---	---
8/25	OPEN	5	66	5.1	60 - 72
9/12, 13, 15	CLOSED	23	72	8.3	50 - 87
SHINER SURFPERCH (Fork Length)					
6/14	OPEN	1	105	---	---
LAMPREY (Total Length)					
6/16	OPEN	1	59	---	---
SACRAMENTO SUCKER (Total Length)					
9/13	CLOSED	1	220	---	---

Table 2011.3. Mean condition factor (K'), sample size, standard deviation, minimum and maximum values of captured salmonids measured (fork length cm) and weighed (g) from the Redwood Creek embayment, Humboldt County, California, during the summer of 2011. Condition factor is calculated as: $K' = 100W_{(g)} / FKL_{(cm)}^b$. Slope (b) was calculated as: $\log_{10} \text{Weight}_{(g)} = \log_{10} a + b \log_{10} \text{Fork Length}_{(cm)}$.

Condition Factor (K') - Redwood Creek Estuary 2011					
Date (week of)	6/13/2011	7/11/2011	8/22/2011	9/12/2011	Summer 2011
Chinook Salmon (b = 3.1288)					
Mean	0.8088	0.8423	0.8154	0.8234	0.8225
Standard Deviation	0.0696	0.0349	0.0468	0.0504	0.0528
Minimum	0.5725	0.7590	0.6666	0.7331	0.5725
Maximum	0.9103	0.8964	0.8899	0.9204	0.9204
Count	30	30	30	30	120.
Coho Salmon (b = 2.5252)					
Mean	3.6897	---	---	---	---
Standard Deviation	0.2607	---	---	---	---
Minimum	2.9904	---	---	---	---
Maximum	4.5784	---	---	---	---
Count	112	---	---	---	---
Steelhead Trout (b = 2.9502)					
Mean	1.3241	1.2311	1.2424	1.2551	1.2631
Standard Deviation	0.1263	0.1152	0.1132	0.0664	0.1124
Minimum	1.0106	0.9634	1.0996	1.0840	0.9634
Maximum	1.7301	1.4705	1.6983	1.3805	1.7301
Count	30	30	30	30	120
Cutthroat Trout (b = 3.1353)					
Mean	0.7107	0.6842	0.7194	0.7860	0.7219
Standard Deviation	0.0629	0.0530	0.0319	0.3308	0.1677
Minimum	0.5808	0.6109	0.6815	0.6130	0.5808
Maximum	0.8589	0.8272	0.7886	2.3224	2.3224
Count	37	29	14	24	104

2012 Results

Fish Monitoring

Sampling Dates – The Redwood Creek estuary embayment was sampled four weeks during the summer of 2012 for concurrent population and growth estimates. Sample dates were June 4, 5, and 7; July 9, 10, and 12; August 6, 7, and 9; and September 10, 11, and 13, 2012. A planned growth estimate for October 16 was cancelled when the mouth breached the day before. Incoming ocean waves within the estuary were too large to launch the boat and seine.

Seines and Fish Handled - The total number of estuary seine hauls in 2012 was 71. The numbers of salmonid fish processed during estuary monitoring were 2,754 juvenile chinook (43 incidental mortalities, 1.6%), 1,540 steelhead (1 incidental mortality, 0.06%), 333 coho (0 incidental mortality), and 58 coastal cutthroat (0 incidental mortality) for a total of 4,685 fish and 44 incidental mortalities (0.94%). Authorization for handling threatened fish was under Redwood National Park's 4(d) NOAA/CDFW permit #17558 and CDFW Scientific Collecting Permit #SC-10028.

Fish Presence – During the summer of 2012 four salmonid species were seined in the Redwood Creek embayment; chinook and coho salmon, and steelhead and coastal cutthroat trout. Juvenile chinook and steelhead, and cutthroat were present on all sample weeks between June 4 and September 10. Coho salmon were captured on all three sample days in June and none the rest of summer.

In addition to the juvenile salmonids and adult cutthroat captured, eight additional fish species were captured; Coastrange Sculpin, Penpoint Gunnel, Prickly Sculpin, Shiner Surfperch, Staghorn Sculpin, Starry Flounder, Surf Smelt, and Threespine Stickleback. Surf smelt presence, a marine species, was due to the mouth of the creek being open to the ocean.

Seined Species		2012 Date (Week of)			
Common Name	Scientific Name	June 4	July 9	August 6	September 10
Salmonid Fish					
Chinook Salmon *	<i>Oncorhynchus tshawytscha</i>				
Coastal Cutthroat Trout	<i>Oncorhynchus clarki</i>				
Coho Salmon *	<i>Oncorhynchus kisutch</i>				
Steelhead Trout *	<i>Oncorhynchus mykiss</i>				
Other Fish					
Coastrange Sculpin	<i>Cottus aleuticus</i>				
Penpoint Gunnel	<i>Apodichthys flavidus</i>				
Prickly Sculpin	<i>Cottus asper</i>				
Shiner Surfperch	<i>Cymatogaster aggregata</i>				
Staghorn Sculpin	<i>Leptocottus armatus</i>				
Starry Flounder	<i>Platichthys stellatus</i>				
Surf Smelt	<i>Hypomesus pretiosus</i>				
Threespine Stickleback	<i>Gasterosteus aculeatus</i>				
* = Federally listed as Threatened Shading denotes presence.					

Table 2012.1. Population estimates and 95 percent confidence intervals for juvenile chinook and coho salmon, juvenile steelhead trout, and coastal cutthroat trout seined in the Redwood Creek estuary embayment, Humboldt County, California, summer 2012. Mouth of creek denotes if Redwood Creek mouth was open or closed to the Pacific Ocean during the estimate.

2012 DATE	Mouth of Creek (Open or Closed)	Chinook Salmon		Coho Salmon	
		Population Estimate	95% Confidence Interval	Population Estimate	95% Confidence Interval
6/4, 5, 7	OPEN	2,710	± 820 1,890 - 3530	1,960	$\pm 1,060$ 900 – 3,030
7/9, 10, 12	OPEN	95,700	$\pm 70,250$ 25,450 – 165,950	None caught	---
8/6, 7, 9	CLOSED	139 ^a	---	None caught	---
9/10, 11, 13	CLOSED	2,370	$\pm 2,220$ 205 ^b - 4590	None caught	---
		Steelhead Trout		Cutthroat Trout	
6/4, 5, 7	OPEN	1,630	$\pm 1,120$ 510 – 2,740	170	± 310 23 ^b – 480
7/9, 10, 12	OPEN	14,910	$\pm 8,570$ 6,340 – 23,480	8 ^a	---
8/6, 7, 9	CLOSED	49 ^a	---	65	± 110 17 ^b - 180
9/10, 11, 13	CLOSED	430	± 380 79 ^b - 810	5 ^a	---
a. Actual number of fish captured in seine net hauls. No marked fish were recaptured.					
b. Actual minimum count, calculated 95% lower confidence interval was below what was actually caught					

Table 2012.2a. Mean fork length (mm), mean weight (g), standard deviation, range, dates, and numbers sampled of juvenile chinook and coho salmon; and steelhead, coastal cutthroat seined in the Redwood Creek estuary embayment, Humboldt County, California, during summer of 2012. Mouth denotes if Redwood Creek mouth was open or closed to the ocean.

Growth - Redwood Creek Estuary – Summer 2012									
2012 DATE	MOUTH	FORK LENGTH (mm)				WEIGHT (g)			
		No. Measured	Mean	Std. Dev	Range	No. Weighed	Mean	Std. Dev.	Range
JUVENILE CHINOOK SALMON									
6/4, 5	OPEN	205	61	6.4	48 - 79	30	3.0	1.1	1.3 – 5.3
7/9, 10, 12	OPEN	207	78	7.9	56 – 98	32	5.0	1.5	1.9 – 8.2
8/6, 7, 9	CLOSED	140	81	5.4	64 - 96	32	6.1	1.3	4.1 – 9.3
9/10, 11, 13	CLOSED	204	93	5.7	76 – 108	32	9.4	1.7	6.2 – 13.3
JUVENILE COHO SALMON									
6/4, 5, 7	OPEN	319	114	8.0	68 – 146	50	17.1	3.2	11.0 – 27.5
7/9, 10, 12	OPEN	None caught	---	---	---	---	---	---	---
8/6, 7, 9	CLOSED	None caught	---	---	---	---	---	---	---
9/10, 11, 13	CLOSED	None caught	---	----	----	----	----	----	---
JUVENILE STEELHEAD TROUT									
6/4, 5, 7	OPEN	208	129	19.4	52 – 185	30	25.9	8.9	9.0 – 43.7
7/9, 10	OPEN	245	129	18.7	72 – 193	30	25.6	11.8	3.8 – 51.4
8/6, 7, 9	CLOSED	49	144	30.0	63 – 204	30	37.7	17.7	2.9 – 70.6
9/10, 11, 13	CLOSED	79	154	20.0	103 – 199	30	38.7	11.4	10.2 – 63.1
CUTTHROAT TROUT									
6/4, 5, 7	OPEN	26	245	55.5	159 – 319	26	185.6	114.6	43.8 - 380
7/9, 10, 12	OPEN	8	261	71.1	140 – 326	8	242.3	162.3	29.0 - 434
8/6, 7, 9	CLOSED	17	270	64.3	198 - 422	17	259.6	208.0	68.1 - 788
9/10, 11, 13	CLOSED	5	256	41.9	221 – 310	5	201.1	114.1	109.0 - 364

Table 2012.2b. Mean fork length or total length (mm), standard deviation, range, dates, and numbers sampled of non-salmonid fish seined in the Redwood Creek estuary embayment, Humboldt County, California, during summer of 2012. Mouth denotes if Redwood Creek mouth was open or closed to the ocean.

2012 DATE	MOUTH	LENGTH (mm)			
		No. Measured	Mean	Std. Dev	Range
STARRY FLOUNDER (Total Length)					
6/4, 5, 7	OPEN	12	148	11.6	126 - 163
7/9, 10, 12	OPEN	11	139	51.1	37 - 198
8/6, 7, 9	CLOSED	8	65	10.6	51 -82
9/10, 11, 13	CLOSED	15	78	9.1	64 - 92
SHINER SURFPERCH (Fork Length)					
6/4, 5, 7	OPEN	98	105	10.5	81 - 133
PENPOINT GUNNEL (Total Length)					
6/4, 5, 7	OPEN	1	114	---	---

Table 2012.3. Mean condition factor (K'), sample size, standard deviation, minimum and maximum values of captured salmonids measured (fork length cm) and weighed (g) from the Redwood Creek embayment, Humboldt County, California, during the summer of 2012. Condition factor is calculated as: $K' = 100W_{(g)} / FKL_{(cm)}^b$. Slope (b) was calculated as: $\log_{10} \text{Weight}_{(g)} = \log_{10} a + b \log_{10} \text{Fork Length}_{(cm)}$.

Condition Factor (K') - Redwood Creek Estuary 2012					
Date (week of)	6/4/2012	7/9/2012	8/7/2012	9/10/2012	Summer 2012
Chinook Salmon (b = 3.0440)					
Mean	1.0453	0.9640	1.0356	1.0644	1.0270
Standard Deviation	0.1691	0.1087	0.0866	0.1024	0.1245
Minimum	0.8185	0.6521	0.9096	0.8791	0.6521
Maximum	1.6967	1.3264	1.4054	1.2979	1.6967
Count	30	32	32	32	126
Coho Salmon (b = 2.6123)					
Mean	3.0005	---	---	---	---
Standard Deviation	0.1880	---	---	---	---
Minimum	2.6516	---	---	---	---
Maximum	3.5375	---	---	---	---
Count	50	---	---	---	---
Steelhead Trout (b = 2.9365)					
Mean	1.3153	1.2973	1.3138	1.2227	1.2873
Standard Deviation	0.1030	0.1158	0.1332	0.0711	0.1134
Minimum	1.0987	0.8788	1.1562	1.0824	0.8788
Maximum	1.5376	1.4975	1.7234	1.3721	1.7234
Count	30	30	30	30	120
Cutthroat Trout (b = 3.2125)					
Mean	0.5518	0.5577	0.5362	0.5500	0.5477
Standard Deviation	0.0423	0.0411	0.0487	0.0428	0.0438
Minimum	0.4723	0.5053	0.4504	0.4996	0.4504
Maximum	0.6096	0.6149	0.6052	0.5991	0.6149
Count	26	8	17	5	56

*Prepared by: David G. Anderson, REDW Fishery Biologist
Redwood National and State Parks, P.O. Box 7, 121200 Highway 101, Orick, CA 95555
(707) 465-7771 david_g_anderson@nps.gov*