DISTRIBUTION AND ABUNDANCE OF COHO AND STEELHEAD IN REDWOOD CREEK IN AUGUST 1995

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ABSTRACT. Despite heavy January and March storms, coho density in Redwood Creek in 1995 was similar to 1992 and 1993. Steelhead were much more abundant than in previous sampling years. High summer streamflows prevented coho and steelhead losses, due to pumping, which occurred at downstream sites in dry years.

INTRODUCTION

Previous electroshock sampling on Redwood Creek in 1988 (Hofstra and Anderson 1989), 1992, 1993 and 1994 (Smith 1994a) has shown very strong coho <u>(Oncorhynchus kisutch)</u> year classes in 1992 and 1993 and weak year classes in 1988 and 1994. Since wild female coho are exclusively three year olds (Shapovalov and Taft 1954), weak year classes will tend to repeat in subsequent three year cycles, if not extirpated. Thus the weak year class in 1994, 2 cycles after the weak 1988 year class, was expected. Similar pronounced variation among year classes has also been shown for Waddell and Scott creeks in Santa Cruz County (Smith 1994b).

The existence of missing or weak year classes appears to be due to severe droughts, which block adult or smolt migration, or to severe floods, which destroy most spawning redds (Smith 1994b). For example, on Scott Creek a strong 1988 coho year class was nearly eliminated in 1991, because of poor adult access due to drought. A February flood also appears to have been a factor in the weak year classes in Scott and Waddell creeks in 1992 (Smith 1994b).

Heavy flooding occurred on many central California streams in January and March of 1995, and destruction of coho redds or recently emerged fry was likely to have occurred in some watersheds. Therefore, previously sampled sites on Redwood Creek were resampled to determine whether the 1995 coho year class had been impacted by the floods.

METHODS

Electroshock sampling was conducted on the four Redwood Creek sites which had previously been sampled in each year from 1992 to 1994 (Table 1). At each site most of the same individual pool, glide, run and riffle habitats were sampled. Changes in channel configuration resulted in some changes in habitats sampled among years, and the total length of stream sampled at the four sites was somewhat less in 1995 than in other years (Tables 1 and 2).

Individual habitats or habitat units (ie. continuous glide/pool sequence) were block-netted and sampled with 2 passes with a backpack electroshocker (Smith-Root, Type 7). Salmonids were measured in 5 mm increments (standard length) and released. Steelhead (0. mykiss) young-of-year were distinguished from yearlings and older fish by length/frequency at each site. Sampled habitats were habitat typed, and depths and cover ratings determined.

RESULTS AND DISCUSSION

None of the four sampled sites showed evidence of severe channel impact from the high flows in January and March. Banks were not eroded, pool frequency did not appear to be altered, and most habitats and structural features (root wads, logs and debris piles) remained in place. Of 14 resampled pools, 4 were substantially increased in mean and maximum depth; 2 of those pools, which were previously separated by glide habitat, were joined to make a larger pool. In six resampled pools the extent of scour and mean depth was substantially reduced. The changes appeared to reflect sustained high flows, rather than flashy, erosive runoff.

Coho

Coho were collected at all four sites, and overall coho density in 1995 (42 per 100 feet) was similar to that observed in 1992 and 1993 (45-46 per 100 feet) (Table 1). However, the pattern of coho density throughout the stream in 1995 was different from that found in 1992 and 1993, with much smaller differences among sites in 1995 (Table 2). In 1992 and 1993 the highest coho density was at Muir Woods, the uppermost site; in 1995, density at the upper site was about half (45 per 100 feet) of that found in 1992 (84) and 1993 (91) (Table 2) and very close to the overall mean for the 4 sampled sites. In 1992 coho were nearly eliminated from the site downstream of the town and agricultural wells, due to drying of most of the streambed, but in 1995 coho density was 26 per 100 feet.

1995 sampling results indicate little overall adverse impact from the January and March storms, although density at Muir Woods (the uppermost site) was substantially lower than in 1992 and 1993. High spring flows in 1995 appear to have dispersed coho more evenly throughout the stream, and sustained summer flows prevented the coho losses to pumping which occurred in dry years (1992, 1994). Since coho rear primarily in pools, they are affected less than steelhead from summer streamflows, beyond those necessary to maintain pool depth and water quality (Smith 1994C).

Steelhead

Overall, young-of-year steelhead density was much higher in 1995 (97 fish per 100 feet) than in 1992 (23 per 100 feet), 1993 (56 per 100 feet) and both July and October 1994 (69 and 34 per 100 feet) (Tables 1). Much of the difference between 1995, 1992 and 1994 was due to substantial density differences among years at the two downstream sites. In 1995 young-of-year steelhead density was more than twice as high (132 and 143 fish per 100 feet) at the two downstream sites, as at the two upstream sites (57 and 51 per 100 feet) (Table 2). However, in 1992 and 1994 pumping by the agricultural and domestic wells dried or severely reduced flow, resulting in severely reduced densities of steelhead at the two downstream sites.

The sustained high stream flows in the summer of 1995 probably prevented the substantial late summer density declines which occur in dry years, such as in 1994 (Smith 1994C). The higher streamflows in 1995 also resulted in better growth than in dry years (Figure 1). The higher growth, resulting from high summer streamflows, may be at least as important as the increased density, as smolting and ocean survival are size dependent (Shapovalov and Taft 1954).

Yearling steelhead density in 1995 (4 per 100 feet) was the same as that found in 1992 and 1993. The higher yearling densities observed in 1994 primarily reflect intensive sampling of pools in an attempt to locate the scarce coho. The apparently low densities of yearling steelhead in all years suggests many steelhead smolts may spend only one year in Redwood Creek, rather than the 2 years more typical of steelhead in small streams (Shapovalov and Taft 1954). One-year smolting can occur when first summer growth is good, as in productive lagoons or productive streams with high summer flows; this is not the case in Redwood Creek. One-year smolting can also occur if feeding conditions in the stream or lagoon are very good for an extended period prior to spring outmigration. Analysis of the scales of adult steelhead would indicate the proportion of one and two year old smolts and the also the role of spring feeding prior to outmigration.

LITERATURE CITED

Hofstra, T. and D. Anderson. 1989. Survey of salmonid fish and their habitat. Redwood Creek. Marin County, California. Unpublished National Park Service Report. 18+ pp.

Shapovalov. L. and A.C. Taft. 1954. The life histories of the steelhead (Salmo gairdneri gairdneri) and silver salmon (Oncorhynchus kisutch) with special reference to Waddell Creek, California, and recommendations regarding their management. Calif. Fish and Game Fish Bulletin 98. 303 pp + apps.

Smith, J. 1994a. Abundance of coho and steelhead in Redwood Creek in 1994. Report to Golden Gate National Recreation Area, National Park Service. 10 pp.

Smith. J. 1994b. Distribution and abundance of juvenile coho and steelhead in Scott and Waddell creeks in 1988 and 1994: implications for status of southern coho. 12 page unpublished report.

Smith, J. 1994c. The effect of drought and pumping on steelhead and coho in Redwood Creek from July to October 1994. Report to Golden Gate National Recreation Area, National Park Service. 6 pp.

Table 1. Habitats sampled and estimated mean densities of coho and steelhead on Redwood Creek in 1988 (Hofstra and Anderson 1989), 1992, 1993, 1994, 1995.

Number of Sites	Sample Date	Habitat Types Sampled				Length Sampled (feet)	Density		
		Pol	Gld	Run	Rif		Coho	Steelhead 0+	Steelhead 1/2+
4 sites	Oct 88					436 +	5	---16---	
4 sites	Jun-Sep 92	37	40	5	7	1032	45	23	4
4 sites	Jun-Aug 93	48	25	18	9	951	46	56	4
7 sites	July 94	58	25	12	6	1287	2	69	14
5 sites	Oct 94	83	10	4	3	1018	2	34	6
4 sites	Aug 95	41	30	19	10	796	42	97	4

Table 2. Density estimates (number of fish per 100 feet) for coho and steelhead collected on Redwood Creek at the four sites sampled in each year from 1992 through 1995.

Sites	Sample Date	Habitat Types Sampled				Length Sampled (feet)	Density		
		Pol	Gld	Run	Rif		Coho	Steelhead 0+	Steelhead 1/2+
2. Lower Muir Woods (Miles 2.5 & 2.8)	20 Aug 92	30	53	12	5	302	84	19	8
	24 Jun 93	45	23	22	9	233	91	52	4
	7 Jul 94	47	32	15	6	256	0	56	15
	22 Aug 95	37	30	21	11	276	45	57	6
5. >3rd Bridge (mile 1.25)	19 Sep 92	60	15	7	19	166	30	16	7
	19 Aug 93	63	12	10	15	253	30	26	5
	7 Jul 94	63	10	14	13	136	0	45	14
	30 Oct 94	53	25	15	7	177	0	20	8
	22 Aug 95	75		16	10	127	43	51	7
6. Downstream of Diversions (mile 0.85)	19 Sep 92	19	37	dry		250 129 wet	13	6	1
	14 Nov 92					250	4	6	0.4
	24 Jun 93	55	29	9	7	210	25	90	3
	10 Sep 93	51	34	9	6	221	16	72	4
	7 Jul 94	41	36	17	6	231	0	148	9
	30 Oct 94		isolated pools			231	0	0	0
	23 Aug 95	39	36	19	6	209	26	132	3
7. 1st Bridge (Mile 0.35)	23 Jul 92	39	56	2	4	314	54	49	1
	14 Nov 92	39	56	2	4	314	33	29	2
	8 Jun 93	27	35	32	5	255	39	55	4
	10 Sep 93	26	49	16	9	271	14	34	1
	8 Jul 94	14	46	30	10	242	0.4	75	0.4
	23 Aug 95	13	55	19	13	184	54	142	0.5

Figure 1. Standard lengths of young-of-year steelhead at Site 5 (Third Bridge) and Site 3 (> Kent Canyon) in October 1994 and at Site 5 in August 1995.

		1994	1995
40 - 44	mm	xxxxxxx	
45 - 49		xxxxxxxxxxxxxx	xx
50 - 54		xxxxxxx	xxxxxxxxxxx
55 - 59		xxxxxxxxxx	xxxxxxxxxxxxxxx
60 - 64		xxxxxx	xxxxxxxxxxxxxx
65 - 69		xxxxxxxx	xxxxxx
70 - 74		x	xxxxxx
75 - 79			xx
80 - 84			xx
85 - 89			x

Appendix A. Density estimates (number of fish per 100 feet) for coho and steelhead collected on Redwood Creek in 1988 (Hofstra and Anderson 1989), 1992, 1993, 1994 and 1995. (*Data for site 8 are actual capture totals, not density estimates).

Site	Sample Date			Habitat Types Sampled				Length Sampled	Density		
				Pol	Gld	Run	Rif	(feet)	Coho	Steelhead 0 +	Steelhead 1/2 +
1. Upper Muir Woods (Miles 3.3 & 3. 6)	5	Oct	88					233	10	---18---	
	26	Jul	94	30	20			175	4	40	12
2. Lower Muir Woods (Miles 2.5 & 2.8)	20	Aug	92	30	53	12	5	302	84	19	8
	24	Jun	93	45	23	22	9	233	91	52	4
	7	Jul	94	47	32	15	6	256	0	56	15
	30	Oct	94	75	25			220	1	14	16
	22	Aug	95	37	30	21	11	276	45	57	6
3. 0.35 mi > Kent Cyn (mile 2.1)	6	Oct	88					105	11	---24--	
	26	Jul	94	75	13	7	5	179	9	60	9
	30	Oct	94	86	0	8	6	148	10	19	7
4. 0.5 Mi > 3rd bridge (mile 1.65)	8	Jul	94	84	16	0	0	68	0	61	35
5. >3rd Bridge (mile 1.25)	6	Oct	88					98	1	---23--	
	19	Sep	92	60	15	7	19	166	30	16	7
	19	Aug	93	63	12	10	15	253	30	26	5
	7	Jul	94	63	10	14	13	136	0	45	14
	30	Oct	94	53	25	15	7	177	0	20	8
	22	Aug	95	75		16	10	127	43	51	7

Appendix A (continued)

Site	Sample Date	Habitat Types Sampled Pol	Gld	Run	Rif	Length Sampled (feet)	Density Coho	Steelhead 0 +	1/2 +
6. Downstream of Diversions (mile 0.85)	6 Oct 86	dry					0	6	0
	19 Sep 92	19	37	dry		250 129 wet	13	6	1
	14 Nov 92					250	4	6	0.4
	24 Jun 93	55	29	9	7	210	25	90	3
	10 Sep 93	51	34	9	6	221	16	72	4
	7 Jul 94	41	36	17	6	231	0	148	9
	30 Oct 94	isolated pools				231	0	0	0
	23 Aug 95	39	36	19	6	209	56	132	3
7. 1st Bridge (Mile 0.35)	23 Jul 92 14 Aug 92	39	56	2	4	314	54	49	1
	14 Nov 92	39	56	2	4	314	33	29	2
	8 Jun 93	27	35	32	5	255	39	55	4
	10 Sep 93	26	49	16	9	271	14	34	1
	8 Jul 94	14	46	30	10	242	0.4	75	4
	30 Oct 94	isolated pools				242	0	6	0.4
	23 Aug 95	13	55	19	13	184	54	142	0.5
8.* Pools Above Delta (Mile 0.15)	23 Jul 92	70	30			200	59	22	3
	14 Aug 92	70	30			200	6	2	3
	14 Nov 92	70	30			200	0	0	0
	4 Jun 93	99				50	29	14	4
	8 Jun 93	70	30			200	17	6	2
	19 Aug 93	70	30			200	6	16	0
	10 Sep 93	70	30			200	4	9	0
	8 Jul 94	60	40			160	0	1	3