D.W. ALLEY & Associates Aquatic Biology

2006 Juvenile Steelhead Densities in the San Lorenzo, Soquel, Aptos and Corralitos Watersheds, Santa Cruz County, California

Coastrange Sculpin Photographed by Jessica Wheeler

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REPORT SUMMARY

The most significant findings in 2006 were:

- Especially low juvenile densities (young-of-the-year fish (YOY's) and yearlings) in the San Lorenzo and Soquel watersheds (especially in the lower San Lorenzo and Soquel mainstems and below Mill Pond on East Branch Soquel),

- Much better YOY production in the Corralitos (especially Browns) and Aptos watersheds compared to the 2 other watersheds,

- Rebound in juvenile densities in the Corralitos watershed from lower densities in 1994 (a very dry year),

- Fast growth rates of YOY's in all watersheds so that many reached smolt size,

- Habitat improvement in the lower mainstems of the San Lorenzo and Soquel watersheds and generally habitat decline elsewhere except improvement in West Branch Soquel,

- Streambed conditions were generally degraded in the Aptos and Corralitos watersheds compared to the most recent past monitoring (1981 in Aptos and 1994 in Corralitos),

- Apparent inability of adult steelhead to pass Girl Scout Falls II on West Branch Soquel.

Smolt habitat at sampling sites was rated, based on smolt-sized (=>75 mm SL) juvenile steelhead density according to the rating scheme developed by Smith (**1982**). (Note: the scheme was applied to all sites, and lower San Lorenzo sites were rated very good and excellent in 1981.) This scheme assumed that rearing habitat was usually near saturation with smolt-sized juveniles, and spawning rarely limited juvenile steelhead abundance. This was doubtful in 2006 in the San Lorenzo and Soquel watersheds because much higher juvenile densities would be expected with the higher than average streamflows, based on past years of sampling. Juvenile steelhead densities (both young-of-the-year fish (YOY's) and yearlings) were below average at all sampling sites in the San Lorenzo and Soquel watersheds. Refer to the following summary table for smolt-sized juvenile densities and Figures 2, 4, 6 and 8 excerpted from the main report and provided in the summary to compare 2006 smolt densities to averages calculated from all monitored years of data.

Sampling Sites in 2006 in the San Lorenzo, Soquel, Aptos and Corralitos Watersheds Rated by Smolt-Sized Juvenile Density (=>75 mm SL) and Reach Habitat Trends from Most Recent Past Monitoring.

Site	Avg Density* (Smolts/ 100 ft)	2006 Density (Smolts/ 100 ft)	2006 Smolt Habitat Rating	Reach Habitat Trend
Low. San Lorenzo #1	14.1	1.2	Very Poor**	+
Low. San Lorenzo #4	17.6	16.2	Good	+
Mid. San Lorenzo #6	5.4	2.3	Poor	–
Mid. San Lorenzo #8	8.4	5.8	Below Average	–
Up. San Lorenzo #11	8.5	3.0	Poor	–
Zayante #13a	11.8	11.7	Fair	Similar
Zayante #13c	13.2	12.6	Fair	
Zayante #13d	17.8	17.3	Good	–
Lompico #13e		5.7	Below Average	
Bean #14b	15.7	11.9	Fair	
Bean #14c	13.9	17.1	Good	–
Newell # 16	13.5	16.2	Good	–
Boulder #17a	13.2	18.2	Good	–
Boulder #17b	11.2	13.7	Fair	–
Bear #18a	13.8	13.6	Fair	–
Branciforte #21a	11.9	10.8	Fair	–
Mainstem Soquel #4	11.2	2.8	Poor	+
Mainstem Soquel #10	9.2	6.3	Below Average	+
East Branch Soquel #13a	10.1	3.2	Poor	Similar
East Branch Soquel #16	8.8	9.1	Fair	–
West Branch Soquel #19	3.5	4.7	Below Average	
West Branch Soquel #20	4.0	5.8	Below Average	+
West Branch Soquel #21	11.1	14.1***	Fair	Similar
Aptos #3	14.9	19.0	Good	– ****
Aptos #4	8.0	10.1	Fair	– ****
Valencia #2	10.2	3.8	Poor	– ****
Valencia #3	13.1	12.9	Fair	– ****
Corralitos #3	11.0	19.3	Good	– ****
Corralitos #8	16.6	13.2	Fair	– ****
Corralitos #9	28.4	41.6	Very Good	– ****
Shingle Mill #1	16.9	16.2	Good	– ****
Shingle Mill #3	3.7	3.4	Poor	– ****
Browns Valley #1	20.0	17.0	Good	– ****
Browns Valley #2	9.4	16.9	Good	– ****

* Average calculated from all years of sampling at the sites representing segments with the same number designations.

** Refer to Table 40 for the range of smolt densities in each rating category.

*** From NOAA Fisheries Sampling Site Data.

**** Comparison between 2006 reach conditions and previous site conditions in either 1981 or 1994.

Figure 2. Juvenile Steelhead Site Densities for Size Class II and III Fish in the San Lorenzo River in 2006 Compared to the 8-Year Average Density. (First year of sampling for Lompico (13e) and 6th for Newell (16) since 1998.)

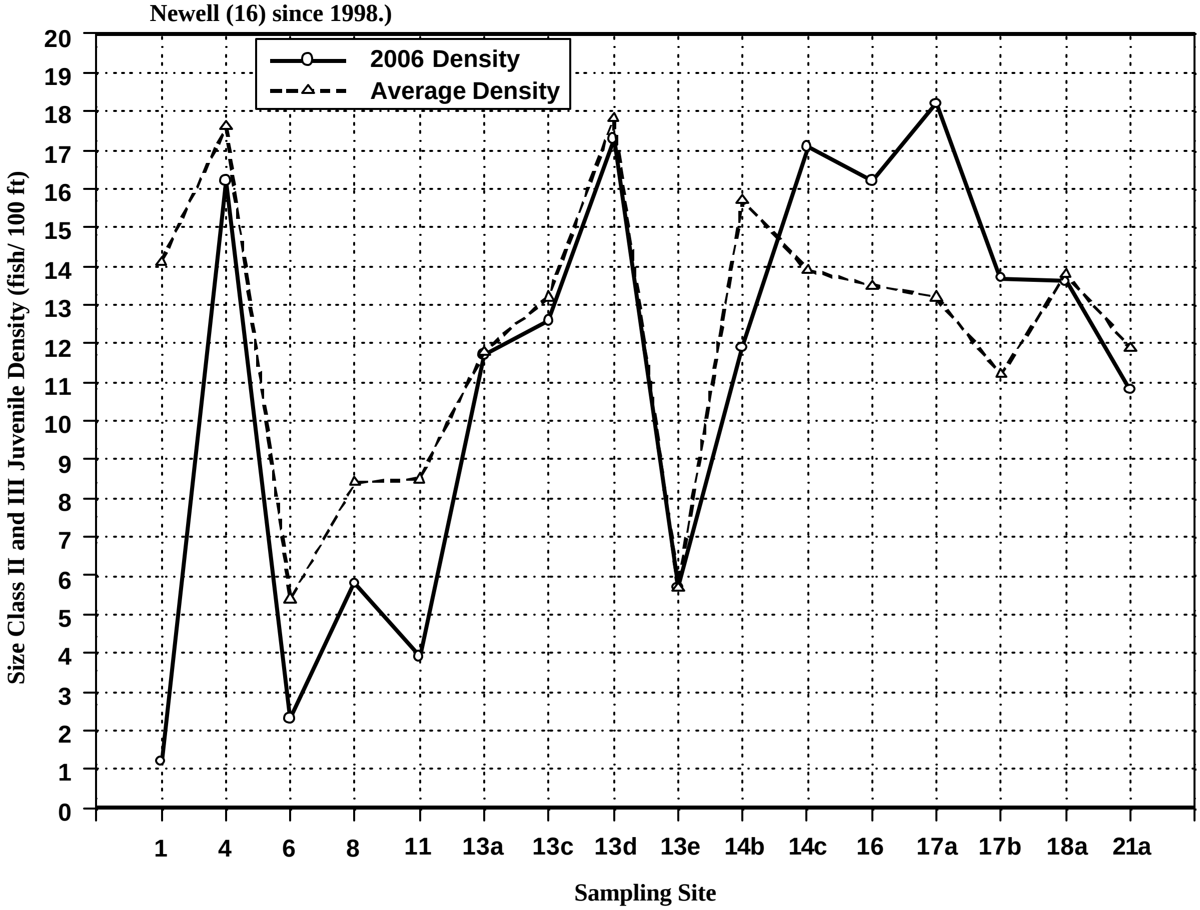


Figure 4. Juvenile Steelhead Site Densities for Size Class II and III Fish in Soquel Creek in 2006 Compared to the 9- or 10-Year Average Density. (Fifth year of sampling above Girl Scout Falls I (21) and 6th below Hester Creek (19).)

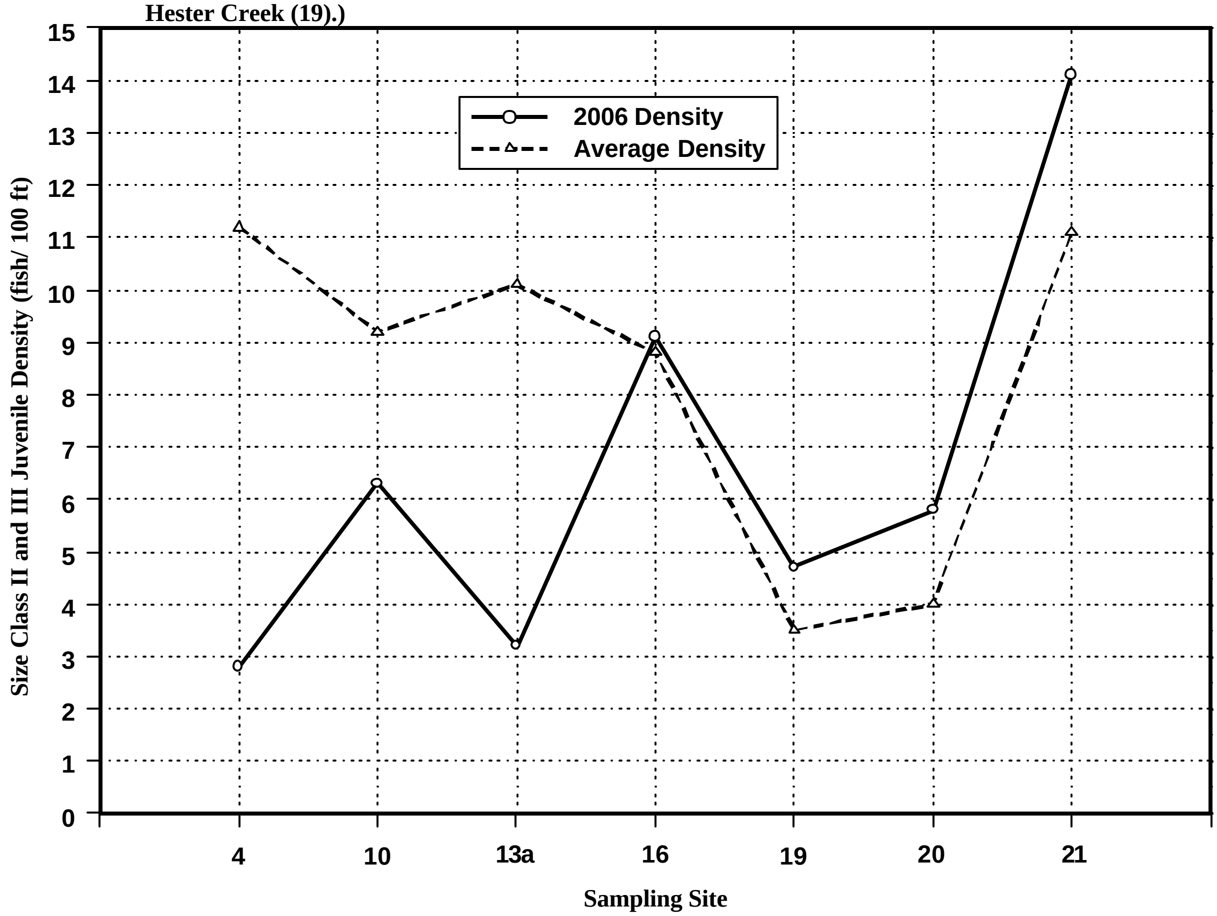


Figure 6. Juvenile Steelhead Site Densities for Size Class II and III Fish in Aptos and Valencia Creeks in 1981 and 2006.

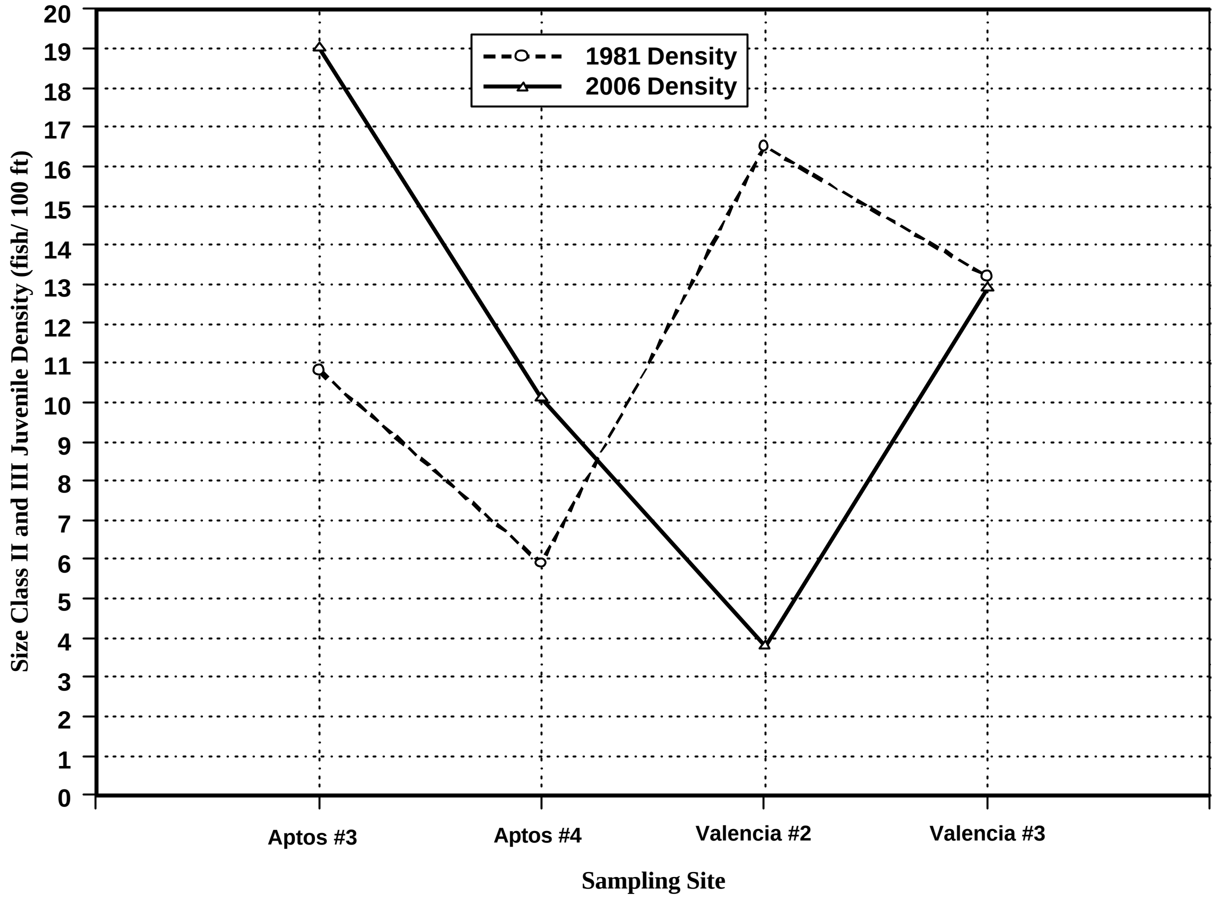
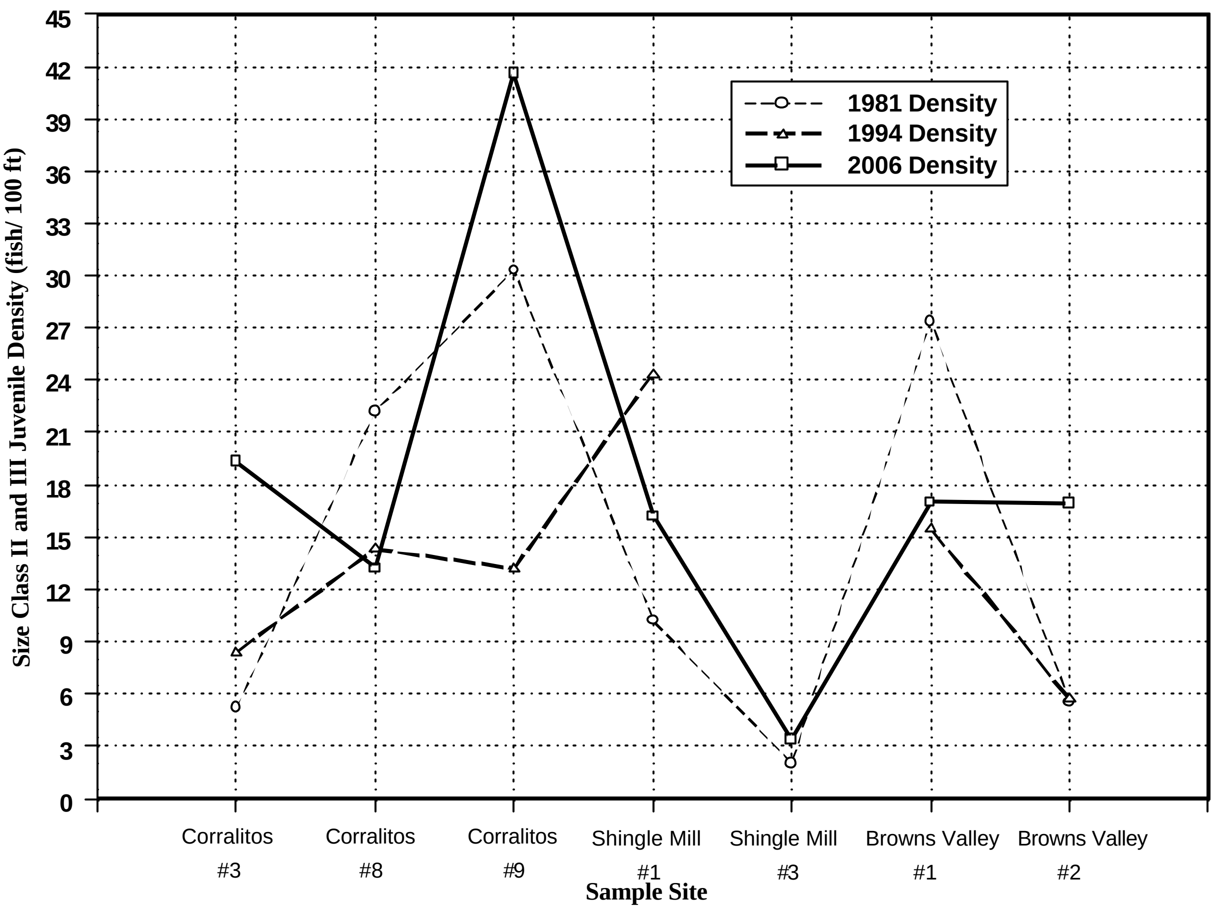


Figure 8. Juvenile Steelhead Site Densities for Size Class II and III Fish in Corralitos, Shingle Mill and Browns Valley Creeks in 1981, 1994 and 2006.



There are likely multiple reasons for the low juvenile densities in 2006. The timing and intensity of the previous winter storms likely played a major role. We see from USGS hydrographs that the first onslaught of heavy rains came early, in January. Then there was a drier period followed by repeated high stormflows in March through May. Early spawners took advantage of the first pulse of winter stormflows. Yearlings took advantage of the high spring flow to grow quickly and enter the bay without staying another year. The early emerging YOY's from the early spawners grew quickly, but many likely suffered heavy mortality from high spring stormflows. The near absence of large wood to provide overwintering habitat likely increased the mortality. The inherently high sediment component to stream channels and easily eroding streambanks in the Santa Cruz Mountains likely greatly reduced egg survival in redds prepared during the repeated spring stormflows with several bankfull events in April and May. Much below average fish densities occurred in the San Lorenzo mainstem while habitat improved in the lower mainstem and declined in the middle and upper mainstem. Juvenile densities declined in San Lorenzo tributaries, consistent with reduced habitat quality. However, 9 of 10 tributary sites had near average or above average densities of smolt-sized juveniles due to fast YOY growth rates in a year with ample streamflow and reduced competition. In Soquel Creek, very low juvenile densities were found despite improved habitat quality in the mainstem and West Branch. Habitat conditions in the East Branch declined somewhat from 2005. However, densities of smolt-sized juveniles were above average at 4 of 5 tributary sites. The site below Mill Pond had surprisingly low juvenile densities.

In the Aptos and Corralitos watersheds, smolt saturation may have been more closely attained in 2006 than in the San Lorenzo and Soquel watersheds. This was because YOY densities in Aptos and Corralitos were more similar to previous years and faster growth associated with higher streamflows increased the smolt density with faster growing YOY's despite the lower yearling densities. In Aptos Creek, juvenile densities were less in 2006 than 1981, consistent with decline in habitat quality in 2006. However, 2006 densities of smolt-sized juveniles were much greater due to faster growth rates of YOY's to smolt-size compared to the low streamflow conditions of 1981. In Valencia Creek, total juvenile densities were similar between 1981 and 2006, though densities of yearlings and smolt-sized juveniles were less with much habitat degradation observed in the lower reach and similar habitat quality in the upper reach. In Corralitos and Browns creeks, YOY and smolt-sized juvenile densities were higher in 2006 than 1994 despite reduced habitat quality in both. This was due to very successful late spawning in 2006 compared to drought conditions in 1994 that presumably limited adult access for spawning, and YOY's grew much faster to smolt size in 2006 with the high streamflows.

Scope of Work. Annual monitoring of juvenile steelhead began in 1994 in the San Lorenzo and 1997 in Soquel Creek. The Corralitos sub-watershed was last sampled in 1994. Aptos Creek was last sampled in 1981. In fall 2006, 4 Santa Cruz County watersheds were sampled for juvenile steelhead with the purpose of comparing habitat quality and juvenile densities with past results. Refer to maps in **Appendix A** that delineate reaches and sampling sites. The mainstem San Lorenzo River and 7 tributaries were sampled with 15 total sites. Thirteen half-mile segments were habitat typed to assess habitat conditions and select habitats of average quality to sample. Tributaries included Branciforte, Zayante, Lompico, Bean, Newell, Boulder and Bear creeks. Seven steelhead sites were sampled below anadromy barriers in Soquel Creek and its branches. Five half-mile segments were habitat typed. In the Aptos Creek watershed, 2 sites in Aptos Creek and 2 sites in Valencia Creek were sampled, and the 4 associated half-mile segments were habitat typed. In the Corralitos sub-watershed of the Pajaro River drainage, 3 sites were sampled in Corralitos Creek, 2 sites were sampled in Shingle Mill Gulch and 2 sites were sampled in Browns Creek were sampled, along with 7 associated half-mile segments habitat typed.

For annual comparisons, fish were divided into two age classes and three size classes. Age classes were young-of-the-year (YOY) and yearlings and older. The size classes were Size Class I (<75 mm Standard Length (SL)), Size Class II (between 75 and 150 mm SL) and Size Class III (<=150 mm SL). Juveniles in Size Classes II and III were considered to be "smolt-sized," based on scale analysis of out-migrating smolts by Smith (**2005**).

Steelhead Life History. Most juvenile steelhead spend 1-2 years in freshwater before smolting and migrating to the ocean to reach sexual maturity. In the ocean they spend 1-2 years of rapid growth before returning as adults to their natal streams to spawn. When juveniles reach 75 mm SL by fall sampling time (~ 3 ½ inches total length) they are considered large enough to smolt the following late winter and spring. Unpublished, independent research has shown that many returning adult steelhead in some local streams reached smolt size their first growing season (**J. Smith, pers. comm.; E. Freund, pers. comm.**). Therefore, habitat conditions are very important in portions of the watersheds that have the capacity to grow YOY's most rapidly to smolt size. These portions include the lagoons of the San Lorenzo River, Aptos and Soquel creeks, the lower mainstem of the San Lorenzo River and Soquel Creek, and the middle mainstem of the San Lorenzo River. Enhancement of smolt production is necessary to increase adult returns.

YOY's emerge from the spawning gravels and spread throughout the watershed in spring and early summer. Since more adult steelhead spawning tends to occur in the upstream and tributary reaches of the watershed (barring passage difficulties), the highest initial YOY densities tend to be there. Therefore, it is likely that juveniles distribute mostly in a downstream direction where competition is reduced. Once habitats have been selected, juveniles remain in the same habitats or in close proximity throughout the summer and fall. They distribute according to the quality of feeding habitat (fastwater with adequate depth) and/ or maintenance habitat (water depth and degree of escape cover as overhanging vegetation, undercut banks, surface turbulence, cracks under boulders and submerged wood). Habitat quality improves when less sand enters the stream (called sedimentation) from soil and streambank erosion because less sand input increases aquatic insect habitat. With less sand, embeddedness of larger cobbles and boulders is reduced to provide more cracks and crevices for insects to use. Less sand and embeddedness provides better fish habitat with more escape cover for fish to hide under and by increasing water depth around scour objects (more escape cover) and increasing insect drift for fish food.

San Lorenzo River and Tributaries– Habitat and Fish Density Comparisons. Refer to **Appendix A** for maps of reach locations. Refer to Tables 6, 7, 9 and 12 excerpted from the main report and included in the summary to indicate habitat conditions. The **lower mainstem** (downstream of the Zayante Creek confluence) showed overall habitat improvement between 2000 and 2006. Pool scouring and deepening was evident, and there was more escape cover in fastwater habitat. From 2000 through 2005 there had been steady habitat improvement in the **middle mainstem** (between the Zayante and Boulder creek confluences). However, overall habitat degraded from 2005 to 2006 in the middle mainstem. Overall habitat quality declined from 2005 to 2006 in the **upper mainstem** San Lorenzo (upstream of the Boulder Creek confluence) as indicated from data collected in Reach 11.

There was a higher percentage fines, less escape cover and no improvement in pool depth. Some of the lowest densities of young-of-the-year and yearling steelhead were detected in 2006 compared to past results in the San Lorenzo watershed. Juvenile densities at the 5 mainstem San Lorenzo sites were 50-90 percent below average for total density, well below average for age classes and Size Class I fish, and 30-93 percent below average at 4 of the 5 sites for larger size classes (II/III).

San Lorenzo tributaries in 2006 showed reduced habitat quality compared to either 2000 or 2005 in the case of Zayante, Bean, Newell, Boulder, Bear and Branciforte creeks. Aspects of habitat that tended to worsen included increased percent fines, greater embeddedness and less escape cover in most of these creeks. Although escape cover was much reduced in Newell Creek, it showed improvements atypical to other tributaries. Pools were deeper with less percent fines and lower embeddedness likely resulting from sediment being trapped behind the dam upstream.

At 10 San Lorenzo tributary sites, the total juvenile density and YOY density were below average at all sites except upper Bean (14c). Yearling densities were well below average at all tributary sites. Despite low juvenile densities and few yearlings holding over, Size Class II and III (smolt-size) juvenile densities were above average at 4 of 10 tributary sites and close to average at another 5 sites. This indicated that with reduced juvenile numbers and higher than usual baseflows, growth rate of YOY's was increased with less competition, resulting in above average or close to average densities of large juveniles in tributaries. A mid-Zayante Creek site (13c) was more than 25 percent below average density for smolt-sized juveniles. Compared to 2005, Size Class II/ III densities in 2006 were greater at 4 of 9 tributary sites.

The trend in juvenile steelhead densities between 2005 and 2006 was analyzed by using a paired t-test (**Snedecor and Cochran 1967; Sokal and Rohlf 1995; Elzinga et al. 2001**). Only the San Lorenzo watershed had multiple 2005 steelhead sites that were re-sampled in 2006 and could be statistically analyzed. Despite only 7 comparable sites in the San Lorenzo drainage, declines from 2005 to 2006 in total juvenile density, YOY's, Size Class 1 juveniles and yearlings were statistically significant at the 0.05 level and even lower.

Table 6. Averaged Mean and Maximum WATER DEPTH (ft) of Habitat in SAN LORENZO Reaches Since 2000.

Reach	Pool 2000	Pool 2003	Pool 2005	Pool 2006	Riffle 2000	Riffle 2003	Riffle 2005	Riffle 2006	Run/Step-Run 2000	Run/Step-Run 2003	Run/Step-Run 2005	Run/Step-Run 2006
1- L. Main	1.9/ 3.5			**2.5/ 4.4**	0.9/ 1.4			**1.1/ 1.5**	1.2/ 1.8			2.4/ 3.1
2- L. Main	3.0/ 5.2				1.2/ 2.0				1.7/ 2.4			
3- L. Main	3.1/ 5.2				1.9/ 2.6				2.1/ 3.1			
4- L. Main	2.2/ 3.8			**2.6/ 4.4**	0.8/ 1.4			**0.9/ 1.5**	1.5/ 2.3			1.6/ 2.2
5- L. Main	1.7/ 3.3				0.8/ 1.3				1.1/ 1.8			
6- M. Main	1.9/ 3.4	1.9/ 3.5	1.9/ 3.4	**2.2/ 4.3**	0.8/ 1.2	0.6/ 0.9	0.9/ 1.4	**0.8/ 1.3**	1.1/ 1.9	1.2/ 1.9	1.1/ 2.1	1.3/ 1.85
7- M. Main	2.2/ 3.9	1.8/ 3.7	2.0/ 3.5		0.7/ 1.1	0.6/ 1.0	0.7/ 1.1		1.0/ 1.5	0.9/ 1.4	1.1/ 1.4	
8- M. Main	2.8/ 5.4	2.5/ 5.2	2.6/ 5.8	**2.7/ 5.5**	0.9/ 1.4	0.6/ 1.0	1.0/ 1.5	**1.1/ 1.6**	1.4/ 2.1	1.0/ 1.4	1.3/ 2.1	1.3/ 2.25
9- M. Main	2.0/ 3.6	1.7/ 3.0	1.9/ 3.5		0.7/ 1.1	0.6/ 1.1	0.7/ 1.1		1.0/ 1.6	0.8/ 1.2	1.0/ 1.4	
10- U. Main	1.3/ 2.7	1.4/ 2.9	1.4/ 2.8		0.4/ 0.6	0.3/ 0.5	0.4/ 0.7		0.8/ 1.2	0.5/ 0.9	0.7/ 1.0	
11- U. Main	1.2/ 2.1		1.1/ 2.0	**1.1/ 2.1**	0.4/ 0.6		0.4/ 0.7	**0.5/ 0.8**	0.5/ 1.0		0.5/ 1.0	0.6/ 1.1
12b- U. Main	1.4/ 2.2		1.3/ 2.2		0.5/ 0.9		0.3/ 0.6		0.6/ 1.1		0.5/ 0.8	
Zayante 13a	1.4/ 2.3	1.1/ 2.1	1.5/ 2.5	**1.6/ 2.6**	0.65/ 1.0	0.7/ 1.1	0.6/ 0.9	**0.6/ 0.9**	0.85/ 1.2	0.7/ 1.2	0.8/ 1.1	0.85/ 1.2
Zayante 13b	1.5/ 2.8	1.5/ 2.4	1.7/ 2.9		0.6/ 0.9	0.5/ 0.7	0.5/ 0.9		0.8/ 1.1	0.8/ 1.1	0.7/ 1.2	
Zayante 13c	1.5/ 2.5	1.2/ 2.2	1.35/ 2.4		0.6/ 0.8	0.4/ 0.7	0.5/ 0.8		0.7/ 1.1	0.5/ 1.0	0.7/ 1.0	
Zayante 13d	1.3/ 2.1	1.1/ 1.7	1.1/ 2.1	**1.35 / 2.1**	0.6/ 1.0	0.4/ 0.6	0.5/ 0.7	**0.45/ 0.8**	0.9/ 1.3	0.8/ 1.3	0.8/ 1.4	0.9/ 1.4
Lompico 13e				**1.1/ 1.8**				**0.3/ 0.6**				0.45/ 0.8
Bean 14a	1.2/ 2.0	0.8/ 1.6	1.0/ 1.9		0.5/ 0.85	0.4/ 0.7	0.4/ 0.7		0.65/ 1.2	0.6/ 1.2	0.7/ 1.1	
Bean 14b	1.1/ 1.6	0.9/ 1.5	1.0/ 1.9		0.3/ 0.55	0.3/ 0.6	0.3/ 0.5		0.6/ 1.0	0.6/ 0.9	0.6/ 0.8	
Bean 14c	1.1/ 2.0	1.0/ 1.7	1.0/ 1.7	**1.0/ 1.8**	0.2/ 0.5	0.1/ 0.3	0.1/ 0.3	**0.2/ 0.3**	0.5/ 0.7	0.25/ 0.4	0.2/ 0.5	0.35/ 0.5
Newell 16	1.4/ 2.6			**1.6/ 2.8**	0.4/ 0.65			**0.3/ 0.5**	0.6/ 0.9			0.6/ 0.9
Boulder	1.8/		1.8/	**2.0/**	0.6/		0.5/	**0.6/**	0.7/ 1.1		0.7/ 1.2	0.9/ 1.4

17a	2.7		2.9	**3.1**	1.0		0.9	**1.0**				
Boulder 17b	1.75/ 2.8		1.7/ 2.8	**1.7/ 2.8**	0.5/ 1.0		0.4/ 1.0	**0.6/ 1.0**	0.7/ 1.2		0.7/ 1.2	0.8/ 1.4
Boulder 17c	2.5/ 3.7		1.9/ 2.9		0.4/ 0.7		0.4/ 0.8		0.8/ 1.3		0.9/ 1.5	
Bear 18a	1.8/ 3.0	2.0/ 3.4	2.0/ 3.4	**2.0/ 3.35**	0.5/ 0.8	0.4/ 0.7	0.4/ 0.7	**0.6/ 0.9**	0.7/ 1.1	0.6/ 0.9	0.7/ 1.1	0.8/ 1.25
Bear 18b	1.4/ 2.4				0.55/ 1.2				0.6/ 1.2			
Branciforte 21a-2	1.05/ 2.0			**1.1/ 1.9**	0.3/ 0.6			**0.3/ 0.5**	0.6/ 0.9			0.5/ 1.0
Branciforte 21b	1.0/ 1.7		1.1/ 1.7		0.4/ 0.6		0.4/ 0.7		0.5/ 0.85		0.3/ 0.6	

Table 7. Average PERCENT FINE SEDIMENT IN SAN LORENZO Reaches River Since 2000.

Reach	Pool 2000	Pool 2003	Pool 2005	Pool 2006	Riffle 2000	Riffle 2003	Riffle 2005	Riffle 2006	Run/Step-Run 2000	Run/Step-Run 2003	Run/Step-Run 2005	Run/Step-Run 2006
1	80			**80**	20			**20**	55			**40**
2	70				25				50			
3	80				40				60			
4	70			**75**	30			**20**	50			**50**
5	95				35				70			
6	80	70	70	**75**	35	25	20	**25**	60	35	40	**38**
7	70	70	70		25	25	20		45	50	40	
8	75	55	65	**60**	30	25	20	**20**	45	40	25	**25**
9	70	70	60		30	25	15		45	30	30	
10	75	60	70		25	20	15		45	25	35	
11	65	55	35	**40**	20	40	15	**25**	30	45	25	**15**
12b	55	50	35		25	35	35		35	40	10	
Zayante 13a	80	85	65	**65**	30	40	25	**35**	55	70	50	**40**
Zayante 13b	80	65	65		30	30	30		45	45	30	
Zayante 13c	55	50	45		20	25	10		25	30	20	
Zayante 13d	60	40	40	**50**	25	25	25	**15**	45	25	25	**40**
Lompico 13e				**50**				**20**				**30**
Bean 14a	80	80	70		45	40	25		70	70	35	
Bean 14b	80	85	80		25	45	15		60	80	45	
Bean 14c	70	70	60	**65**	25	25	5	**15**	35	40	30	**40**
Newell 16	50			**25**	20			**5**	35			**20**
Boulder 17a	45		30	**35**	30		20	**5**	30		15	**20**
Boulder 17b	40		30	**35**	10		5	**10**	25		15	**15**
Boulder 17c	45		25		5		5		20		5	
Bear 18a	55	55	50	**60**	15	15	15	**15**	30	25	20	**25**
Bear 18b	40				10				25			
Branciforte 21a-2	65			**75**	30			**40**	45			**55**
Branciforte 21b	65		55		30		15		40		65	

Table 9. Reach-wide ESCAPE COVER Index (Habitat Typing Method*) in RIFFLE HABITAT in MAINSTEM Reaches of the SAN LORENZO, Based on Habitat Typed Segments.

Reach	1998	1999	2000	2003	2005	2006
1	0.187	0.244	0.084	-	-	0.270
2	-	0.503	0.260	-	-	
3	0.250	0.216	0.257	-	-	
4	0.125	0.078	0.109	-	-	0.183
5	0.032	0.001	0.222	-	-	
6	**0.099**	**0.093**	**0.042**	**0.027**	**0.152**	**0.101**
7	**0.148**	**0.146**	**0.050**	**0.130**	**0.187**	
8	**0.335**	**0.173**	**0.124**	**0.080**	**0.320**	**0.241**
9	**0.038**	**0.080**	**0.043**	**0.066**	**0.161**	
10	0.011	0.039	0.012	0.018	0.040	
11	0.025	0.020	0.017	-	0.056	0.014
12	0.086	0.022	0.036	-	0.044	

***Habitat Typing Method = linear feet of escape cover divided by reach length as riffle habitat.**

Table 12. ESCAPE COVER Index (Habitat Typing Method*) for POOL HABITAT in TRIBUTARY Reaches of the SAN LORENZO.

Reach	1998	1999	2000	2003	2005	2006
Zayante 13a	0.320	0.069	0.056	0.169	0.081	**0.074**
Zayante 13b	0.150	0.093	0.072	0.130	0.087	
Zayante 13c	0.114	0.110	0.095	0.110	0.109	
Zayante 13d	0.145	0.191	0.132	0.237	0.269	**0.126**
Lompico 13e						**0.089**
Bean 14a	0.248	0.143	0.186	0.124	0.155	
Bean 14b	0.378	0.280	0.205	0.288	0.212	
Bean 14c	0.259	0.093	0.100	0.142	0.141	**0.131**
Newell 16	0.285		0.325			**0.102**
Boulder 17a	0.131	0.051	0.061	-	0.108	**0.064**
Boulder 17b	0.129	0.141	0.164	-	0.232	**0.100**
Boulder 17c	0.250	0.072	0.057	-	0.143	
Bear 18a	0.069	-	0.103	0.119	0.114	**0.074**
Branciforte 21a-2						**0.121**
Branciforte 21b	0.147	0.083	0.102	-	0.189	

***Habitat Typing Method = linear feet of escape cover divided by reach length as pool habitat.**

No juvenile coho salmon were captured in the San Lorenzo system in fall 2006 during our electrofishing or snorkeling, nor were any seen during snorkel surveys by NOAA Fisheries biologists in 19 random (spatially balanced), approximately 1 km reaches (Brian Spence, NOAA Fisheries, pers. comm.). Two adult coho had been trapped at the Felton Diversion dam between mid-January and late March 2006. This was in contrast to fall 2005 when we electrofished 4 juvenile coho from Bean Creek, 5 were observed during NOAA Fisheries snorkel surveys in Bean Creek and 2 were captured from an impoundment on Zayante Creek in Mt. Hermon (Hagar Environmental Science). A total of 18 adult coho were trapped at Felton in winter 2004-2005 between mid-December and late January.

Soquel Creek and Its Branches– Habitat and Fish Density Comparisons. Refer to Tables 14, 15 and 17 excerpted from the main report and placed in this summary below. The lower mainstem (from the lagoon to the Moores Gulch confluence) had overall habitat improvement from 2005 to 2006. The biggest improvements were in reduced percent fines and more pool escape cover. The upper mainstem (from the Moores Gulch confluence to the Branches) had slightly improved habitat compared to 2005 in that pool depth increased and pool escape cover somewhat increased. Pool escape cover was the highest since 2000.

The lower East Branch (Reach 9) had similar habitat quality compared to 2005 but lower quality than in 2000. Compared to 2005, the one substantial improvement was increased pool depth. However, pool escape cover was less. The important upper East Branch (Reach 12a) showed overall habitat degradation from 2005 to 2006, but conditions were still better than in 2000. Pool escape cover decreased in 2006 from 2005, but it was still much higher than in 2000. The step-run escape cover index decreased slightly, indicating slightly reduced habitat quality there.

The habitat quality in the West Branch generally improved. Downstream of Olson Road Bridge (Reach 14a), habitat depth increased greatly in all habitat types and embeddedness was much less in fastwater habitat. Habitat quality between Girl Scout Falls I and II (Reach 14b) had some improvement due to increased pool depth but was generally similar to 2002 conditions.

In Soquel Creek, site densities in 2006 were 50 percent or more below average in total density. All age and size categories were substantially below average, except for similar and somewhat above average densities for Size Class II/ III juveniles at 4 branch sites out of 7 total sampling sites. Site 22 above Girl Scout Falls II was judged to be a resident rainbow trout site due to the much lower YOY and total density there compared to Site 21 below the falls. Compared to 2005, steelhead site densities were substantially less (mostly < 50 percent) for total density and YOY density at all 7 compared sites. Densities in 2006 were substantially less than in 2005 at 5 of 6 compared sites for yearlings, at 4 of 6 compared sites for small Size Class I fish and at 3 of 7 compared sites for the important Size Class II/ III juveniles.

Table 14. Averaged Mean and Maximum WATER DEPTH (ft) of Habitat in SQOUEL CREEK Reaches Since 2000.

Reach	Pool 2000	Pool 2003	Pool 2005	Pool 2006	Riffle 2000	Riffle 2003	Riffle 2005	Riffle 2006	Run/Step-Run 2000	Run/Step-Run 2003	Run/Step-Run 2005	Run/Step-Run 2006
1	1.3/ 2.5	1.4/ 2.7	1.1/ 2.8			-/ 0.5	-/ 0.7			-/ 0.7	-/ 0.8	
2	1.0/ 1.9	1.0/ 1.6	1.0/ 1.7			-/ 0.5	-/ 0.6			-/ 0.7	-/ 1.1	
3	1.3/ 2.4	1.35/ 2.5	1.3/ 2.3	**1.4/ 2.5** partial *		-/ 0.5	-/ 0.7	**0.5/ 0.8** partial		-/ 0.8	-/ 1.0	**0.7/ 1.0** partial
4	1.3/ 2.3	1.2/ 2.6	1.1/ 2.6			-/ 0.6	-/ 0.8			-/ 0.7	-/ 0.9	
5	1.3/ 2.2	1.2/ 2.2	1.2/ 2.3			-/ 0.5	-/ 0.7			-/ 0.8	-/ 0.9	
6	1.3/ 2.4	1.45/ 2.5	1.25/ 2.2			-/ 0.6	-/ 0.7			-/ 0.8	-/ 0.9	
7	1.4/ 2.4	1.6/ 2.9	1.2/ 2.2	**1.3/ 2.3** partial		-/ 0.7	-/ 0.8	**0.5/ 0.8** partial		-/ 0.9	-/ 0.9	**0.8/ 1.2** partial
8	1.5/ 2.7	1.6/ 2.9	1.4/ 2.7			-/ 0.6	-/ 0.8			-/ 0.9	-/ 0.9	
9	1.4/ 2.3		1.3/ 2.1	**1.5/ 2.5**	-/ 0.7		-/ 0.6	**0.4/ 0.6**	-/ 1.1		-/ 0.9	**0.6/ 1.0**
10	1.5/ 2.4											
11	1.9/ 3.3											
12a	1.1/ 1.6		1.1/ 1.7	**1.3/ 2.05**	-/ 0.6		-/ 0.6	**0.45/ 0.8**	-/ 0.9 (S.run)		-/ 1.1 (S.run)	**0.7/ 1.2**
12b	1.3/ 2.0		1.1/ 1.6		-/ 0.5		-/ 0.5		-/ 1.0 (S.run)		-/ 1.0 (S.Run)	
13	1.3/ 2.7											
14a	1.3/ 2.4		1.0/ 1.8	**1.4/ 2.4**	-/ 0.7		-/ 0.5	**0.5/ 0.8**	-/ 1.0		-/ 0.7	**0.6/ 1.0**
14b		1.5/ 2.6 2002		**1.6/ 2.9**				**0.4/ 0.6**				**0.7/ 1.0**
14c		1.4/ 2.4 2002										

*** Partial, ½-mile segments habitat typed in 2006. Previously, the entire mainstem was habitat typed.**

Table 15. Average PERCENT FINE SEDIMENT in Habitat-typed Reaches in SOQUEL CREEK Since 2000.

Reach	Pool 2000	Pool 2003	Pool 2005	Pool 2006	Riffle 2000	Riffle 2003	Riffle 2005	Riffle 2006	Run/Step -Run 2000	Run/Step -Run 2003	Run/Step-Run 2005	Run/Step - Run 2006
1	81	73	84			21	25			45	36	
2	71	69	80			20	24			47	34	
3	77	70	75	**62** partial *		25	17	**14** partial		34	43	**29** partial
4	69	72	61				21				29	
5	72	66	69				21				27	
6	68	59	63				14				26	
7	80	66	69	**69** partial			17	**21/** partial			35	**33** partial
8	70	59	64				16				24	
9	65		56	**62**	24		17	**12**	36		25	**30**
10	63											
11	56											
12a	48		33	**40**	20		9	**12**	29(S.run)		15(S.run)	**21(S.run)**
12b	49		36		14		5		40		18	
13	73											
14a	71		55	**66**	23		15	**14**	36(run)		31(run)	**28(run)**
14b				**51**				**15**				**35 (run)**
14c												

*** Partial, ½-mile segments habitat typed in 2006. Previously, the entire mainstem was habitat typed.**

Table 17. ESCAPE COVER Index (Habitat Typing Method*) in Pool Habitat in SOQUEL CREEK, Based on Habitat Typed Segments.

Reach	Pool 2000	Pool 2003	Pool 2005	Pool 2006
1	0.091	0.103	0.107	
2	0.086	0.055	0.106	
3	0.085	0.092	0.141	**0.178** partial**
4	0.041	0.071	0.086	
5	0.061	0.023	0.075	
6	0.082	0.102	0.099	
7	0.089	0.101	0.129	**0.141** partial
8	0.047	0.036	0.060	
9	0.146		0.101	**0.086**
10	0.100			
11	0.068			
12a	0.113		0.222	**0.175**
12b	0.129		0.158	
13	0.077			
14a	0.064			**0.048**
14b		0.051 (2002)		**0.058**
14c		0.068 (2002)		

* Habitat Typing Method = linear feet of escape cover divided by reach length as pool habitat.
** Partial, ½-mile segments habitat typed in 2006. Previously, the entire mainstem was habitat typed.

Aptos and Valencia Creeks– Habitat and Fish Density Comparisons. Refer to Table 18 for habitat conditions as excerpted from the main report and provided in the summary below. Substrate conditions degraded in Aptos and Valencia creeks in 2006 compared to 1981. The large stormflow of January 1982 caused considerable erosion and stream sedimentation throughout the Santa Cruz Mountains, and some streams have not recovered. At the 2 sampling sites in Aptos Creek in 2006, juvenile steelhead densities were less than in 1981 for total juveniles, YOY's, yearling and older, and Size Class I categories. However, 2006 densities in the important Size Class II/ III category were much higher than in 1981. This was because more of the YOY's in 2006 grew into the larger size class than in 1981, a much drier year. At the 2 sampling sites in Valencia Creek in 2006, total juvenile densities were similar and YOY and Size Class 1 densities were higher than in 1981. However, yearling and Size Class II/ III densities were much less in the badly sedimented lower reach than in 1981 and similar between years in the upper reach.

Corralitos, Shingle Mill and Browns Valley Creeks– Habitat and Fish Density Comparisons. Substrate conditions in Corralitos Creek have generally degraded in the 3 reaches studied (Table 18 excerpted below). Those were below Rider Creek (Reach 3), below Eureka Gulch (Reach 6) and above Eureka Gulch (Reach 7) compared to 1994. Substrate conditions in 2006 were more similar to 1981 conditions, which were more degraded than in 1994. With only 3 years of site densities to compare in the Corralitos watershed, higher densities in age and size classes were generally observed in 1981 than 1994 (more than 100 percent more in 1981 for total density, YOY density and Size Class I density at all 7 sites and substantially higher yearling and Size Class II/III fish at 2 of 3 Corralitos sites, 1 of 2 Shingle Mill sites and 1 of 2 Browns Valley sites). A rebound from low 1994 densities was observed in 2006 for all categories except for yearlings at all sites and Size Class II/III fish at the upper Corralitos site and lower Shingle Mill site. The years 1981 and 1994 were drier than average and 2006 was wetter than average, based on hydrographs for Corralitos Creek and the San Lorenzo River.

Substrate conditions in Shingle Mill Gulch have generally degraded since 1994. 2006 substrate was more similar to 1981 conditions. In the much smaller tributary, Shingle Mill Gulch, at the more accessible Site 1, total steelhead densities were similar between 1994 and 2006. Because most of the Size Class II juveniles were likely yearlings and fewer yearlings held over in 2006, there were lower densities of this larger size class in 2006 than 1994. This was in contrast to most Corralitos and Browns Valley sites, where more YOY's were believed to have grown into Size Class II in 2006. At the upper, less accessible Site 3 on Shingle Mill Gulch, total juvenile density was higher in 1981 than 2006. Densities of Size Class II/ III juveniles were similarly low in both years. This site is within the San Andreas rift zone and consistently has much lower baseflow than the lower site.

Substrate conditions in Browns Valley Creek generally declined in 2006 compared to 1994 in the 2 reaches studied (Reaches 1 and 2). In 2006, the YOY densities in Browns Valley Creek were much higher than in the other two streams, with evidence of very late spawners (multiple size modes of YOY's). Densities of yearling and older juveniles were substantially lower in 2006 than 1994 at 6 of the 7 sites, with the exception of the lowermost Site 3 on Corralitos Creek. With higher growth rate of YOY's in 2006 in Corralitos and Browns Valley creeks, 2006 densities of the larger Size Class II/ III juveniles were higher than in 1994 at 4 of 5 sites.

Table 18. Average POOL HABITAT CONDITIONS for Reaches in APTOS, VALENCIA, CORRALITOS, SHINGLE MILL and BROWNS VALLEY Creeks in 2006 (and at Sampling Sites only in Aptos/ Valencia in 1981 and in Corralitos/ Browns Valley in 1981 and 1994).

Sample Site	Mean Depth/ Maximum Depth	Escape Cover*	Embeddedness			Percent Fines		
			1981	1994	2006	1981	1994	2006
Aptos #3- in County Park	1.4/ 3.0	0.123	35		82	75		85
Aptos #4- Above Steel Bridge Xing (Nisene Marks)	1.3/ 2.4	0.059	35		80	65		78
Valencia #2- Below Valencia Road Xing	0.7/ 1.2	0.115	35		88	85		93
Valencia #3- Above Valencia Road Xing	1.0/ 1.7	0.119	55		82	70		83
Corralitos #3- Above Colinas Drive	1.5/ 2.6	0.138	60	45	52	45	35	47
Corralitos #8- Below Eureka Gulch	1.3/ 2.2	0.061	54	50	54	35	20	45
Corralitos #9- Above Eureka Gulch	1.2/ 1.8	0.160	56	60	47	35	15	33
Shingle Mill #1- Below 2nd Road Xing	1.15/ 1.8	0.180	42	45	71	23	8	49
Shingle Mill #3- Above 3rd Road Xing	1.15/ 1.8	0.190	60		71			55
Browns Valley #1- Below Dam	1.4/ 2.4	0.051	58	37	71	38	47	61
Browns Valley #2- Above Dam	1.45/ 2.35	0.120	73	47	69	47	37	53

Steelhead Density Comparisons with Other Central Coast Streams. YOY steelhead densities in 2006 were substantially below average and less than in 2005 in 6 of 7 Central Coast streams where long-term data are available, the exception being Santa Rosa Creek (San Luis Obispo County; **Alley**

2007a). The 6 streams were the San Lorenzo River, Soquel, San Simeon (San Luis Obispo County; **Alley 2007b**), and streams sampled by Smith (**2007**): Scott, Waddell and Gazos creeks in Santa Cruz and San Mateo counties. To clarify, YOY densities in Santa Rosa Creek were above average at 6 of 12 sites with the YOY population estimate below average (though greater than in 2005). Streams where yearling densities were below average and less than in 2005 included the San Lorenzo River, Soquel Creek, Santa Rosa Creek, and San Simeon Creek. Yearling densities on Scott, Waddell and Gazos creeks were also below average.

INTRODUCTION

I-1. Steelhead and Coho Salmon Ecology

Migration. Adult steelhead in small coastal streams tend to migrate upstream from the ocean through an open sandbar after several prolonged storms; the migration seldom begins earlier than December and may extend into May if late spring storms develop. Many of the earliest migrants tend to be smaller than those entering the stream later in the season. Adult fish may be blocked in their upstream migration by barriers such as bedrock falls, wide and shallow riffles and occasionally log-jams. Man-made objects, such as culverts, bridge abutments and dams are often significant barriers. Some barriers may completely block upstream migration, but many barriers in coastal streams are passable at higher streamflows. If the barrier is not absolute, some adult steelhead are usually able to pass in most years, since they can time their upstream movements to match peak flow conditions. In 1992 we located a partial migrational barrier in the San Lorenzo River Gorge caused by a large boulder field, which is probably passable at flows above approximately 50-70 cubic feet per second (cfs) as it was observed in 2002. In most years it is not a problem. However, in drought years and years when storms are delayed, it can be a serious barrier to steelhead and especially coho salmon spawning migration. In 1998 and 1999, a difficult passage riffle was observed in the upper portion of Reach 2 in the Rincon area. A split channel was developing, causing difficult passage conditions for adults at flows less than approximately 50-70 cfs as observed in 2002.

Coho salmon often have severe migrational problems because their migration period, November through early February, is often prior to the stormflows needed to pass shallow riffles, boulder falls and partial logjam barriers. Access at the river mouth is also a greater problem for coho salmon because they die at maturity and cannot wait in the ocean an extra year if access is poor due to failure of sandbar breaching during drought or delayed stormflow. In recent years, the rainfall pattern has brought early winter storms to allow for good coho access to the San Lorenzo system.

Smolts (young steelhead and coho salmon which have physiologically transformed in preparation for ocean life) in local coastal streams tend to migrate downstream to the lagoon and ocean in March through early June. In streams with lagoons, young-of-the-year and yearling fish may spend several months in this highly productive lagoon habitat and grow rapidly. In some small coastal streams, downstream migration can occasionally be blocked or restricted by low flows due primarily to heavy streambed percolation or early season stream diversions. Flashboard dams or closure of the stream mouth or lagoon by sandbars are additional factors, which adversely affect downstream migration. However, for most local streams, downstream migration is not a major problem except under extreme drought conditions.

Spawning. Steelhead and coho salmon require spawning sites with gravels (from 1/4" to 3 1/2" diameter) having a minimum of fine material (sand and silt) and with good flows of clean water moving over and through them. Flow of oxygenated water through the redd (nest) to the fertilized eggs is restricted by increased fine materials from sedimentation and cementing of the gravels with fine materials. These restrictions reduce hatching success. In many local streams, steelhead appear to successfully utilize spawning substrates with high percentages of coarse sand, which probably reduces hatching success. Steelhead that spawn earlier in the winter are more likely to have their redds washed out or buried by winter storms. Steelhead spawning success may be limited by scour from winter storms in some Santa Cruz County streams. Unless hatching success has been severely reduced, however, survival of eggs and alevins is usually sufficient to saturate the limited available rearing habitat in most small coastal streams and San Lorenzo tributaries. However, in the mainstem San Lorenzo River downstream of the Boulder Creek confluence, spawning success may be an important limiting factor. The production of young-of-the-year fish is related to spawning success, which is a function of the quality of spawning conditions, the pattern of storm events and ease of spawning access to upper reaches of tributaries, where spawning conditions are generally better.

Rearing Habitat. In the mainstem San Lorenzo River, downstream of the Boulder Creek confluence, many steelhead require only one summer of residence before reaching smolt size. Except in streams with high summer flow volumes (greater than about 0.2 to 0.4 cubic feet per second (cfs) per foot of stream width), steelhead require two summers of residence before reaching smolt size. This is the case for most juveniles inhabiting tributaries of the San Lorenzo River. Juvenile steelhead are generally identified as young-of-the-year (first year) and yearlings (second year). The slow growth and often two-year residence time of most local juvenile steelhead indicate that the year class can be adversely affected by low streamflows or other problems during either of the two years of residence. Nearly all coho salmon, however, smolt after one year under most conditions, despite their smaller size.

Growth of young-of-the-year (YOY) steelhead and coho salmon appears to be regulated by available insect food, although cover (hiding areas, provided by undercut banks, large rocks which are not buried or "embedded" in finer substrate, surface turbulence, etc.) and pool, run and riffle depth are also important in regulating juvenile numbers, especially for larger fish. Densities of yearling and smolt-sized steelhead in small streams, the upper San Lorenzo (upstream of the Boulder Creek confluence) and San Lorenzo tributaries, are usually regulated by water depth and the amount of escape cover during low-flow periods of the year (July-October). In most small coastal streams, availability of this "maintenance habitat" provided by depth and cover appears to determine the number of smolts produced (**Alley 2006a; 2006b**). Abundance of food (aquatic insects and terrestrial insects that fall into the stream) and fast-water feeding positions for capture of drifting insects in "growth habitat" (provided mostly in spring and early summer) determine the size of these smolts. Where found together, young steelhead use pools and faster water in riffles and runs/ step-runs, while young coho salmon use primarily pools. Aquatic insect production is maximized in unshaded, high gradient riffles dominated by relatively unembedded substrate larger than about 4 inches in diameter.

Yearling steelhead growth usually shows a large increase during the period of March through June. Larger steelhead then may smolt as yearlings. For steelhead that stay a second summer, summer growth is very slight in many tributaries (or even negative in terms of weight) as flow reductions eliminate fast-water feeding areas and reduce insect production. A short growth period may occur in fall and early winter after leaf-drop of riparian trees, after increased streamflow from early storms, and before water temperatures decline below about 48ºF or water clarity becomes too turbid for feeding. The "growth habitat" provided by higher flows in spring and fall (or in summer for the mainstem river) is very important, since ocean survival to adulthood increases exponentially with smolt size.

During summer in the mainstem San Lorenzo River downstream of the Boulder Creek confluence, steelhead use primarily fast-water habitat where insect drift is the greatest. This habitat is found in deeper riffles, heads of pools and faster runs. YOY and small yearling steelhead that have moved down from tributaries can grow very fast in this habitat if streamflows are high and sustained throughout the summer. The shallow riffle habitat in the upper mainstem is used almost exclusively by small YOY's, although most YOY's are in pools. In the warm mainstem Soquel Creek, downstream of Moores Gulch, juvenile steelhead utilize primarily heads of pools in all but the highest flow years, with some YOY's using shallower runs and riffles. Upstream of Moores Gulch in summer on the mainstem and in the two Branches (East and West) juvenile steelhead use much of the pool habitat where cover is available and deeper step-runs primarily. Riffles are used by primarily YOY's and more so in the upper mainstem than the branches where they become more shallow. Pool habitat and step-run habitat are the primary habitat for steelhead in summer in San Lorenzo tributaries, the upper San Lorenzo River above the Boulder Creek confluence, Aptos, Valencia, Corralitos, Shingle Mill and Browns Valley creeks because riffles and runs are very shallow, offering limited escape cover. Primary feeding habitat is at the heads of pools and in deeper pocket water of step-runs. The deeper the pools, the more value they have. Higher streamflow enhances food availability, surface turbulence and habitat depth, all factors in increasing steelhead densities and growth rates. Where found together, young steelhead use pools and faster water in riffles and runs/ step-runs, while coho salmon use primarily pools.

Juvenile steelhead captured during fall sampling included a smaller size class of juveniles less than (<) 75 mm (3 inches) Standard Length (SL); these fish would almost always require another growing season before smolting. The larger size class included juveniles 75 mm SL or greater (=>) and constituted fish that are called "smolt size" because a majority will likely out-migrate the following spring. Smolt size was based on scale analysis of out-migrant smolts captured in 1987-89 in the lower San Lorenzo River. This size class in fall may include fast growing young-of-the-year steelhead inhabiting the mainstem San Lorenzo River, lower reaches of larger San Lorenzo tributaries, lower reaches of Corralitos and Aptos creeks and slower growing yearlings and older fish inhabiting San Lorenzo tributaries, the middle and upper mainstem San Lorenzo in lower flow years, Aptos, Valencia, Shingle Mill Corralitos and Browns Valley creeks.

A basic assumption in relating juvenile densities to habitat conditions where they are captured is that juveniles do not move substantially from the vicinity where they are captured during the growing season. This is a reasonable assumption because it has been observed at sites in close proximity (**D. Alley pers. observation**), such as adjacent larger mainstem and smaller tributary sites, where juveniles are consistently larger in the mainstem. This indicates a lack of movement between sites. In addition, Davis (**1995**) marked juvenile steelhead in June in Waddell Creek and recaptured the same fish in September in the same habitats or immediately adjacent habitats that they had been marked in during a study of growth rates in different habitats.

There has been concern expressed that summer flashboard dams without ladders may impede upstream movements of juvenile salmonids during non-migrational periods such as summer. This needs further study because evidence is lacking that would indicate juvenile movement upstream during the dry season. Shapovalov and Taft (**1954**) after 9 consecutive years of fish trapping on Waddell Creek detected very limited upstream juvenile steelhead movements. And most of that was in the winter only.

Overwintering Habitat. Deeper pools, undercut banks, side channels, large unembedded rocks and large wood clusters provide shelter for fish against the high winter flows. In some years, such as 1982 and 1998, extreme floods may make overwintering habitat the critical factor in steelhead production. In years when bankfull or greater stormflows occur, these refuges are critical, and it is unknown how much refuge is actually needed. The remaining coho streams, such as Gazos Waddell and Scott creeks, have considerably more instream wood for winter refuge than streams where coho have been extirpated, such as Soquel Creek (**Leicester 2005**).

I-3. Project Purpose and General Study Approach

The intent of the 2006 fall fish sampling and habitat evaluation included comparison of 2006 juvenile steelhead densities at sampling sites and rearing habitat conditions with those in 1997–2001 and 2003–2005 in the San Lorenzo River and 7 tributaries and in the Soquel Creek mainstem and branches with steelhead densities and habitat conditions in 1997–2005. In addition, fall steelhead densities and habitat conditions in the Corralitos Creek watershed were compared to those in 1981 and 1994. Fall 2006 steelhead densities and habitat conditions in the Aptos Creek watershed were compared to those in 1981. Habitat conditions were assessed primarily from measurement of streamflow (San Lorenzo watershed only), escape cover, water depth and visual estimates of streambed substrate composition and substrate embeddedness.

METHODS

M-1. Choice of Reaches and Vicinity of Sites to be Sampled- Methods

In 2006, the assignment was to compare fish densities at average habitat quality sampling sites in previously determined reaches and locations with past fish densities without estimating fish population sizes for reaches and extrapolation to adult indices. In so doing, report preparation could be reduced and more sites could be sampled in more watersheds. However, the fish density data collected by habitat type in 2006 could be combined with habitat proportions determined during habitat typing to estimate juvenile production in the reaches sampled in 2006, consistent with past years.

The mainstem San Lorenzo was divided into 13 reaches, based on past survey work (**Table 1a; Appendix A map, Figure 2**). Much of the San Lorenzo River was surveyed during a past water development feasibility study in which general geomorphic differences were observed (**Alley 1993**). This work involved survey and determination of reach boundaries in the mainstem and certain tributaries, including Kings and Newell creeks (**Tables 1a-b; Appendix A map, Figure 2**). In past work for the San Lorenzo Valley Water District, Zayante and Bean creeks were surveyed and divided into reaches. Previous work for the Scotts Valley Water District required survey of Carbonera Creek and reach determination. Conversations with long-time Lompico Creek resident, Kevin Collins, were used to determine reach boundaries in Lompico Creek. Considerations included summer baseflows, past road impacts, water diversion impacts and extent of perennial channel.

In each tributary and the upper mainstem of the San Lorenzo, the uppermost extent of steelhead use was approximated. For the upper San Lorenzo River, topographic maps were used with attention to change in gradient and tributary confluences to designate reach boundaries (**Table 1b; Appendix A map, Figure 2**). The uppermost reach boundaries for Bean and Bear creeks were based on a steep gradient change seen on the topographic map, indicative of passage problems. The Deer Creek confluence was used on Bear Creek, although steelhead access is somewhat further. Known barriers were upper reach boundaries in Carbonera, Fall, Newell, Boulder and Kings creeks. The extent of perennial stream channel in most years was used for setting boundaries on Branciforte, Zayante and Lompico creeks. Steelhead estimates in Zayante Creek stopped at the Mt. Charlie Gulch confluence in past years, although steelhead habitat exists above in Zayante Creek and Mt. Charlie Gulch in many years. Steelhead habitat in the Zayante tributary, Lompico Creek, was first sampled in 2006.

In 2006, sampled tributaries of the San Lorenzo included Zayante, Lompico, Bean, Newell, Boulder, lower Bear and lower Branciforte creeks. Refer to **Table 1c, Appendix A, Figure 2** and page 2 for a list of sampling sites and locations. Steelhead inhabit other tributaries, and in the past, 9 major tributaries were sampled. Other tributaries known to contain steelhead from past sampling and observation include (from lower to upper watershed) Eagle Creek in Henry Cowell State Park, Lockhart Gulch, Mountain Charlie Gulch in the upper Zayante Creek drainage, Love Creek, Clear

Creek, Two Bar Creek, Logan Creek tributary to Kings Creek and Jamison Creek (a Boulder Creek tributary). Other creeks likely to provide steelhead access and perennial habitat include Glen Canyon and Granite creeks in the Branciforte system; Powder Mill Creek, Gold Gulch (lower mainstem San Lorenzo tributaries); and Ruins and Mackenzie creeks (2 small Bean Creek tributaries). This list is not exhaustive for steelhead. Resident rainbow trout undoubtedly exist upstream of steelhead migrational barriers in some creeks and especially upper Boulder Creek above the bedrock chute near the Boulder Creek Country Club.

In Soquel Creek, reach boundaries downstream of the East and West Branch confluence were determined from habitat typing and stream survey work in September 1997. For reaches on the East and West branches, boundaries were based on observations made while hiking to sampling sites, observations made during previous survey work, and reach designations made by Dettman during earlier work (**Dettman and Kelley 1984**). Changes in habitat characteristics that necessitated reach boundary designation often occurred when stream gradient changed. Stream gradient is often associated with changes in habitat proportions, pool depth, substrate size distribution and channel type. Other important factors separating reaches are a change in tree canopy closure or significant tributary confluences that increase summer baseflow and may be locations of sediment input from tributaries in the winter.

The 7.1 miles of Soquel Creek (excluding the lagoon) downstream of the East and West Branches were divided into 8 reaches (**Table 2a; Appendix A of watershed maps**). The lagoon was designated Reach 0. The 7 miles of the East Branch channel between the West Branch confluence and Ashbury Gulch were divided into 4 reaches. The upstream limit of steelhead in this analysis was considered Ashbury Gulch due to the presence of a bedrock falls and several boulder drops constituting Ashbury Falls immediately downstream. These impediments likely prevent adult access to areas above the falls in many years. Furthermore, the salmonid size distribution of previous years at Site 18 above Ashbury Falls (delineated in **Table 2b**) indicated that a higher proportion of larger resident rainbow trout was present in the population upstream of Reach 12b. The West Branch had 2 reliable steelhead reaches (13 and 14a). The upper West Branch reach was shortened in 2000 when a bedrock chute (Girl Scout Falls I) was observed upstream of Olson Road (formerly Olsen Road) near the Girl Scout camp. This chute is likely impassable during many stormflows. Therefore, juvenile steelhead population estimates for previous years were reduced to exclude potential juvenile production above this passage impediment. Sampling in 2003 and 2005 indicated that steelhead likely passed Girl Scout Falls I but not Girl Scout Falls II. Sampling in 2004 indicated that some steelhead might have passed Girl Scout Falls II, though young-of-the-year production above Girl Scout Falls II was approximately half what it was downstream.

In 2002, the upper West Branch was surveyed. Significant impediments to salmonid migration were found and used as reach boundaries. Reach 14b was designated between Girl Scout Falls I and Girl Scout Falls II. Reach 14c was designated between Girl Scout Falls II and Tucker Road (formerly Tilly's Ford). Reach 14d was designated between Tucker Road and Laurel Mills Dam.

In 2006, the number of sampling sites in the Soquel Creek watershed was reduced to allow for additional sampling in the Aptos and Corralitos watersheds. All captured fish were scanned to detect any previously tagged individuals at NOAA Fisheries sites. Soquel Creek sites included 2 mainstem sites with one in the lower mainstem below Moores Gulch in Reach 3 (Site 4) and one in the upper mainstem in Reach 7 (Site 10) (**Table 2b**). Half-mile segments in the vicinity of these sites were habitat typed to determine sampling sites with average habitat quality.

Sampling sites were chosen to represent the lower East Branch Reach 9 (Site 13a) and the upper East Branch Reach 12a (Site 16) (**Table 2b**) in the upper Soquel Creek watershed where most of the spawning usually occurs. On the West Branch, sampling sites were chosen downstream of Girl Scout Falls I in Reach 20 (Site 20) and above Girl Scout Falls II in Reach 14c leading to Tucker Road (Site 22) to help assess passage above the falls. The reach between the falls was habitat typed (Reach 14b) to compare habitat conditions with 2002. NOAA Fisheries sampled this reach, and juvenile steelhead densities were measured from their efforts. Reach 14a was habitat typed to choose Site 20. However, a landowner interrupted sampling there and prevented completion of the site. Densities at that site were based on the habitat sampled. An additional sampling site was added at location of Site 19 to adequately sample the West Branch.

In the Aptos Creek watershed, 2 sites on Aptos were designated, representing the low-gradient Reach 2 above the Valencia Creek confluence and the higher gradient Reach 3 in Nisene Marks State Park (**Appendix A map**). Two sites on Valencia were sampled in the vicinity of historical sites previously sampled in 1981 (**Table 3**). These were Reach 2 above passage impediments near Highway 1 and Reach 3 above the passage impediment at the Valencia Road culvert crossing that has been modified. Half-mile segments in the vicinity of historical sampling sites were habitat typed so that pools with average habitat quality could be chosen for sampling, along with adjacent fastwater habitat. Site numbers were consistent with 1981 numbering.

In the Corralitos Creek sub-watershed of the Pajaro River Watershed, sampling sites were chosen based on historical sampling locations (**Smith 1982; Alley 1995a**) and historical reach designations determined in 1994 (**Alley 1995a**). Reach delineations were based on previous stream survey work of streambed conditions, streamflow and habitat proportions by Alley of the extent of steelhead distribution in sub-watershed in 1981 and past knowledge of streamflow and sediment inputs from tributaries by Smith and Alley during drought and flood (**Table 4a; Appendix A**). Half-mile segments in the vicinity of the historical sampling sites chosen for 2006 sampling were habitat typed to identify pools with average habitat quality and their adjacent fastwater habitat to sample. Site numbers were kept consistent with the original 1981 designations to prevent confusion.

In Corralitos Creek, 3 reaches were chosen: Reach 3 downstream of Rider Creek as streamflow steadily increased toward the diversion dam (Site 3), Reach 6 upstream of Rider Creek (a historical sediment source) and the tunnel bridge (box culvert) crossing that is a partial passage impediment (Site 8) and Reach 7 upstream of Eureka Gulch, a historical sediment source (Site 9) (**Tables 4a and 4b; Appendix A map**).

In Shingle Mill Gulch, Reach 1 was chosen below the partial passage impediment at the second road crossing (Site 1) and Reach 3 above the second and third road crossings and the steep Reach 2. Reach 3 is a lower gradient, low flow reach that enters Grizzly Flat (Site 3) (**Tables 4a and 4b; Appendix A map**).

In Browns Valley Creek, Sites 1 and 2 were chosen to represent the 2 reaches previously delineated there (**Tables 4a and 4b; Appendix A map**). The diversion dam demarcated the reach boundaries because of its potential effect on surface flow and possible adult and juvenile steelhead passage impedance. Other valuable steelhead habitat exists in Ramsey Gulch and Gamecock Canyon Creek (**Smith 1982**).

M-2. Classification of Habitat Types and Measurement of Habitat Characteristics

In each watershed, ½-mile stream segments were habitat-typed using a modified CDFG Level III habitat inventory method, with fish sampling sites chosen within each segment based on average habitat conditions. See sampling methods for more details. Additional sampling sites were added in 2006 at historical locations without stream segments in their vicinities habitat typed. These sites were Zayante #13c, Bean #14b, West Branch Soquel #19 and West Branch Soquel #22.

Habitat types were classified according to the categories outlined in the California Salmonid Stream Habitat Restoration Manual (**Flosi et al. 1998**). Some habitat characteristics were estimated according to the manual's guidelines, including length, width, mean depth, maximum depth, shelter rating and tree canopy (tributaries only in 1998). More data were collected for escape cover than required by the manual to obtain more detailed, biologically relevant information.

M-3. Measurement of Habitat Parameters

During habitat typing in 2006, visual estimates of substrate composition and embeddedness were made. The observer looked at the habitat and made mental estimates based on what he saw with his trained eye. Therefore, these estimates are somewhat subjective, with consistency between data collectors requiring calibration from one to the other. An assumption is that the same data collector will be consistent in visual estimates. If more than one data collector contributes to the same study, the original observer trains the others to be consistent ("calibrated") on visual estimates. Changes in visual estimates of substrate abundance or embeddedness of about 10% or more between sites and years probably represent real changes in habitat quality.

Fine Sediment

Fine sediment was visually estimated as particles smaller than approximately 0.08 inches. In the Santa Cruz Mountains, there is little gradual gradation in particle size between sand and larger substrate, making visual estimates of fines relatively easy. There is generally a shortage of gravel-sized substrate.

The comparability of these visual estimates to data collection via pebble counts would depend on the skill of the visual estimator and the skill of the pebble count collectors. Untrained volunteers tend to select larger substrate to pick up and measure during pebble counts, resulting in an overestimate of particle size composition of the streambed. The accuracy of pebble counts is also dependent on sample size. Neither the pebble count nor the visual estimate will provide data for substrate below the streambed surface. The McNeil Sampler may be used for core samples, and results from this method may not comparable to the other methods. The substrate that may be sampled with core sampling is restricted by the diameter of the sampler. Both the pebble count method and the core sampling method are too labor intensive for habitat typing. We do not believe more in-depth estimates than those taken for percent fines during habitat-typing are necessary for purposes of this fishery study. It is best to have annual consistency in data collecting personnel during habitat-typing, however.

Embeddedness

Embeddedness was visually estimated as the percent that cobbles and boulders larger than 150 mm (6 inches) in diameter were buried in finer substrate. Previous to 1999, the cobble range included substrate larger than 100 mm (4 inches). The change in cobble size likely had little effect on embeddedness estimates. The reason the cobble size was increased to 150 mm was because substrate smaller than that probably offered little benefit for fish escape cover, and embeddedness of smaller substrate was not a good indicator of habitat quality for fish.

The previous years' data was not reviewed prior to data collection so as not to bias the latest data collection. Cobbles and boulders larger than approximately 150 mm in diameter provided good, heterogeneous habitat for aquatic insects in riffles and runs and some fish cover if embedded less than 25%. Cobbles and boulders larger than 225 mm provided the best potential fish cover if embedded less than 25%.

Tree Canopy Closure

Quantitative estimates of tree canopy closure were made with a densiometer. Included in the tree canopy closure measurement were trees growing on slopes considerable distance from the stream. The percent deciduous value was based on visual estimates of the relative proportion of deciduous canopy closure provided to the stream channel. Tree canopy closure directly determines the amount of solar radiation that reaches the stream on any date of the year, but the relationship changes as the sun angle changes through the seasons. Our measure of canopy closure estimated the percent of blue sky blocked by the vegetative canopy and was not affected by the sun angle.

Greater tree canopy inhibits warming of the water and is critically important in small tributaries. Increased water temperature increases the metabolic rate and food requirements of steelhead. Tree canopy in the range of 75-90% is optimal in the upper mainstem river (Reaches 10-12) and tributaries because water temperatures are well within the tolerance range of juvenile steelhead and coho salmon. If reaches with low summer baseflow become unshaded, water temperature rapidly increases. Limited openings (10-15%) in the canopy provide some sunlight during the day for algal growth and visual feeding by fish. In the San Lorenzo River system, it is important that the tributaries remain well shaded so that tributary inflows to the mainstem are sufficiently cool to prevent excessively high water temperatures in the lower mainstem river (Reaches 1-5), where tree canopy is often in the 50-75% range. There is an inverse relationship between tree canopy and insect production in riffles, which allows faster steelhead growth in larger, mainstem reaches of the San Lorenzo River having deeper, fast-water feeding areas, despite the elevated temperatures and steelhead metabolic rate (and associated food requirements.) In addition, very dense shading reduces visibility of drifting insect prey and reduces fish feeding efficiency. However, as fast-water feeding areas diminish in smaller stream channels with less streamflow further up the watershed, high water temperatures may increase steelhead food demands beyond the benefits of greater food production in habitat lacking in fast-water feeding areas. Here is where shade canopy must increase to maintain cooler water temperature and lowered metabolic rate and food requirements of juvenile steelhead.

Escape Cover- Sampling Sites

The escape cover index for each habitat type within sampled sites was quantitatively determined in the same manner in 1994-2001 and in 2003-2006. The importance of escape cover is that the more there is in a habitat, the higher the production of steelhead, particularly for steelhead => 75 mm SL. Water depth itself provides some escape cover when 2 feet deep and good escape cover when it is 3 feet deep (1 meter) or greater. Escape cover was measured as the ratio of the linear distance under submerged objects within the habitat type that fish at least 75 mm (3 inches) Standard Length (SL) could hide under, divided by the length of the habitat type. The summer escape cover (as unembedded cobbles, undercut banks and instream wood) also provides overwintering habitat in the tributaries. This allowed annual comparisons for the habitats at historical sites.

Escape Cover- Habitat Typing Method by Reach

Reach averages in 1997-2000, 2003, 2005 and 2006 for escape cover by habitat type were determined from habitat-typed segments. Reach cover indices were determined for habitat types in reach segments for purposes of annual comparisons. They were calculated as linear feet of cover under submerged objects that size class 2 and 3 juveniles divided by feet of stream channel for each habitat type in the reach segment. Objects of cover included unembedded boulders, submerged woody debris, undercut banks, bubble curtains and overhanging tree branches and vines that entered the water. Man-made objects, such as boulder rip-rap, concrete debris and plywood also provided cover. Escape cover constituted areas where fish could be completely hidden from view. This was not a measure of the less effective overhead cover that may be caused by surface turbulence or vegetation hanging over the water but not touching.

Water Depth, Channel Length and Width

Water depth is important because deeper habitat is more utilized by steelhead. Deeper pools are associated with scour objects that often provided escape cover. Mean depth and maximum depth were determined with a dip net handle, graduated in half- foot increments for the first foot and foot increments for the remainder of the handle. Soundings throughout the habitat type were made to estimate mean and maximum depth. Annual comparisons of habitat depth were possible because measurements were taken in the fall of each year. Minimum depth was determined approximately one foot from the stream margin in earlier years. Stream length was measured with a hip chain. Width in each year was measured with the graduated dip net except in wider habitats of the mainstem. In wider habitats (greater than approximately 20 feet), a range finder was used to measure width.

Streamflow

For 1995 and 1998 onward, the Marsh McBirney Model 2000 flowmeter was more extensively used at most sampling sites. Streamflow measurement was beyond the project scope and budget in 2006. However, it was measured at historical sites in the San Lorenzo watershed anyway. Mean column velocity was measured at 20 or more verticals at each cross-section.

M-4. Choice of Specific Habitats Within Reaches to be Sampled- Methods

Based on the habitat typing conducted in each reach prior to fish sampling in 2006, representative habitat units were selected with average habitat quality values in terms of water depth and escape cover to determine fish densities by habitat type. In mainstem reaches of the lower and middle San Lorenzo River (Sites 1, 4, 6 and 8), riffles and runs that were close to the average width and depth for the reach were sampled by electrofishing. Pools in these reaches were divided into long pools (greater than 200 feet long) and short pools (less than 200 feet) and at least one pool of each size class was either snorkel censused or electrofished. The exception was Reach 1, which had only one pool less than 200 ft long, which was not censused. Only a long pool was censused in Reach 1 (which historically consisted of a long pool and a short pool). In these mainstem reaches, most fish were in the fastwater habitat of riffles, runs and the heads of pools and not using most of the pool habitat. Some of the pools are hundreds of feet long with very few juveniles, except for those at the heads of pools.

For all other reaches in this study– in the upper San Lorenzo River above the Boulder Creek confluence, all San Lorenzo tributaries and in the Aptos and Corralitos watersheds, the location of representative pools with average habitat quality in terms of water depth and escape cover determined the pool habitat to be sampled. Pools were deemed representative if they had escape cover ratios and water depths similar to the average values for all pools in the half-mile segment that was habitat typed within the reach. Therefore, pools that were much deeper or much shallower than average or had much less or much more escape cover than average were not sampled. Once the pools were chosen for electrofishing, adjacent riffles, step-runs, runs and glides were sampled, as well. In these smaller channel situations, these latter habitat types showed great similarity between individual habitats of those types. Namely, riffles runs, step-runs and glides were all about the same in depth and escape cover. Since habitat conditions may change from year to year and locations of individual habitat units may shift depending on winter storm conditions, sampled units may also change. The assumption in this method is that fish sampling of representative habitat will reflect the mean habitat quality for the reach and provide average fish densities for specific habitat types throughout the reach. The assumption here is that there is a correlation between fish density and habitat quality in that better habitat has more fish. Past modeling has indicated that densities of yearling-sized juveniles are well correlated with water depth and escape cover in small, low summer flow streams (**Smith 1984**). The fish density for each habitat type was calculated as the number of fish per linear foot of that habitat type. Thus, the number of fish calculated for each censused pool in the reach was divided by the linear feet of habitat sampled.

M-5. Consistency of Data Collection Techniques in 1994-2001 and 2003-2006

Habitat parameters were measured at the monitoring sites in 2006 consistent with methods used in 1981 and 1994-2001 and 2003-2005. Donald Alley, the principal investigator and data collector in 1994-2001 and 2003-2006, had also collected the fish and habitat data at 9 of 18 San Lorenzo River sites and 5 of 8 tributary sites in the 1981 study for the County Water Master Plan (**Smith 1982**). His qualitative estimates of embeddedness, streambed composition and habitat types were calibrated to be consistent with those of Dr. Smith, the primary investigator for the 1981 sampling program. Mr. Alley's method of measuring escape cover for smolt-sized (=>75 mm SL) and larger steelhead was consistent through the years, although the escape cover index in 1981 was based upon linear cover per habitat perimeter and later escape cover indices were based on linear cover per habitat length. During electrofishing from 1996 onward, block nets were used to partition off habitats at all electrofishing sites. This prevented steelhead escapement. A multiple pass method was used in each habitat with at least three passes.

From 1998 onward, underwater visual (snorkel) censusing was incorporated with electrofishing so that pool habitat in the mainstem San Lorenzo River, which had been electrofished in past years, could be effectively censused despite it being too deep in 1998 (a high-flow year) for backpack electrofishing. Snorkel censusing was also used to obtain density estimates in deeper pools previously unsampled prior to 1998 at Sites 2, 3, 7, 8 and 9, in an effort to increase the accuracy of production estimates. A better juvenile production estimate and predictions of adult returns were made with snorkel-censusing of pool habitat in the mainstem San Lorenzo River for 1998–2005. In 2006, deeper pools were snorkel-censused at Sites 1, 4 and 8 in the lower and middle mainstem to determine site densities only.

Table 1a. Defined Reaches in the Mainstem San Lorenzo River.

(Refer to Appendix A for map designations. Surveyed reaches indicated by asterisk)

Reach #	Reach Boundaries	Reach Length (ft)
0	Water Street to Tait Street Diversion CM0.92 – CM1.92	5,277
1*	Highway 1 to Buckeye Trail Crossing CM1.92 - CM4.73	14,837
2	Buckeye Trail Crossing to the Upper End of the Wide Channel Representation on the Felton USGS Quad Map CM4.73 - CM6.42	8,923
3	From Beginning of Narrow Channel Representation in the Gorge to the Beginning of the Gorge (below the Eagle Creek Confluence) CM6.42 - CM7.50	5,702
4*	From the Beginning of the Gorge to Felton Diversion Dam CM7.50 - CM9.12	8,554
5	Felton Diversion Dam to Zayante Creek Confluence CM9.12 - CM9.50	2,026
6*	Zayante Creek Confluence to Newell Creek Confluence CM9.50 - CM12.88	17,846
7	Newell Creek Confluence to Bend North of Ben Lomond CM12.88 - CM14.54	8,765
8*	Bend North of Ben Lomond to Clear Creek Confluence in Brookdale CM14.54 - CM16.27	9,138
9	Clear Creek Confluence to Boulder Creek Confluence CM16.27 - CM18.38	11,137
10	Boulder Creek Confluence to Kings Creek Confluence CM18.38 - CM20.88	13,200
11*	Kings Creek Confluence to San Lorenzo Park Bridge Crossing CM20.88 - CM24.23	17,688
12	San Lorenzo Park Bridge to Gradient Change, North of Waterman Gap CM24.23 - CM26.73	13,200
	TOTAL	136,293 (25.8 miles)

Table 1b. Defined Reaches in Major Tributaries of the San Lorenzo River.

Creek-Reach #	Reach Boundaries (Downstream to Upstream)	Reach Length (ft)
Zayante 13a*	San Lorenzo River Confluence to Bean Creek Confluence CM0.0-CM0.61	3,221
13b	Bean Creek Confluence to Trib. Draining from S.Cruz Aggregate Quarry CM0.61-CM2.44	9,662
13c	Santa Cruz Aggregate Tributary to Lompico Creek Confluence CM2.44-CM3.09	3,432
13d*	Lompico Creek Confluence to Mt. Charlie Gulch Confluence CM3.09-CM5.72	13,886
Lompico 13e*	Lompico Creekmouth to 1st Culvert Crossing CM0.0-CM0.8	4,265
Lompico 13f	1st Culvert Crossing to Carol Road Bridge CM0.8-CM1.77	5,077
Lompico 13g	Carol Road Bridge to Mill Creek Confluence CM1.77-CM2.35	3,046
Lompico 13h	Mill Creek Confluence to End of Perennial Channel CM2.35-CM3.73	7,311
Bean 14a	Zayante Creek Confluence to Mt. Hermon Road Overpass CM0.0-CM1.27	6,706
14b	Mt. Hermon Road Overpass to Ruins Creek Confluence CM1.27-CM2.15	4,646
14c*	Ruins Creek Confluence to Gradient Change Above the Second Glenwood Road Crossing CM2.15-CM5.45	17,424
Fall 15	San Lorenzo River Confluence to Boulder Falls CM0.0-CM1.58	8,342
Newell 16*	San Lorenzo River Confluence to Bedrock Falls CM0.0-CM1.04	5,491
Boulder 17a*	San Lorenzo River Confluence to Foreman Creek Confluence CM0.0-CM0.85	4,488
17b*	Foreman Creek Confluence to Narrowing of Gorge Adjacent Forest Springs CM0.85-CM2.0	6,072
17c	Narrow Gorge to Bedrock Chute At Kings Highway Junction with Big Basin Way CM2.0-CM3.46	7,709

Creek- Reach #	Reach Boundaries (Downstream to Upstream)	Reach Length (ft)
Bear 18a*	San Lorenzo River Confluence to Unnamed Tributary at Narrowing of the Canyon Above Bear Creek Country Club CM0.0-CM2.42	12,778
18b	Narrowing of the Canyon to the Deer Creek Confluence CM2.42-CM4.69	11,986
Kings 19a	San Lorenzo River Confluence to Unnamed Tributary at Former Fragmented Dam Abutment Location CM0.0-CM2.04	10,771
19b	Tributary to Bedrock-Boulder Cascade CM2.04-CM3.73	8,923
Carbonera 20a	Branciforte Creek Confluence to Old Road Crossing and Gradient Increase CM0.0-CM1.38	7,293
20b	Old Road Crossing to Moose Lodge Falls CM1.38-CM3.39	10,635
Branciforte 21a*	Carbonera Creek Confluence to Granite Creek Confluence CM1.12-CM3.04	10,138
21b	Granite Creek Confluence to Tie Gulch Confluence CM3.04-CM5.73	14,203
	TOTAL	177,806
		(33.7 miles)

Table 1c. Fish Sampling Sites in the San Lorenzo Watershed in 2001, with 2006 Sites Indicated by Asterisk.

Reach #	Sampling Site # -Channel Mile	MAINSTEM SITES Location of Sampling Sites
0	0a –CM1.6	Above Water Street Bridge
0	0b –CM2.3	Above Highway 1 Bridge
1	*1 -CM3.8	Paradise Park
2	2 -CM5.7	Lower Gorge at Rincon Trail Access
3	3 -CM7.4	Upper End of the Gorge
4	*4 -CM8.9	Downstream of the Cowell Park Entrance Bridge
5	5 -CM9.3	Downstream of Zayante Creek Confluence
6	*6 -CM10.4	Below Fall Creek Confluence
7	7 -CM13.8	Above Lower Highway 9 Crossing in Ben Lomond
8	*8 -CM15.9	Upstream of the Larkspur Road (Brookdale)
9	9 -CM18.0	Downstream of Boulder Creek Confluence
10	10 -CM20.7	Below Kings Creek Confluence
11	*11 -CM22.3	Upstream of Teilh Road, Riverside Grove
12	12a -CM24.7	Downstream of Waterman Gap and Highway 9
	12b -CM25.2	Waterman Gap Upstream of Highway 9

Table 1c. Fish Sampling Sites in the San Lorenzo Watershed in 2001, with 2006 Sites indicated by Asterisk (continued).

Reach #	Sampling Site # -Channel Mile	TRIBUTARY SITES Location of Sampling Sites
13a	*13a-CM0.3	Zayante Creek Upstream of Conference Drive Bridge
13b	13b-CM1.6	Zayante Creek Above First Zayante Rd Xing
13c	*13c-CM2.8	Zayante Creek downstream of Zayante School Road Intersection with E. Zayante Road
13d	*13d-CM4.1	Zayante Creek upstream of Third Bridge Crossing of East Zayante Road After Lompico Creek Confluence
14a	14a-CM0.1	Bean Creek Upstream of Zayante Creek Confluence
14b	*14b-CM1.8	Bean Creek Below Lockhart Gulch Road
14c	*14c-CM4.7	Bean Creek 1/2-mile Above Mackenzie Creek Confluence and Below Golpher Gulch Rd.
15	15 -CM0.8	Fall Creek, Above and Below Wooden Bridge
16	*16 -CM0.5	Newell Creek, Upstream of Glen Arbor Road Bridge
17a	*17a-CM0.2	Boulder Creek Just Upstream of Highway 9
17b	*17b-CM1.6	Boulder Creek Below Bracken Brae Creek Confluence
17c	17c-CM2.6	Boulder Creek, Downstream of Jamison Creek
18a	*18a-CM1.5	Bear Creek, Just Upstream of Hopkins Gulch
18b	18b-CM4.2	Bear Creek, Downstream of Bear Creek Road Bridge and Deer Creek Confluence
19a	19a-CM0.8	Kings Creek, Upstream of First Kings Creek Road Bridge
19b	19b-CM2.5	Kings Creek, 0.2 miles Above Boy Scout Camp and Upstream of the Second Kings Creek Road Bridge
20a	20a-CM0.7	Carbonera Creek, Upstream of Health Services Complex
20b	20b-CM1.9	Downstream of Buelah Park Trail
21a	*21a-CM2.8	Branciforte Creek, Downstream of Granite Creek Confluence
21b	21b-CM4.6*	Upstream of Granite Creek Confluence and Happy Valley School

Table 2a. Defined Reaches on Soquel Creek.
(Refer to Appendix A for map designations. Surveyed reaches indicated by asterisk.)

Reach #	Reach Boundaries (Downstream to Upstream)	Reach Length (ft)
0	Soquel Creek Lagoon	3,168
1	Upper Lagoon's Extent to Soquel Avenue CM0.6 - CM1.41	4,449
2	Soquel Avenue to First Bend Upstream CM1.41 - CM1.77	2,045
3*	First Bend Above Soquel Avenue to Above the Bend Closest to Cherryvale Avenue CM1.77 - CM2.70	4,827
4	Above the Bend Adj. Cherryvale Ave to Bend at End of Cherryvale Ave CM2.70 – CM3.54	4,720
5	Above Proposed Diversion Site to Sharp Bend Above Conference Center CM3.54 - CM4.06	3,041
6	Sharp Bend Above Conference Center to the Moores Gulch Confluence CM4.06-CM5.34	6,640
7*	Moores Gulch Confluence to Above the Purling Brook Road Crossing CM5.34 - CM6.41	5,569
8	Above Purling Brook Road Crossing to West Branch Confluence CM6.41 - CM7.34	5,123
	Subtotal	39,582 (7.5 miles)
9a*	West Branch Confluence to Mill Pond Diversion CM7.34 - CM9.28	10,243
9b	Mill Pond Diversion to Hinckley Creek Confluence CM9.28 - CM9.55	1,425
10	Hinckley Creek Confluence to Soquel Creek Water District Weir CM9.55 - CM10.66	5,856
11	Soquel Creek Water District Weir to Amaya Creek Confluence CM10.66 - CM11.79	5,932
12a*	Amaya Creek Confluence to Gradient Increase CM11.79 – 12.56	4,062
12b	Gradient Increase to Ashbury Gulch Confluence CM12.56 - CM14.38	9,647
	SUBTOTAL	76,747 (14.5 miles)

Table 2a. Defined Reaches on Soquel Creek (CONTINUED).

Reach #	Reach Boundaries (Downstream to Upstream)	Reach Length (ft)
13	West Branch Confluence to Hester Creek Confluence on West Branch CM0.0 - CM0.98	5,173
14a*	Hester Creek Confluence to Girl Scout Falls I CM0.98- CM2.26	6,742
	SUBTOTAL	88,662 (16.8 miles)
14b*	Girl Scout Falls I to Girl Scout Falls II CM2.26 – CM2.89	3,311
14c	Girl Scout Falls II to Tucker Road (Tilly's Ford) CM2.89 – CM4.07	6,216
14d	Tucker Road (Tilly's Ford) to Laurel Mill Dam- 1,465 ft Below Confluence of Laurel and Burns Creeks on West Branch CM4.07 - CM6.56	13,123
	TOTAL	111,312 (21.1 miles)

Table 2b. Locations of Sampling Sites by Reach on Soquel Creek.
(An asterisk indicates sampling in 2006.)

Reach #	Site # –Channel Mile	Location of Sampling Sites
2003-2004 1	1 –CM0.8	Below Highway 1
2	2 -CM1.6	Near the USGS Gaging Station
3	3 –CM2.1	Above Bates Creek Confluence
3	*4 -CM2.7	Upper Reach 3, Adjacent Cherryvale Ave Flower Fields
4	5 -CM2.9	Near Beach Shack (Corrugated sheet metal)
4	6 -CM3.4	Above Proposed Diversion Site
5	*7 -CM3.9	Upstream to Proposed Reservoir Site, End of Cherryvale
6	8 -CM4.2	Adjacent to Rivervale Drive Access
6	9 -CM4.8	Below Moores Gulch Confluence, Adjacent Mountain School
7	10 -CM5.5	Above Moores Gulch Confluence and Allred Bridge
7	11 -CM5.9	Below Purling Brook Road Ford
8	12 -CM7.0	Above Soquel Creek Road Bridge
9a	*13a-CM8.9	Adjacent Mill Pond
9b	13b-CM9.2	Below Hinckley Creek Confluence
10	14 -CM9.7	Above Hinckley Creek Confluence
11	15 -CM10.8	Above Soquel Creek Water District Weir
12a	*16 -CM12.3	Above Amaya Creek Confluence
12b	17 -CM13.0	Above Fern Gulch Confluence
	18 -CM15.2	Above Ashbury Gulch Confluence One Mile
13	*19 -CM0.9	West Branch below Hester Creek Confluence
14a	*20 –CM2.0	West Branch Near End of Olson Road
14b	21 –CM2.4	Above Girl Scout Falls I (Added in 2002)
14c	*22 –CM3.0	Above Girl Scout Falls II (Added in 2002)

Table 3. Locations of Sampling Sites by Reach in the Aptos Watershed.
(An asterisk indicates sampling in 2006.)

Reach #	Site # -Channel Mile	Location of Sampling Sites
Aptos Creek		
1	1 –CM0.4	Below Mouth of Valencia Creek
2	2 –CM0.5	Just Upstream of Valencia Creek Confluence
2	*3 –CM0.9	Above Railroad Crossing in County Park near Center
3	*4 –CM2.9	In Nisene Marks State Park, 0.3 miles above First Bridge Crossing
Valencia Creek		
1	1 –CM0.9	0.9 miles Up from the Mouth
2	* 2 –CM2.85	0.15 miles (840 ft) Below Valencia Road Crossing
3	*3 –CM3.26	0.26 miles (1,400 ft) Above Valencia Road Crossing

Table 4a. Defined Reaches in the Corralitos Sub-Watershed.
(Refer to Appendix A for map designations. Reaches surveyed indicated by asterisk.)

Corralitos Creek

Reach #	Reach Boundaries (Downstream to Upstream)	Reach Length (ft)
1	Browns Creek Confluence to 0.25 miles Below Diversion Dam	4,171
2	0.25 miles below Diversion Dam to Diversion Dam CM10.25.6 - CM10.5	1,320
3*	Diversion Dam to Rider Creek Confluence CM10.5 – CM11.77	6,706
4	Rider Creek Confluence to Box Culvert Crossing above Rider Creek Confluence CM11.77 – CM12.87	3,643
5	First Bridge Crossing Above Rider Creek to Clipper Gulch Confluence CM12.46 – CM12.87 CM2.70 - CM3.54	2,165
6*	Clipper Gulch Confluence to Eureka Gulch Confluence CM12.87 – CM13.33	2,429
7*	Eureka Gulch Confluence to Shingle Mill Gulch Confluence CM13.33 –CM13.98	3,432
1*	Shingle Mill Gulch Confluence to Second Road Crossing on Shingle Mill Gulch CM0.0 – CM0.35	1,848
2	Shingle Mill Gulch from 2nd Road Crossing to 3rd Road Crossing CM0.35 – CM0.62	1,420
3*	3rd Road Crossing (Shingle Mill Gulch) to Beginning of Steep Gradient on Rattlesnake Gulch CM0.62 –CM1.35	3,858
	Total	30,992 (5.9 miles)

Table 4a. Defined Reaches in the Corralitos Sub-Watershed (continued).

Reach #	Reach Boundaries (Downstream to Upstream)	Reach Length (ft)
Browns Valley Creek *		
1*	First Bridge Crossing on Browns Valley Road below the Diversion Dam to the Diversion Dam	1,015
2*	Diversion Dam to Redwood Canyon Creek Confluence	4,468
	Total	5,483 (1.04 miles)

* More steelhead habitat exists above Reach 2 in Browns Valley Creek and in Redwood Canyon Creek, Ramsey Gulch and Gamecock Canyon Creek. Varying amount of perennial steelhead habitat exists downstream of Reach 1, depending on bypass flows from the diversion dam.

Table 4b. Locations of Sampling Sites by Reach in the Corralitos Sub-Watershed.
(An asterisk indicates sampling in 2006.)

Corralitos Creek

Reach #	Site # -Channel Mile	Location of Sampling Sites
2	1–CM10.3	Below Diversion Dam Around the Bend
3	2 –CM10.6	Just Upstream of Diversion Dam
	*3 –CM11.1	0.6 miles Upstream of Diversion Dam (above Colinas Drive)
	4 –CM11.3	Below Rider Creek Confluence below bridge crossing
	5 –CM11.4	Below Rider Creek confluence and upstream of bridge crossing
4	6 –CM11.4	Upstream of Rider Creek Confluence
5	7 –CM12.0	Upstream of First Bridge Crossing above Rider Creek Confluence
6	*8 –CM12.9	Downstream of Eureka Gulch Confluence
7	*9 –CM13.6	0.4 miles Above Eureka Gulch Confluence

Shingle Mill Gulch

1	*1 –CM0.3	Below Second Bridge on Shingle Mill Gulch
2	2 –CM0.5	Above Second Bridge on Shingle Mill Gulch
3	* 3 –CM0.9	Above Washed Out Check Dams below Grizzly Flat on Shingle Mill Gulch

Browns Valley Creek

1	*1 –CM1.9	Between First Browns Valley Road Crossing and Diversion Dam Upstream
2	*2 –CM2.7	Above Diversion Dam but Below Redwood Canyon Creek Confluence

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M-6. Juvenile Steelhead Densities at Sampling Sites - Methods

Electrofishing was used at sampling sites to determine densities according to two juvenile age classes and three size classes in all 4 watersheds in 2006. Block nets were used at all sites to separate habitats during electrofishing. A three-pass depletion process was used to estimate fish densities. If there was poor depletion on 3 passes, a fourth pass was performed and the fish captured in 4 passes were assumed to be a total count of fish in the habitat. Electrofishing mortality rate has been approximately 0.5% or less over the years. Snorkel-censusing was used in deeper pools that could not be electrofished at sites in the mainstem reaches of the San Lorenzo River, downstream of the Boulder Creek confluence. For the middle mainstem reaches included in Table 2, underwater censusing of deeper pools was incorporated into density estimates with electrofishing data from more shallow habitats.

Visual censusing was judged inappropriate in other habitats because it would be inaccurate in fastwater habitat in the mainstem and in 80-90% of the habitat in tributaries. For example, twenty-four of 26 sampled tributary pools had more than 20 fish in 2005. Most tributary sites are well shaded and many pools have substantial escape cover, making it very difficult to count all of the juveniles, much less divide them into size and age classes. Riffles, step-runs, runs and glides are usually too shallow to snorkel in tributaries. Dense shading in most tributaries also reduces snorkeling effectiveness.

In larger rivers of northern California, density estimates from electrofishing are commonly combined with those determined by underwater observation in habitats too deep for electrofishing. Ideally, underwater censusing would be calibrated to electrofishing data in habitat where capture approached 100%. Calibration was originally attempted by Hankin and Reeves (**1988**) for small trout streams. Their intent was to substitute snorkel censusing for electrofishing. However, attempts at calibration of the two methods of censusing in large, deep pools of the mainstem San Lorenzo River was judged impractical, beyond the scope of the study and probably inadequate.

Two divers were used in snorkel censusing. In wide pools, divers divided the channel longitudinally into counting lanes, combining their totals after traversing the habitat in an upstream direction. Divers would warn each other of juveniles being displaced into the other's counting lane to prevent double-counting. For juveniles near the boundaries of adjacent counting lanes, divers would verbally agree to who would include them in their tallies. In narrower pools, divers would alternate passes through the pool to obtain replicates to be averaged. In most pools, three replicate passes were accomplished per pool. The average number of steelhead observed per pass in each age and size category became the density estimate. Visual censusing of deeper pools occurred prior to electrofishing of the sites in 2006. The relative proportions of steelhead in the three Size Classes obtained from electrofishing were considered in dividing visually censused steelhead into size and age classes. In Reaches 1-4, most juveniles were greater than 75 mm SL, and yearlings were considerably larger than YOY fish. Therefore, it was relatively easy to separate fish into size and age classes. In Reaches 6-9, more juveniles are normally around 75 mm SL, leading to a small error for some individuals in deciding size class division between Classes 1 and 2. However, there was no difficulty in distinguishing age classes.

Steelhead were visually censused for two size classes of pools in the San Lorenzo. There were short pools less than approximately 200 feet in length and those more than approximately 200 feet. Juvenile densities in censused pools were extrapolated to other pools in their respective size categories. Steelhead were censused by size and age class, as in electrofishing. If less than 20 juveniles were observed in a pool, the maximum number observed on a pass was the estimate. When 20 or more fish were observed, the average of the three passes was the best estimate.

Visual censusing offered realistic density estimates of steelhead in deeper mainstem pools. It was the only practical way to inventory such pools, which were mostly bedrock- or boulder- scoured and had limited escape cover. Visibility was 15 feet or more, making the streambed and counting lanes observable. Very few steelhead used these pools in 1999-2001 and 2003-2006, compared to 1998 when mainstem baseflow was considerably higher (minimum of 30 cubic feet per second at the Big Trees Gage compared to approximately 20 cfs or less in later years).

M-7. Capture and Mortality Statistics

For this study overall, 2,422 juvenile steelhead were captured by electrofishing among all sites, with 16 mortalities (0.66% mortality rate). All but one of the lost steelhead were small YOY fish. Five mainstem sites and 10 tributary sites were sampled in the San Lorenzo watershed in 2006. A total of 1,045 juvenile steelhead were captured with 4 mortalities (0.4%). A total of only 315 juvenile steelhead and rainbow trout (one site) were captured at 7 sites in the Soquel watershed in 2006 with 3 mortalities (0.95%). A total of 333 juveniles steelhead were captured in the Aptos Watershed at 4 sites with 4 mortalities (1.2%). A total of 729 juveniles were captured in the Corralitos watershed at 7 sites with 5 mortalities (0.6%).

M-8. Age and Size Class Divisions

With electrofishing data, the young-of-the-year (YOY) age class was separated from the yearling and older age class in each habitat, based on the site-specific break in the length-frequency distribution (histogram) of fish lengths combined into 5 mm groupings. Density estimates of age classes in each habitat type were determined by the standard depletion model used with multiple pass capture data. Densities were expressed in fish per 100 feet of channel. Density estimates were measured in the lowest baseflow period of the year when juvenile salmonids remain in specific habitats without up or downstream movement. Density is typically provided per channel length by convention and convenience. Channel length may be accurately measured quickly. If the density measure is consistent from year to year, valid comparisons can be made.

Depletion estimates of juvenile steelhead density were applied separately to two size categories in each habitat at each site. The number of fish in Size Class 1 and combined Classes 2 and 3 were recorded for each pass. The size class boundary between Size Classes 1 and 2 was 75 mm Standard Length (SL) (3 inches) because smaller fish would almost always spend another growing season in freshwater before smolting and entering the ocean the following spring. Although some fish larger than 75 mm SL stayed a second year in the stream, the large majority of fish captured during fall sampling that were larger than 75 mm SL were found to smolt the very next spring to enter the ocean. These assumptions are based on scale analysis, back-calculated annuli and standard length determinations by Smith of steelhead smolts captured in spring of 1987 and 1989 (**Smith unpublished**). He found that 97% of a random sample (n=248) of yearling smolts in spring were 76 mm SL or longer after their first growing season. In addition, about 75% of smolts that were 75 mm SL or larger at their first annulus (n=319) smolted as yearlings. All 2-year old smolts from a random sample (n=156) were larger than 75 mm SL after 2 growing seasons prior to smolting. Also, 95% of these 2-year olds were at least 60 mm SL after their first growing season, indicating that few YOY's less than 60 mm SL survived to smolt.

The depletion method estimated the number of fish in each sampled habitat in two size categories; those less than (<) 75 mm SL (Class 1) and those equal to or greater than (=>) 75 mm SL (Classes 2 and 3). Then, the number of juveniles => 75 mm SL (Class 2) was estimated separately from the juveniles => 150 mm SL (Class 3). This was done by multiplying the proportion of each size class (Class 2 and 3 separately) in the group of captured fish by the estimate of fish density for all fish => 75 mm SL. A density estimate for each habitat type at each site was then determined for each size class. Densities in each habitat type were added together and divided by the total length of that habitat type at the sampling site to obtain a density estimate by habitat type.

The depletion method was also used to estimate the number of fish in each sampled habitat based on 2 age classes: young-of-the-year (YOY) and yearling and older (1+) age classes. Age classes in the mainstem San Lorenzo and mainstem Soquel Creek were determined by scale analysis of a spectrum of fish sizes in 2006. A total of 24 larger San Lorenzo juvenile steelhead and 6 larger Soquel Creek juveniles were aged by scale analysis. Sample sizes were limited due to low juvenile densities in the mainstems in 2006. These limited results showed that the majority of large fish on the mainstem were YOY, but also included yearlings that moved into the mainstem after slow tributary growth in their first year. These data provided information for age class division for both watersheds. Scale analysis, along with past experience of growthrates, and breaks in fish length histograms were used to discern age classes at other sampling sites. Density estimates determined by size class and age class were not the same when YOY's reached Size Class II by fall. Three Valencia Creek juveniles were also aged from scale samples to confirm slow growth rates there. Scales from eighteen juveniles inhabiting Soquel Creek Lagoon were analyzed to confirm fast growth rates there.

In 2006, the lower mainstem of the San Lorenzo River and Soquel Creek, many YOY steelhead reached Size Class 2 size in one growing season, as did some in the middle mainstem San Lorenzo and San Lorenzo tributaries. In this monitoring report, sampling site densities were compared for 9 years in the San Lorenzo system by size and age (1997-2001 and 2003-2006) and for 10 years in Soquel Creek (1997-2006). At each sampling site, habitat types were sampled separately with density estimates calculated for each habitat. Then these density estimates were combined and divided by the stream length of the entire site for annual site density comparisons.

RESULTS

R-1. Habitat Change in the San Lorenzo River and Tributaries

Refer to **Appendix A** for maps of reach locations. The lower mainstem (downstream of the Zayante Creek confluence) showed overall habitat improvement between 2000 (**Alley 2002**) and 2006. Pool scouring and deepening was evident, and there was more escape cover in fastwater habitat. From 2000 through 2005 there had been steady habitat improvement in the middle mainstem (between the Zayante and Boulder creek confluences). However, overall habitat degraded from 2005 to 2006 in the middle mainstem. Embeddedness worsened and escape cover was lost in fastwater habitat. Overall habitat quality declined from 2005 to 2006 in the upper San Lorenzo (upstream of the Boulder Creek confluence). There was higher percent fines, less escape cover and no improvement in pool depth.

San Lorenzo tributaries showed reduced habitat quality compared to either 2000 or 2005 in the case of Zayante, Bean, Newell, Boulder, Bear and Branciforte creeks. Percent fines, embeddedness and escape cover all worsened in these creeks. The one exception to substrate degradation was Newell Creek. With it being downstream of a dam that captures fine sediment, substrate embeddedness and percent fines improved and pools deepened. However, escape cover was considerably less, leading to overall habitat decline. Water depth increased in some habitats in each creek, indicating some habitat improvement in that habitat parameter and scouring of fine sediment.

The year 2006 had a greater baseflow in the **lower mainstem** (downstream of Zayante Creek confluence) with approximately 5 cfs more than in 2000 (**Table 5**), likely offering enhanced food supply from higher rates of insect drift. There was overall improvement in habitat quality in the lower mainstem from 2000 to 2006. Habitat was substantially deeper in pools and somewhat deeper in fastwater habitat in Reaches 1 and 4 (**Table 6**), likely stemming from scouring of sand from the streambed and more streamflow. Compared to 2000, in 2006 there was similar percent fine sediment in pools and riffles in Reach 1 and similar percent fines in pools but 10% less in riffles in 2006 (**Table 7**). Regarding substrate embeddedness between 2000 and 2006 at Sites 1 and 4, there were similar amounts in the only habitats that data were available- runs and step runs (**Table 8**). Regarding escape cover, there was substantially more in riffle and run habitat in 2006 compared to 2000 in Reaches 1 and 4 (**Table 9 and 10**).

Until 2006 there had been steady habitat improvement in the **middle mainstem** (between the Zayante and Boulder creek confluences) since 2000 (**Alley 2002; 2006a**). However, habitat quality declined from 2005 to 2006, primarily because of less escape cover in important fastwater habitat without consistent deepening in fastwater habitat or improvement in substrate conditions. Overall substrate conditions in 2005 and 2006 in Reaches 6 and 8 were similar, while remaining better than 2000 conditions in pools of Reach 8 and fastwater habitat in both Reaches 6 and 8 with regard to percent fines (**Table 7**). Regarding embeddedness, it was similar between years for pools and riffles in both reaches, similar for runs between 2005 and 2006 and between 2000 and 2006 except for improvement in Reach 8 (**Table 8**). Escape cover in riffle fastwater habitat also worsened since 2005 but was still better than 2000 or 2003 in Reaches 6 and 8 (**Table 9**). Regarding escape cover in run fastwater habitat, 2005 and 2006 had similar amounts in Reach 6 but less in 2006 than 2005 in Reach 8 (**Table 10**). Comparing 2000 with 2006, escape cover in runs improved in Reach 6 and declined in Reach 8. There was continued habitat improvement in Reach 6 with regard to deeper pool habitat, while fastwater habitat shallowed in 2006 in average depth compared to 2005 but remained similar to 2000 (**Table 6**). In Reach 8, pools shallowed in average maximum depth and deepened in average mean depth compared to 2005, while fastwater habitat deepened compared to 2005 and 2000. Deepening indicated scour of fines.

Based on data from Reach 11 in the **upper San Lorenzo** (upstream of the Boulder Creek confluence), overall habitat quality declined from 2005 to 2006. Although there was more depth in fastwater habitat and reduced embeddedness, the important pool habitat did not deepen, had greater percent fines and less escape cover (**Tables 6-10**).

In **Zayante Creek** in 2006, habitat quality was similar to 2005 in the lower reach (13a) and had worsened in the upper reach (13d). Water depth positively increased in both reaches (as deep as anytime since 2000), but pool escape cover, embeddedness and percent fines all worsened in the upper Reach 13d (**Tables 6-8 and 12**). In lower Reach 13a, pool escape cover (**Table 12**), embeddedness (**Table 8**) and percent fines (**Table 7**) were about the same in 2005 and 2006, though percent fines increased in riffles and decreased in runs. In tributaries and the upper mainstem, pools and their habitat conditions are the most important for steelhead rearing habitat. Riffles are important in producing aquatic insects for food. The fact that riffle embeddedness lessened in 2006 in both analyzed reaches indicated improved insect habitat.

In **upper Bean Creek** (Reach 14c) in 2006 (where coho salmon had been captured in 2005), habitat conditions degraded somewhat since 2005. Although water depth was slightly greater due to scour and likely higher baseflow, conditions that worsened included percent fines in riffles and runs, embeddedness in pools and riffles, pool escape cover (slightly) and run escape cover (slightly) (**Tables 6-8, 12-13**). The steady improvement in pool escape cover from 2000 to 2005 was reversed in 2006 and was much less than in 1998.

Overall habitat quality worsened in **Newell Creek** from 2000 to 2006 primarily due to great loss in escape cover. Substrate generally improved in Newell Creek (Reach 16) from 2000 to 2006. Pools were deeper, with substantial improvement in percent fines and embeddedness (**Tables 6-8**). However, escape cover was substantially less in pools and runs, indicating habitat decline in this important habitat indicator (**Tables 12 and 13**). A streamside resident was cutting down a large riparian tree from the far side of the creek from his house during data collection.

In **Boulder Creek** in 2006, habitat worsened overall, primarily in the loss of pool escape cover. Although water depth increased in pools and step-runs of the lower portion (Reach 17a), and in step-runs of the middle portion (Reach 17b) (indicating scour of sediment), habitat parameters that worsened included slight reduction in percent fines in pools in both reaches and in runs/step-runs in Reach 17a, moderately increased embeddedness (10%) in riffles of Reach 17b with slight increases (less than 10%) in other habitats and decreased escape cover in pools and run/ step-runs (except escape cover increased in step-runs in Reach 17a) (**Tables 6-8, 12-13**).

With the exception of greater depth in fastwater habitat in **lower Bear Creek** (18a) (indicating scour of some fine sediment), the general improvement in habitat conditions observed in 2005 were reversed in 2006. Pool depth remained similar, but percent fines increased in pools, embeddedness increased in all habitat types, and escape cover worsened in pools and runs (**Tables 6-8, 12-13**). Streamflow was slightly greater in 2006, but likely not enough to affect habitat depth (1.1 cfs in 2006 vs. 0.9 cfs in 2005).

Although the **middle Branciforte** (Reach 21a-2) showed similar habitat depths between 2000 and 2006, there was general habitat degradation that was detected in substrate conditions. It had more percent fines in all habitat types and greater embeddedness in pools (only habitat typed that could be compared) (**Tables 6-8**). No reach escape cover indices were available in 2000 for comparisons with 2006.

R-2. Habitat Change in Soquel Creek and Its Branches

Refer to **Appendix A** for maps of reach locations. The **lower mainstem** (from the lagoon to the Moores Gulch confluence) (as indicated from data collected in Reach 3) had overall habitat improvement in 2006. Habitat depth increased in pools and runs over 2005, though was similar to past years (**Table 14**) (**Alley 2006b**). The biggest improvements were in reduced percent fines in pools and runs (**Table 15**) and more pool escape cover (**Table 17**). Embeddedness remained similar (**Table 16**).

The **upper mainstem** (from the Moores Gulch confluence to the Branches) (as indicated from data collected in Reach 7) had slightly improved habitat overall in 2006 compared to 2005 in that pool depth was slightly increased, and pool escape cover was slightly increased (**Tables 14 and 17**). Pool escape cover was the highest since 2000. Pool depth was less than in 2003. Percent fine sediment was similar between 2005 and 2006 (**Table 15**). Embeddedness was similar between years (**Table 16**).

The **lower East Branch** (as indicated from data collection in Reach 9 below and adjacent to Mill Pond) had similar habitat quality in 2006 compared to 2005 but lower quality than in 2000. Compared to 2005, the one substantial improvement was increased pool depth in 2006 (**Table 14**). However, pool escape cover was less (**Table 17**). Regarding substrate conditions, percent fines increased somewhat in pools and runs and lessened in riffles (**Table 15**). Embeddedness improved in pools and riffles and worsened in runs (**Table 16**). Reach 9 is an unstable reach that periodically has influxes of large wood and streambed reconfiguration. Pool escape cover has declined steadily from 2000 (**Table 17**).

The important **upper East Branch** (as indicated from data collection in Reach 12a in the Soquel Demonstration State Forest) showed overall habitat degradation from 2005 to 2006 primarily due to lost escape cover and higher percent fines in pools. But conditions were still better than in 2000. In 2006, pools, riffles and step-runs had greater average and maximum depths than in 2005 (**Table 14**). However, the amount of habitat as pools, riffles and runs decreased in 2006 while step-run habitat increased. In 2005 there were 23 pools in the habitat typed reach, and in 2006 there were only 16. The increased pool depth in 2006 may not indicate pool deepening but may have occurred because habitat identified as shallow pools in 2005 (lowering the reach average for pools for 2005) may have been considered step-run in 2006 because they had shallowed (increasing the reach average for step-runs in 2006). Therefore, the increased pool depth seen in 2006 may have been a result of lost shallow pool habitat to step-run and not increased scour in pools. There was similar substrate embeddedness between years and greatly increased percent fines in pools in 2006 (**Tables 15 and 16**). Pool escape cover decreased in 2006 from 2005 but was still much higher than in 2000 (**Table 17**). The step-run escape cover index decreased slightly from 0.094 in 2005 to 0.086 in 2006, indicating slightly reduced habitat quality there.

In the **West Branch** downstream of Olson Road Bridge (**Reach 14a**), overall habitat quality improved. Substrate conditions improved and habitat depth increased in, recovering from the sediment influx earlier in the decade. Compared to 2005, habitat depth increased greatly in all habitat types and embeddedness was much less in fastwater habitat (**Tables 14 and 15**). On the down side, percent fines increased in pools and pool escape cover remained low (**Tables 16 and 17**).

In the **West Branch** between Girl Scout Falls I and II (**Reach 14b**), habitat conditions were similar between 2002 and 2006 regarding pool escape cover and habitat embeddedness, with some improvement due to increased pool depth (**Tables 14, 16 and 17**). Percent fines were not measured in 2002 for comparisons. At the repeated sampling site above Girl Scout Falls II (**Reach 14c**), habitat conditions improved in 2006 over 2005 with much deeper habitat in pools and step-runs and reduced pool embeddedness, both indicating scour of fine sediment. Pool escape cover and percent fines were similar in both years. No habitat typing was budgeted for Reach 14c in 2006.

R-3. Habitat Change in Aptos and Valencia Creeks

Refer to **Appendix A** for maps of reach locations. No habitat typing data were collected for reaches of Aptos or Valencia creeks in 1981. Based on substrate comparisons between fish sampling sites in 1981 (**Smith 1982**) and habitat typed reaches in 2006, substrate conditions have degraded in Aptos Creek from 1981 to 2006 (**Tables 18-20**). The January 1982 storm caused severe streambank erosion and landsliding throughout the Santa Cruz Mountains, and streams have been recovering since. The 1997-98 winter also brought significant stormflow and sedimentation in other watersheds, such as the San Lorenzo River (**Alley 2000**). Percent fines and embeddedness in pool habitat have increased, and especially embeddedness. Percent fines in fastwater habitat may have been greater in lower Aptos in 1981 than in 2006, with similar amounts in the upstream reach in Nisene Marks. However, values were combined for riffles and runs in 1981, making comparisons difficult. Embeddedness in runs in lower Aptos was much greater in 2006 than 1981, with similarity between the two years in riffles in lower Aptos.

Based on substrate comparisons between fish sampling sites in 1981 and habitat typed reach averages in 2006, substrate conditions have degraded in both Reaches 2 and 3 in Valencia Creek from 1981 to 2006 (**Tables 18-20**). Percent fines increased in pools of both reaches and in percent fines in Reach 3 pools. Percent fines in pools remained high and slightly higher in Reach 2. Pool embeddedness was much higher in both reaches. Embeddedness in riffle habitat has increased greatly. Percent fines in fastwater habitat were similar.

R-4. Trends in Habitat Change in Corralitos, Shingle Mill and Browns Valley Creeks

Refer to **Appendix A** for maps of reach locations. No habitat typing data were collected for reaches of the Corralitos sub-watershed in 1981 or 1994. Substrate comparisons were made between fish sampling sites in 1981 and 1994 (**Smith 1982**; **Alley 1995a**) and habitat typed reach averages in 2006. Substrate conditions in Corralitos Creek have generally degraded in the 3 reaches studied. Those were below Rider Creek (Reach 3), below Eureka Gulch (Reach 6) and above Eureka Gulch (Reach 7) compared to 1994. Substrate conditions in 2006 were more similar to the more degraded conditions in 1981 (**Tables 18-20**). In the most important habitat type, namely pools, percent fines worsened (increased) in all 3 reaches, while it was similar in riffle and run habitat except for much improvement in run habitat in Reach 3 and worsening in Reach 6. Pool embeddedness was similar between 1994 and 2006 except it improved (decreased) in Reach 7. Riffle embeddedness was similar between years except it worsened in Reach 6. Run and step-run embeddedness was similar between years.

Based on substrate comparisons between fish sampling sites in 1981 and 1994 and habitat typed reach averages in 2006, substrate conditions in Shingle Mill Gulch have generally degraded in the 2 reaches studied (Reaches 1 and 3) (**Tables 18-20**). Embeddedness and percent fines have increased from 1994 to 2006 in all three habitat types in both reaches where comparisons were available, except for less embeddedness in riffle habitat in lower Shingle Mill. 2006 conditions were more similar to the more degraded 1981 substrate conditions.

Substrate conditions in Browns Valley Creek have generally degraded in the 2 reaches studied (Reaches 1 and 2), based on substrate comparisons between fish sampling sites in 1981 and 1994 and habitat typed reach averages in 2006, (**Tables 18-20**). In pool habitat, both embeddedness and percent fines worsened (increased) from 1994 to 2006, they being more similar to the more degraded conditions in 1981. Embeddedness and percent fines were similar in riffle habitat between 1994 and 2006, but they greatly increased in run/step-run habitat in Reach 1 in 2006. Comparisons were unavailable for percent fines or embeddedness in fastwater habitat of Reach 2.

Table 5. Fall STREAMFLOW (cubic feet/ sec) Measured by Flowmeter at SAN LORENZO Sampling Sites.

Site # - Location	1995	1996	1998	1999	2000	2001	2003	2004	2005	2006
1- SLR/ Paradise Pk	22.9	25.5	34.3	26.2	21.7	19.6				26.2
2- SLR/Rincon				24.0	21.1	17.2				
3-SLR Gorge	23.3	20.5								
4-SLR/Henry Cowell	18.7		32.7	23.3	21.8	15.5				24.1
5- SLR/Below Zayante			31.9							
6- SLR/ Below Fall	14.6		23.4	12.8	11.6	9.4	10.6	8.8	18.9	14.3
7- SLR/ Ben Lomond	5.8				5.4	3.7	5.4	3.7	8.1	
8- SLR/Below Clear Ck	4.2		10.3	4.9	4.2	3.1	4.2	2.7	7.1	6.4
9- SLR/Below Boulder Ck	4.6		7.2	3.5		3.0	3.7	2.1	5.8	
10- SLR/Below Kings Ck				3.0	1.1	1.3	0.6	0.52	1.4	
11- SLR/ Teihl Rd			1.7	0.8	0.8	0.4	0.9	0.63	1.5	
12a- SLR/Lower Waterman G			1.0	0.7						
13a- Zayante below Bean			8.5	6.3	5.2	4.7	5.4	5.1	7.4	7.8*
13b- Zayante above Bean			3.9	2.9	2.8	1.9	2.1	1.7	3.2	2.8
14b- Bean below Lockhart G	1.5		1.1	1.1	1.0	1.1	1.1	0.77	1.0	1.1
15- Fall	2.0		3.4	2.2	1.7	1.7				
16- Newell	1.6				0.51					
17a- Boulder	2.0		2.2		1.1	1.0	1.25	0.9	1.6	1.7
18a- Bear				0.45	0.61	0.34	0.6	0.51	0.90	1.1
19a- Lower Kings			1.1	0.11	0.17	0.02				
20a- Lower Carbonera	0.33	0.36								
21a-2- Branciforte			0.80							

*Streamflow in lower Zayante Creek done 3 weeks earlier than usual and before other locations.

Table 6. Averaged Mean and Maximum WATER DEPTH (ft) of Habitat in SAN LORENZO Reaches Since 2000.

Reach	Pool 2000	Pool 2003	Pool 2005	Pool 2006	Riffle 2000	Riffle 2003	Riffle 2005	Riffle 2006	Run/Step-Run 2000	Run/Step-Run 2003	Run/Step-Run 2005	Run/Step-Run 2006
1- L. Main	1.9/ 3.5			**2.5/ 4.4**	0.9/ 1.4			**1.1/ 1.5**	1.2/ 1.8			2.4/ 3.1
2- L. Main	3.0/ 5.2				1.2/ 2.0				1.7/ 2.4			
3- L. Main	3.1/ 5.2				1.9/ 2.6				2.1/ 3.1			
4- L. Main	2.2/ 3.8			**2.6/ 4.4**	0.8/ 1.4			**0.9/ 1.5**	1.5/ 2.3			1.6/ 2.2
5- L. Main	1.7/ 3.3				0.8/ 1.3				1.1/ 1.8			
6- M. Main	1.9/ 3.4	1.9/ 3.5	1.9/ 3.4	**2.2/ 4.3**	0.8/ 1.2	0.6/ 0.9	0.9/ 1.4	**0.8/ 1.3**	1.1/ 1.9	1.2/ 1.9	1.1/ 2.1	1.3/ 1.85
7- M. Main	2.2/ 3.9	1.8/ 3.7	2.0/ 3.5		0.7/ 1.1	0.6/ 1.0	0.7/ 1.1		1.0/ 1.5	0.9/ 1.4	1.1/ 1.4	
8- M. Main	2.8/ 5.4	2.5/ 5.2	2.6/ 5.8	**2.7/ 5.5**	0.9/ 1.4	0.6/ 1.0	1.0/ 1.5	**1.1/ 1.6**	1.4/ 2.1	1.0/ 1.4	1.3/ 2.1	1.3/ 2.25
9- M. Main	2.0/ 3.6	1.7/ 3.0	1.9/ 3.5		0.7/ 1.1	0.6/ 1.1	0.7/ 1.1		1.0/ 1.6	0.8/ 1.2	1.0/ 1.4	
10- U. Main	1.3/ 2.7	1.4/ 2.9	1.4/ 2.8		0.4/ 0.6	0.3/ 0.5	0.4/ 0.7		0.8/ 1.2	0.5/ 0.9	0.7/ 1.0	
11- U. Main	1.2/ 2.1		1.1/ 2.0	**1.1/ 2.1**	0.4/ 0.6		0.4/ 0.7	**0.5/ 0.8**	0.5/ 1.0		0.5/ 1.0	0.6/ 1.1
12b- U. Main	1.4/ 2.2		1.3/ 2.2		0.5/ 0.9		0.3/ 0.6		0.6/ 1.1		0.5/ 0.8	
Zayante 13a	1.4/ 2.3	1.1/ 2.1	1.5/ 2.5	**1.6/ 2.6**	0.65/ 1.0	0.7/ 1.1	0.6/ 0.9	**0.6/ 0.9**	0.85/ 1.2	0.7/ 1.2	0.8/ 1.1	0.85/ 1.2
Zayante 13b	1.5/ 2.8	1.5/ 2.4	1.7/ 2.9		0.6/ 0.9	0.5/ 0.7	0.5/ 0.9		0.8/ 1.1	0.8/ 1.1	0.7/ 1.2	
Zayante 13c	1.5/ 2.5	1.2/ 2.2	1.35/ 2.4		0.6/ 0.8	0.4/ 0.7	0.5/ 0.8		0.7/ 1.1	0.5/ 1.0	0.7/ 1.0	
Zayante 13d	1.3/ 2.1	1.1/ 1.7	1.1/ 2.1	**1.35 / 2.1**	0.6/ 1.0	0.4/ 0.6	0.5/ 0.7	**0.45/ 0.8**	0.9/ 1.3	0.8/ 1.3	0.8/ 1.4	0.9/ 1.4
Lompico 13e				**1.1/ 1.8**				**0.3/ 0.6**				0.45/ 0.8
Bean 14a	1.2/ 2.0	0.8/ 1.6	1.0/ 1.9		0.5/ 0.85	0.4/ 0.7	0.4/ 0.7		0.65/ 1.2	0.6/ 1.2	0.7/ 1.1	
Bean 14b	1.1/ 1.6	0.9/ 1.5	1.0/ 1.9		0.3/ 0.55	0.3/ 0.6	0.3/ 0.5		0.6/ 1.0	0.6/ 0.9	0.6/ 0.8	
Bean 14c	1.1/ 2.0	1.0/ 1.7	1.0/ 1.7	**1.0/ 1.8**	0.2/ 0.5	0.1/ 0.3	0.1/ 0.3	**0.2/ 0.3**	0.5/ 0.7	0.25/ 0.4	0.2/ 0.5	0.35/ 0.5
Newell 16	1.4/ 2.6			**1.6/ 2.8**	0.4/ 0.65			**0.3/ 0.5**	0.6/ 0.9			0.6/ 0.9

Boulder 17a	1.8/ 2.7		1.8/ 2.9	**2.0/ 3.1**	0.6/ 1.0		0.5/ 0.9	**0.6/ 1.0**	0.7/ 1.1		0.7/ 1.2	0.9/ 1.4
Boulder 17b	1.75/ 2.8		1.7/ 2.8	**1.7/ 2.8**	0.5/ 1.0		0.4/ 1.0	**0.6/ 1.0**	0.7/ 1.2		0.7/ 1.2	0.8/ 1.4
Boulder 17c	2.5/ 3.7		1.9/ 2.9		0.4/ 0.7		0.4/ 0.8		0.8/ 1.3		0.9/ 1.5	
Bear 18a	1.8/ 3.0	2.0/ 3.4	2.0/ 3.4	**2.0/ 3.35**	0.5/ 0.8	0.4/ 0.7	0.4/ 0.7	**0.6/ 0.9**	0.7/ 1.1	0.6/ 0.9	0.7/ 1.1	0.8/ 1.25
Bear 18b	1.4/ 2.4				0.55/ 1.2				0.6/ 1.2			
Branciforte 21a-2	1.05/ 2.0			**1.1/ 1.9**	0.3/ 0.6			**0.3/ 0.5**	0.6/ 0.9			0.5/ 1.0
Branciforte 21b	1.0/ 1.7		1.1/ 1.7		0.4/ 0.6		0.4/ 0.7		0.5/ 0.85		0.3/ 0.6	

Table 7. Average PERCENT FINE SEDIMENT IN SAN LORENZO Reaches River Since 2000.

Reach	Pool 2000	Pool 2003	Pool 2005	Pool 2006	Riffle 2000	Riffle 2003	Riffle 2005	Riffle 2006	Run/Step-Run 2000	Run/Step-Run 2003	Run/Step-Run 2005	Run/Step-Run 2006
1	80			**80**	20			**20**	55			**40**
2	70				25				50			
3	80				40				60			
4	70			**75**	30			**20**	50			**50**
5	95				35				70			
6	80	70	70	**75**	35	25	20	**25**	60	35	40	**38**
7	70	70	70		25	25	20		45	50	40	
8	75	55	65	**60**	30	25	20	**20**	45	40	25	**25**
9	70	70	60		30	25	15		45	30	30	
10	75	60	70		25	20	15		45	25	35	
11	65	55	35	**40**	20	40	15	**25**	30	45	25	**15**
12b	55	50	35		25	35	35		35	40	10	
Zayante 13a	80	85	65	**65**	30	40	25	**35**	55	70	50	**40**
Zayante 13b	80	65	65		30	30	30		45	45	30	
Zayante 13c	55	50	45		20	25	10		25	30	20	
Zayante 13d	60	40	40	**50**	25	25	25	**15**	45	25	25	**40**
Lompico 13e				**50**				**20**				**30**
Bean 14a	80	80	70		45	40	25		70	70	35	
Bean 14b	80	85	80		25	45	15		60	80	45	
Bean 14c	70	70	60	**65**	25	25	5	**15**	35	40	30	**40**
Newell 16	50			**25**	20			**5**	35			**20**
Boulder 17a	45		30	**35**	30		20	**5**	30		15	**20**
Boulder 17b	40		30	**35**	10		5	**10**	25		15	**15**
Boulder 17c	45		25		5		5		20		5	
Bear 18a	55	55	50	**60**	15	15	15	**15**	30	25	20	**25**
Bear 18b	40				10				25			
Branciforte 21a-2	65			**75**	30			**40**	45			**55**
Branciforte 21b	65		55		30		15		40		65	

Table 8. Average EMBEDDEDNESS IN SAN LORENZO Reaches Since 2000.

Reach	Pool 2000	Pool 2003	Pool 2005	Pool 2006	Riffle 2000	Riffle 2003	Riffle 2005	Riffle 2006	Run/Step-Run 2000*	Run/Step-Run 2003	Run/Step-Run 2005	Run/Step - Run 2006
1				**59**				**31**	43*			**49**
2									30*			
3									50*			
4				**64**				**37**	45*			**47**
5									60*			
6		52	49	**56**		27	31	**31**	50*	38	46	**41**
7		53	54			34	27		40*	49	40	
8		49	53	**56**		32	25	**28**	45*	44	29	**35**
9		52	39			32	25		43*	40	31	
10		38	39			32	27		45*	32	34	
11			58	**48**	41		30	**33**	46*		45	**27**
12b			58				27		38*		45	
Zayante 13a	46	44	45	**54**		33	29	**23**	42	41	44	**50**
Zayante 13b	42	44	46			36	25		41	43	39	
Zayante 13c	49	48	48			29	25		39	33	38	
Zayante 13d	45	41	47	**51**		35	48	**37**	39	33	43	**42**
Lompico 13e				**55**				**42**				**46**
Bean 14a	46	46	45			32	21		54	49	37	
Bean 14b	46	35	41			35	20		43	41	29	
Bean 14c	47	49	50	**62**		19	27	**36**	46	43	46	**52**
Newell 16	42			**36**				**12**				**33**
Boulder 17a	40		34	**48**			24	**29**			30	**33**
Boulder 17b	39		36	**43**			14	**24**			29	**34**
Boulder 17c	44		31				18				13	
Bear 18a	48	48	42	**54**		28	22	**35**	42	47	30	**41**
Bear 18b	42											
Branciforte 21a-2	52			**68**				**41**				**59**
Branciforte 21b	47		41		41		28				32	

* Was from sampling sites and not reaches and for riffle and runs combined.

Table 9. Reach-wide ESCAPE COVER Index (Habitat Typing Method*) in RIFFLE HABITAT in MAINSTEM Reaches of the SAN LORENZO, Based on Habitat Typed Segments.

Reach	1998	1999	2000	2003	2005	2006
1	0.187	0.244	0.084	-	-	0.270
2	-	0.503	0.260	-	-	
3	0.250	0.216	0.257	-	-	
4	0.125	0.078	0.109	-	-	0.183
5	0.032	0.001	0.222	-	-	
6	**0.099**	**0.093**	**0.042**	**0.027**	**0.152**	**0.101**
7	**0.148**	**0.146**	**0.050**	**0.130**	**0.187**	
8	**0.335**	**0.173**	**0.124**	**0.080**	**0.320**	**0.241**
9	**0.038**	**0.080**	**0.043**	**0.066**	**0.161**	
10	0.011	0.039	0.012	0.018	0.040	
11	0.025	0.020	0.017	-	0.056	0.014
12	0.086	0.022	0.036	-	0.044	

*Habitat Typing Method = linear feet of escape cover divided by reach length as riffle habitat.

Table 10. Reach-wide ESCAPE COVER Index (Habitat Typing Method*) in RUN HABITAT in MAINSTEM Reaches of the SAN LORENZO, Based on Habitat Typed Segments.

Reach	1998	1999	2000	2003	2005	2006
1	0.273	0.130	0.064	-	-	0.131
2	0.228	0.136	0.100	-	-	
3	0.186	0.113	0.144	-	-	
4	0.234	0.159	0.091	-	-	0.125
5	0.071	0.249	0.261	-	-	
6	**0.145**	**0.107**	**0.044**	**0.068**	**0.098**	**0.101**
7	**0.038**	**0.030**	**0.023**	**0.165**	**0.074**	
8	**0.129**	**0.152**	**0.131**	**0.154**	**0.164**	**0.103**
9	**0.138**	**0.051**	**0.036**	**0.046**	**0.098**	
10	0.072	0.041	0.081	0.062	0.057	
11	0.026	0.016	0.022	-	0.021	0.0084
12	0.031	0.069	0.126	-	0.048	

*Habitat Typing Method = linear feet of escape cover divided by reach channel length as run habitat.

Table 11. ESCAPE COVER Index (Habitat Typing Method*) in Pool Habitat in MAINSTEM Reaches of the SAN LORENZO, Based on Habitat Typed Segments.

Reach	Pools 2003	Pools 2005	Pools 2006
1	-	-	0.271
2	-	-	
3	-	-	
4	-	-	0.203
5	-	-	
6	**0.077**	**0.077**	**0.044**
7	**0.134**	**0.105**	
8	**0.026**	**0.027**	**0.039**
9	**0.037**	**0.070**	
10	0.054	0.051	
11	0.054 (2000)	0.059	0.031
12	-	0.178	

*Habitat Typing Method = linear feet of escape cover divided by reach length as pool habitat.

Table 12. ESCAPE COVER Index (Habitat Typing Method*) for POOL HABITAT in TRIBUTARY Reaches of the SAN LORENZO.

Reach	1998	1999	2000	2003	2005	2006
Zayante 13a	0.320	0.069	0.056	0.169	0.081	**0.074**
Zayante 13b	0.150	0.093	0.072	0.130	0.087	
Zayante 13c	0.114	0.110	0.095	0.110	0.109	
Zayante 13d	0.145	0.191	0.132	0.237	0.269	**0.126**
Lompico 13e						**0.089**
Bean 14a	0.248	0.143	0.186	0.124	0.155	
Bean 14b	0.378	0.280	0.205	0.288	0.212	
Bean 14c	0.259	0.093	0.100	0.142	0.141	**0.131**
Newell 16	0.285		0.325			**0.120**
Boulder 17a	0.131	0.051	0.061	-	0.108	**0.064**
Boulder 17b	0.129	0.141	0.164	-	0.232	**0.100**
Boulder 17c	0.250	0.072	0.057	-	0.143	
Bear 18a	0.069	-	0.103	0.119	0.114	**0.074**
Branciforte 21a-2						**0.121**
Branciforte 21b	0.147	0.083	0.102	-	0.189	

*Habitat Typing Method = linear feet of escape cover divided by reach length as pool habitat.

Table 13. ESCAPE COVER Index (Habitat Typing Method*) for RUN HABITAT in TRIBUTARY Reaches of the SAN LORENZO.

Reach	1998	1999	2000	2003	2005	2006
Zayante 13a	0.127	0.059	0.059	0.065	0.031	**0.038**
Zayante 13b	0.060	0.127	0.087	0.152	0.103	
Zayante 13c	0.116	0.095	0.070	0.016	0.070	
Zayante 13d	0.050	0.098	0.143	0.223	0.297	**0.071**
Lompico 13e						**0.001**
Bean 14a	0.060	0.058	0.092	0.051	0.086	
Bean 14b	0.045	0.048	0.041	0.107	0.050	
Bean 14c	-	0.018	0.023	0.015	0.012	**0.009**
Newell 16	0.072		0.129			**0.020**
Boulder 17a	0.188	0.093	0.170	-	0.135	**0.169**
Boulder 17b	0.116	0.156	0.137	-	0.194	**0.102**
Boulder 17c	0.019	0.122	0.107	-	0.114	
Bear 18a	0.073	-	0.177	0.063	0.088	**0.063**
Branciforte 21a-2						**0.028**
Branciforte 21b	0.138	0.014	0.087	-	0.133	

*Habitat Typing Method = linear feet of escape cover divided by reach length as run habitat.

Table 14. Averaged Mean and Maximum WATER DEPTH (ft) of Habitat in SQOUEL CREEK Reaches Since 2000.

Reach	Pool 2000	Pool 2003	Pool 2005	Pool 2006	Riffle 2000	Riffle 2003	Riffle 2005	Riffle 2006	Run/Step-Run 2000	Run/Step-Run 2003	Run/Step-Run 2005	Run/Step - Run 2006
1	1.3/ 2.5	1.4/ 2.7	1.1/ 2.8			-/ 0.5	-/ 0.7			-/ 0.7	-/ 0.8	
2	1.0/ 1.9	1.0/ 1.6	1.0/ 1.7			-/ 0.5	-/ 0.6			-/ 0.7	-/ 1.1	
3	1.3/ 2.4	1.35/ 2.5	1.3/ 2.3	**1.4/ 2.5** partial *		-/ 0.5	-/ 0.7	**0.5/ 0.8** partial		-/ 0.8	-/ 1.0	**0.7/ 1.0** partial
4	1.3/ 2.3	1.2/ 2.6	1.1/ 2.6			-/ 0.6	-/ 0.8			-/ 0.7	-/ 0.9	
5	1.3/ 2.2	1.2/ 2.2	1.2/ 2.3			-/ 0.5	-/ 0.7			-/ 0.8	-/ 0.9	
6	1.3/ 2.4	1.45/ 2.5	1.25/ 2.2			-/ 0.6	-/ 0.7			-/ 0.8	-/ 0.9	
7	1.4/ 2.4	1.6/ 2.9	1.2/ 2.2	**1.3/ 2.3** partial		-/ 0.7	-/ 0.8	**0.5/ 0.8** partial		-/ 0.9	-/ 0.9	**0.8/ 1.2** partial
8	1.5/ 2.7	1.6/ 2.9	1.4/ 2.7			-/ 0.6	-/ 0.8			-/ 0.9	-/ 0.9	
9	1.4/ 2.3		1.3/ 2.1	**1.5/ 2.5**	-/ 0.7		-/ 0.6	**0.4/ 0.6**	-/ 1.1		-/ 0.9	**0.6/ 1.0**
10	1.5/ 2.4											
11	1.9/ 3.3											
12a	1.1/ 1.6		1.1/ 1.7	**1.3/ 2.05**	-/ 0.6		-/ 0.6	**0.45/ 0.8**	-/ 0.9 (S.run)		-/ 1.1 (S.run)	**0.7/ 1.2**
12b	1.3/ 2.0		1.1/ 1.6		-/ 0.5		-/ 0.5		-/ 1.0 (S.run)		-/ 1.0 (S.Run)	
13	1.3/ 2.7											
14a	1.3/ 2.4		1.0/ 1.8	**1.4/ 2.4**	-/ 0.7		-/ 0.5	**0.5/ 0.8**	-/ 1.0		-/ 0.7	**0.6/ 1.0**
14b		1.5/ 2.6 2002		**1.6/ 2.9**				**0.4/ 0.6**				**0.7/ 1.0**
14c		1.4/ 2.4 2002										

*Partial, ½-mile segments habitat typed in 2006. Previously, the entire mainstem was habitat typed.

Table 15. Average PERCENT FINE SEDIMENT in Habitat-typed Reaches in SOQUEL CREEK Since 2000.

Reach	Pool 2000	Pool 2003	Pool 2005	Pool 2006	Riffle 2000	Riffle 2003	Riffle 2005	Riffle 2006	Run/Step -Run 2000	Run/Step -Run 2003	Run/Step-Run 2005	Run/Step - Run 2006
1	81	73	84			21	25			45	36	
2	71	69	80			20	24			47	34	
3	77	70	75	**62** partial *		25	17	**14** partial		34	43	**29** partial
4	69	72	61				21				29	
5	72	66	69				21				27	
6	68	59	63				14				26	
7	80	66	69	**69** partial			17	**21/** partial			35	**33** partial
8	70	59	64				16				24	
9	65		56	**62**	24		17	**12**	36		25	**30**
10	63											
11	56											
12a	48		33	**40**	20		9	**12**	29(S.run)		15(S.run)	**21(S.run)**
12b	49		36		14		5		40		18	
13	73											
14a	71		55	**66**	23		15	**14**	36(run)		31(run)	**28(run)**
14b				**51**				**15**				**35 (run)**
14c												

*Partial, ½-mile segments habitat typed in 2006. Previously, the entire mainstem was habitat typed.

Table 16. Average EMBEDDEDNESS in Pool and Fastwater (Riffle and Run) Habitat of SOQUEL CREEK Reaches Since 2000, Based on Habitat Typed Segments.

Reach	Pool 2000	Pool 2003	Pool 2005	Pool 2006	Riffle 2000	Riffle 2003	Riffle 2005	Riffle 2006	Run/Step -Run 2000	Run/Step -Run 2003	Run/Step-Run 2005	Run/Step - Run 2006
1	47	55	57			33	25			55	35	
2	55	60	56			39	34			69	46	
3	57	59	58	**55** partial *		30	27	**27** partial		46	42	**46** partial
4	55	58	61			40	31			54	48	
5	51	52	55			36	27			48	42	
6	52	50	53			31	28			43	40	
7	49	53	53	**56** partial		33	30	**25** partial		43	43	**39** partial
8	53	49	60			38	29			46	45	
9	56		59	**54**	38		34	**26**	44		45	**50**
10	51											
11	54											
12a	55		53	**53**	35		29	**30**	46(S.run)		37(S.run)	**38**(S.run)
12b	51		59		35		30		42		47	
13			55									
14a	50		58	**57**	28		47	**18**	46(run)		59(run)	**34**(run)
14b		55 2002		**57**		33 2002		**32**		47(run) 2002		**46**(run)
14c		61 2002				30 2002				45 2002		

*Partial, ½-mile segments habitat typed in 2006. Previously, the entire mainstem was habitat typed.

Table 17. ESCAPE COVER Index (Habitat Typing Method*) in Pool Habitat in SOQUEL CREEK, Based on Habitat Typed Segments.

Reach	Pool 2000	Pool 2003	Pool 2005	Pool 2006
1	0.091	0.103	0.107	
2	0.086	0.055	0.106	
3	0.085	0.092	0.141	**0.178** partial**
4	0.041	0.071	0.086	
5	0.061	0.023	0.075	
6	0.082	0.102	0.099	
7	0.089	0.101	0.129	**0.141** partial
8	0.047	0.036	0.060	
9	0.146		0.101	**0.086**
10	0.100			
11	0.068			
12a	0.113		0.222	**0.175**
12b	0.129		0.158	
13	0.077			
14a	0.064			**0.048**
14b		0.051 (2002)		**0.058**
14c		0.068 (2002)		

* Habitat Typing Method = linear feet of escape cover divided by reach length as pool habitat.
** Partial, ½-mile segments habitat typed in 2006. Previously, the entire mainstem was habitat typed.

Table 18. Average POOL HABITAT CONDITIONS for Reaches in APTOS, VALENCIA, CORRALITOS, SHINGLE MILL and BROWNS VALLEY Creeks in 2006 (and at Sampling Sites only in Aptos/ Valencia in 1981 and in Corralitos/ Browns Valley in 1981 and 1994).

Sample Site	Mean Depth/ Maximum Depth	Escape Cover*	Embeddedness			Percent Fines		
			1981	1994	2006	1981	1994	2006
Aptos #3- in County Park	1.4/ 3.0	0.123	35		82	75		85
Aptos #4- Above Steel Bridge Xing (Nisene Marks)	1.3/ 2.4	0.059	35		80	65		78
Valencia #2- Below Valencia Road Xing	0.7/ 1.2	0.115	35		88	85		93
Valencia #3- Above Valencia Road Xing	1.0/ 1.7	0.119	55		82	70		83
Corralitos #3- Above Colinas Drive	1.5/ 2.6	0.138	60	45	52 2003-	45	35	47
Corralitos #8- Below Eureka Gulch	1.3/ 2.2	0.061	54	50	54	35	20	45
Corralitos #9- Above Eureka Gulch	1.2/ 1.8	0.160	56	60	47	35	15	33
Shingle Mill #1- Below 2nd Road Xing	1.15/ 1.8	0.180	42	45	71	23	8	49
Shingle Mill #3- Above 3rd Road Xing	1.15/ 1.8	0.190	60		71			55
Browns Valley #1- Below Dam	1.4/ 2.4	0.051	58	37	71	38	47	61
Browns Valley #2- Above Dam	1.45/ 2.35	0.120	73	47	69	47	37	53

Table 19. Average RIFFLE HABITAT CONDITIONS for Reaches in APTOS, VALENCIA, CORRALITOS, SHINGLE MILL and BROWNS VALLEY Creeks in 2006 (and at Sampling Sites only in Corralitos/Browns Valley in 1981 and 1994).

Sample Site	Mean Depth/ Maximum Depth	Escape Cover*	Embeddedness			Percent Fines		
			1981	1994	2006	1981	1994	2006
Aptos #3- in County Park	0.4/ 0.7	0.007	50		48	68 riffle & run		26
Aptos #4- Above Steel Bridge Xing (Nisene Marks)	0.5/ 0.8	0.004	40		47	30 riffle & run		25
Valencia #2- Below Valencia Road Xing	0.3/ 0.4	0.003	15		54	48 riffle & run		50
Valencia #3- Above Valencia Road Xing	0.3/ 0.5	0.004	30		56	30 riffle & run		33
Corralitos #3- Above Colinas Dr.	0.5/ 0.9	0.028	53	30	26	35	10	18
Corralitos #8- Below Eureka Gulch	0.4/ 0.7	0.021	50	50	28	25	5	14
Corralitos #9- Above Eureka Gulch	0.5/ 0.8	0.041	60	30	33	35	7	7
Shingle Mill #1- Below 2nd Road Xing	0.25/ 0.5	0.022	45	40	19	10	0	31
Shingle Mill #3- Above 3rd Road Xing	0.2/ 0.3	0.020	20		25			5
Browns Valley #1- Below Dam	0.4/ 0.7	0	60	45	36	20	10	15
Browns Valley #2- Above Dam	0.3/ 0.6	0	35		40			15

Table 20. Average RUN or STEP-RUN (Depending on Most Common) HABITAT CONDITIONS for Reaches in APTOS, VALENCIA, CORRALITOS, SHINGLE MILL and BROWNS VALLEY Creeks in 2006 (and at Sampling Sites only in Corralitos/Browns Valley in 1981 and 1994).

Sample Site	Mean Depth/ Maximum Depth	Escape Cover*	Embeddedness			Percent Fines		
			1981	1994	2006	1981	1994	2006
Aptos #3- in County Park	0.75/ 1.4 run	0.030	40		66	68 riffle & run		53
Aptos #4- Above Steel Bridge Xing (Nisene Marks)	0.7/ 1.0 run	0.014			61	30 riffle & run		39
Valencia #2- Below Valencia Road Xing	0.3/ 0.6 run	0.018			77	48 riffle & run		90
Valencia #3- Above Valencia Road Xing	0.4/ 0.7 run	0.008			59	30 riffle & run		48
Corralitos #3- Above Colinas Dr.	0.75/ 1.1 run	0.017	60	40	43	90	60	25
Corralitos #8- Below Eureka Gulch	0.6/ 0.95 run	0.010	60	50	48	49	5	21
Corralitos #9- Above Eureka Gulch	0.8/ 1.3 step-run	0.63			34			16
Shingle Mill #1- Below 2nd Road Xing	0.6/ 1.2 step-run	0.013	45	30	48	18	5	19
Shingle Mill #3- Above 3rd Road Xing	0.4/ 0.8 step-run	0.023			45			18
Browns Valley #1- Below Dam	0.6/ 1.05 step-run	0.015	70	35	58	35	10	36
Browns Valley #2- Above Dam	0.6/ 1.05 step-run	0.015			58			32

STEELHEAD DENSITY COMPARISONS

R-5. Comparison of 2006 Steelhead Densities in the San Lorenzo Drainage with Those Since 1997

Juvenile densities at the 5 mainstem sites sampled in 2006 were 50-90 percent below average for total density, and well below average for all age and size classes (30-93 percent below average at 4 of the 5 sites for larger size classes) (**Tables 21–25; Figures 1 and 2**). 2006 densities at the 3 repeated sites were less than in 2005 in all categories except Size Class II/ III at Site 6 (**Tables 21–25**). The 2006 densities at Sites 1 and 11 were the lowest since 1997 in all categories. Densities in 2006 were similar to the unusually low values of 2000. Only Site 4 approached the average density for the larger Size Class II and III juveniles.

At the 10 tributary sites with multiple-year density measurements, the total juvenile density and YOY density in 2006 were substantially below average at all sites except upper Bean (14c) (**Tables 26 and 27; Figure 1**). Middle Boulder (17b) and lower Bear (18a) had densities next closest to average for these categories, but even those sites were 14-30 percent below average. Yearling densities at tributary sites were well below average at all sites in 2006 (**Table 28**). Juvenile densities in 2006 were much less than 2005 densities in total density, YOY density and yearling density at all sites except for yearlings in lower Boulder Creek (17a) (**Table 28**). Despite low juvenile densities in the watershed and few yearlings holding over, Size Class II and III (smolt-size) juvenile densities were substantially above average at 4 of 10 tributary sites and close to average at another 5 sites (**Table 29; Figure 2**). A mid-Zayante Creek site (13c) was more than 25 percent below average density for smolt-sized juveniles. Compared to 2005, Size Class II/ III densities in 2006 were greater at 4 of 9 sites (**Table 29**).

Total densities, densities by size class and density by year class were higher overall in the tributaries than the mainstem in 2006 (**Tables 21–29**). However, yearling densities were more similar between the two parts of the watershed.

No juvenile coho salmon were captured in 2006 during our sampling or snorkeling at sites in the San Lorenzo system, nor were any seen during snorkel surveys by NOAA Fisheries biologists. This was in contrast to 2005 when 4 juvenile coho were electrofisned in Bean Creek and 5 were observed during NOAA Fisheries snorkel surveys in Bean Creek.

R-6. Comparison of 2006 Steelhead Densities in Soquel Creek with Those Since 1997

Site densities in 2006 were 50 percent or more below average in total density (**Figure 3**). All age and size categories were also substantially below average except for similar or somewhat higher densities for Size Class II/ III juveniles at Site 16 (East Branch below Long Ridge Road Crossing in SDSF), Site19 (West Branch below Hester Creek), Site 20 (West Branch above Hester Creek) and Site 21

(West Branch between Girl Scout Falls I and II (**Tables 30-34; Figures 3 and 4**). Site 22 above Girl Scout Falls II was judged a resident rainbow trout site due to the much lower YOY and total density there compared to Site 21 below the falls. Compared to 2005, steelhead site densities in 2006 were substantially less (mostly < 50 percent) for total density and YOY density at all 6 compared sites (**Tables 30 and 31**). In 2006 compared to 2005, yearling densities were substantially less at 6 of 7 compared sites, small Size Class I fish were substantially less at 4 of 6 compared sites and were substantially less for the important Size Class II/ III juveniles at 3 of 7 compared sites (**Tables 32-34**). Smolt sized juveniles were equal between years at Site 16 and higher in 2006 than 2005 at the West Branch Sites 20 and 21 (**Table 34**). The most extreme reduction in 2006 juvenile densities from 2005 levels was at Site 13a below Mill Pond on the East Branch, where Size Class 1 and II/III densities declined by 85-100 percent (**Tables 33 and 34**). While habitat typing of that reach, an eroded drainage channel was observed upstream of the sampling site, leading from Mill Pond into the creek near the cottage. Sediment deposits were visible in the creek for 300 feet downstream of the drainage channel entry. Evidently, water had been released down the drainage channel at high volume. Water was clear during habitat typing.

R-7. Comparison of 2006 Steelhead Densities in Aptos and Valencia Creeks with Those in 1981 and 1994

At the 2 sampling sites in Aptos Creek in 2006, juvenile steelhead densities were less than in 1981 for total juveniles, YOY's, yearling and older, and Size Class I categories (**Tables 35-38; Figure 5**). However, 2006 densities in the important Size Class II/ III category were much higher than in 1981 (**Table 39; Figure 6**). This was because more of the YOY's in 2006 grew into the larger size class than in 1981, a much drier year.

At the 2 sampling sites in Valencia Creek in 2006, total juvenile densities were similar and YOY and Size Class 1 densities were higher than in 1981. However, yearling and Size Class II/ III densities were much less in the badly sedimented lower reach than in 1981 and similar between years in the upper reach (**Tables 35-39; Figures 5 and 6**).

R-8. Comparison of 2006 Steelhead Densities in Corralitos, Browns Valley and Shingle Mill with those in 1981 and 1994

With 3 years of site densities to compare in the Corralitos watershed, higher densities in age and size classes were generally observed in 1981 than 1994 (more than 100 percent more in 1981 for total density, YOY density and Size Class I density at all 7 sites and substantially higher yearling and Size Class II/III fish at 2 of 3 Corralitos sites, 1 of 2 Shingle Mill sites and 1 of 2 Browns Valley sites) (**Tables 35-39**). A rebound from low 1994 densities was observed in 2006 for all categories except for yearlings at all sites and Size Class II/III fish at the upper Corralitos site and lower Shingle Mill site. The years 1981 and 1994 were drier than average, and 2006 was wetter than average, based on hydrographs for Corralitos Creek (**Figures 32-34**) and hydrographs for the San Lorenzo River (**Figures 9-19**). 2006 juvenile densities in the 3 Corralitos mainstem sites and the 2 Browns Valley

Creek sites were substantially higher than 1994 for total density, YOY's and Size Class 1 juveniles; they were similar for the one comparable Shingle Mill Gulch site (**Tables 35-38; Figure 7)**. In 2006, the YOY densities in Browns Valley Creek were much higher than in the other two streams, with evidence of very late spawners (multiple size modes of YOY's). For densities of yearling and older juveniles, they were substantially lower in 2006 than 1994 at 6 of the 7 sites, with the exception being the lowermost Site 3 on Corralitos Creek. With the higher growth rate of YOY's in 2006 in Corralitos and Browns Valley creeks, 2006 densities of the larger Size Class II/ III juveniles were higher than in 1994 at 4 of 5 sites, the exception being Site 8 below Eureka Gulch that had similar densities between years (**Table 39; Figure 8**).

In the much smaller tributary, Shingle Mill Gulch, some YOY's were believed to have reached Size Class II at Site 1 in 2006 but not in other years. At the more accessible Site 1, total densities were similar between 1994 and 2006, despite much higher densities of YOY's and Size Class 1 fish in 2006 (**Tables 35-38; Figure 7**). This was presumably due to more yearlings holding over in 1994 than 2006, with higher densities of yearlings in 1994. Because most of the Size Class II juveniles were likely yearlings, there were lower densities of this larger size class in 2006 than 1994 (**Table 39; Figure 8**). This was in contrast to most Corralitos and Browns Valley sites, where more YOY's grew into Size Class II in 2006.

At the upper, less accessible Site 3 on Shingle Mill Gulch, no 1994 fish data were collected. The site is within the San Andreas rift zone and consistently has much lower baseflow than the lower site; total juvenile density was higher in 1981 than 2006 (**Table 35; Figure 7**). No YOY's were believed to reach Size Class II in either year. There were similar densities of YOY's, but much higher densities of Size Class 1 and yearlings in 1981 (**Tables 36-38**). In the dry year of 1981, baseflow in this reach declined to a few hundredths of a cfs, and some yearlings remained in Size Class I at fall sampling. Their small size caused them to hold over in Spring 1981 and remain in fall for sampling. Growth rate was faster in 2005, presumably allowing all yearlings to reach smolt size in spring, causing more of them to emigrate in spring and not hold over for fall sampling in 2006. Densities of Size Class II/ III juveniles were similarly low in both years (**Table 39; Figure 8**).

Table 21. Density of Juvenile Steelhead for ALL SIZES at MAINSTEM SAN LORENZO River Monitoring Sites in 1997-2001 and 2003-2006.

Sample Site	1997	1998	1999	2000	2001	2003	2004	2005	2006	Avg
0a				5.4						
0b				4.3	5.2					4.8
1	34.2*	26.9	17.6	3.4	7.6				1.2	15.2
2a	74.9	21.4	4.6	3.9	13.5					23.7
2b				24.8	15.4					20.1
3	83.9	73.5	29.0	33.0	36.0					51.1
4	86.9	37.8	39.6	12.0	33.1				16.6	37.7
5		133.8	46.2	4.5	23.6					52.0
6	45.4	46.0	14.1	4.0	10.9	4.7	8.7	6.7	4.5	16.1
7	149.3	21.7	11.8	7.6	15.5	29.4	38.9	11.0		35.7
8	158.6	140.1	48.2	11.2	21.4	32.3	21.6	20.3	13.7	51.9
9	126.8	77.3	27.6	12.0	29.6	17.4	10.9	17.1		39.8
10	69.1	17.9	10.9	18.4	19.7	51.9	44.6	21.9		31.8
11	73.0	10.9	33.4	28.7	25.1	57.2	45.7	32.3	3.0	34.4
12a	56.8	30.8	21.1	39.9	49.8					39.7
12b		32.2	25.9	43.5	30.4	51.9	48.4	98.2		47.2

*** Density in number of fish per 100 feet of stream.**

Table 22. Density of Juvenile Steelhead for the YOUNG-OF-THE-YEAR Age Class at MAINSTEM SAN LORENZO River Monitoring Sites in 1997-2001 and 2003-2006.

Sample Site	1997	1998	1999	2000	2001	2003	2004	2005	2006	Avg
0a				2.2						
0b				3.3	2.3					2.8
1	32.3*	25.6	12.6	1.8	6.8				1.2	13.4
2a	66.3	19.2	3.2	2.7	11.0					20.5
2b				21.2	12.1					16.7
3	84.3	68.2	24.7	29.4	29.6					47.2
4	86.2	32.9	34.2	10.5	30.5				13.9	34.7
5		132.4	38.5	3.5	22.8					49.3
6	42.0	44.4	13.2	3.3	10.6	4.4	8.5	5.9	4.2	15.2
7	143.5	19.8	5.7	3.6	12.0	29.7	38.0	11.2		32.9
8	152.0	135.3	44.2	10.9	21.0	30.5	20.9	18.7	11.6	49.5
9	119.9	69.7	23.4	11.0	28.9	17.6	10.0	15.4		37.0
10	65.8	11.7	6.5	13.4	15.9	45.1	40.5	18.4		27.2
11	64.2	6.8	27.6	16.4	21.8	49.8	34.5	29.6	1.5	28.0
12a	50.9	27.9	5.4	34.4	37.3					31.2
12b		24.2	14.3	37.9	15.8	44.4	39.3	89.1		37.9

***Density in Number of Juveniles per 100 feet of Stream Reach**

Table 23. Density of Juvenile Steelhead for YEARLINGS AND OLDER at MAINSTEM SAN LORENZO River Monitoring Sites in 1997-2001 and 2003-2006.

Sample Site	1997	1998	1999	2000	2001	2003	2004	2005	2006	Avg
0a				2.2						
0b				1.0	2.9					2.0
1	1.6*	1.4	2.9	1.9	0.5				0	1.4
2a	7.9	1.5	0.9	1.2	1.5					2.6
2b				2.4	2.0					2.2
3	5.2	5.3	3.9	4.4	6.6					5.1
4	7.6	4.7	2.2	1.2	0.5				2.4	3.1
5		2.9	5.4	1.0	0.8					2.5
6	4.6	2.2	0.8	0.7	0.5	0.3	0.2	0.8	0.3	1.2
7	6.0	2.5	6.3	4.8	3.6	0.4	0.3	3.0		3.0
8	5.4	4.2	4.1	0.3	0.4	2.0	2.6	2.4	1.6	2.6
9	4.3	8.1	2.5	1.0	0.6	0.8	1.9	2.5		2.5
10	3.3	6.4	4.6	5.5	4.1	6.8	2.7	4.7		4.7
11	8.8	3.9	6.5	11.2	4.7	7.4	3.0	7.1	1.5	6.0
12a	5.9	3.2	15.7	5.5	12.9					8.6
12b		6.8	12.6	5.5	14.3	7.5	9.1	9.3		9.3

***Density in Number of Juveniles per 100 feet of Stream Reach**

Table 24. Density of Juvenile Steelhead for SIZE CLASS I (<75 mm SL) at MAINSTEM SAN LORENZO River Monitoring Sites in 1997-2001 and 2003-2006.

Sample Site	1997	1998	1999	2000	2001	2003	2004	2005	2006	Avg
0a				0						
0b				0	0					0
1	3.3*	0.2	2.2	0	0.7				0	1.1
2a	7.9	1.3	0.4	0.2	2.5					2.5
2b				1.2	6.7					4.0
3	47.7	9.4	3.7	5.9	18.1					17.0
4	63.0	8.6	6.8	3.1	17.6				0.5	16.6
5		19.1	5.2	0	8.1					8.1
6	35.1	20.5	11.2	1.8	8.4	4.1	8.3	4.7	2.2	10.7
7	126.7	11.7	2.9	1.5	8.6	23.6	35.0	4.9		26.9
8	138.6	118.7	37.4	8.0	20.5	27.9	19.9	13.2	7.9	43.6
9	102.2	57.5	18.5	6.2	28.4	15.4	9.6	12.2		31.3
10	65.8	9.6	4.4	10.1	12.2	45.1	39.8	17.6		25.6
11	64.2	4.1	26.9	15.6	18.7	49.8	34.5	19.3	0	25.9
12a	50.9	26.2	5.4	34.4	40.3					31.4
12b		19.5	4.1	37.0	17.4	44.4	39.3	87.6		35.6

*** Density in number of fish per 100 feet of stream.**

Table 25. Density of Juvenile Steelhead for SIZE CLASS II/ III (=>75 mm SL) at MAINSTEM SAN LORENZO River Monitoring Sites in 1997-2001 and 2003-2006.

Sample Site	1997	1998	1999	2000	2001	2003	2004	2005	2006	Avg
0a				5.4						
0b				4.3	5.2					4.8
1	30.9*	26.7	15.4	3.4	6.9				1.2	14.1
2a	67.0	20.1	4.2	3.7	11.0					21.2
2b				23.6	8.7					16.2
3	36.2	64.1	25.3	27.1	17.9					34.1
4	23.8	29.2	32.8	8.9	15.5				16.2	17.6
5		114.7	41.0	4.5	15.5					43.9
6	10.3	25.5	2.9	2.2	2.5	0.6	0.4	2.0	2.3	5.4
7	22.6	10.0	8.9	6.1	6.9	5.8	3.9	6.1		8.8
8	20.0	21.4	10.8	3.2	0.9	4.4	1.7	7.1	5.8	8.4
9	24.6	19.8	9.1	5.8	1.2	2.0	1.3	4.9		8.6
10	3.3	8.3	6.5	8.3	7.5	6.8	4.8	4.3		6.2
11	8.8	6.8	6.5	13.1	6.4	7.4	11.2	13.0	3.0	8.5
12a	5.9	4.6	15.7	5.5	9.5					8.2
12b		12.7	21.8	6.5	13.0	7.5	9.1	10.6		11.6

*** Density in number of fish per 100 feet of stream.**

Table 26. TOTAL DENSITY of Juvenile Steelhead at SAN LORENZO TRIBUTARY Monitoring Sites in 1997-2001 and 2003-2006.

Sample Site	1997	1998	1999	2000	2001	2003	2004	2005	2006	Avg
Zayante 13a		83.0	104.0	46.6	54.8	68.3	69.9	53.6	17.0	62.2
Zayante 13b	74.9*	50.7	74.9	24.9	38.0	70.0	65.1	53.3		56.5
Zayante 13c		69.0	61.9	25.8	40.0	123.6	63.4	78.2	18.0	60.0
Zayante 13d		82.2	105.0	57.5	84.1	243.8	145.3	99.7	69.8	110.9
Lompico 13e									26.2	
Bean 14a		44.2	45.9	17.0	38.0	50.9	31.9	54.0		45.4
Bean 14b	73.0	115.6	92.1	48.3	65.5	146.4	78.5	103.5	13.1	81.8
Bean 14c		78.2	22.7	87.5	36.8	41.3	99.6	87.4	66.0	64.9
Fall 15	84.5	82.7	85.0	55.0	59.8					73.4
Newell 16	94.9	76.3	40.5	28.8	40.3				26.0	51.1
Boulder 17a	134.2	149.2	68.5	32.0	61.1	60.0	38.6	40.1	30.7	68.3
Boulder 17b	100.7	74.9	49.5	43.0	51.8	98.6	54.2	70.2	57.6	66.7
Boulder 17c		42.8	33.9	36.0	39.4	75.8	81.5	67.4		53.9
Bear 18a	118.5	81.2	76.0	33.6	58.8	86.8	87.7	87.9	52.9	75.9
Bear 18b		69.5	116.1	67.6	63.5					79.2
Kings 19a		10.8	0.5	8.4	7.6					6.8
Kings 19b	52.7	22.9	44.9	37.5	41.6					39.9
Carbonera 20a	13.4	21.0	18.9	9.7	19.6					16.5
Carbonera 20b		53.4	51.7	45.2	45.2					48.9
Branciforte 21a	70.0	60.2	47.1	65.2	45.2				29.5	52.9
Branciforte 21b		67.8	57.6	59.6	57.5			20.4		52.1

*** Density in number of fish per 100 feet of stream.**

Table 27. Density of Juvenile Steelhead for YOUNG-OF-THE-YEAR Fish at SAN LORENZO TRIBUTARY Monitoring Sites in 1997-2001 and 2003-2006.

Sample Site	1997	1998	1999	2000	2001	2003	2004	2005	2006	Avg
Zayante 13a		80.0	96.4	29.0	52.9	64.4	68.3	50.1	14.6	57.0
Zayante 13b	64.9*	43.5	60.6	7.7	31.2	60.4	58.7	48.1		46.9
Zayante 13c		66.9	50.2	9.4	30.9	112.9	53.2	74.2	17.1	51.9
Zayante 13d		77.4	77.7	41.9	67.0	220.6	130.0	88.5	68.0	96.4
Lompico 13e									24.2	
Bean 14a		43.4	42.0	11.1	36.0	46.4	30.0	50.9		37.1
Bean 14b	60.7	104.3	59.0	41.3	60.2	137.3	70.3	84.7	10.9	69.9
Bean 14c		71.8	6.9	76.6	18.1	23.0	87.4	81.5	61.1	53.3
Fall 15	79.6	74.8	68.1	45.1	45.4					62.6
Newell 16	77.1	67.6	17.7	19.9	35.6				20.1	43.6
Boulder 17a	119.2	141.5	50.7	22.9	55.9	45.6	31.3	36.5	25.3	58.8
Boulder 17b	91.8	68.0	36.2	33.9	38.9	84.1	48.0	62.0	56.1	57.7
Boulder 17c		37.6	15.3	27.5	30.7	64.0	69.7	61.3		43.7
Bear 18a	100.2	72.4	57.9	12.6	50.8	75.0	76.6	75.2	51.0	63.5
Bear 18b		66.6	89.2	58.3	48.1					65.6
Kings 19a		9.8	0	6.6	6.0					5.6
Kings 19b	48.2	20.8	32.1	31.5	28.5					32.2
Carbonera 20a	9.1	17.2	13.2	5.6	16.5					12.3
Carbonera 20b		50.9	40.3	29.7	33.4					38.6
Branciforte 21a	64.6	54.1	35.5	47.2	34.2				30.6	44.4
Branciforte 21b		60.1	44.2	45.8	49.4			9.1		41.7

*** Density in number of fish per 100 feet of stream.**

Table 28. Density of Juvenile Steelhead for YEARLING and OLDER Fish at SAN LORENZO TRIBUTARY Monitoring Sites in 1997-2001 and 2003-2006.

Sample Site	1997	1998	1999	2000	2001	2003	2004	2005	2006	Avg
Zayante 13a		3.0	7.6	17.7	1.9	3.9	1.6	3.5	3.2	5.3
Zayante 13b	10.0*	7.2	14.3	17.2	6.8	9.6	6.4	5.2		13.2
Zayante 13c		2.1	11.7	16.4	9.1	10.7	10.2	4.0	1.0	8.2
Zayante 13d		4.7	27.3	15.6	17.1	23.2	15.3	11.2	1.7	14.5
Lompico 13e									1.9	
Bean 14a		0.8	3.9	5.9	2.0	4.5	1.9	3.1		4.6
Bean 14b	12.3	11.3	33.1	7.0	5.3	9.1	8.2	18.8	2.0	11.9
Bean 14c		6.4	15.8	10.9	18.7	18.3	12.2	5.9	4.1	11.5
Fall 15	4.9	7.9	16.9	9.9	14.4					10.8
Newell 16	17.8	8.7	22.8	8.9	4.7				5.4	11.4
Boulder 17a	15.0	7.7	17.8	9.1	5.2	14.4	7.3	3.6	5.9	9.6
Boulder 17b	8.9	6.9	13.3	9.1	12.9	14.5	6.2	8.2	1.1	9.0
Boulder 17c		5.2	18.6	8.5	8.7	11.8	11.8	6.1		10.4
Bear 18a	18.3	7.8	18.1	21.0	8.0	11.8	11.1	12.7	1.6	12.3
Bear 18b		2.9	26.9	9.3	15.4					13.6
Kings 19a		1.0	0.5	1.8	1.6					1.2
Kings 19b	4.5	2.1	12.8	6.0	13.1					7.7
Carbonera 20a	4.3	3.8	5.7	4.1	3.1					4.2
Carbonera 20b		2.5	11.4	15.5	11.8					10.3
Branciforte 21a	5.4	6.1	11.6	18.0	11.0				0	8.7
Branciforte 21b		7.6	13.4	11.1	8.1			11.3		12.7

*** Density in number of fish per 100 feet of stream.**

Table 29. Density of Juvenile Steelhead for SIZE CLASS II/III (=>75 mm SL) Fish at SAN LORENZO TRIBUTARY Monitoring Sites in 1998-2001 and 2003-2006.

Sample Site	1998	1999	2000	2001	2003	2004	2005	2006	Avg
Zayante 13a	12.3*	13.5	17.7	1.9	3.9	1.6	31.4	11.7	11.8
Zayante 13b	14.9	19.9	17.2	7.1	9.6	6.4	17.3		13.2
Zayante 13c	14.7	16.8	16.4	9.5	10.7	10.2	15.0	12.6	13.2
Zayante 13d	10.7	27.3	15.6	17.1	23.2	15.3	15.7	17.3	17.8
Lompico 13e								5.7	
Bean 14a	2.1	3.9	5.9	2.0	4.5	1.9	12.0		4.6
Bean 14b	11.3	33.1	7.1	5.3	9.1	8.2	39.4	11.9	15.7
Bean 14c	6.4	15.8	10.9	18.4	18.3	12.2	12.4	17.1	13.9
Fall 15	13.3	16.9	9.9	13.0					13.3
Newell 16	14.9	22.8	8.9	4.7				16.2	13.5
Boulder 17a	21.9	17.8	9.1	5.2	16.9	7.3	9.0	18.2	13.2
Boulder 17b	11.5	13.3	9.1	12.9	14.5	6.2	8.2	13.7	11.2
Boulder 17c	5.2	18.6	8.5	8.7	11.8	11.8	8.4		10.4
Bear 18a	13.0	18.1	21.0	8.0	11.8	11.1	13.7	13.6	13.8
Bear 18b	6.2	26.9	9.3	13.2					13.9
Kings 19a	6.2	0.5	1.8	1.6					2.5
Kings 19b	6.2	12.8	6.0	10.0					8.8
Carbonera 20a	11.5	5.7	4.1	3.1					6.1
Carbonera 20b	11.4	11.4	15.5	11.8					12.5
Branciforte 21a	8.5	11.6	18.0	10.8				10.8	11.9
Branciforte 21b	14.8	13.4	11.1	8.1			16.0		12.7

*** Density in number of fish per 100 feet of stream.**

Table 30. TOTAL Juvenile Steelhead SITE DENSITIES (fish/ 100 ft) at Monitoring Sites in SOQUEL CREEK in 1997–2006.
(Resident rainbow trout likely present at Sites 18 and 22).

Sample Site	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Avg
1-DS GrangeHall	2.9	5.6	3.0	2.4	3.5	7.4	2.5	1.7	9.5	-	4.3
2- Adj. USGS Gage	4.5	9.4	1.2	5.9	7.7	-	4.1	3.5	4.2	-	5.1
3- Above Bates Ck	13.2	50.6	7.6	2.2	8.4	14.8	-	-	7.9	-	15.0
4- Adj. Flower Fld	49.6	20.7	6.8	5.5	23.0	33.3	7.7	20.1	9.2	3.2	17.9
5-Adj. Beach Shk	50.3	20.6	8.1	9.2	28.0	-	-	-	-	-	23.2
6- End of Cherryvale	24.7	9.4	2.6	5.3	5.7	47.69	15.9	13.1	16.1	-	15.6
7- Adj. Orchard	96.6	14.0	5.6	2.0	27.5	-	-	-	-	-	29.1
8- Below Rivervale	21.0	10.7	4.1	4.9	12.4	59.2	-	-	-	-	18.7
9- Adj. Mt. School	61.6	18.4	5.1	7.9	20.7	94.8	26.2	45.8	26.8	-	28.2
10- Above Allred	54.2	11.9	9.1	9.2	15.5	70.7	19.9	37.2	26.2	12.1	26.6
11- Below Purling Bk	81.9	13.1	10.5	13.1	31.6	-	-	-	-	-	30.0
12- Near Soquel Ck Bridge	83.5	19.5	17.4	12.0	34.4	65.5	20.1	48.5	21.3	-	35.8
13a- Below Mill Pond	79.4	57.6	21.5	22.8	26.2	142.0	33.3	110.5	46.9	3.2	54.3
13b- Below Hinckley	-	-	17.0	24.4	47.3	110.6	-	-	-	-	49.8
14- Above Hinckley	49.6	47.7	23.6	18.5	37.7	107.6	86.0	78.0	39.5	-	54.2
15- Below Amaya Ck	137.9	79.9	55.4	39.0	38.3	91.6	-	-	-	-	73.7
16- Above Amaya Ck*	153.2	179.7	283.5	122.6	85.7	121.9	134.6	98.7	127.3	69.4	137.6
17- Above Fern Glch*	138.3	104.2	170.9	93.8	96.3	129.5	102.4	117.2	157.3	-	123.4
18- Above Ashbury G*	44.1	24.5	53.0	-	-	-	-	-	-	-	40.5
19- Below Hester Ck	62.3	21.7	32.1	27.6	37.8	-	-	-	-	8.3	31.6
20- Above Hester Ck	-	28.2	36.9	37.7	28.3	52.1	49.1	87.2	50.2	22.9	43.6
21- Above GS Falls I	-	-	-	-	-	119.0	112.9	99.4	102.0	44.2**	95.5
22- Abv GS Falls II	-	-	-	-	-	65.5	27.5	58.1	5.5	8.6	33.1

* Raw data obtained from the Soquel Demonstration State Forest, 1997–1999.
** Raw Data obtained from NOAA Fisheries in 2006.

Table 31. SITE DENSITIES (fish/ 100 ft) of Juvenile Steelhead by YOUNG-OF-THE-YEAR AGE CLASS at Monitoring Sites in SOQUEL CREEK in 1997–2006.
(Resident rainbow trout likely present at Sites 18 and 22).

Sample Site	1997	1998	1999	2000	2001	2002	2003	2004	005	2006	Avg
1-DS GrangeHall	6.1	4.3	1.0	0.9	2.8	6.7	1.7	1.2	8.6	-	3.7
2- Adj. USGS Gage	4.1	8.3	0.4	5.3	6.3	-	4.9	3.5	2.6	-	4.4
3- Above Bates Ck	11.7	48.0	5.6	2.0	8.2	14.1	-	-	6.7	-	13.8
4- Adj. Flower Fld	45.7	18.2	6.2	3.5	19.9	28.8	7.1	19.4	8.7	2.4	16.0
5-Adj. Beach Shk	54.0	19.2	5.8	7.6	27.2	-	-	-	-	-	22.8
6- End of Cherryvale	21.1	8.3	2.4	4.4	5.1	46.4	15.8	12.8	12.9	-	14.4
7- Adj. Orchard	94.0	13.6	5.2	1.6	26.4	-	-	-	-	-	28.2
8- Below Rivervale	18.9	9.9	3.9	1.7	11.4	57.2	-	-	-	-	17.2
9- Adj. Mt. School	53.4	16.0	4.5	4.9	18.8	92.5	22.7	43.6	22.2	-	31.0
10- Above Allred	52.2	10.8	7.8	7.9	12.9	68.8	17.2	36.3	22.3	11.8	24.8
11- Below Purling Bk	78.3	12.4	9.5	10.2	31.7	-	-	-	-	-	28.4
12- Near Soquel Ck Bridge	79.8	18.7	14.4	11.2	33.1	65.1	19.7	48.6	9.3	-	34.4
13a- Below Mill Pond	75.3	57.4	20.9	24.5	24.0	73.4	30.9	109.9	41.7	2.5	46.1
13b- Below Hinckley	-	-	16.2	22.0	45.9	109.5	-	-	-	-	48.4
14- Above Hinckley	46.9	46.6	24.7	14.6	37.2	104.6	83.7	76.8	36.7	-	52.4
15- Below Amaya Ck	139.0	76.9	49.6	35.8	35.4	87.1	-	-	-	-	70.6
16- Above Amaya Ck*	148.6	171.9	271.6	123.8	77.6	113.9	131.1	96.4	122.4	65.8	132.3
17- Above Fern Glch*	131.9	101.3	159.4	84.7	8.1	112.4	4.4	10.1	147.9	-	113.4
18- Above Ashbury G*	29.4	24.8	33.3	-	-	-	-	-	-	-	29.2
19- Below Hester Ck	60.6	5.7	30.8	27.0	36.6	-	-	-	-	8.3	28.2
20- Above Hester Ck	-	30.6	36.3	34.3	26.2	49.2	45.3	84.9	49.4	21.5	41.9
21- Above GS Falls I	-	-	-	-	-	107.2	104.0	93.7	98.7	42.7**	89.3
22- Abv GS Falls II	-	-	-	-	-	56.2	24.7	53.2	1.0	6.1	28.2

*Raw data obtained from the Soquel Demonstration State Forest, 1997–1999.
** Raw data obtained from NOAA Fisheries in 2006.

Table 32. SITE DENSITIES (fish/ 100 ft) of Juvenile Steelhead by YEARLING AND OLDER AGE CLASS at Monitoring Sites in SOQUEL CREEK in 1997–2006.
(Resident rainbow trout likely present at Sites 18 and 22).

Sample Site	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Avg
1-DS GrangeHall	1.2	1.5	1.0	1.9	0.7	0.6	0.9	0.5	1.0	-	1.0
2- Adj. USGS Gage	0.6	1.2	0.4	0.5	1.4	-	0	0	1.3	-	0.7
3- Above Bates Ck	2.5	2.6	2.0	0.5	0.2	0.5	-	-	1.3	-	1.4
4- Adj. Flower Fld	2.2	1.5	0.9	2.0	0.7	2.6	0.6	0.7	0.6	0.7	1.2
5-Adj. Beach Shk	2.8	1.4	2.0	1.6	0.5	-	-	-	-	-	1.7
6- End of Cherryvale	3.2	1.7	0.7	1.0	0.5	1.3	0	0.3	3.1	-	1.3
7- Adj. Orchard	2.2	0.5	0.4	0.4	1.1	-	-	-	-	-	0.9
8- Below Rivervale	1.0	0.9	0.7	3.1	1.4	1.6	-	-	-	-	1.5
9- Adj. Mt. School	3.4	1.7	1.3	4.7	1.7	2.6	3.6	2.3	4.5	-	2.9
10- Above Allred	1.3	1.1	1.3	1.1	0.9	1.8	3.0	0.2	2.9	0.4	1.4
11- Below Purling Bk	2.7	0.6	2.2	4.1	0.3	-	-	-	-	-	2.0
12- Near Soquel Ck Bridge	3.6	0.5	2.0	1.1	0.9	0.3	0.5	0	1.9	-	1.2
13a- Below Mill Pond	7.1	0	1.1	2.9	2.1	2.6	2.1	0.6	5.3	0.7	2.4
13b- Below Hinckley	-	-	1.1	4.7	1.4	2.0	-	-	-	-	2.3
14- Above Hinckley	2.6	1.0	1.6	4.8	1.9	2.9	1.4	0.6	2.8	-	2.2
15- Below Amaya Ck	0	2.5	6.7	4.0	2.9	4.3	-	-	-	-	3.4
16- Above Amaya Ck*	3.6	5.4	11.6	2.8	8.1	8.0	3.5	2.3	4.4	3.5	5.3
17- Above Fern Gch*	5.7	3.1	11.5	6.9	18.2	17.0	7.8	7.1	9.6	-	9.7
18- Above Ashbury G*	13.8	9.6	19.8	-	-	-	-	-	-	-	14.4
19- Below Hester Ck	1.2	0.4	1.6	1.2	1.2	-	-	-	-	0.3	1.0
20- Above Hester Ck	-	0.3	0.3	3.0	2.1	2.9	3.8	2.3	1.0	0.6	1.8
21- Above GS Falls I	-	-	-	-	-	11.9	8.8	5.3	2.1	1.2**	5.9
22- Abv GS Falls II	-	-	-	-	-	9.3	2.8	4.9	4.5	2.5	4.8

* Raw data obtained from the Soquel Demonstration State Forest, 1997–1999.
** Raw Data obtained from NOAA Fisheries in 2006.

Table 33. SITE DENSITIES (fish/ 100 ft) of Juvenile Steelhead by SIZE CLASS I at Monitoring Sites in SOQUEL CREEK in 1997–2006.
(Resident rainbow trout likely present at Sites 18 and 22).

Sample Site	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Avg
1-DS GrangeHall	1.7	0.2	0	0	0.5	3.5	0.3	0.5	0	-	0.7
2- Adj. USGS Gage	0.9	0.2	0	0	2.2	3.5	1.7	1.9	0	-	0.9
3- Above Bates Ck	1.8	0	0	0.9	4.0	10.4	-	-	0	-	2.4
4- Adj. Flower Fld	20.1	1.5	0	0.5	7.6	20.0	4.4	13.8	0	0.4	6.8
5-Adj. Beach Shk	38.2	0	0.3	1.1	21.6	-	-	-	-	-	12.2
6- End of Cherryvale	14.3	0	0	0	2.8	42.9	13.7	12.5	0.4	-	9.6
7- Adj. Orchard	71.6	1.0	1.6	0.4	21.5	-	-	-	-	-	19.2
8- Below Rivervale	11.7	0.2	1.0	0.2	6.3	49.6	-	-	-	-	11.5
9- Adj. Mt. School	36.7	1.1	0.4	0.5	6.6	79.7	12.7	27.1	2.1	-	18.5
10- Above Allred	43.2	0	3.3	0	9.4	60.8	13.8	34.7	3.5	5.8	17.4
11- Below Purling Bk	60.5	0.9	4.1	2.8	29.1	-	-	-	-	-	19.5
12- Near Soquel Ck Bridge	68.1	3.8	9.2	5.9	28.9	60.1	16.3	44.0	4.5	-	26.8
13a- Below Mill Pond	60.2	30.4	13.0	16.4	23.1	138.3	29.8	109.9	20.8	0	44.2
13b- Below Hinckley	-	-	3.2	15.8	43.9	105.1	-	-	-	-	42.0
14- Above Hinckley	27.4	26.9	11.8	3.5	24.3	101.7	78.9	76.1	17.8	-	40.9
15- Below Amaya Ck	130.4	64.1	38.2	30.5	35.4	84.9	-	-	-	-	63.9
16- Above Amaya Ck*	143.3	164.8	267.8	114.7	77.6	113.9	131.1	96.4	118.2	60.3	128.8
17- Above Fern Glch*	130.3	90.1	151.7	82.4	78.1	112.4	94.4	110.1	130.9	-	108.9
18- Above Ashbury G*	29.2	20.6	33.2	-	-	-	-	-	-	-	27.7
19- Below Hester Ck	60.1	20.4	23.4	24.5	36.6	-	-	-	-	3.6	28.1
20- Above Hester Ck	-	20.6	33.2	32.4	26.2	49.2	45.3	84.9	47.3	17.1	39.6
21- Above GS Falls I	-	-	-	-	-	107.2	103.1	91.8	90.0	30.1**	84.4
22- Abv GS Falls II	-	-	-	-	-	56.2	24.7	50.9	0.3	3.9	27.2

* Raw data obtained from the Soquel Demonstration State Forest, 1997–1999.
** Raw data obtained from NOAA Fisheries in 2006.

Table 34. SITE DENSITIES (fish/ 100 ft) of Juvenile Steelhead by SIZE CLASS II/III at Monitoring Sites in SOQUEL CREEK in 1997–2006.
(Resident rainbow trout likely present at Sites 18 and 22).

Sample Site	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Avg
1-DS GrangeHall	1.2	5.4	3.0	2.4	3.0	3.9	2.3	1.2	9.5	-	3.5
2- Adj. USGS Gage	3.6	9.4	0.8	5.9	5.5	-	2.4	1.6	4.2	-	4.2
3- Above Bates Ck	11.4	50.6	7.6	1.3	4.4	4.4	-	-	7.9	-	12.5
4- Adj. Flower Fld	29.5	19.2	6.8	5.0	15.4	13.3	3.3	6.3	9.2	2.8	11.2
5-Adj. Beach Shk	18.1	20.6	7.8	8.1	6.4	-	-	-	-	-	12.2
6- End of Cherryvale	10.4	9.4	2.6	5.3	2.9	4.7	2.2	0.6	15.7	-	6.0
7- Adj. Orchard	25.0	13.0	4.0	1.6	6.0	-	-	-	-	-	9.9
8- Below Rivervale	9.3	10.5	3.1	4.7	6.1	9.6	-	-	-	-	7.2
9- Adj. Mt. School	24.9	17.3	4.7	7.4	14.1	15.1	13.5	18.7	24.7	-	15.6
10- Above Allred	11.0	11.9	5.8	9.2	6.1	9.9	6.1	2.5	22.7	6.3	9.2
11- Below Purling Bk	21.4	12.2	6.4	10.3	2.5	-	-	-	-	-	10.6
12- Near Soquel Ck Bridge	15.4	15.7	8.2	6.1	5.5	5.4	3.8	4.5	16.8	-	9.0
13a- Below Mill Pond	19.2	27.2	8.5	6.4	3.1	3.7	3.5	0.6	26.1	3.2	10.1
13b- Below Hinckley	-	-	13.8	8.6	3.4	5.5	-	-	-	-	7.8
14- Above Hinckley	22.2	20.8	11.8	15.0	13.4	5.9	7.1	1.9	21.7	-	13.3
15- Below Amaya Ck	7.5	15.8	17.2	8.5	2.9	6.7	-	-	-	-	9.8
16- Above Amaya Ck*	9.9	14.9	15.7	7.9	8.1	8.0	3.5	2.3	9.1	9.1	8.8
17- Above Fern Glch*	8.0	14.1	19.2	11.4	18.2	17.1	8.0	7.1	26.4	-	14.4
18- Above Ashbury G*	14.9	3.9	19.8	-	-	-	-	-	-	-	12.9
19- Below Hester Ck	2.2	1.3	8.7	3.1	1.2	-	-	-	-	4.7	3.5
20- Above Hester Ck	-	7.6	3.7	5.3	2.1	2.9	3.8	2.3	2.9	5.8	4.0
21- Above GS Falls I	-	-	-	-	-	11.8	9.8	7.6	12.0	14.1**	11.1
22- Abv GS Falls II	-	-	-	-	-	9.3	2.8	7.2	5.2	4.7	5.8

* Raw data obtained from the Soquel Demonstration State Forest, 1997–1999.
**Raw data obtained from NOAA Fisheries in 2006.

Table 35. TOTAL DENSITY of Juvenile Steelhead at Monitoring Sites in APTOS, VALENCIA, CORRALITOS, SHINGLE MILL and BROWNS VALLEY Creeks, 1981, 1994 and 2006.

Sample Site	1981	1994	2006	Avg
Aptos #3- in County Park	35.2*	–	26.2	30.7
Aptos #4- above steel Bridge Xing (Nisene Marks)	43.0	–	38.6	40.8
Valencia #2- below Valencia Road Crossing	33.1	–	28.3	30.7
Valencia #3- Above Valencia Road Crossing	29.8	–	33.4	31.6
Corralitos #3- Above Colinas Drive	39.1	18.6	35.5	31.1
Corralitos #8- Below Eureka Gulch	81.9	28.6	49.0	53.2
Corralitos #9- Above Eureka Gulch	86.1	29.9	87.1	67.7
Shingle Mill #1- Below 2nd Road Crossing	24.5	30.0	33.9	29.5
Shingle Mill #3- Above 2nd Road Crossing	32.6	–	22.9	27.8
Browns Valley #1- Below Dam	54.3	22.5	101.6	59.5
Browns Valley #2- Above Dam	71.6	18.5	99.5	63.2

*** Density in number of fish per 100 feet of stream.**

Table 36. Density of Juvenile Steelhead for YOUNG-OF-THE-YEAR Fish at Monitoring Sites in APTOS, VALENCIA, CORRALITOS, SHINGLE MILL and BROWNS VALLEY Creeks, 1981, 1994 and 2006.

Sample Site	1981	1994	2006	Avg
Aptos #3- in County Park	24.4*	–	23.7	24.1
Aptos #4- above steel Bridge Xing (Nisene Marks)	37.1	–	35.2	36.2
Valencia #2- below Valencia Road Crossing	16.6	–	24.5	20.6
Valencia #3- Above Valencia Road Crossing	16.6	–	20.5	18.6
Corralitos #3- Above Colinas Drive	33.9	10.2	24.6	22.9
Corralitos #8- Below Eureka Gulch	59.7	14.3	45.0	39.7
Corralitos #9- Above Eureka Gulch	55.8	16.7	78.4	50.3
Shingle Mill #1- Below 2nd Road Crossing	14.3	5.7	25.1	15.0
Shingle Mill #3- Above 2nd Road Crossing	18.6	–	19.5	19.1
Browns Valley #1- Below Dam	26.9	7.0	96.6	43.5
Browns Valley #2- Above Dam	66.1	12.8	94.7	57.9

*** Density in number of fish per 100 feet of stream.**

Table 37. Density of Juvenile Steelhead for YEARLING AND OLDER Fish at Monitoring Sites in APTOS, VALENCIA, CORRALITOS, SHINGLE MILL and BROWNS VALLEY Creeks, 1981, 1994 and 2006.

Sample Site	1981	1994	2006	Avg
Aptos #3- in County Park	10.8*	–	3.1	7.0
Aptos #4- above steel Bridge Xing (Nisene Marks)	5.9	–	3.0	4.5
Valencia #2- below Valencia Road Crossing	16.5	–	3.8	10.2
Valencia #3- Above Valencia Road Crossing	13.2	–	12.9	13.1
Corralitos #3- Above Colinas Dr.	5.2	8.4	10.8	8.1
Corralitos #8- Below Eureka Gulch	22.2	14.3	4.0	13.5
Corralitos #9- Above Eureka Gulch	30.3	13.2	9.5	17.7
Shingle Mill #1- Below 2nd Road Crossing	10.2	24.3	9.0	14.5
Shingle Mill #3- Above 2nd Road Crossing	14.0	–	3.4	8.7
Browns Valley #1- Below Dam	27.4	15.5	4.3	15.7
Browns Valley #2- Above Dam	5.5	7.7	2.8	5.3

*** Density in number of fish per 100 feet of stream.**

Table 38. Density of Juvenile Steelhead for SIZE CLASS I Fish (<75 mm SL) at Monitoring Sites in APTOS, VALENCIA, CORRALITOS, SHINGLE MILL and BROWNS VALLEY Creeks, 1981, 1994 and 2006.

Sample Site	1981	1994	2006	Avg
Aptos #3- in County Park	24.4*	–	7.2	15.8
Aptos #4- above steel Bridge Xing (Nisene Marks)	37.1	–	28.5	33.3
Valencia #2- below Valencia Road Crossing	16.6	–	24.5	20.6
Valencia #3- Above Valencia Road Crossing	16.6	–	20.5	18.6
Corralitos #3- Above Colinas Drive	33.9	10.2	16.2	18.0
Corralitos #8- Below Eureka Gulch	59.7	14.3	35.8	21.3
Corralitos #9- Above Eureka Gulch	55.8	16.7	45.5	24.0
Shingle Mill #1- Below 2nd Road Crossing	14.3	5.7	17.7	12.6
Shingle Mill #3- Above 2nd Road Crossing	32.4	–	19.5	30.0
Browns Valley #1- Below Dam	26.9	7.0	84.6	23.0
Browns Valley #2- Above Dam	66.1	12.8	82.6	30.1

*** Density in number of fish per 100 feet of stream.**

Table 39. Density of Juvenile Steelhead for SIZE CLASS II/III Fish (=>75 mm SL) at Monitoring Sites in APTOS, VALENCIA, CORRALITOS, SHINGLE MILL and BROWNS VALLEY Creeks, 1981, 1994 and 2006.

Sample Site	1981	1994	2006	Avg
Aptos #3- in County Park	10.8*	–	19.0	14.9
Aptos #4- above steel Bridge Xing (Nisene Marks)	5.9	–	10.1	8.0
Valencia #2- below Valencia Road Xing	16.5	–	3.8	10.2
Valencia #3- Above Valencia Road Xing	13.2	–	12.9	13.1
Corralitos #3- Above Colinas Dr.	5.2	8.4	19.3	11.0
Corralitos #8- Below Eureka Gulch	22.2	14.3	13.2	16.6
Corralitos #9- Above Eureka Gulch	30.3	13.2	41.6	28.4
Shingle Mill #1- Below 2nd Road Xing	10.2	24.3	16.2	16.9
Shingle Mill #3- Above 2nd Road Xing and check dams	2.0	–	3.4	2.7
Browns Valley #1- Below Dam	27.4	15.5	17.0	20.0
Browns Valley #2- Above Dam	5.5	5.7	16.9	9.4

*** Density in number of fish per 100 feet of stream.**

R-9. Rating of Smolt Rearing Habitat in 2006, Based on Site Densities of Smolt-Sized Fish

Smolt habitat was rated at sampling sites, based on smolt-sized (=>75 mm SL) fish density according to the rating scheme developed by Smith (**1982**) (**Tables 40 and 41**). (Note: the scheme was applied to all sites, and lower San Lorenzo sites were rated very good and excellent in 1981.) This scheme assumed that rearing habitat was usually near saturation with smolt-sized juveniles, and spawning rarely limited juvenile steelhead abundance. This was doubtful in 2006 in the San Lorenzo and Soquel watersheds because much higher juvenile densities would be expected with the higher than average streamflows, based on past years of sampling. Juvenile steelhead densities (both YOY's and yearlings) were below average at all sampling sites in the San Lorenzo and Soquel watersheds (**Tables 21-34**). With the unusually late storms in spring 2006, growth may have been high for yearlings, causing many to leave early rather than hold over until fall sampling. However, the late storms may have seriously reduced survival of redds and recently emerged fry, resulting in too few juveniles to saturate available rearing habitat. The smolt densities were bolstered by faster growth rate, but the low number of YOY's likely prevented saturation of smolt-sized juveniles in these two watersheds. In the Aptos and Corralitos watersheds, smolt saturation may have been more closely attained in 2006. This was because YOY densities were more similar to previous years and faster growth associated with higher streamflows increased the smolt density with faster growing YOY's despite the lower yearling densities.

Table 40. Rating of Steelhead Rearing Habitat For Small, Central Coastal Streams.*
(From Smith 1982.)

<u>Very Poor</u> - less than 2 smolt-sized**	**fish**	**per 100 feet**	**of stream.**
<u>Poor</u> - from 2 to 4	"	"	"
<u>Below Average</u> - 4 to 8	"	"	"
<u>Fair</u> - 8 to 16	"	"	"
<u>Good</u> - 16 to 32	"	"	"
<u>Very Good</u> - 32 to 64	"	"	"
<u>Excellent</u> - 64 or more	"	"	"

* Drainages sampled included the Pajaro, Soquel and San Lorenzo systems, as well as other smaller Santa Cruz County coastal streams. Nine drainages were sampled at over 106 sites.
** Smolt-sized fish were at least 3 inches (75 mm) Standard Length at fall sampling and would be large enough to smolt the following spring.

Table 41. Sampling Sites in 2006 in the San Lorenzo, Soquel, Aptos and Corralitos Watersheds Rated by Smolt-Sized Juvenile Density (=>75 mm SL).

Site	2006 Density (Smolts/ 100 ft)	2006 Smolt Habitat Rating
Low. San Lorenzo #1	1.2	Very Poor
Low. San Lorenzo #4	16.2	Good
Mid. San Lorenzo #6	2.3	Poor
Mid. San Lorenzo #8	5.8	Below Average
Up. San Lorenzo #11	3.0	Poor
Zayante #13a	11.7	Fair
Zayante #13c	12.6	Fair
Zayante #13d	17.3	Good
Lompico #13e	5.7	Below Average
Bean #14b	11.9	Fair
Bean #14c	17.1	Good
Newell # 16	16.2	Good
Boulder #17a	18.2	Good
Boulder #17b	13.7	Fair
Bear #18a	13.6	Fair
Branciforte #21a	10.8	Fair
Soquel# 4	2.8	Poor
Soquel # 10	6.3	Below Average
East Branch Soquel #13a	3.2	Poor
East Branch Soquel #16	9.1	Fair
West Branch Soquel #19	4.7	Below Average
West Branch Soquel #20	5.8	Below Average
West Branch Soquel #21	14.1*	Fair
Aptos #3	19.0	Good
Aptos #4	10.1	Fair
Valencia #2	3.8	Poor
Valencia #3	12.9	Fair
Corralitos #3	19.3	Good
Corralitos #8	13.2	Fair
Corralitos #9	41.6	Very Good
Shingle Mill #1	16.2	Good
Shingle Mill #3	3.4	Poor
Browns Valley #1	17.0	Good
Browns Valley #2	16.9	Good

*** From NOAA Fisheries Sampling Site Data.**

The breakdown of ratings for the 34 sampling sites, was **1** (2.9%) "**Very Poor**," **6** (17.6%)"**Poor**," **5** (14.7%)"**Below Average**," **11** (32.4%)"**Fai**r," **10** (29.4) "**Good**" and **1** (2.9%)"**Very Good**." Therefore, 35% (12 of 34) of the sites were rated less than fair. Sites that fell into the less than fair categories included the 3 mainstem San Lorenzo sites, Lompico, the 2 mainstem Soquel sites, lower East Branch Soquel near Mill Pond, the 2 lower sites on West Branch Soquel, lower Valencia and upper Shingle Mill. However, size of smolt-sized fish is also a factor in evaluating steelhead smolt and adult contribution. Smolt-sized fish at the 3 mainstem San Lorenzo River and the 2 mainstem Soquel Creek sites were relatively large. They would have disproportionately high overwinter and ocean survival and produce a higher proportion of returning adults. The late storms in 2006 had mixed effects. The apparently substantial reduction in egg and emerging fry survival, but higher summer streamflows resulted in higher growth rates of fish. More YOY's reached smolt size and smolt-sized fish were bigger than usual.

R-10. Statistical Analysis of Annual Difference in Juvenile Steelhead Densities

The trend in fish densities between 2005 and 2006 was analyzed by using a paired t-test (**Snedecor and Cochran 1967; Sokal and Rohlf 1995; Elzinga et al. 2001**). Only the San Lorenzo watershed had multiple 2005 sites that were re-sampled in 2006. These were sites in which the same habitats were sampled in both years. With 7 comparable sites in the San Lorenzo system (Site 8 in the middle River and 6 tributary sites), comparisons were made for total density, age classes and size classes (AC1, AC2, SC1, SC2). The paired t-test is among the most powerful of statistical tests, where the difference in mean density (labeled "mean difference" in the analysis) is tested. This test was possible because the data were taken at the same sites between years when consistent with average habitat conditions between years, as opposed to re-randomizing each year. The null hypothesis for the test was that among all sites, the site-by-site difference between years 2005 and 2006 was zero. The non-random nature of the initial choice of sites was necessary for practical reasons and does not violate the statistical assumptions of the test; the change in density is a randomly applied effect (i.e. non-predictable based on knowledge of the initial sites) that does not likely correlate with the initial choice of sites. So, the mean difference is a non-biased sample.

The null hypothesis was that the difference in mean density was zero. Hence, a p-value of 0.05 meant that there was only a 5% probability that the difference between densities was zero. A 2-tailed test was used, meaning that an increase or a decrease was tested for. The confidence limits tell us the limits of where the true mean difference was. The 95% confidence interval indicated that there was a 95% probability that the true mean difference was between these limits. If these limits included zero, then it could not be ruled out that there was no difference between 2005 and 2006 densities. The 95% confidence limits are standard and a p-value of < 0.05 is considered significant. The results are presented below in **Table 42**.

Despite only 7 comparable sites in the San Lorenzo drainage, the declines in total juvenile density, YOY's, Size Class 1 juveniles and yearlings were statistically significant at the 0.05 level and even lower (**Table 42**).

Table 42. Paired T-test for the Trend in Steelhead Site Densities by Size Class and Age Class at All Repeated Sites In the San Lorenzo Watershed (2005 to 2006; n=7).

Statistic	s.c. 1	s.c. 2	a.c. 1	a.c. 2	All Sizes
Mean difference	-34.46	-2.76	-29.86	-7.16	-36.59
Df	6	6	6	6	6
Std Error	8.30	4.27	9.73	2.18	11.13
t Stat	-4.15	-0.65	-3.07	-3.28	-3.29
P-value (2-tail)	0.0060	0.5423	0.0220	0.0169	0.0167
95% CL (lower)	-54.76	-13.20	-53.66	-12.50	-63.83
95% CL (upper)	-14.16	7.69	-6.06	-3.28	-3.29

R-11. Adult Trapping Results at the Fish Ladder on the Felton Diversion Dam

Adult Trapping Results. The trap at the City of Santa Cruz Felton Diversion dam was operated by Terry Umstead, San Lorenzo Valley High School students and other volunteers for approximately 2 months over the winter 2005-2006. It was used from 17 January 2006 through 24 March 2006 (**Table 43**). A total of 247 adult steelhead =>18 inches Fork Length and 2 adult coho were captured. Two returning adults had NOAA Fisheries PIT tags. The trapping period included 2 minor stormflows from late January through February, followed by 5 stormflows in March through the 23rd. Multiple stormflows occurred after this period in March through May but not many during the trapping period (**Figure 19**). The 2006 total was much less than the 1,007 adult steelhead and 14 adult coho captured in 2004 over a similar time period, but stormflows were smaller and more numerous in 2004 (**Figure 16**). The trap is more effective at lower stormflows such as occurred in 2004. The 2006 total was less than the 371 adult steelhead and 18 adult coho captured in 2005 over a longer time period, but trapping began and ended later in the 2006 season than in 2005 and began after several storm events in 2006.

Table 43. Adult Steelhead Trapping Data from the San Lorenzo River With Adult Return Estimates.

Trapping Year	Trapping Period	Number of Adults	Location
1934-35	?	973	Below Brookdale (1)
1938-39	?	412	Below Brookdale (1)
1939-40	?	1,081	Below Brookdale (1)
1940-41	?	671	Boulder Creek (2)
1941-42	Dec 24 - Apr 11	827	Boulder Creek (2)
1942-43	Dec 26 - Apr 22	624	Boulder Creek (3)
1976-77	Jan-Apr	1,614	Felton Diversion (4)
1977-78	Nov 21 - Feb 5	3,000 (Estimate)	Felton Diversion (4)
1978-79	Jan-Apr	625 (After drought)	Felton Diversion (4)
1979-80	Jan-Apr ?	496 (After drought)	Felton Diversion (4)
1982-83		1,506	Alley Estimate from 1981 Mainstem Juve-niles only
1994-95	6 Jan-21 Mar (48 of 105 days-Jan-15 Apr)	311 (After drought)	Felton Diversion (5) Monterey Bay Salmon & Trout Project
1996-97		1,076 (estimate)	Alley Estimate from 1994 Mainstem Juve-niles only
1997-98		1,784 (estimate)	Alley Estimate from 1995 Mainstem Juve-niles only
1998-99		1,541 (estimate)	Alley Revised Esti-mate from 1996 Main-stem Juveniles only
1999-2000	17 Jan-10 Apr	532 (above Felton)	Monterey Bay Salmon & Trout Project
1999-2000		1,300 (estimate)	Alley Index from 1997 Mainstem Juveniles only
2000-01	12 Feb-20 Mar	538 (above Felton)	Monterey Bay Salmon & Trout Project
2000-01		2,500 (estimate)	Alley Index from 1998 Juveniles in Mainstem and 9 Tributaries
2001-02		2,650 (estimate)	Alley Index from 1999 Juveniles in Mainstem and 9 Tributaries
2002-03		1,650 (estimate)	Alley Index from 2000 Juveniles in Mainstem and 9 Tributaries
2003-04		1,600 (estimate)	Alley Index from 2001 Juveniles in Mainstem and 9 Tributaries
2003-04	28 Jan-12 Mar	1,007 Steelhead 14 Coho	SLV High School-Felton Diversion Dam
2004-05	12 Dec 29 Jan	371 Steelhead 18 Coho	SLV High School-Felton Diversion Dam
2005-06	17 Jan-24 Mar	247 Steelhead 2 Coho	SLV High School-Felton Diversion Dam

(1) Field Correspondence from Document # 527, 1945, Div. Fish and Game.
(2) Field Correspondence from Document #523, 1942, Div. Fish and Game.
(3) Inter-office Correspondence, 1943, Div. Fish and Game.
(4) Kelley and Dettman (1981).
(5) Dave Strieg, Big Creek Hatchery Manager, pers. comm. 1995.

DISCUSSION

D-1. Comparisons of the Annual Trend in Young-of-the-Year and Yearling Steelhead Densities in Santa County Streams with Trends in Other Coastal Streams

YOY steelhead densities in 2006 were substantially below average and less than in 2005 in 6 of 7 Central Coast streams where long-term data are available, the exception being Santa Rosa Creek (San Luis Obispo County; **Alley 2007a**). The 6 streams included the San Lorenzo River, Soquel Creek, San Simeon (San Luis Obispo County; **Alley 2007b**), and streams sampled by Smith (**2007**); Scott, Waddell and Gazos creeks in Santa Cruz and San Mateo counties. To clarify, YOY densities in Santa Rosa Creek were above average at 6 of 12 sites with the YOY population estimate below average (though greater than in 2005). In Santa Rosa Creek, YOY site densities were higher in 2006 than 2005 at 8 of 12 sites.

Streams where yearling densities were below average and less than in 2005 included the San Lorenzo River, Soquel Creek, Santa Rosa Creek, and San Simeon Creek. Yearling densities on Scott, Waddell and Gazos creeks were also below average.

D-2. Causal Factors for Average or Above Size Class II/III (Smolt-Sized) Juvenile Steelhead Densities in 2006 and Lower Total Densities Compared to Previous Years in the San Lorenzo and Soquel Watersheds

There are likely multiple reasons for the low juvenile densities in 2006. The timing and intensity of the previous winter storms likely played a major role. We see from the hydrograph that the first onslaught of heavy rains came early, in January. Then there was a drier period followed by repeated high stormflows in March through May (**Figure 31**). Early spawners took advantage of the first pulse of winter stormflows. Yearlings took advantage of the high spring flow and encouragement to enter the bay. The early emerging YOY's from the early spawners grew quickly, but many likely suffered heavy mortality from high spring stormflows. The near absence of large wood to provide overwintering habitat likely increased the mortality. The inherently high sediment component to stream channels and easily eroding streambanks in the Santa Cruz Mountains likely greatly reduced egg survival in redds prepared during the repeated spring stormflows with several bankfull events in April and May. From previous calculations, bankfull at the Big Trees gage was between 2,800 and 4,300 cfs, corresponding to the 1.3 and 1.5 year recurrence intervals, respectively (**Alley 1999**). So the surviving YOY numbers in 2006 were most likely determined by spawning at the end of the spawning season. Much of the YOY segment of the juvenile population likely emerged in late spring after these late storm events. The size distribution of YOY's indicates a small component of large individuals resulting from early emergence between the two heavy rainfall periods, followed by a much larger component of smaller individuals that grew rapidly with the high spring baseflows, but were much smaller than the ones that emerged earlier. With the high spring baseflow, yearlings may have grown sufficiently large to smolt rather than holding over until fall sampling. That would explain the low yearling densities throughout the 4 watersheds. It is also possible that the early winter storms were sufficiently high enough to cause additional yearling mortality. YOY abundance was substantially lower than usual on Gazos, Waddell and Scott creeks in 2006, apparently due to the late storms (**Smith 2007**). However, yearling ("smolt-sized") abundance on those streams was not unusually low.

Rearing habitat in the San Lorenzo and Soquel watersheds showed slight degradation from 2005 conditions. Embeddedness and percent fines increased in 2006. There was less escape cover as a result. However, the higher spring and early streamflow and deeper habitat conditions partially compensated for these negative factors. It is likely that the habitat was not fully saturated with Size Class II and III individuals in the mainstem of both watersheds. If we look at the last especially high streamflow conditions in 1998 with associated fast juvenile growth rates, we see that smolt densities were much higher in the mainstems of both watersheds. In that year, the high stormflows had come earlier in the winter with less heavy stormflow late, as occurred in winter 2005-2006. Summer habitat conditions were not substantially different in 1998 and 2006. Yet smolt densities were much less in 2006. In the tributaries and branches, smolt densities were near average or better in both 1998 and 2006, despite the much low total, YOY and yearling densities in 2006, thanks to the much higher than usual growth rates. However, in Soquel Creek branches, smolt densities were still less than they had been in 1998 due to the low YOY and yearling densities there. YOY densities in the SDSF (Site 16) in 2006 were only 38% of 1998 levels and 54% of 2005 levels, for example.

The low YOY densities in 2006 in the San Lorenzo and Soquel watersheds were not likely due to especially low adult returns in winter of 2005-2006. The juvenile population most contributing to these adult returns was present in fall 2003. The 2003 index of adult returns calculated for the upper San Lorenzo in 2003 for 2005-2006 adult returns was higher than those calculated in 2000 and 2001 (contributing to juvenile densities in 2003 and 2004), yet YOY site densities in 2003 and 2004 were generally much higher than in 2006. In Soquel Creek where an adult index could be calculated in 2002, there were likely more adults spawning in winter 2004-2005 than in 2005-2006, possibly contributing to more spawning effort and YOY production in 2005 compared to 2006. However, the adult indices in 2000 and 2001 in Soquel Creek were similar to 2003, yet YOY site densities in 2003 and 2004 were much greater than in 2006.

D-3. Causal Factors for Similar or Higher Total and Size Class II/ III (Smolt-Sized) Juvenile Steelhead Densities in 2006 Compared to Previous Sampling in Corralitos and Aptos Creeks

Comparing juvenile density between 1981, 1994 and 2006 in the Aptos and Corralitos watersheds, differences in winter and spring streamflow again were likely major factors. In comparing the hydrographs, we see that 1981 and 1994 were much drier years than 2006 (**Figures 9, 19, 32-34**). We are comparing juvenile populations in two very dry years with one in a very wet year. Winter stormflow was so limited in 1981 and 1994 that spawning access and effort may have been much curtailed in the Corralitos watershed, especially in 1994. This was less likely as severe a problem in Aptos but more so in Valencia, with perhaps limited adult passage in Valencia Creek near Highway 1 and at the Valencia Road crossing. So, even though spawning success and emerging YOY survival may have been hampered in 2006 due to late and frequent high stormflows, just as likely occurred in the San Lorenzo and Soquel watersheds, YOY densities in 2006 were similar to or even higher than in 1981 and 1994 to make up for the fewer yearling holdovers in 2006. The success of late spawners was especially evident in Browns Valley Creek in 2006, with numerous small YOY's along with the fewer, much larger YOY's resulting from January spawners. With similar YOY densities in all 3 years and the much faster growth rate of YOY's into the Size Class II category in 2006 (except for Valencia Creek), the density of smolt sized juveniles in 2006 was higher at most sites than in 1981 and 1994. This occurred despite the much lower densities of yearlings holding over in 2006. The relatively similar or higher smolt densities in Aptos and Corralitos watersheds (except Valencia Creek) occurred despite worse substrate conditions in all but the upper reach of Corralitos Creek (Reach 7; Site 9).

Lower Shingle Mill Gulch showed a similar pattern to Corralitos and Browns Valley creeks, with similar total density, higher YOY density, lower yearling density and similar Size Class II/ III densities. However, upper Shingle Mill did not fit the pattern with lower total density in 2006, similar YOY density, much lower yearling density and similarly low Size Class II densities. No YOY's likely reached Size Class II even in 2006 while few yearlings held over to fall sampling. Apparently, there was insufficient additional flow in 2006 to offset generally degraded substrate conditions in Shingle Mill Gulch. We recall observing very high numbers of juvenile steelhead in Grizzly Flat in 1981 during the fish survey, which was not the case in 2006 during habitat typing.

Size Class II/ III juvenile densities were much lower in Valencia Creek in 2006 than 1981 at Site 2 (Reach 2) below the Valencia Road crossing. This was because fewer yearling and older juveniles held over in 2006. This may have been because they grew faster in the spring of 2006 than previous springs or there was insufficient overwintering habitat to retain them. Yearling densities were similar between 2006 and 1981 in the reach upstream, adding support for the latter hypothesis. Growth rates of YOY's in Valencia Creek were slow even in the above average baseflow 2006 year. The substantial substrate degradation (percent fines and embeddedness) from 1981 conditions may have contributed to the much lower densities of yearlings holding over in 2006. Habitat at the site was decimated in the January storm of 1982, and is still lacking in wood for pool development and is dominated by sand. Aquatic insect habitat must have been so limited in this reach that food availability for juvenile steelhead was not substantially improved with higher streamflow. With the very shallow pool conditions in Reach 2 and high sedimentation, overwintering must have been difficult there in 2005-2006. Valencia Creek above the Valencia Road crossing (Reach 3) had similar YOY and yearling densities between 1981 and 2006, with similar smolt densities in 2006. This was the case despite degraded substrate conditions in 2006. Conditions had become further degraded in Reach 2 of Valencia Creek between the time of habitat typing and fish sampling in 2006, with recent pool filling with sediment witnessed during sampling and presumably caused by instream work upstream to improve fish access to the culvert at the Valencia Road crossing. This recent sedimentation was not observed above the culvert.

D-4. Data Gaps

Annual monitoring of steelhead needs to continue through the next drought period and beyond to assess the extent of population recovery. For 2003-2005, only the middle and upper mainstem of the San Lorenzo and 5 tributaries were sampled (except for 1 site in upper Branciforte in 2005), and sampling in several tributaries or portions of them was discontinued. In 2006, only 2 sites were re-established in the lower River below the Zayante Creek confluence, as well as one in Newell Creek and one in lower Branciforte Creek. Therefore, there are large data gaps in the lower mainstem and in several key tributaries that are influenced by human activities. Those include lower Branciforte, Carbonera, Newell, Kings and upper Bear creeks. More fish and habitat monitoring needs to occur in the lower mainstem, including the flood control channel and lagoon/estuary, in order to assess success of management efforts. More fish sampling needs to occur in upper Zayante Creek and Mt. Charlie Gulch adjacent to Santa Cruz City watershed lands to assess success of management efforts.

In 2006, annual estimation of juvenile steelhead population size and calculation of adult indices from juvenile population size ceased for the first time since 1994. This is a significant loss in monitoring information and basis for assessing trends in juvenile steelhead populations. While determination of site densities is much better than no data at all, the relative contributions of different reaches and tributaries to a total population size are lost when only site densities are analyzed. The relative importance of mainstem reaches to tributaries in production of large juveniles is lost when only site densities are considered. Calculation of an index of adult returns is the most meaningful way to compare the value of annual juvenile population sizes because it weights the juveniles according to size categories and size-dependent survival rates.

There is a shortage of streamflow data on the San Lorenzo River mainstem and tributaries. More stream gages should be established and maintained in the watershed to better correlate streamflow with habitat conditions and fish densities and to detect insufficient streamflow. Mainstem locations for gages would include Waterman Gap, above and below the Boulder Creek confluence on the mainstem. Tributaries that need better gauging include Zayante Creek (above and below the Bean Creek confluence), Bean Creek (below Lockhart Gulch and just below the Mackenzie Creek confluence) and Boulder Creek (near the mouth).

There is no streamflow data for the Aptos watershed. It would be beneficial to have stream gages on lower Valencia Creek and Aptos Creek near the lagoon. Any future management of Aptos Lagoon would benefit from continuous streamflow data in relation to sandbar manipulation. It is a valuable tool on Soquel Creek. The only streamflow data for the Corralitos watershed is at Freedom. This is below the City of Watsonville diversions. It would be beneficial to install stream gages at the diversion dams on Browns Valley and Corralitos Creeks. Then the streamflow above and below the diversions could be monitored.

Data gaps on juvenile steelhead use and habitat quality in the heavily impacted mainstem of Soquel

Creek have begun. In 2006, only 1 mile of mainstem was habitat typed when all 7 miles was habitat typed in the past to assess habitat quality. Sampling in Soquel creek was reduced to 6 sites in 2006, though in earlier years there were 21 sites annually sampled. On the plus side, fish sampling and habitat monitoring in the Aptos and Corralitos watersheds were renewed and passage problems on Valencia Creek will be remedied.

CONCLUSIONS

C-1. Habitat Conditions in 2006 Compared to Previous Years

San Lorenzo River and Tributaries– Habitat Comparisons. Refer to **Appendix A** for maps of reach locations. The lower mainstem (downstream of the Zayante Creek confluence) showed overall habitat improvement between 2000 and 2006. Pool scouring and deepening was evident, and there was more escape cover in fastwater habitat. From 2000 through 2005 there had been steady habitat improvement in the middle mainstem (between the Zayante and Boulder creek confluences). However, overall habitat degraded from 2005 to 2006. Embeddedness worsened and escape cover was lost in fastwater habitat. Overall habitat quality declined from 2005 to 2006 in the upper San Lorenzo (upstream of the Boulder Creek confluence). There was a higher percent fines, less escape cover and no improvement in pool depth.

San Lorenzo tributaries showed reduced habitat quality in 2006 compared to either 2000 or 2005 in the case of Zayante, Bean, Boulder, Bear, Branciforte and Newell creeks. Percent fines, embeddedness and escape cover all worsened in these creeks. The one exception to substrate degradation was Newell Creek. With it being downstream of a dam that captures fine sediment, substrate embeddedness and percent fines improved and pools deepened. However, escape cover in Newell Creek pools was much less, causing an overall loss in habitat quality. Water depth increased in some habitats in each creek, indicating habitat improvement.

In Zayante Creek, habitat quality was similar to 2005 in the lower reach (13a) and had worsened in the upper reach (13d). Water depth positively increased in both reaches (as deep as anytime since 2000), but escape cover, embeddedness and percent fines all worsened in the upper reach below Mountain Charlie Gulch. In upper Bean Creek (14c), habitat conditions degraded somewhat since 2005. Although water depth was slightly greater due to scour and likely higher baseflow, percent fines, embeddedness and escape cover all worsened.

Substrate generally improved in Newell Creek (Reach 16) from 2000 to 2006. Pools were deeper, with substantial improvement in percent fines and embeddedness. However, escape cover was substantially less.

In Boulder Creek, habitat worsened overall from 2005 to 2006. Although water depth increased in pools and step-runs of the lower portion (17a), and in step-runs of the middle portion (17b) (indicating scour of sediment), all other habitat parameters worsened– percent fines, embeddedness and escape cover (except in the lower portion escape cover in step-runs increased).

With the exception of greater depth in fastwater habitat in lower Bear Creek (18a) (indicating scour of some fine sediment), the general improvement in habitat conditions observed in 2005 were reversed in

2006. Pool depth remained similar, but percent fines, embeddedness and escape cover worsened.

Middle Branciforte (21a-2) showed similar habitat depths between 2000 and 2006, but had worsening substrate with more percent fines and embeddedness, indicating some habitat degradation. No reach escape cover indices were available for 2000 for comparisons.

Soquel Creek and Its Branches– Habitat Comparisons. Refer to **Appendix A** for maps of reach locations. The lower mainstem (from the lagoon to the Moores Gulch confluence) had overall habitat improvement. Habitat depth increased in pools and runs over 2005, though was similar to past years (**Table 14**). The biggest improvements were in reduced percent fines and more pool escape cover.

The upper mainstem (from the Moores Gulch confluence to the Branches) had slightly improved habitat compared to 2005 in that pool depth was deeper and pool escape cover was somewhat increased. Pool escape cover was the highest since 2000. Pool depth was less than in 2003.

The lower East Branch (Reach 9) had similar habitat quality compared to 2005 but lower quality than in 2000. Compared to 2005, the one substantial improvement was increased pool depth. However, pool escape cover was less. Pool escape cover has declined steadily from 2000. The important upper East Branch (Reach 12a) showed overall habitat degradation from 2005 to 2006. But conditions were still better than in 2000. The increased pool depth in 2006 may not indicate pool deepening but may have occurred because habitat identified as shallow pools in 2005 (lowering the reach average depth for pools) may have been considered step-run in 2006 because they had shallowed further (increasing the reach average depth for pools). Pool escape cover decreased in 2006 from 2005 but was still much higher than in 2000. The step-run escape cover index decreased slightly, indicating slightly reduced habitat quality there.

The habitat quality in the West Branch downstream of Olson Road Bridge (Reach 14a) greatly improved. Compared to 2005, habitat depth increased greatly in all habitat types and embeddedness was much less in fastwater habitat.

Habitat quality in the West Branch between Girl Scout Falls I and II (Reach 14b) had a net improvement. Habitat conditions were similar between 2002 and 2006 regarding pool escape cover and habitat embeddedness, with some improvement due to increased pool depth. At the repeated sampling site above Girl Scout Falls II (Site 22; Reach 14c), habitat conditions improved over 2005 with much deeper habitat in pools and step-runs and reduced pool embeddedness, both indicating scour of fine sediment.

Aptos and Valencia Creeks– Habitat Comparisons. Substrate conditions degraded in Aptos Creek compared to 1981. Percent fines and embeddedness in pool habitat have increased. Embeddedness in runs in lower Aptos was much greater in 2006 than 1981, with similarity between the two years in riffles in lower Aptos.

Substrate conditions degraded in Valencia Creek compared to 1981. Percent fines and embeddedness in pool habitat have increased, and especially embeddedness. Embeddedness in riffle habitat has increased greatly. Percent fines in fastwater habitat also increased.

Corralitos, Shingle Mill and Browns Valley Creeks– Habitat Comparisons. Substrate conditions in Corralitos Creek have generally degraded in the 3 reaches studied. Those were below Rider Creek (Reach 3), below Eureka Gulch (Reach 6) and above Eureka Gulch (Reach 7) compared to 1994. Substrate conditions in 2006 were more similar to the more degraded conditions in 1981. In the most important habitat type, namely pools, percent fines worsened (increased) in all 3 reaches. Pool embeddedness also worsened (increased) in Reaches 3 and 6. Pool habitat improved with regard to pool embeddedness in the uppermost Reach 7.

Substrate conditions in Shingle Mill Gulch have generally degraded in the 2 reaches studied (Reaches 1 and 3). Embeddedness and percent fines increased since 1994 in all three habitat types in both reaches where comparisons were available, except for less embeddedness in riffle habitat in lower Shingle Mill. 2006 conditions were more similar to the more degraded 1981 substrate conditions.

Substrate conditions in Browns Valley Creek generally degraded in the 2 reaches studied (Reaches 1 and 2). In pool habitat, both embeddedness and percent fines worsened (increased) since 1994, they being more similar to the more degraded conditions in 1981.

C-2. Comparison of 2006 Steelhead Densities with Past Results

San Lorenzo Density Comparisons. Some of the lowest densities of young-of-the-year and yearling steelhead were detected in 2006 compared to past results in the San Lorenzo and Soquel watersheds. Juvenile densities at the 5 mainstem San Lorenzo sites were below average for total density and densities of all age and size classes. At the 10 San Lorenzo tributary sites, the total juvenile density and YOY density were below average at all sites except upper Bean (14c). Yearling densities at tributary sites were well below average at all sites. Despite low juvenile densities in the watershed and few yearlings holding over, Size Class II and III (smolt-size) juvenile densities were above average at 4 of 10 tributary sites and close to average at another 5 sites (**Table 29**). Only a mid-Zayante Creek site (13c) did not reach close to average density for smolt-sized juveniles. Compared to 2005, Size Class II/ III densities in 2006 were greater at 4 of 9 compared tributary sites.

Soquel Creek Density Comparisons. Site densities in 2006 were below average in total density and all age and size categories except for Size Class II/ III juveniles at 4 branch sites out of 7 total sampling sites. Site 22 above Girl Scout Falls II was judged to be a resident rainbow trout site due to the much lower YOY and total density there compared to Site 21 below the falls. Compared to 2005, steelhead site densities were less for total density and YOY density at all 7 compared sites (**Tables 30 and 31**). Densities in 2006 were less than in 2005 at 5 of 6 compared sites for yearlings, at 4 of 6 compared sites for small Size Class I fish and at 3 of 7 compared sites for important Size Class II/ III juveniles.

Aptos and Valencia Creek Density Comparisons. At the 2 sampling sites in Aptos Creek in 2006, juvenile steelhead densities were less than in 1981 for total juveniles, YOY's, yearling and older, and Size Class 1 categories. However, 2006 densities in the important Size Class II/ III category were much higher than in 1981. This was because more of the YOY's in 2006 grew into the larger size class than in 1981, a much drier year. At the 2 sampling sites in Valencia Creek in 2006, total juvenile densities were similar and YOY and Size Class 1 densities were higher than in 1981. However, yearling and Size Class II/ III densities were much less in the badly sedimented lower reach than in 1981 and similar between years in the upper reach.

Density Comparisons in Corralitos, Browns Valley and Shingle Mill. With 3 years of site densities to compare in the Corralitos watershed, higher densities in age and size classes were generally observed in 1981 than 1994, with a rebound in 2006. The years 1981 and 1994 were drier than average and 2006 was wetter than average, based on hydrographs for Corralitos Creek and the San Lorenzo River. 2006 juvenile densities in the 3 Corralitos mainstem sites, the one comparable Shingle Mill site and the 2 Browns Valley Creek sites were higher than 1994 for total density, YOY's and Size Class 1 juveniles. In 2006, the YOY densities in Browns Valley Creek were much higher than in the other two streams, with evidence of very late spawners. For densities of yearling and older juveniles, they were lower in 2006 than 1994 at 6 of the 7 sites, with the exception being the lowermost Site 3 on Corralitos Creek. With the higher growth rate of YOY's in 2006 in Corralitos and Browns Valley creeks, 2006 densities of the larger Size Class II/ III juveniles were higher than in 1994 at 4 of 5 sites.

In the much smaller tributary, Shingle Mill Gulch, at the more accessible Site 1, total densities were similar between 1994 and 2006. There were much higher densities of YOY's and Size Class 1 fish in 2006 but higher densities of yearlings in 1994. Because most of the Size Class II juveniles were likely yearlings, there were lower densities of this larger size class in 2006 than 1994. This was in contrast to most Corralitos and Browns Valley sites, where more YOY's grew into Size Class II in 2006.

At the upper, less accessible Site 3 on Shingle Mill Gulch, no 1994 fish data were collected. Total juvenile density was higher in 1981 than 2006. There were similar densities of YOY's but much higher densities of Size Class 1 and yearlings in 1981 (**Tables 36-38**). In the dry year of 1981, baseflow in this reach declined to a few hundredths of a cfs, and some yearlings remained in Size Class I at fall sampling, causing more to hold over in Spring 1981 than presumably did in spring 2006. Densities of Size Class II/ III juveniles were similarly low in both years.

C-3. Statistical Comparison of 2005 and 2006 Steelhead Densities

Statistical Results. The trend in fish densities between 2005 and 2006 was analyzed by using a paired t-test. Only the San Lorenzo watershed had multiple 2005 steelhead sites that were re-sampled in the same habitats in 2006 and could be statistically analyzed. Despite only 7 comparable sites in the San Lorenzo drainage, the declines in total juvenile density, YOY's, Size Class 1 juveniles and yearlings were statistically significant at the 0.05 level and even lower.

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FIGURES

Figure 1. Total Juvenile Steelhead Site Densities in the San Lorenzo River in 2006 Compared to the 8-Year Average Density. (First year for Lompico (13e) sampling and 6th for Newell (16) since 1998.)

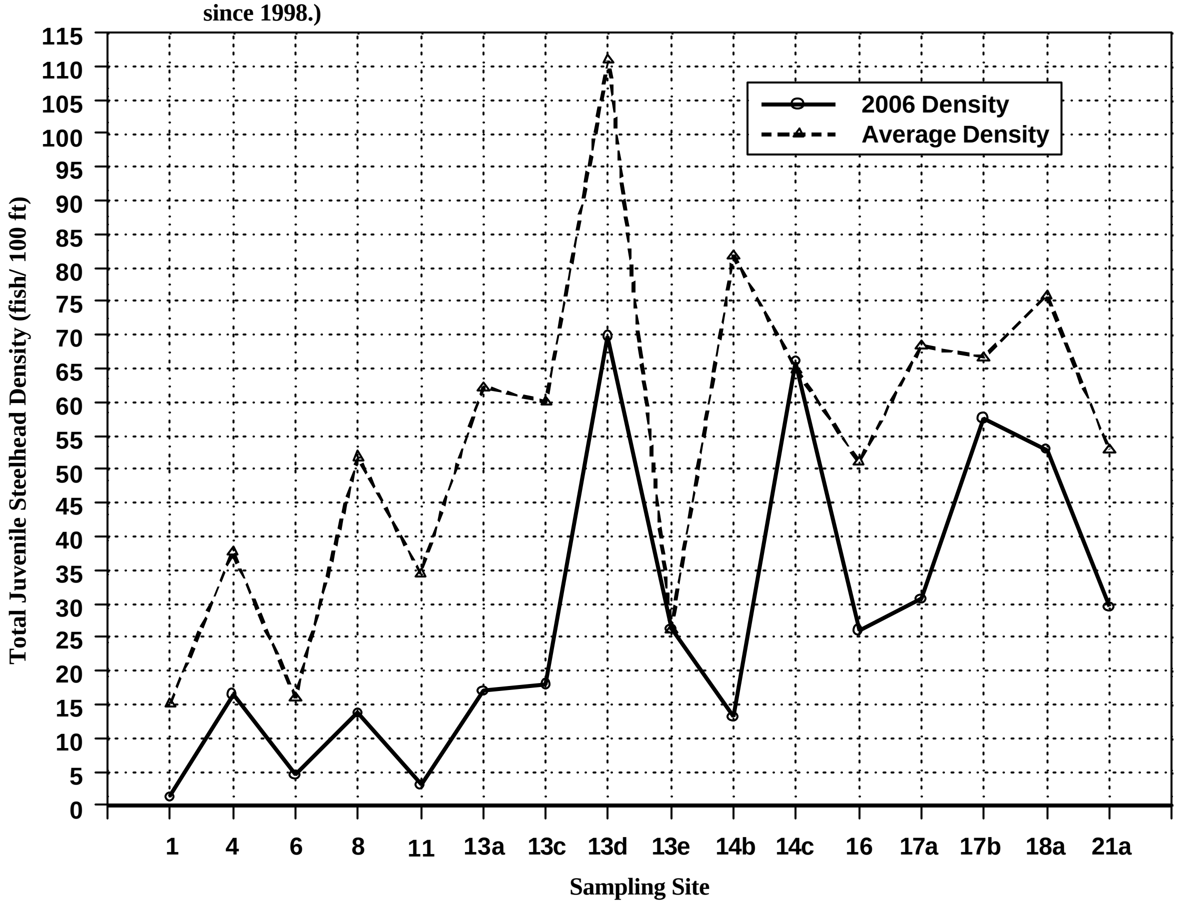


Figure 2. Juvenile Steelhead Site Densities for Size Class II and III Fish in the San Lorenzo River in 2006 Compared to the 8-Year Average Density. (First year of sampling for Lompico (13e) and 6th for Newell (16) since 1998.)

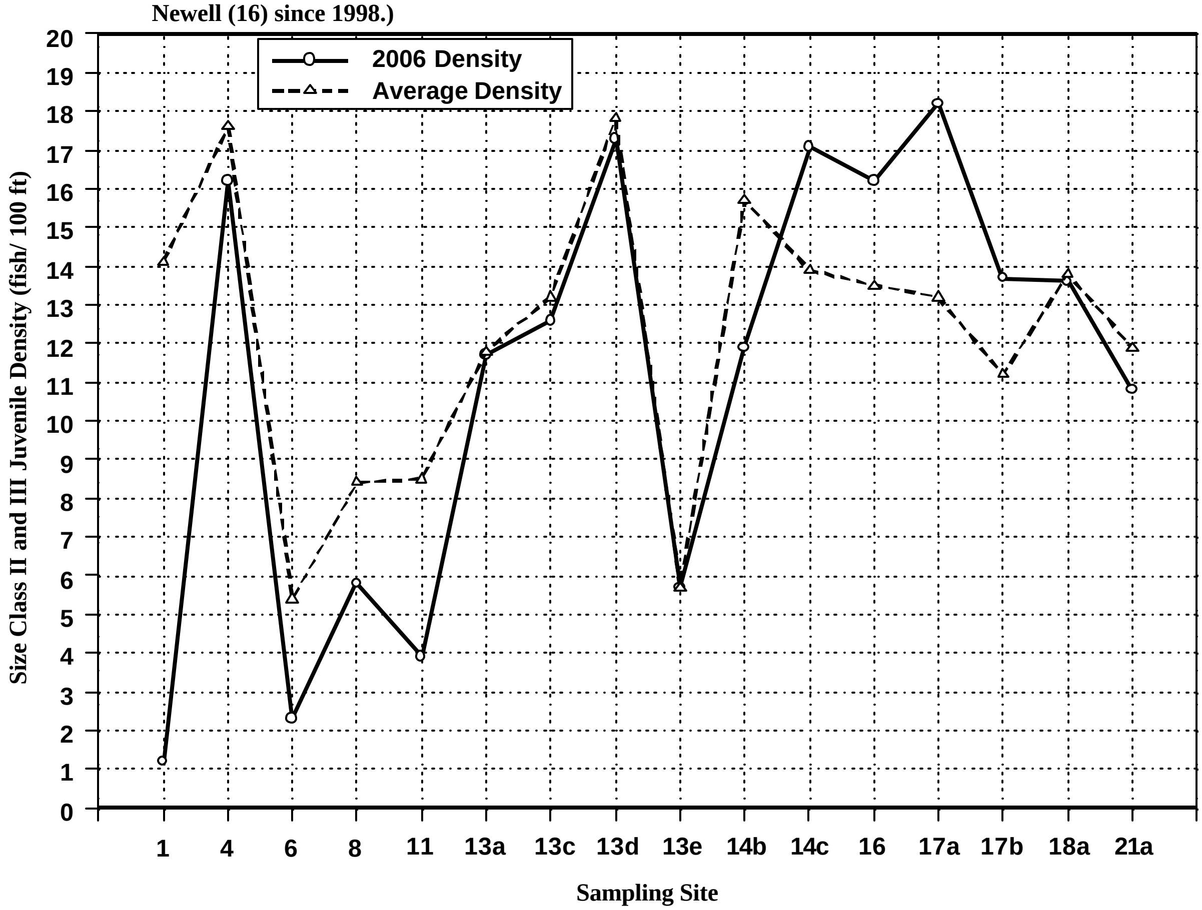


Figure 3. Total Juvenile Steelhead Site Densities in Soquel Creek in 2006 Compared to the 9- or 10-Year Average Density. (Fifth year of sampling above Girl Scout Falls I (21) and 6th below Hester Creek (19).)

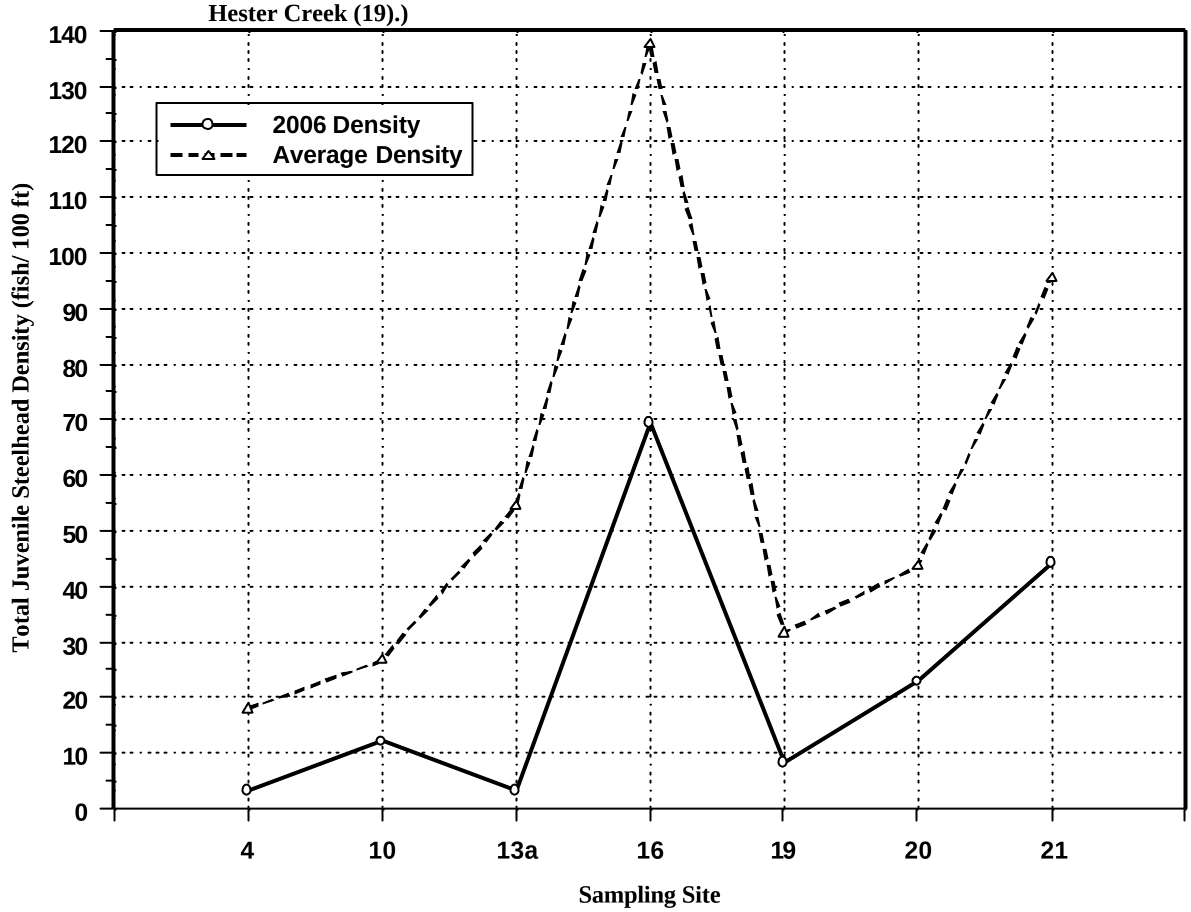


Figure 4. Juvenile Steelhead Site Densities for Size Class II and III Fish in Soquel Creek in 2006 Compared to the 9- or 10-Year Average Density. (Fifth year of sampling above Girl Scout Falls I (21) and 6th below Hester Creek (19).)

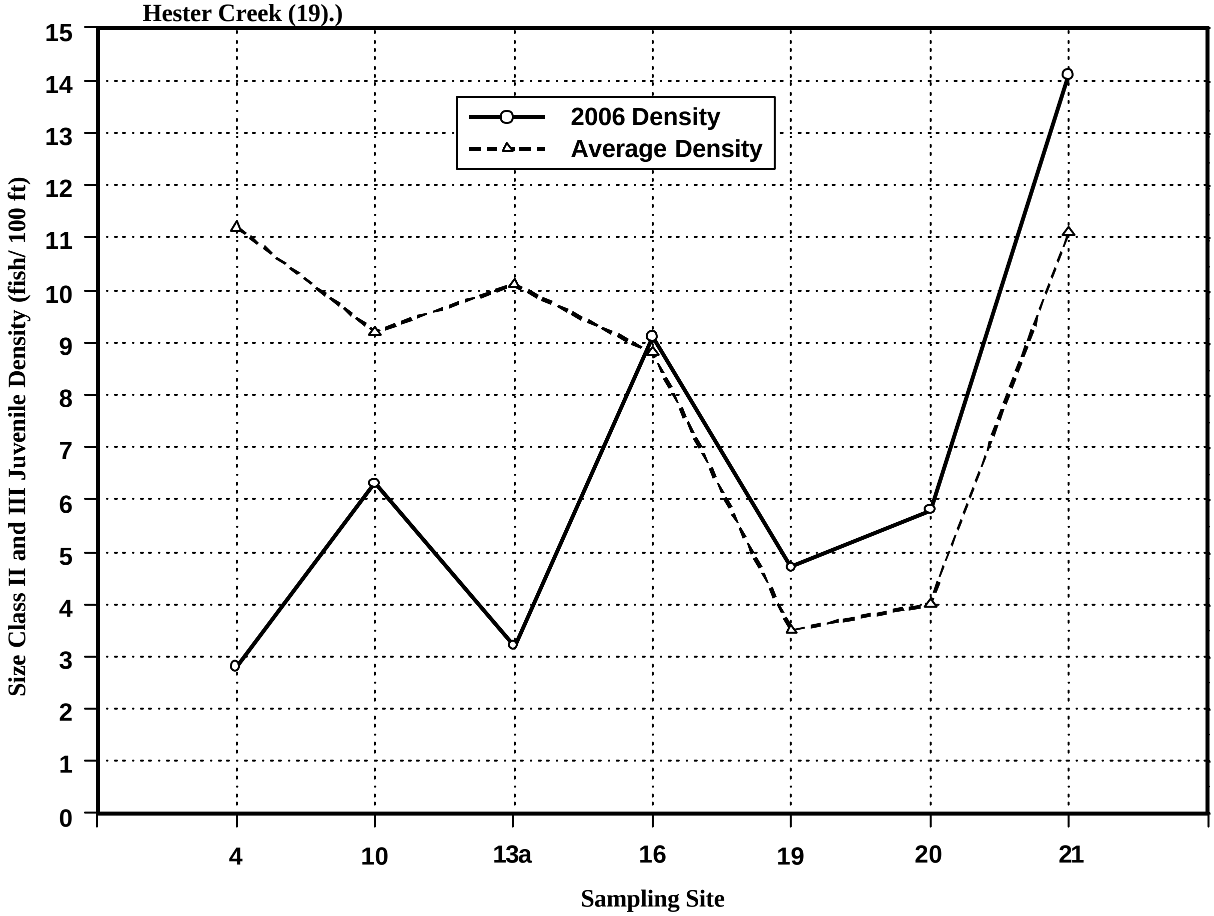


Figure 5. Total Juvenile Steelhead Site Densities in Aptos and Valencia Creeks in 1981 and 2006.

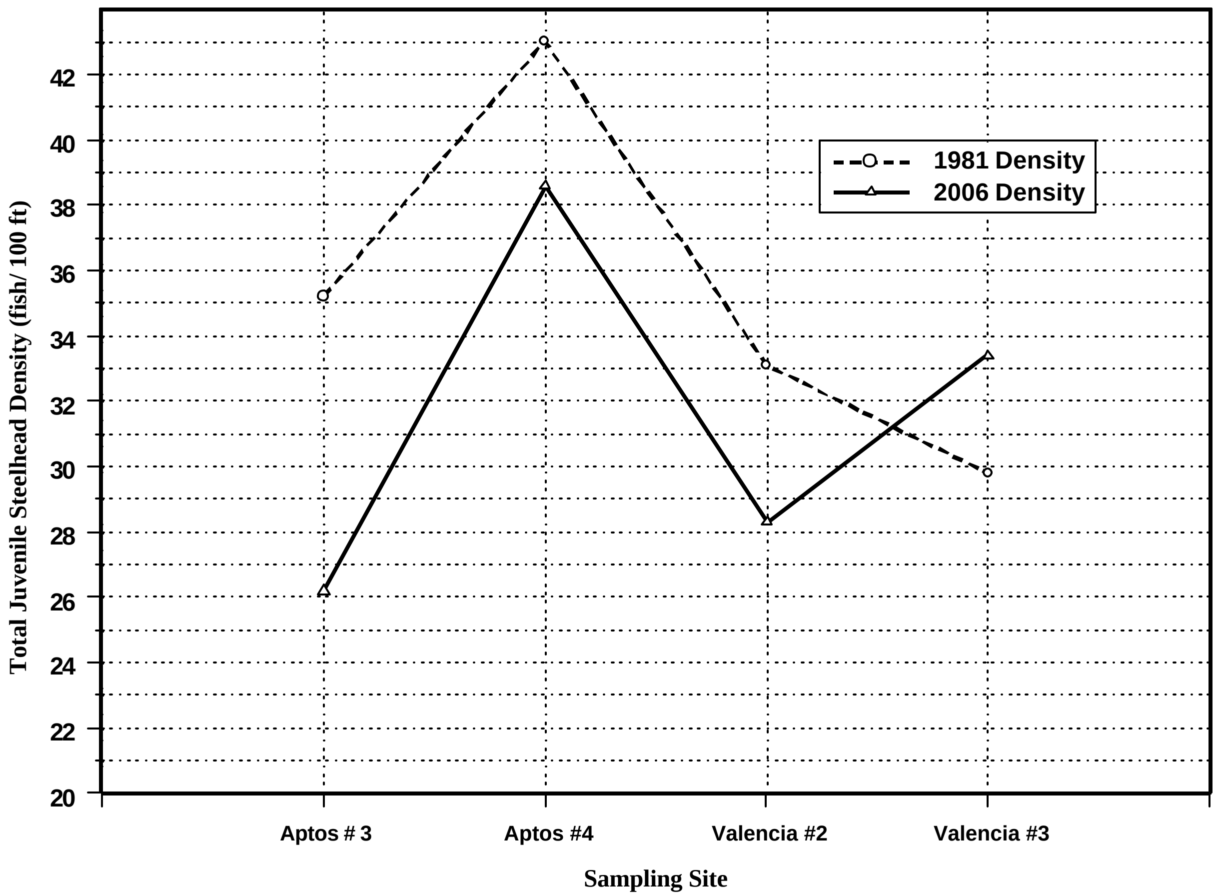


Figure 6. Juvenile Steelhead Site Densities for Size Class II and III Fish in Aptos and Valencia Creeks in 1981 and 2006.

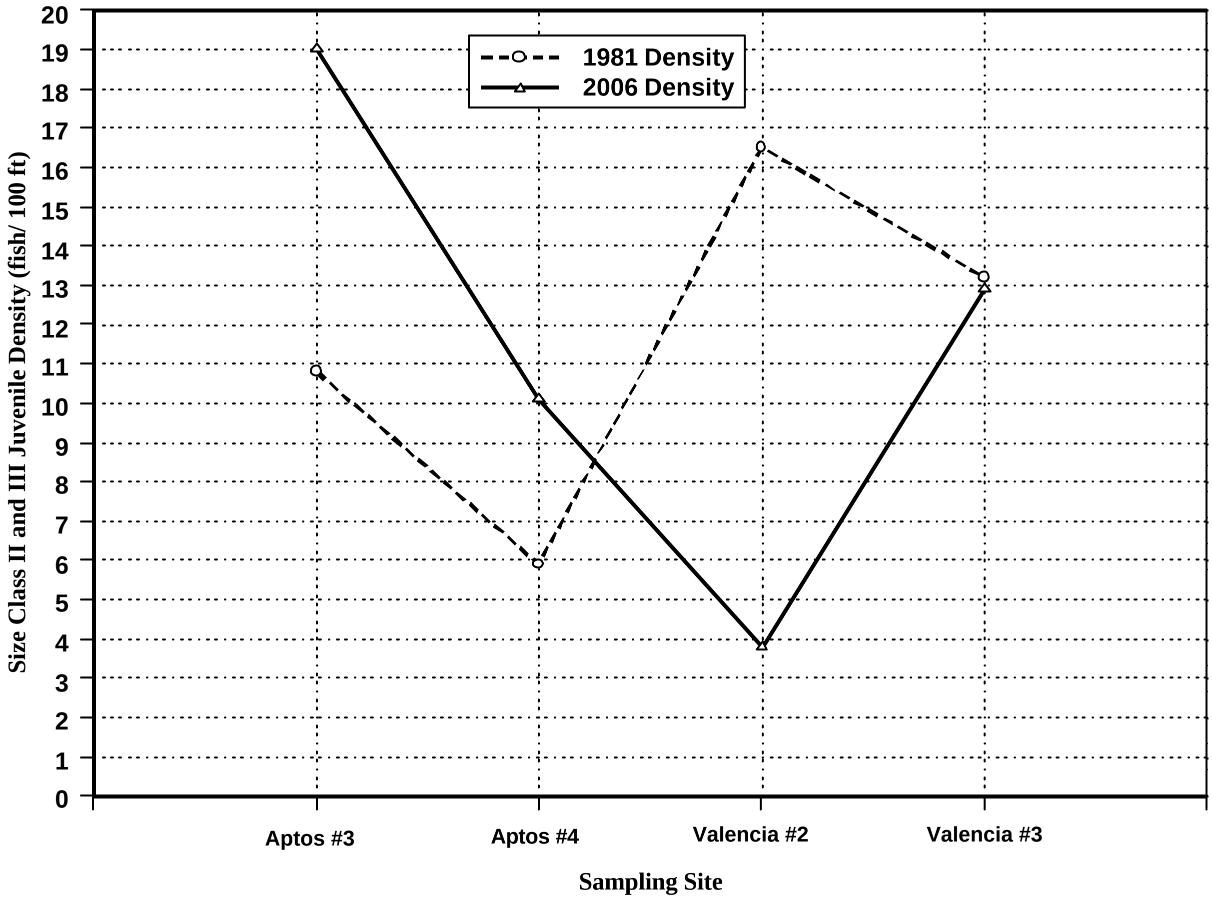


Figure 7. Total Juvenile Steelhead Site Densities in Corralitos, Shingle Mill and Browns Valley Creeks in 1981, 1994 and 2006.

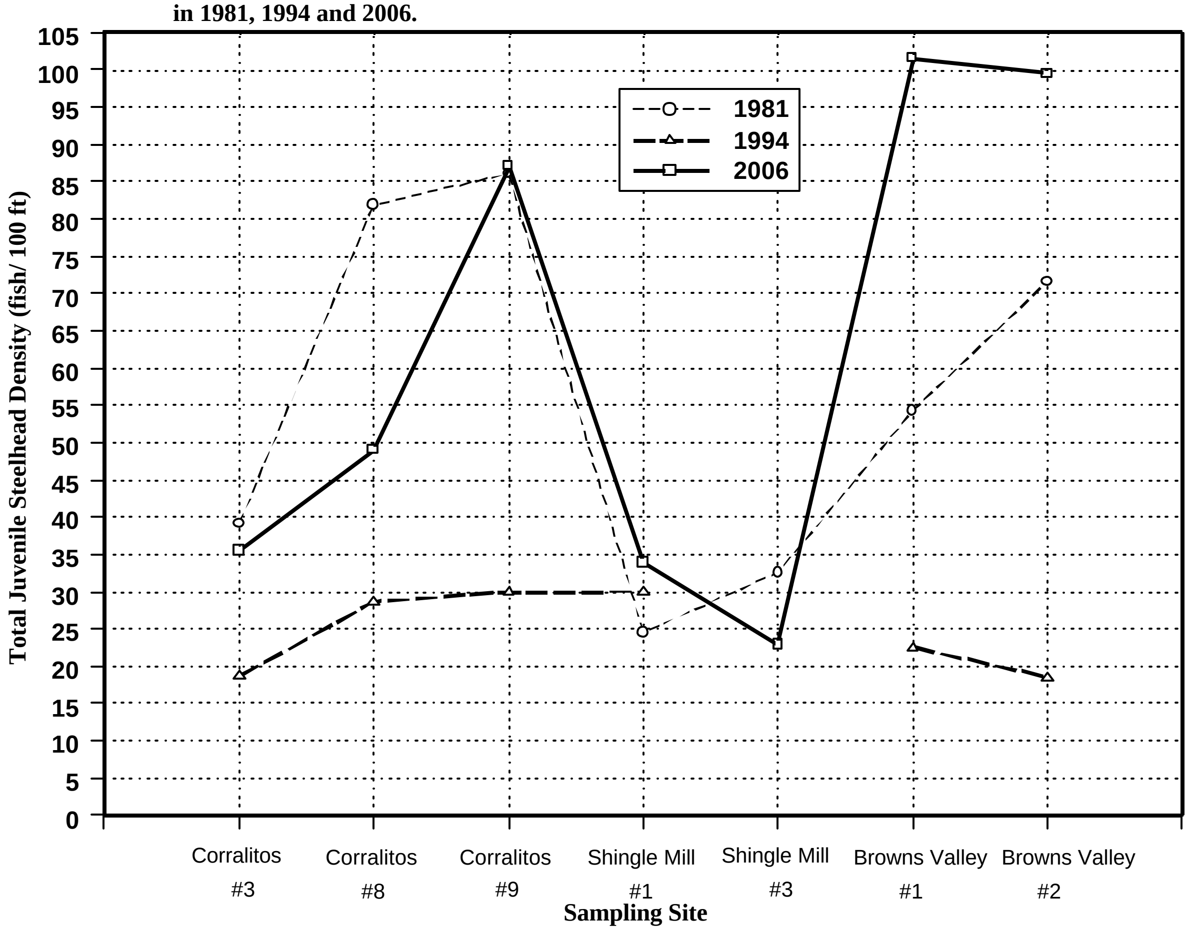


Figure 8. Juvenile Steelhead Site Densities for Size Class II and III Fish in Corralitos, Shingle Mill and Browns Valley Creeks in 1981, 1994 and 2006.

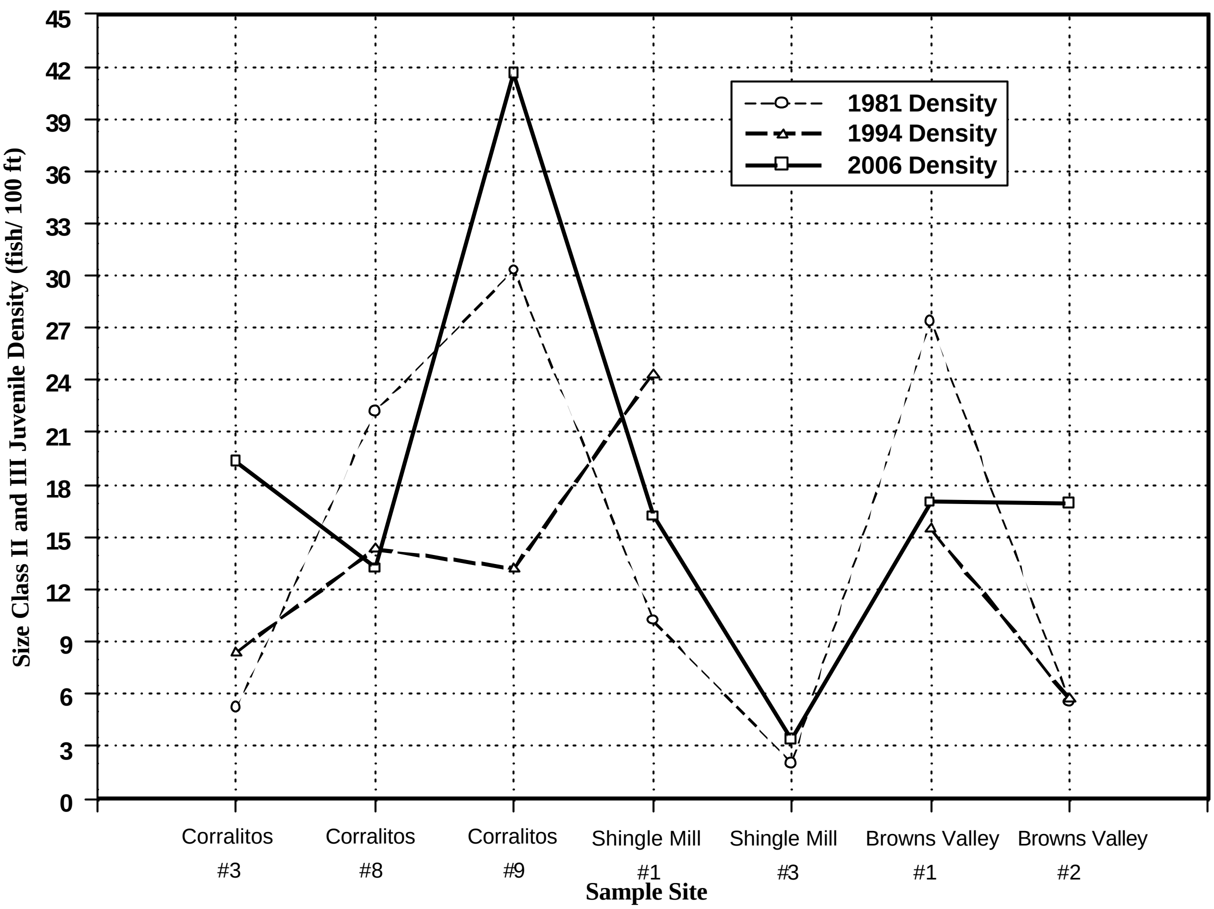


Figure 9. The 1994 Daily Average Discharge for the USGS Gage On the San Lorenzo River at Big Trees.

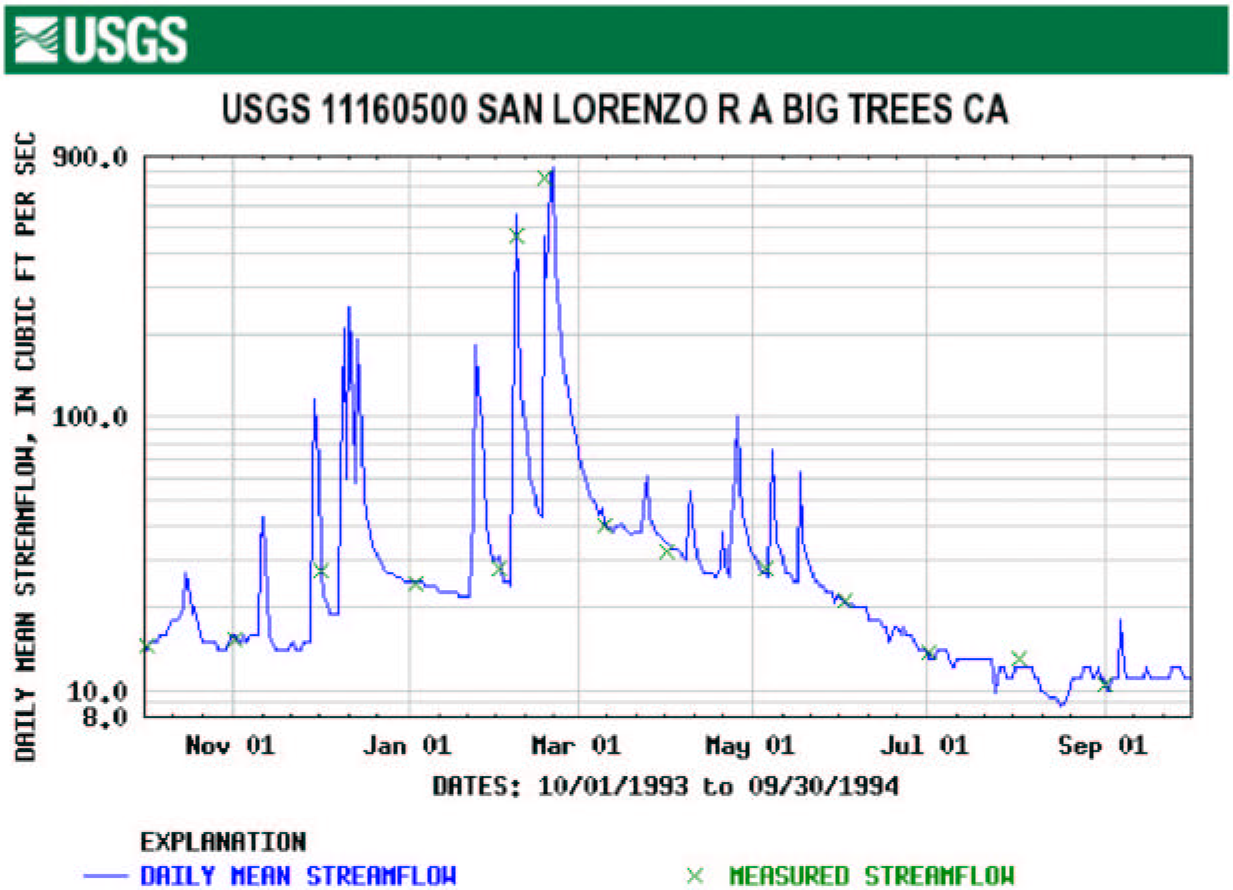


Figure 10. The 1997 Daily Average Discharge for the USGS Gage On the San Lorenzo River at Big Trees.

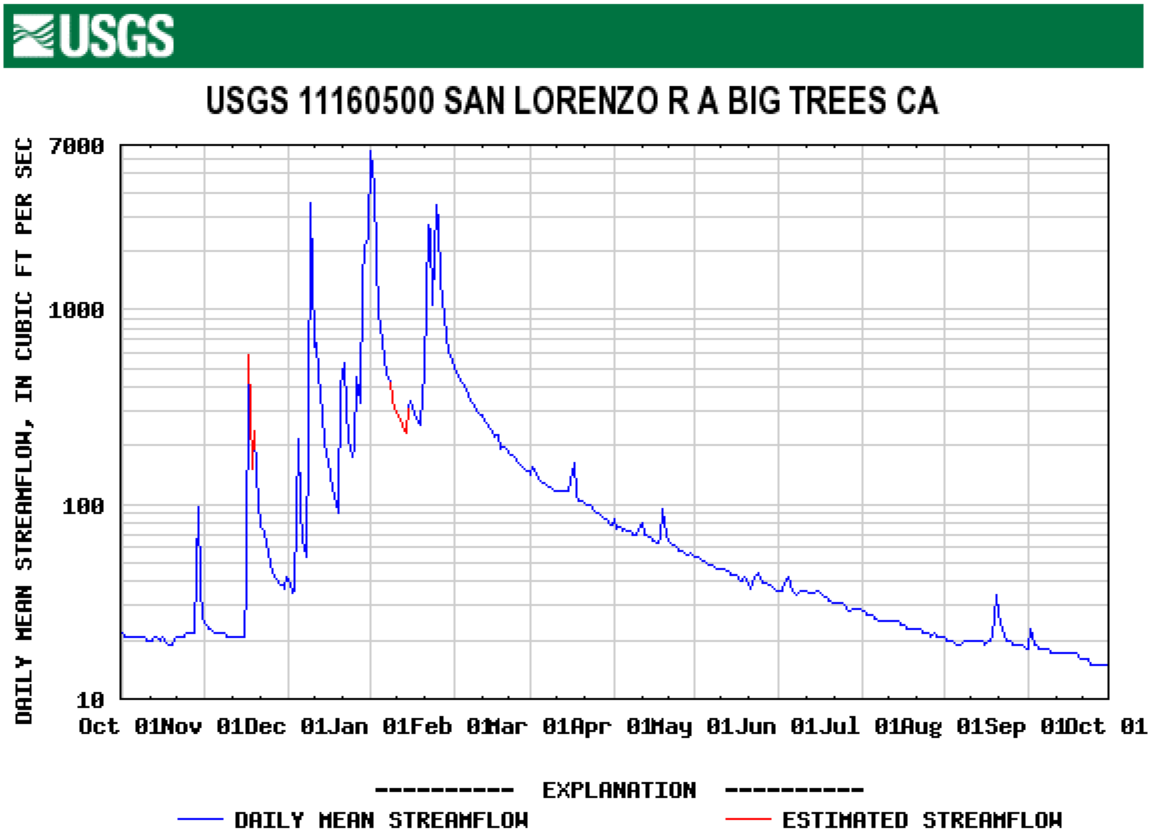


Figure 11. The 1998 Daily Average Discharge for the USGS Gage On the San Lorenzo River at Big Trees.

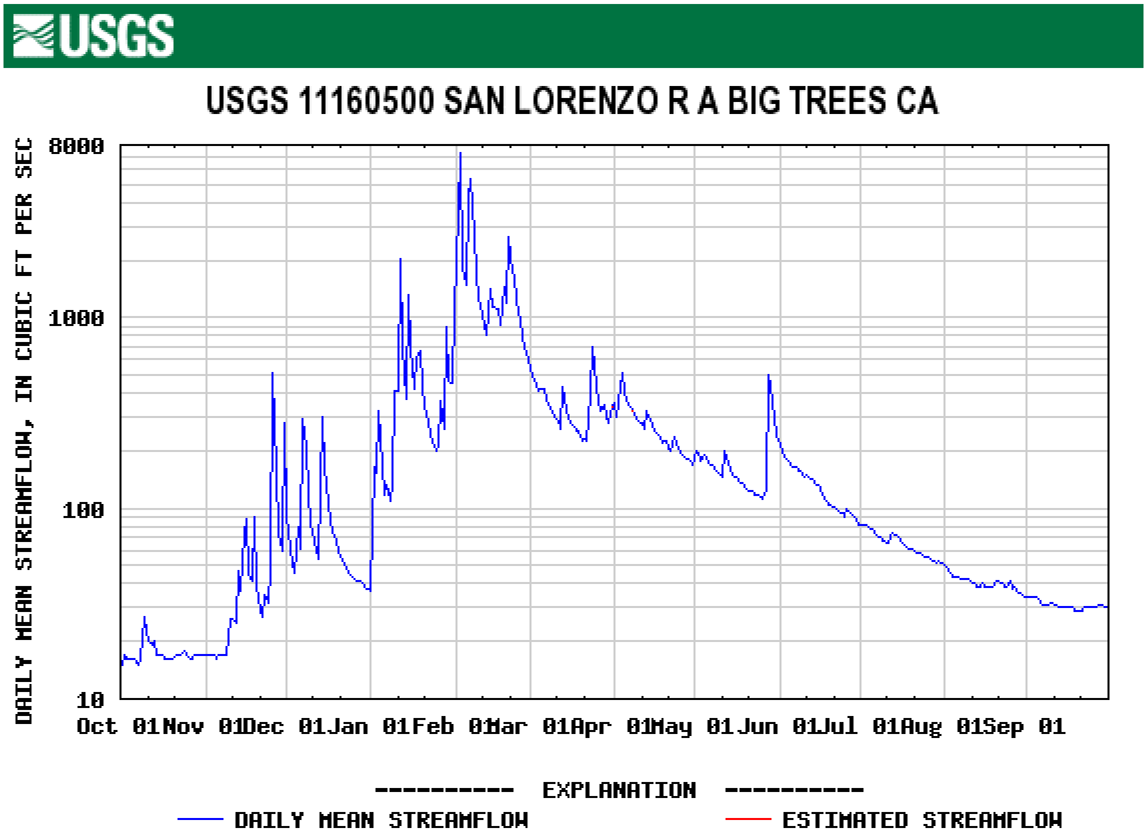


Figure 12. The 1999 Daily Average Discharge for the USGS Gage On the San Lorenzo River at Big Trees.

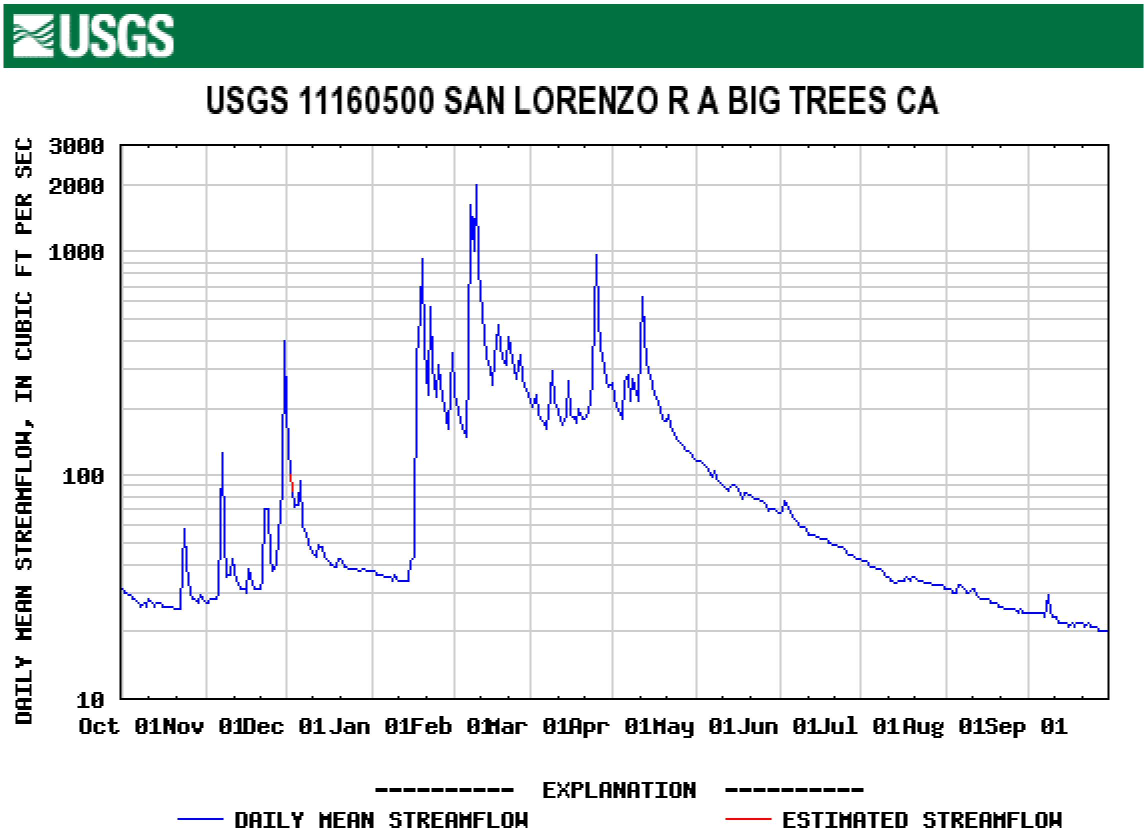


Figure 13. The 2001 Daily Average Discharge for the USGS Gage On the San Lorenzo River at Big Trees.

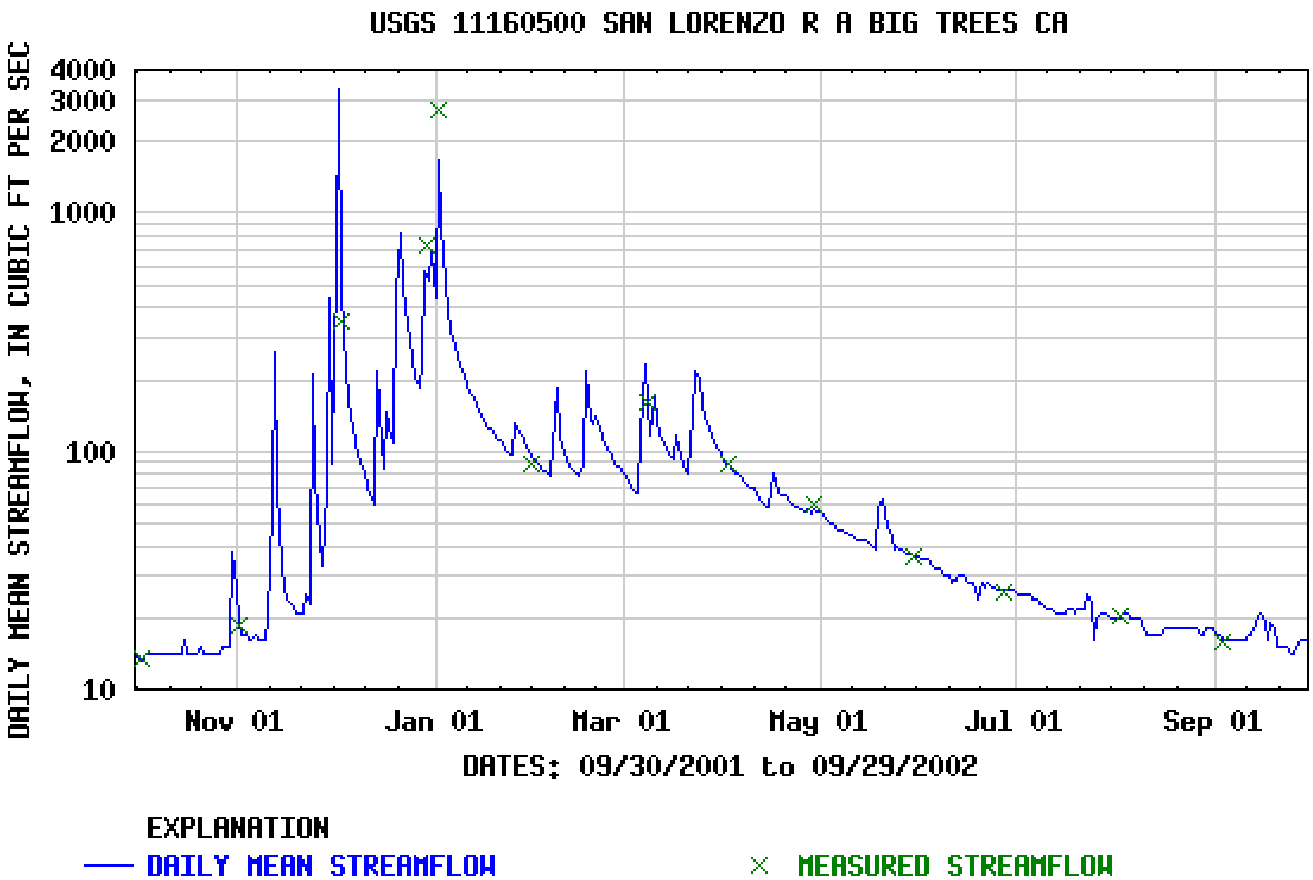


Figure 14. The 2002 Daily Average Discharge for the USGS Gage On the San Lorenzo River at Big Trees.

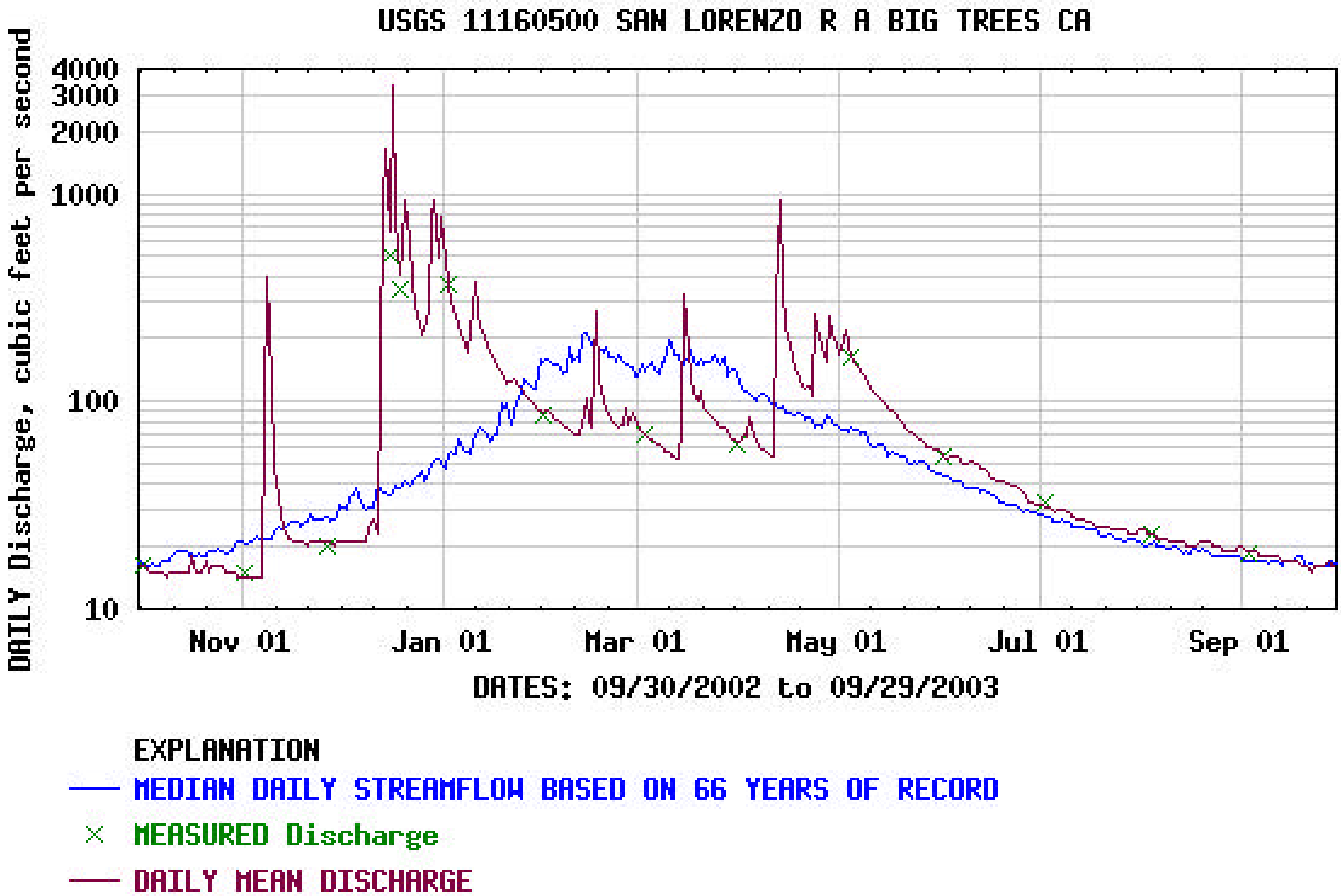


Figure 15. The 2003 Daily Average Discharge and Median Daily Flow on Record for the USGS Gage On the San Lorenzo River at Big Trees.

Figure 16. The 2004 Daily Average Discharge and Median Daily Flow on Record for the USGS Gage On the San Lorenzo River at Big Trees.

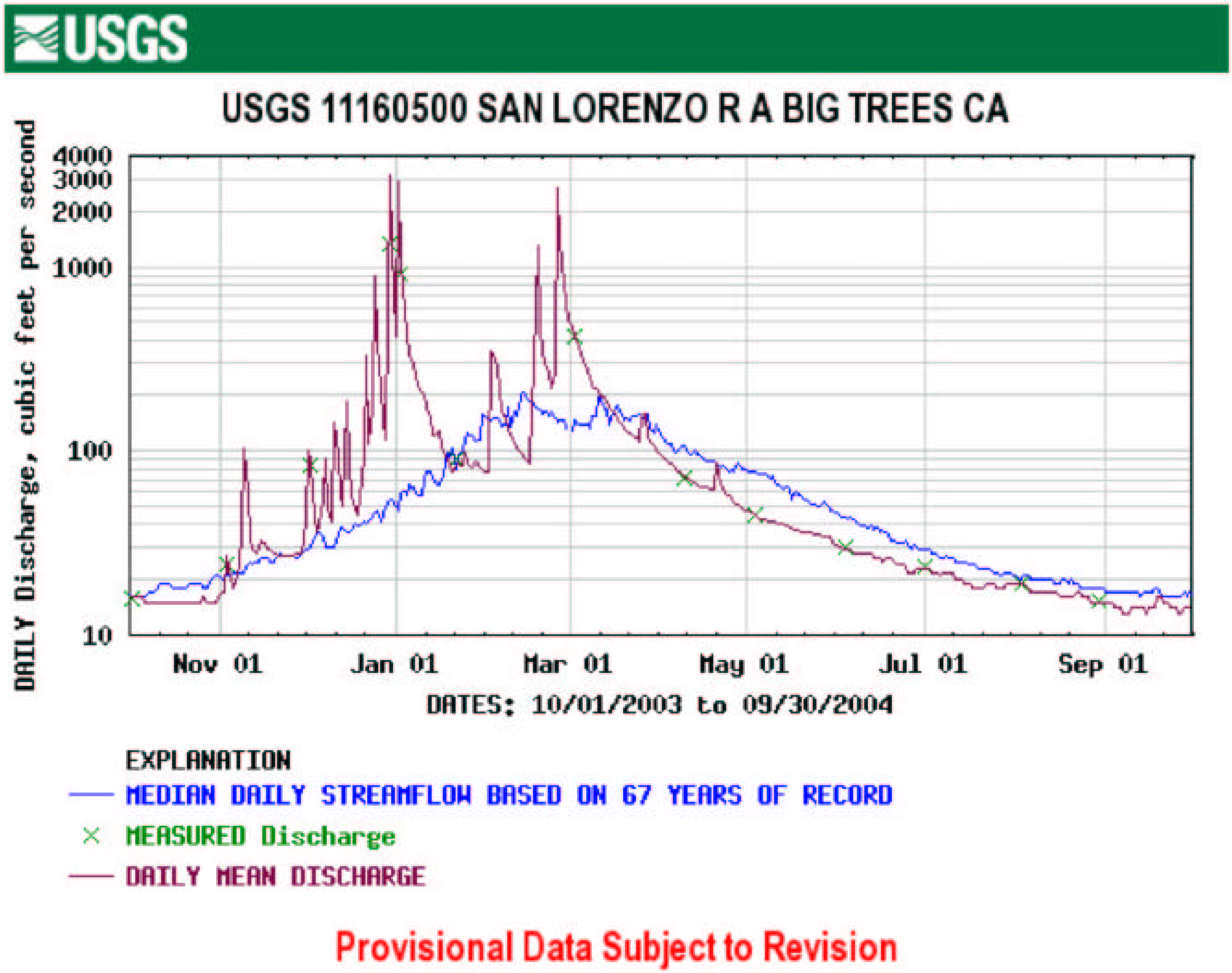


Figure 17. The 2005 Daily Average Discharge and Median Daily Flow on Record for the USGS Gage On the San Lorenzo River at Big Trees.

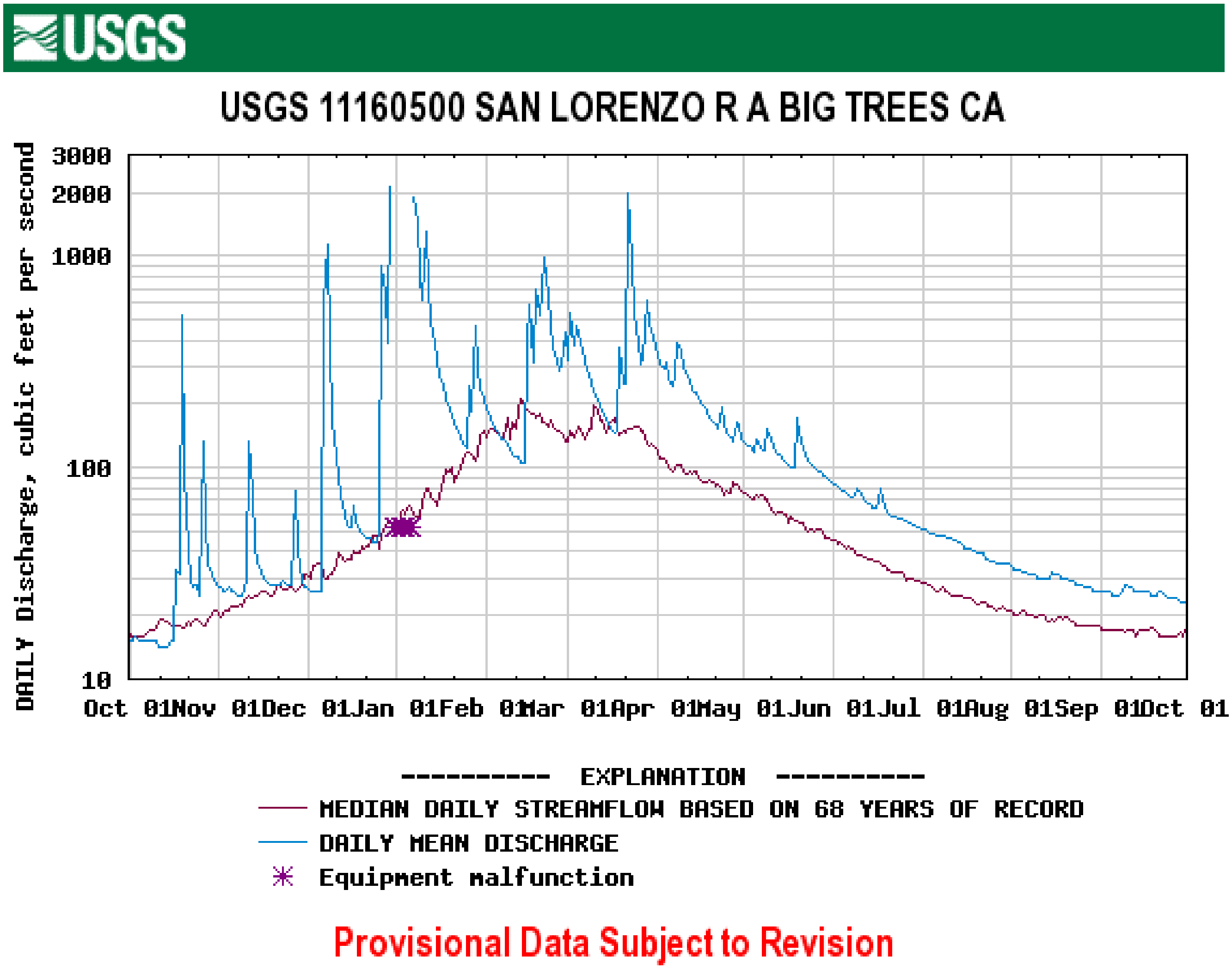


Figure 18. The 2005 Daily Average Discharge and Median Daily Flow on Record for the USGS Gage On the San Lorenzo River at Santa Cruz. (Included because of equipment malfunction at the Big Trees Gage during a stormflow in early January.)

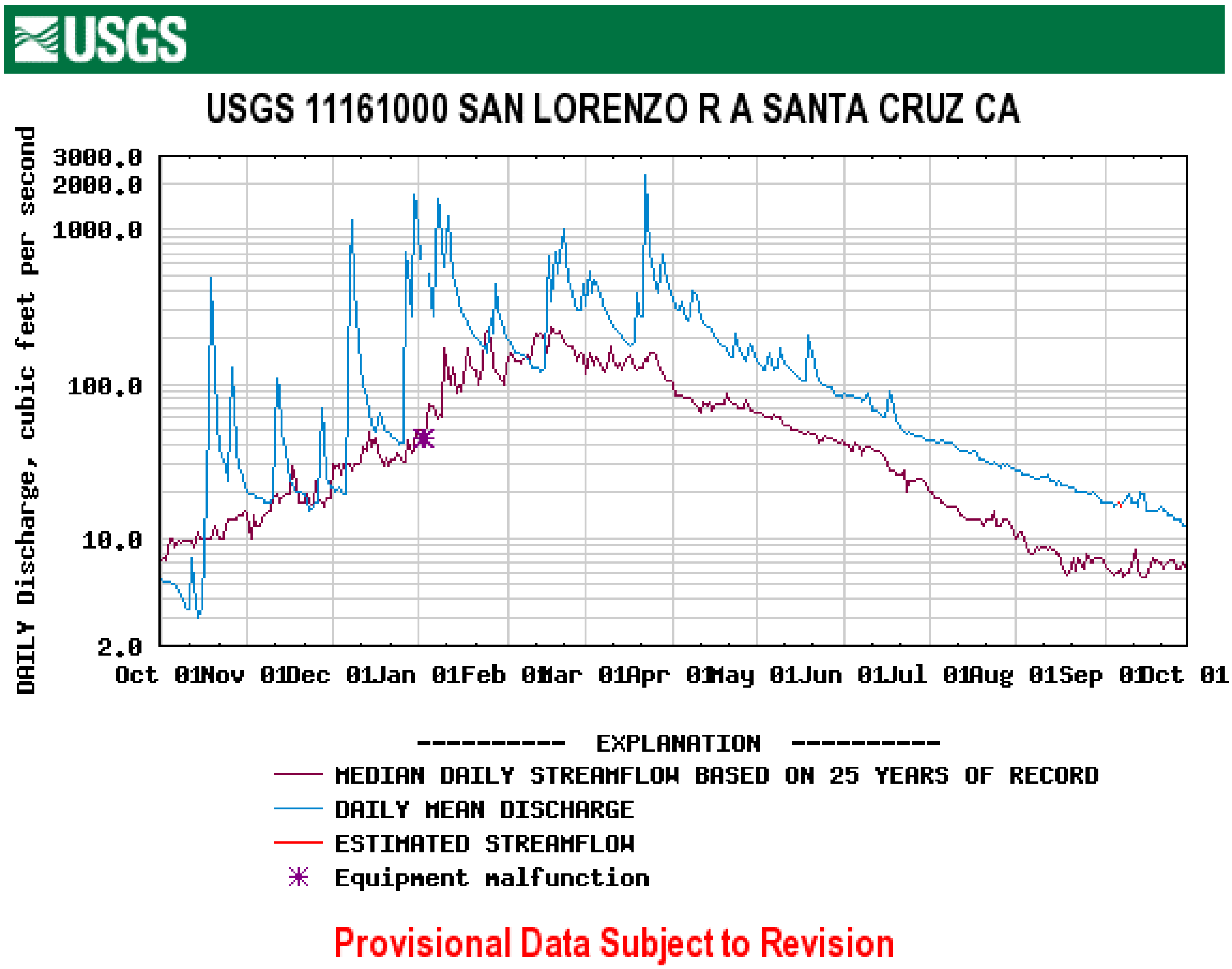


Figure 19. The 2006 Daily Average Discharge and Median Daily Flow on Record for the USGS Gage On the San Lorenzo River at Big Trees.

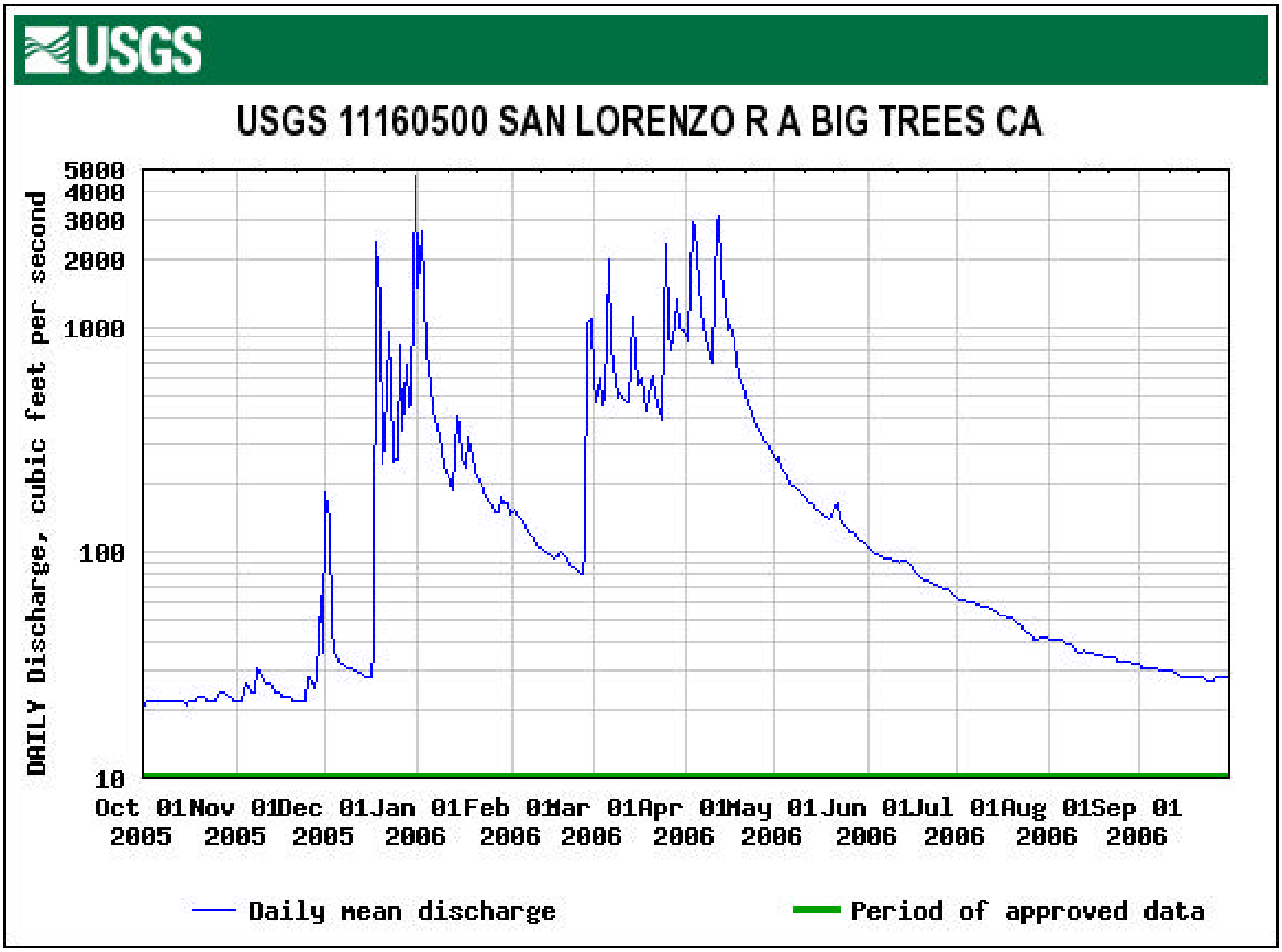


Figure 20. The 1995 Daily Mean and Peak Flood Flow at the USGS Gage on Soquel Creek at Soquel.

Figure 1. The 1995 daily mean and peak flood flow for the USGS gage on Soquel Creek at Soquel.

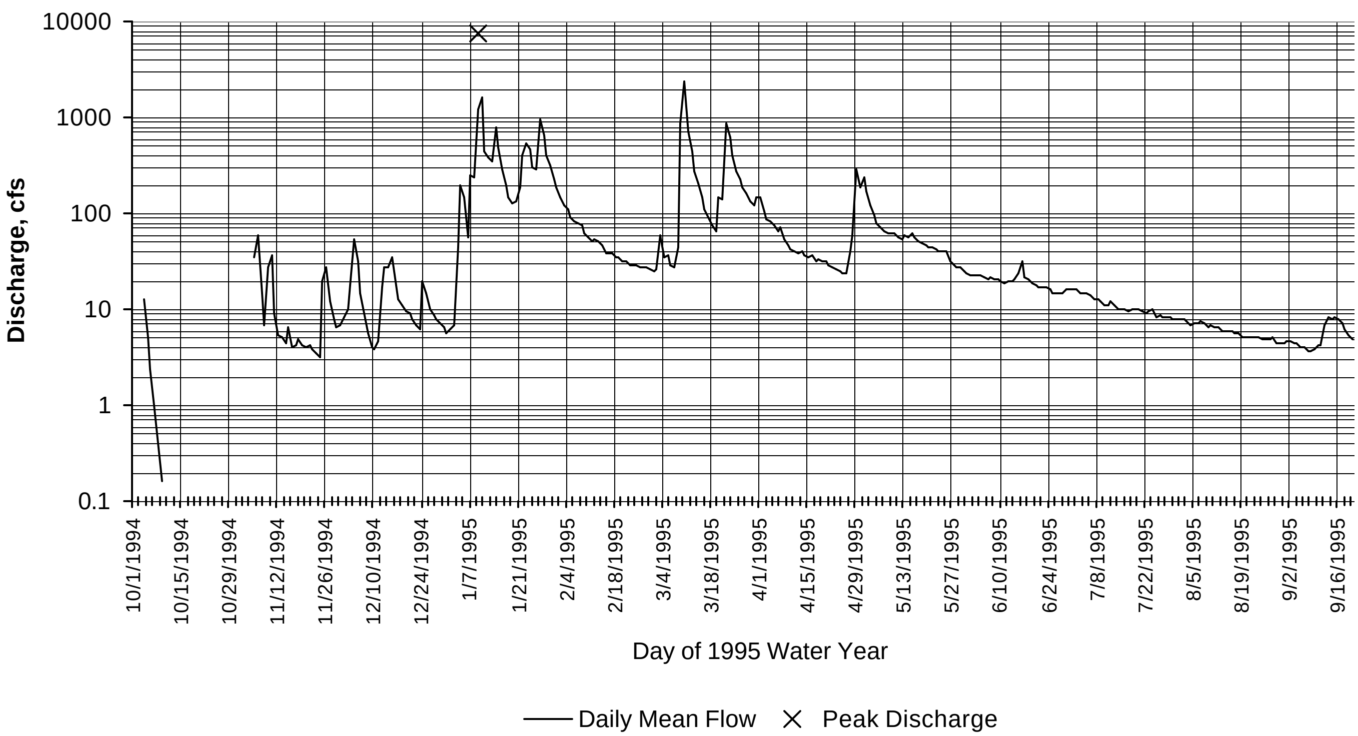


Figure 21. The 1996 Daily Mean and Peak Flood Flow at the USGS Gage on Soquel Creek at Soquel.

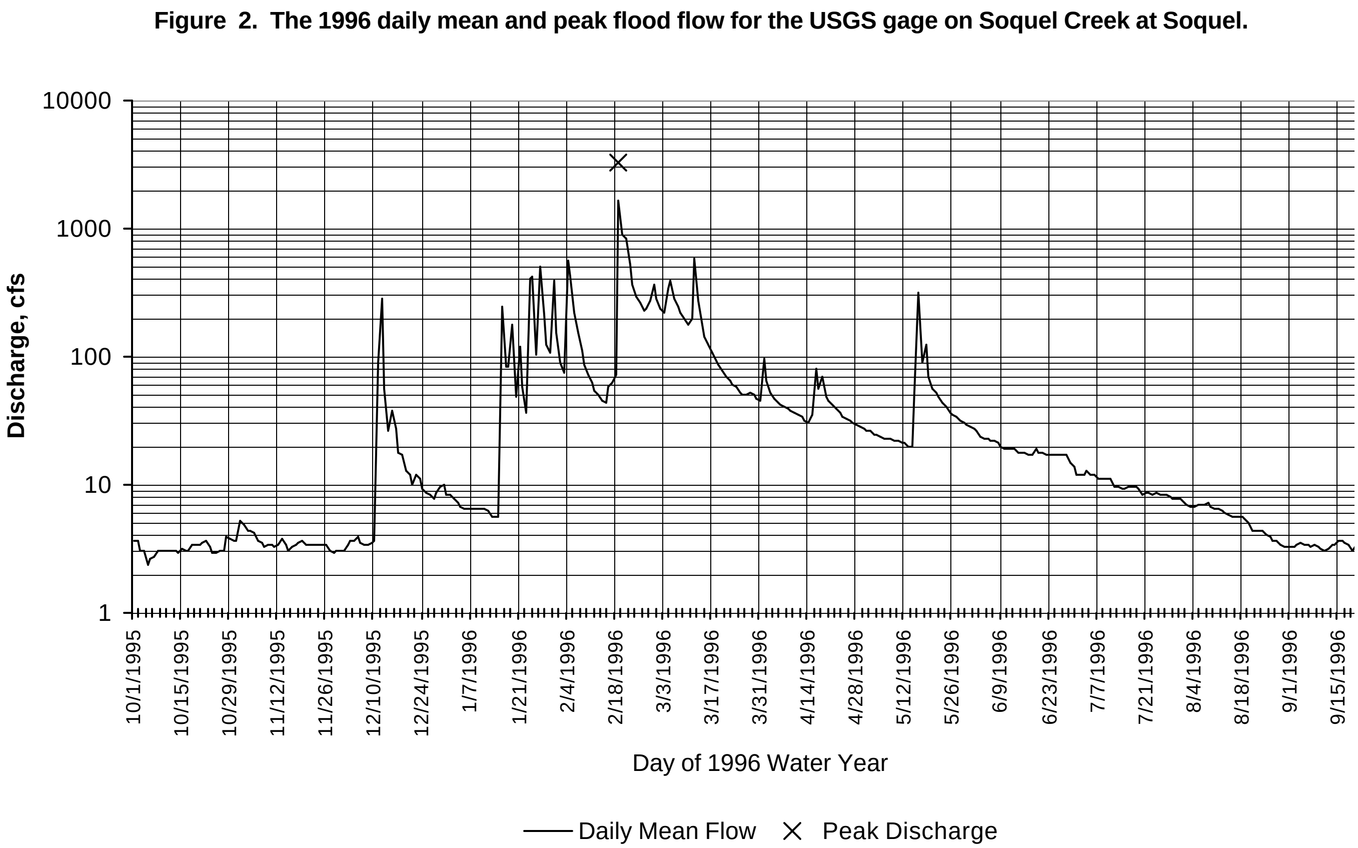


Figure 22. The 1997 Daily Mean and Peak Flood Flow at the USGS Gage on Soquel Creek at Soquel.

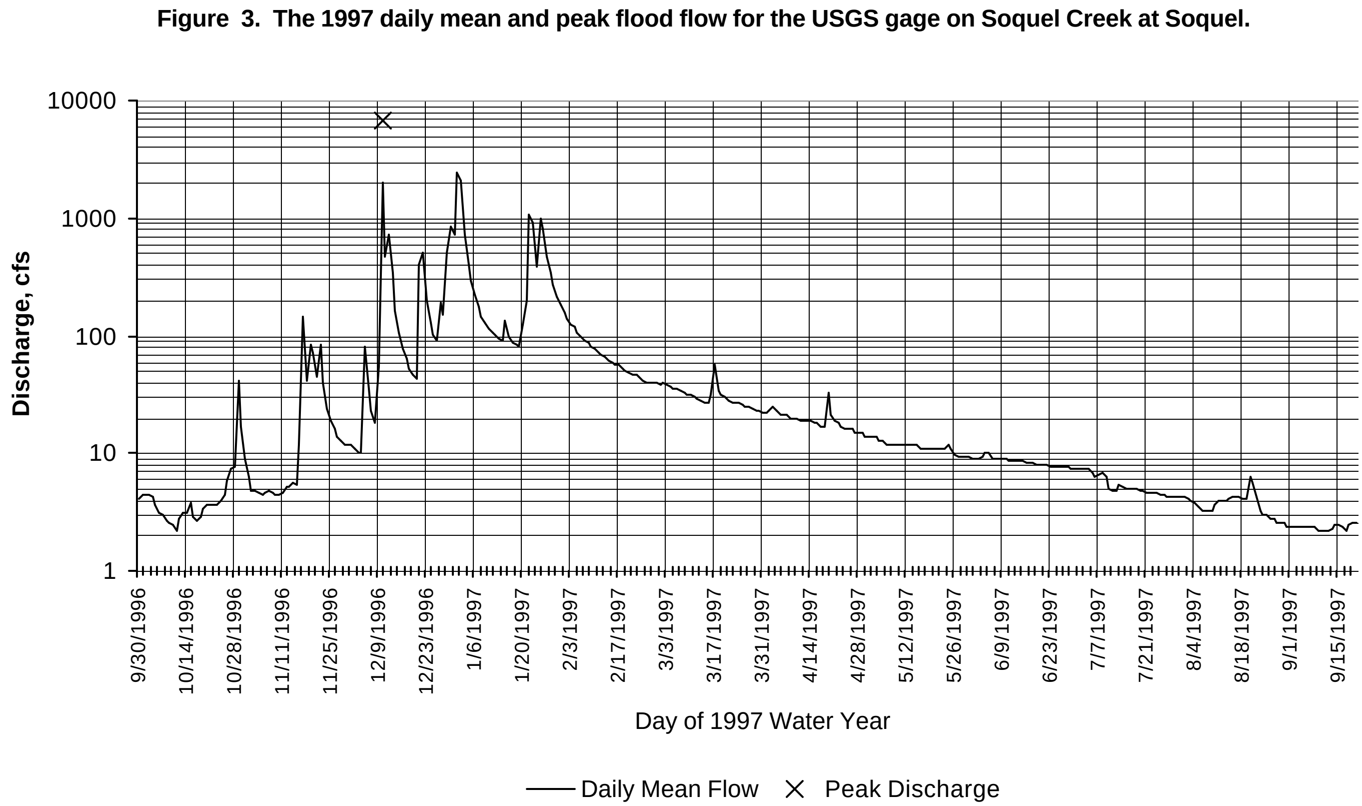


Figure 23. The 1998 Daily Mean and Peak Flood Flow at the USGS Gage on Soquel Creek at Soquel.

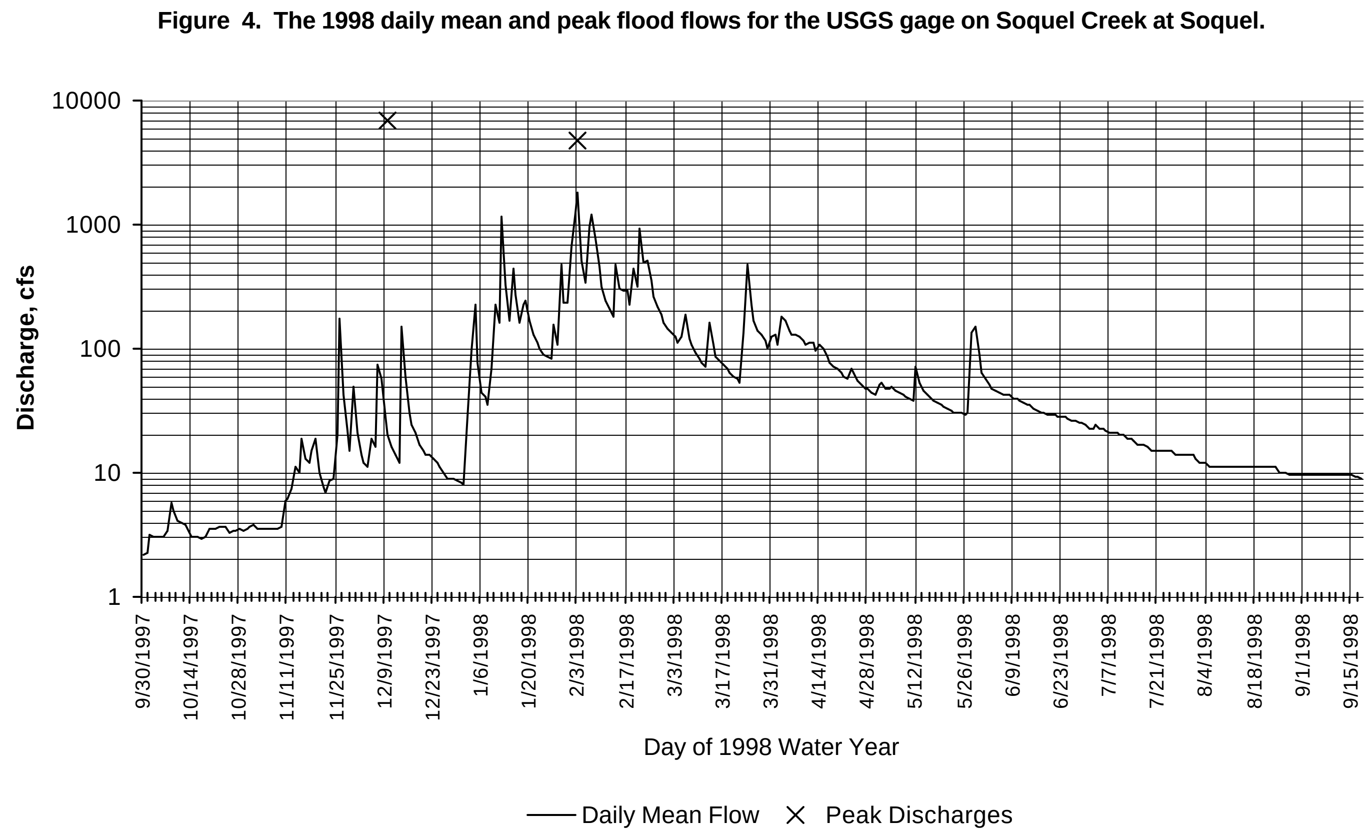


Figure 24. The 1999 Daily Mean and Peak Flood Flow at the USGS Gage on Soquel Creek at Soquel.

Figure 5. The 1999 daily mean and peak flood flow for the USGS gage on Soquel Creek at Soquel.

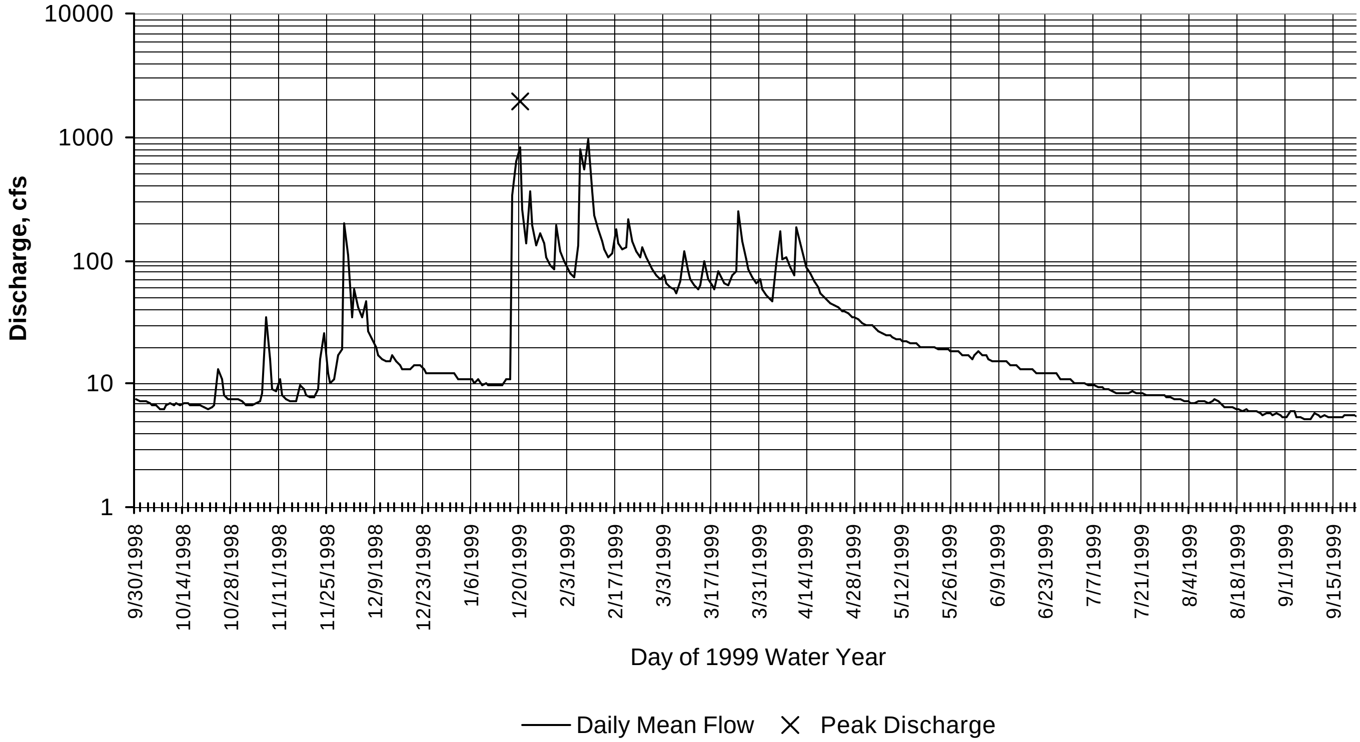


Figure 25. The 2000 Daily Mean and Peak Flood Flow at the USGS Gage on Soquel Creek at Soquel.

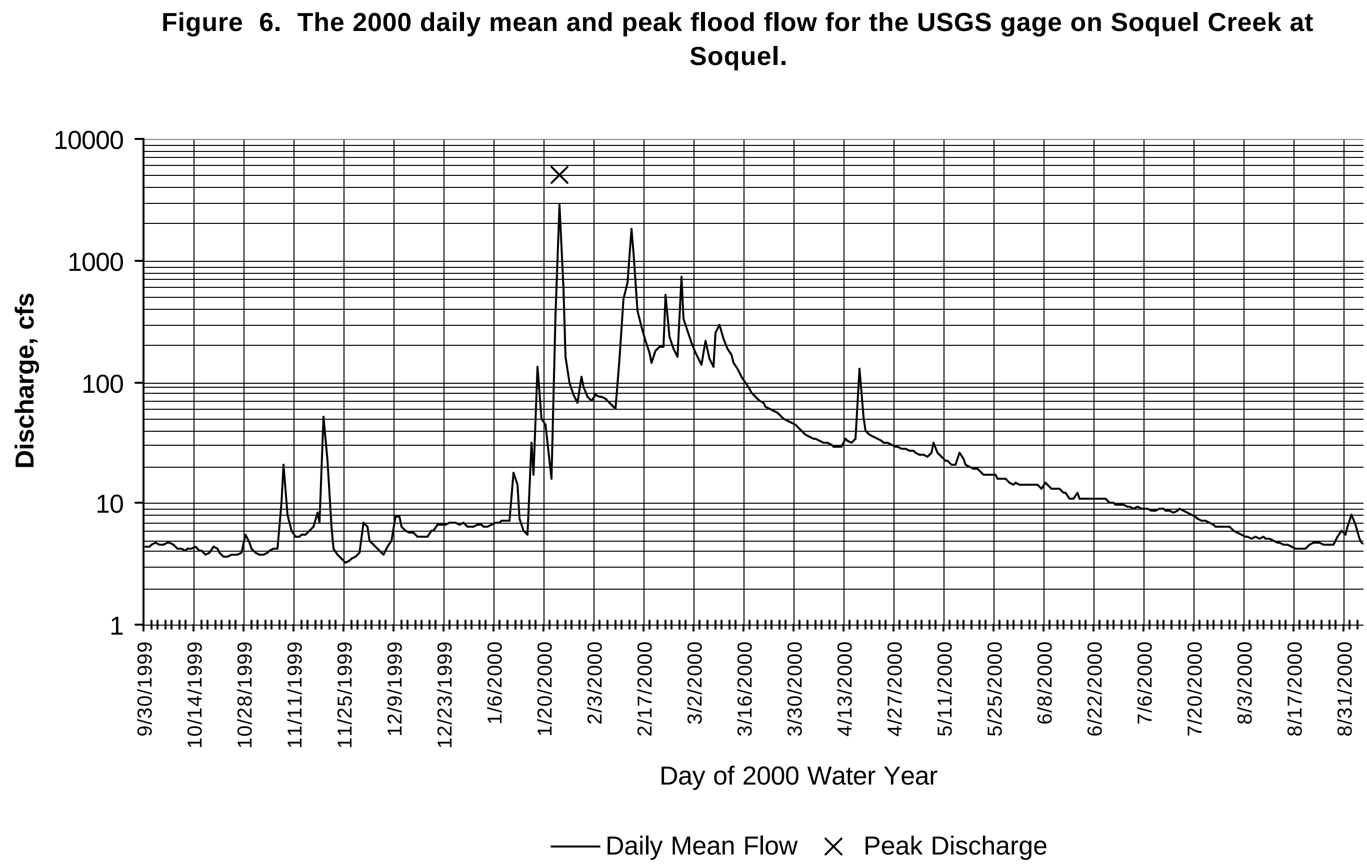


Figure 26. The 2001 Daily Mean and Peak Flood Flow at the USGS Gage on Soquel Creek at Soquel.

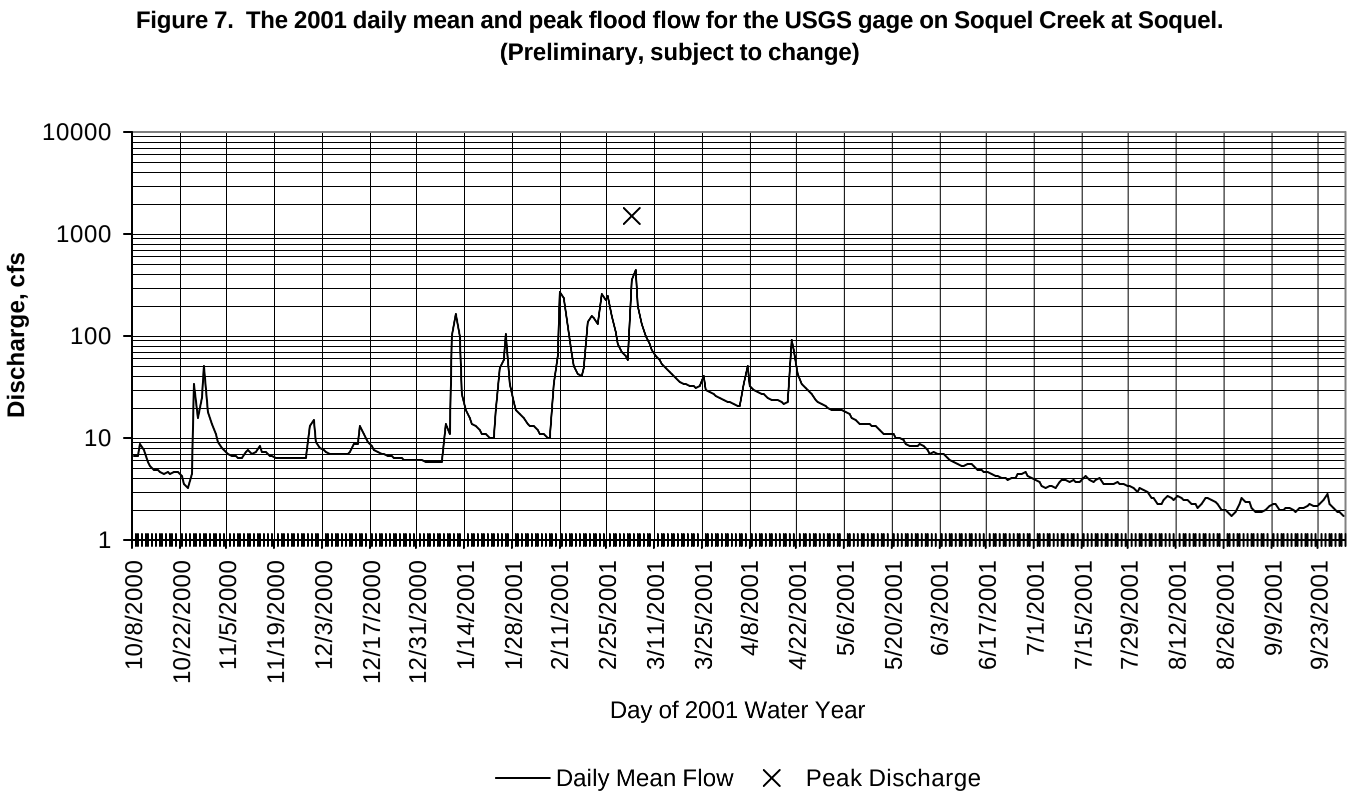


Figure 27. The 2002 Daily Mean and Peak Flood Flow at the USGS Gage on Soquel Creek at Soquel.

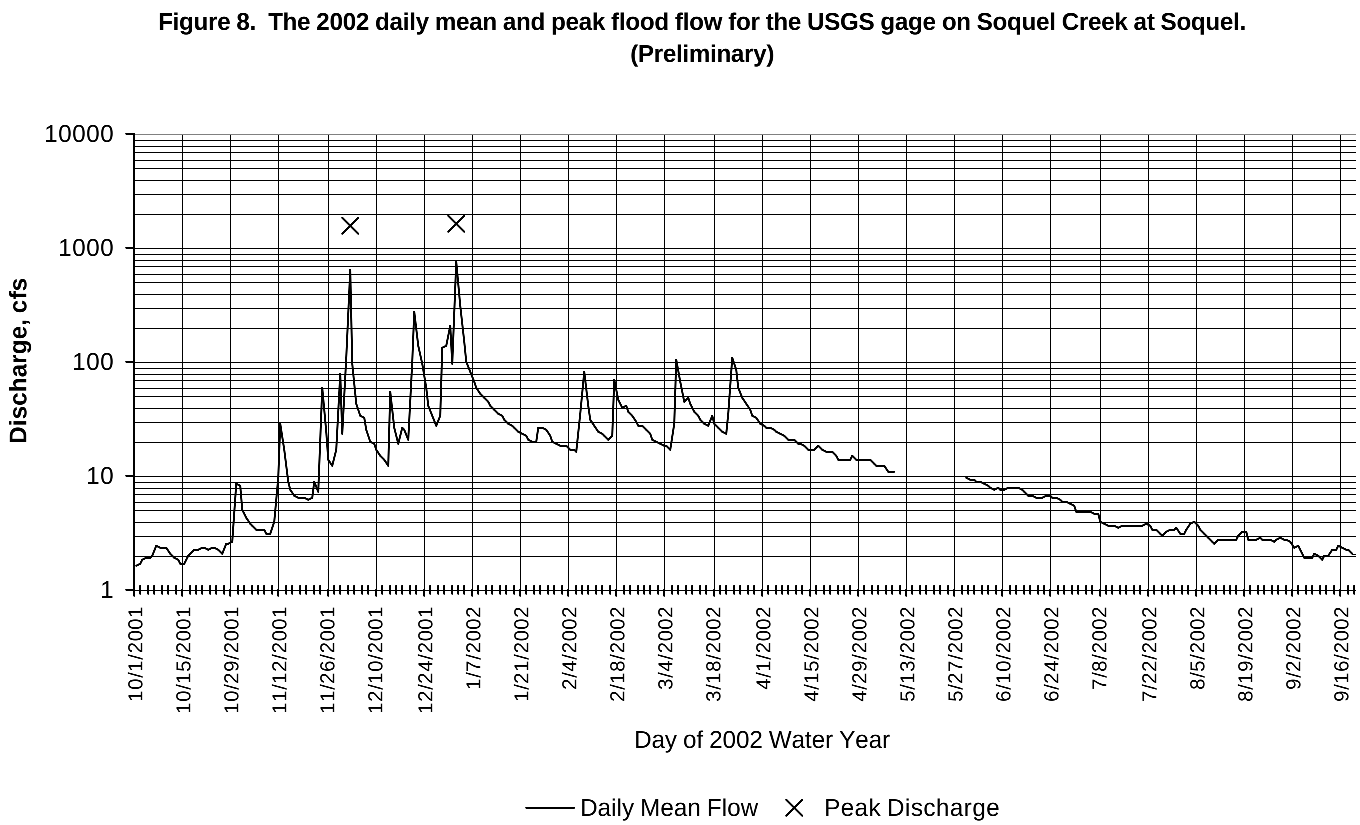


Figure 28. The 2003 Daily Mean and Median Flow at the USGS Gage on Soquel Creek at Soquel.

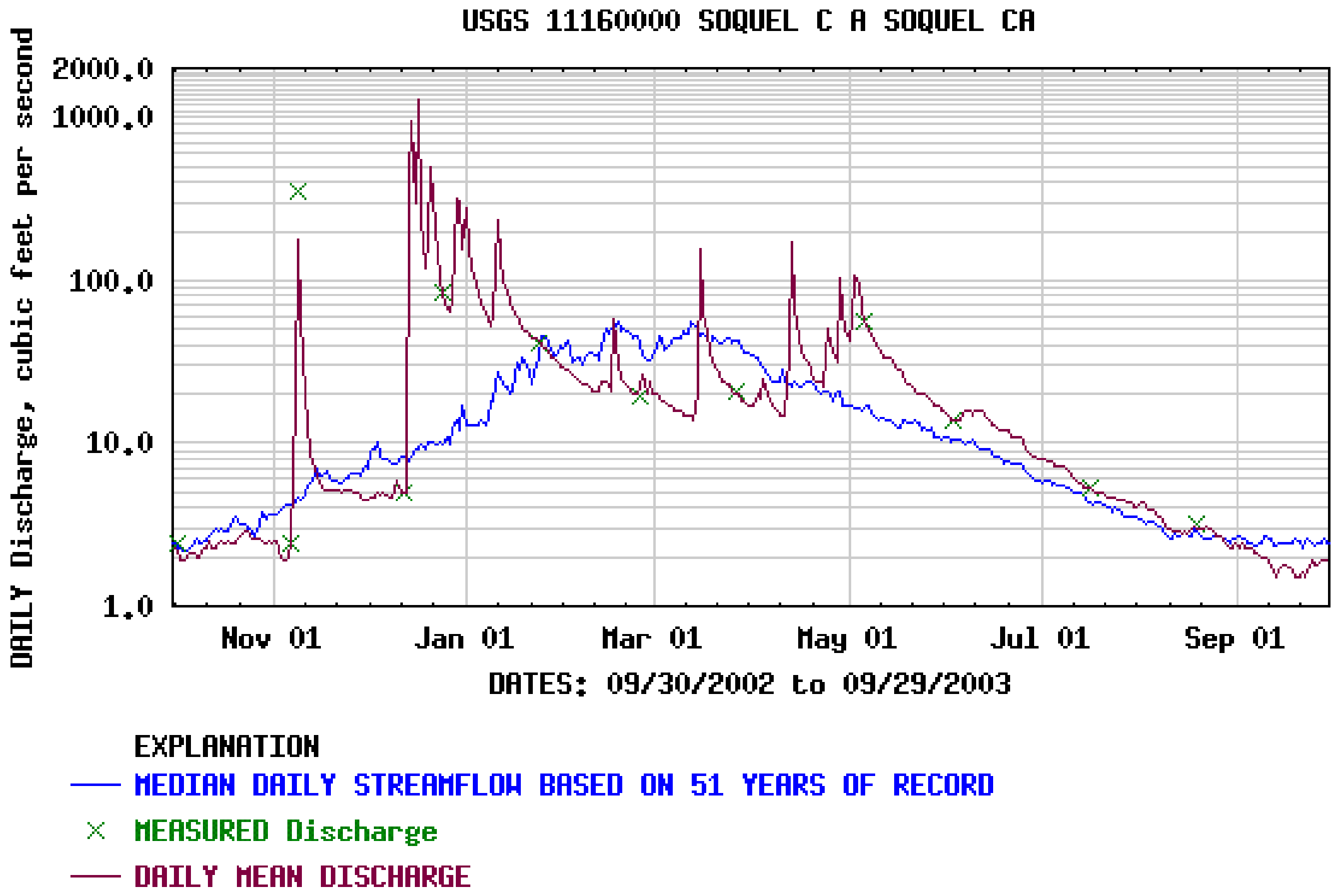


Figure 29. The 2004 Daily Mean and Median Flow at the USGS Gage on Soquel Creek at Soquel.

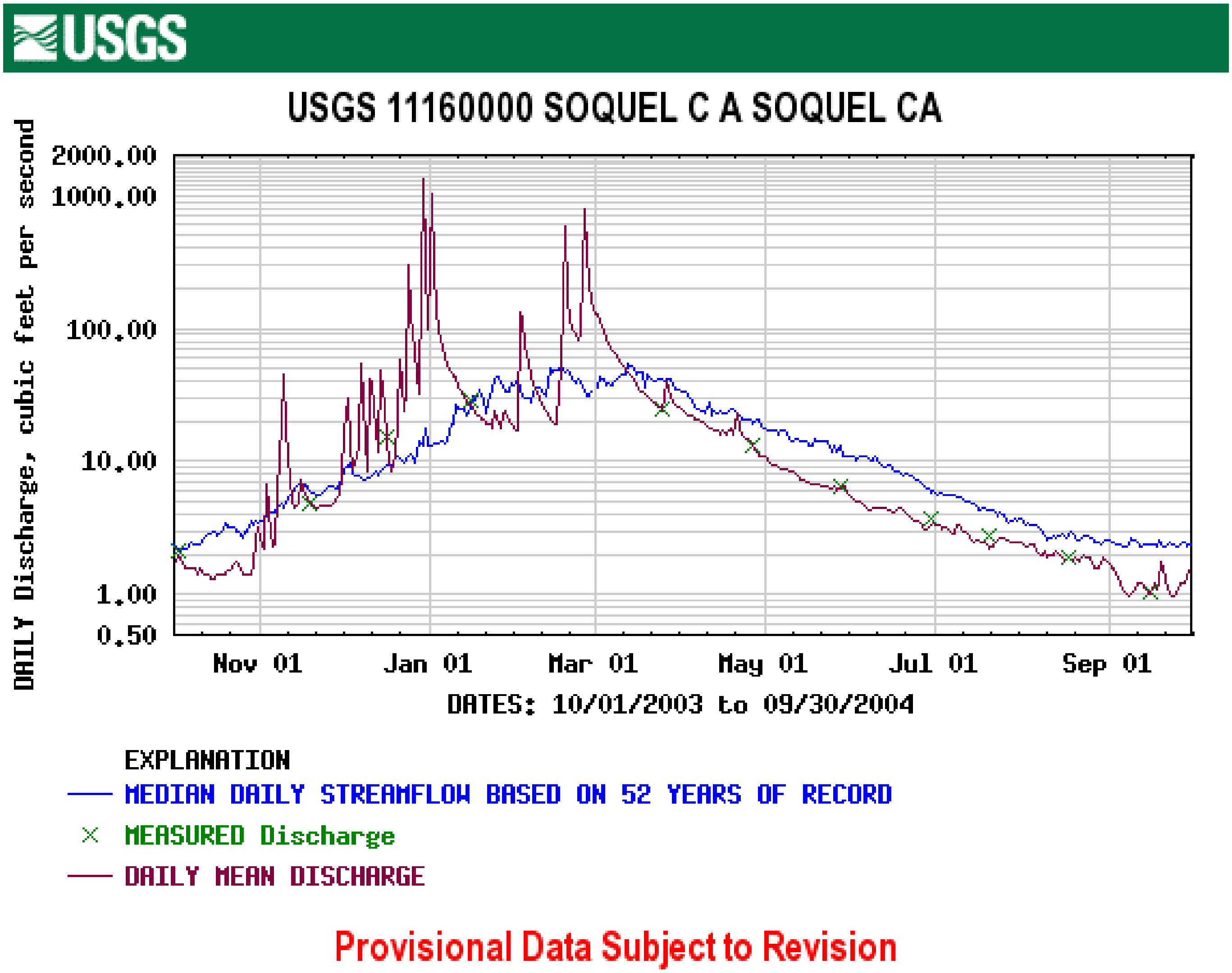


Figure 30. The 2005 Daily Mean and Median Flow at the USGS Gage on Soquel Creek at Soquel.

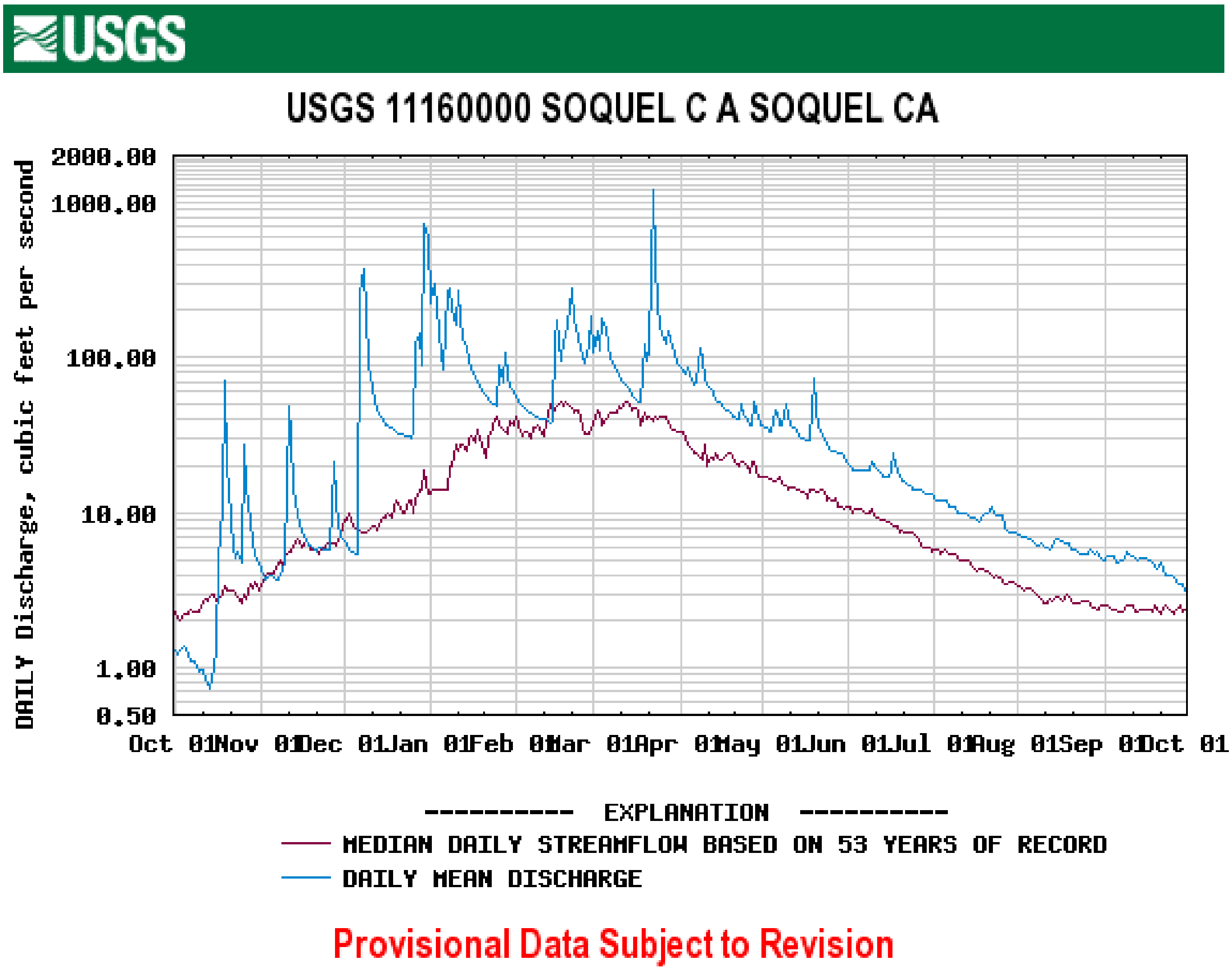


Figure 31. The 2006 Daily Mean Flow at the USGS Gage on Soquel Creek at Soquel.

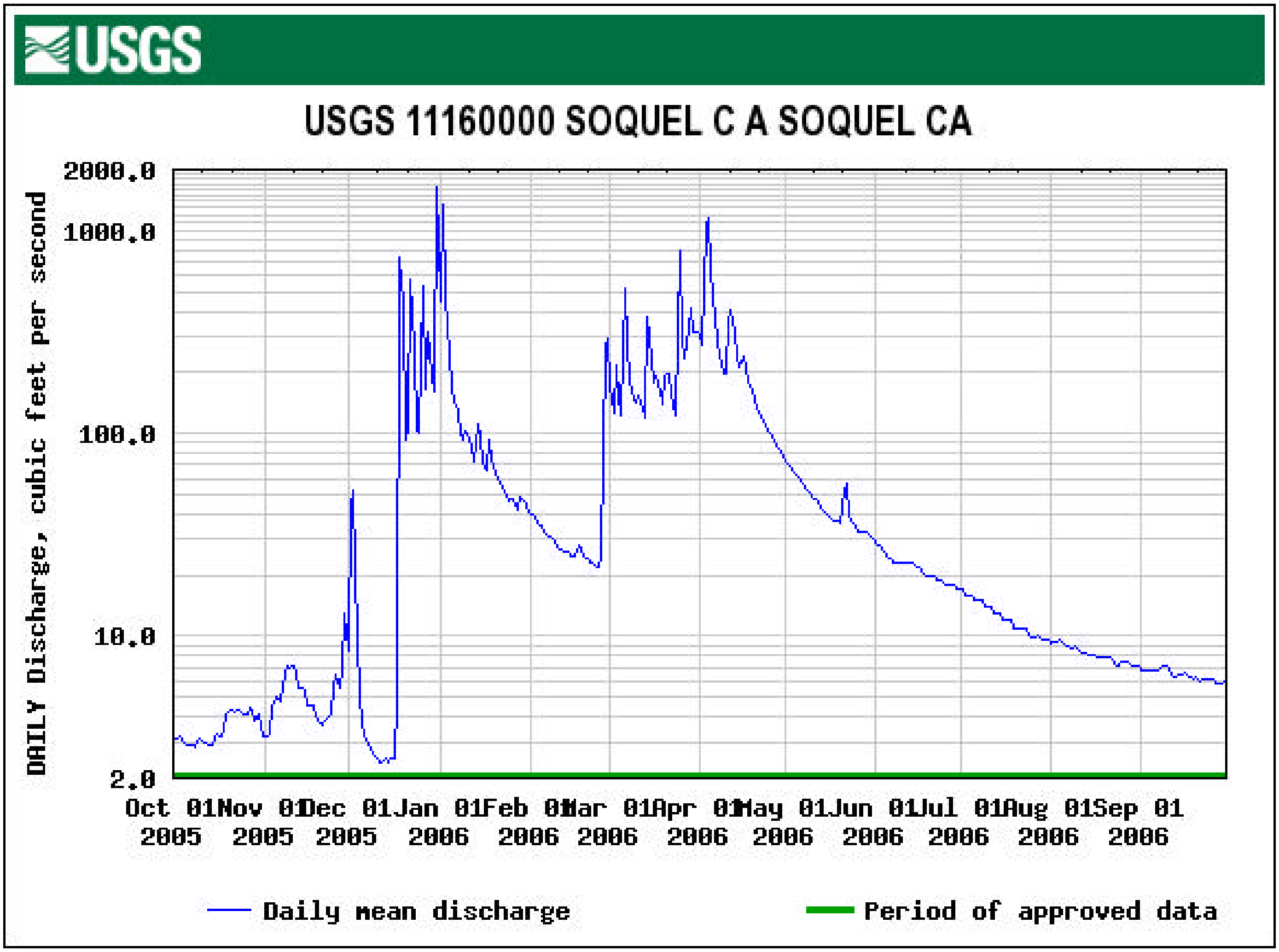


Figure 32. The 1981 Daily Mean Flow at the USGS Gage on Corralitos Creek at Freedom.

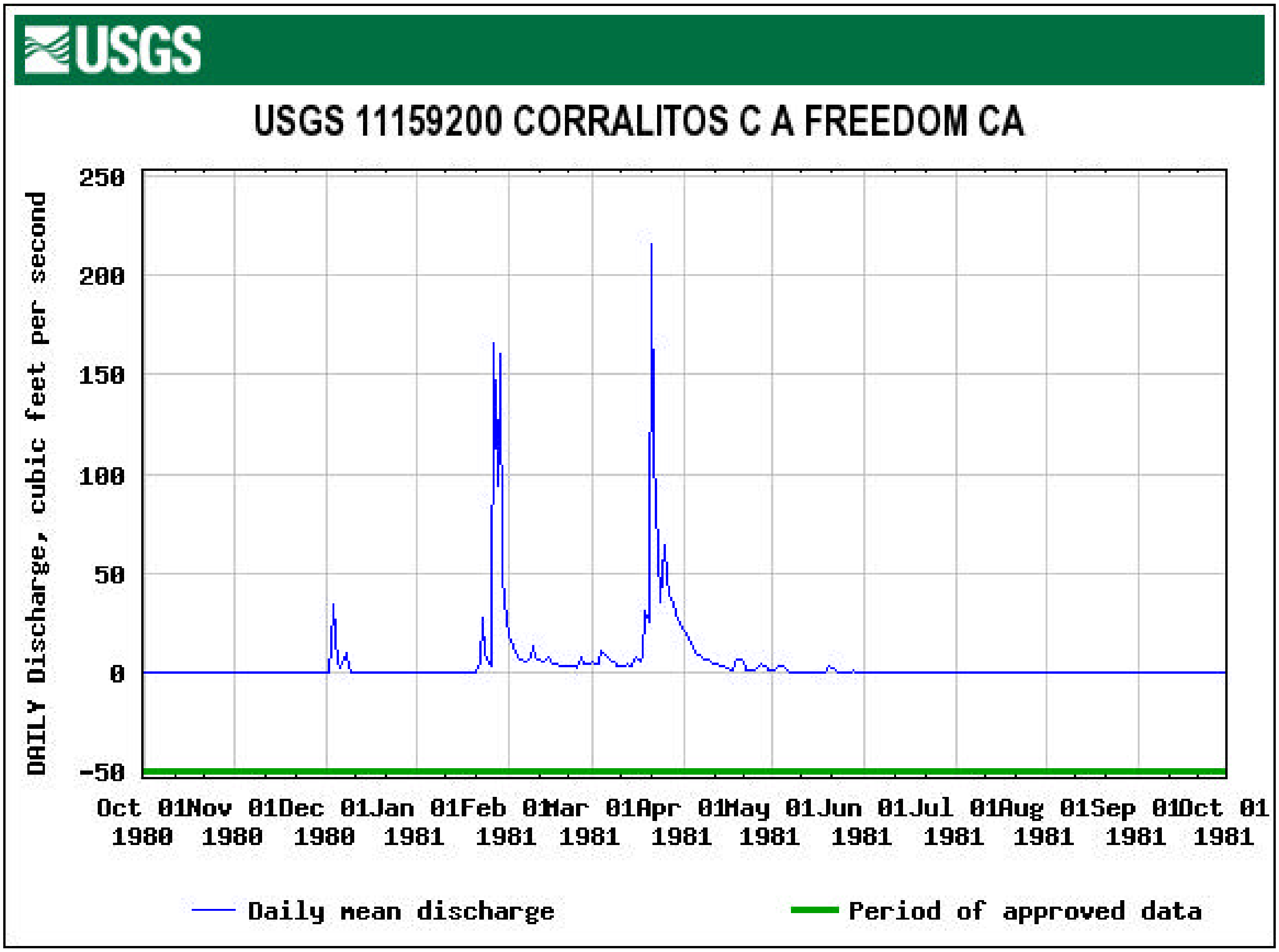


Figure 33. The 1994 Daily Mean Flow at the USGS Gage on Corralitos Creek at Freedom.

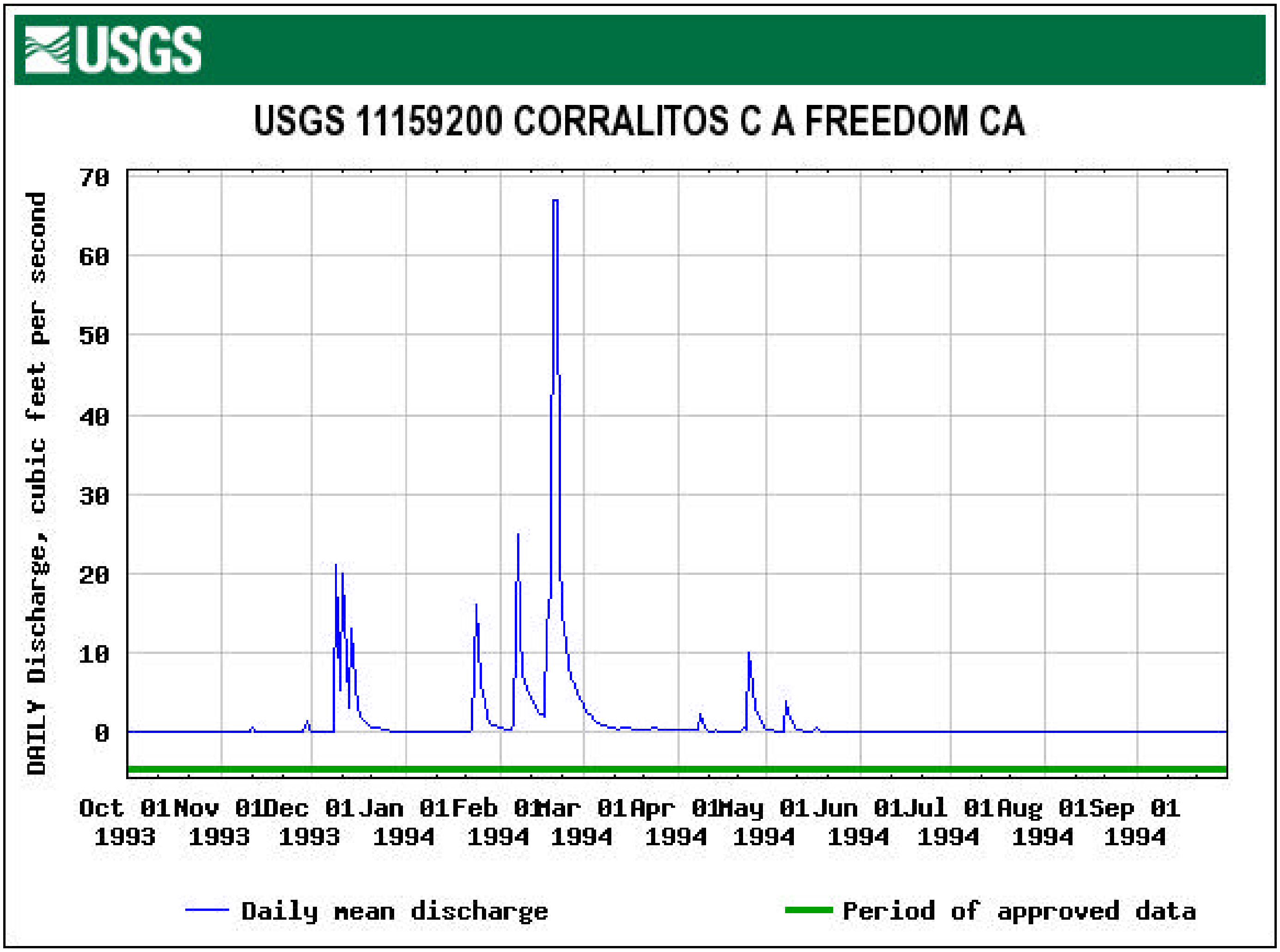
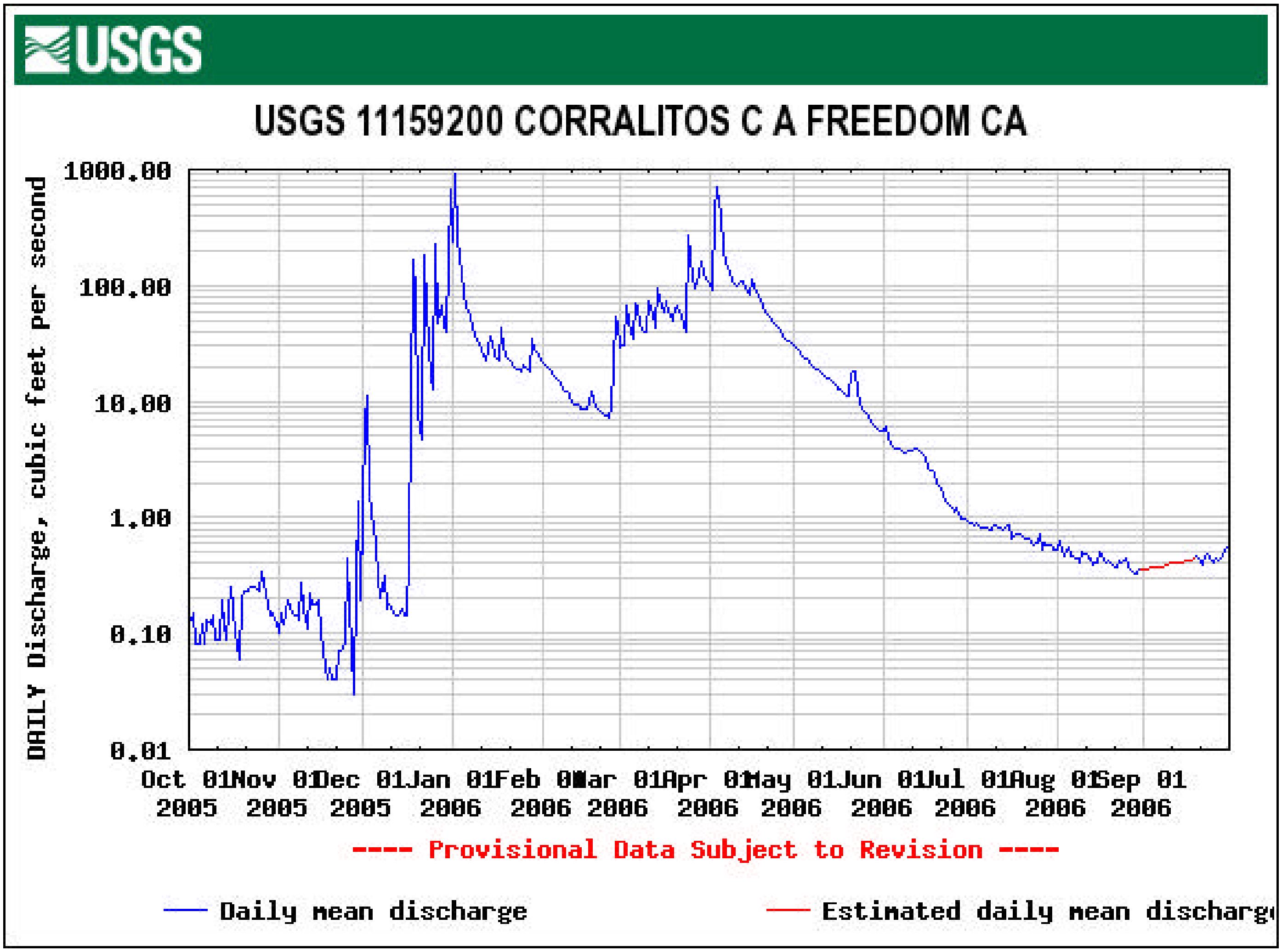


Figure 34. The 2006 Daily Mean Flow at the USGS Gage on Corralitos Creek at Freedom.



APPENDIX A. Maps of Sampling Sites.

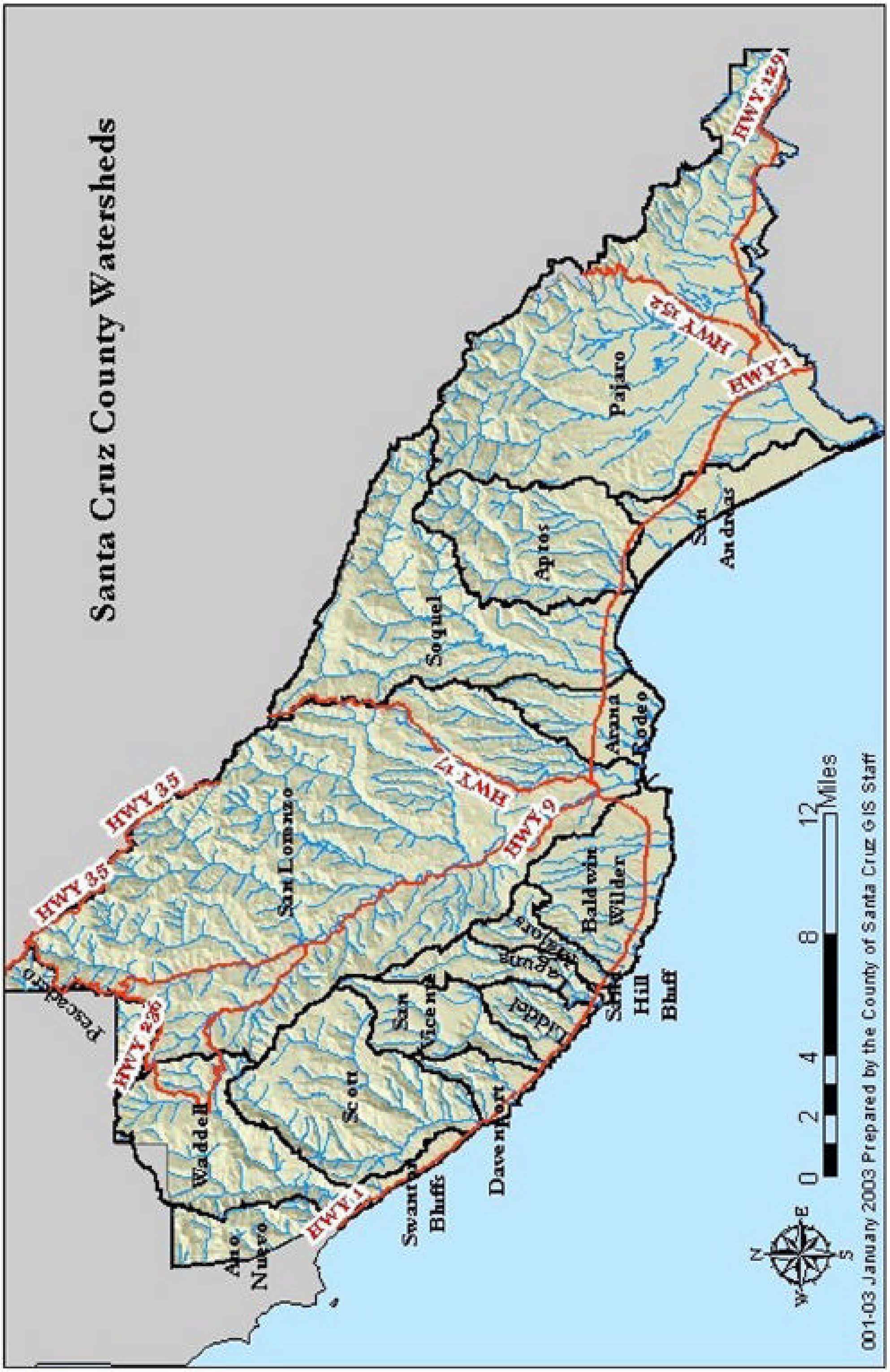
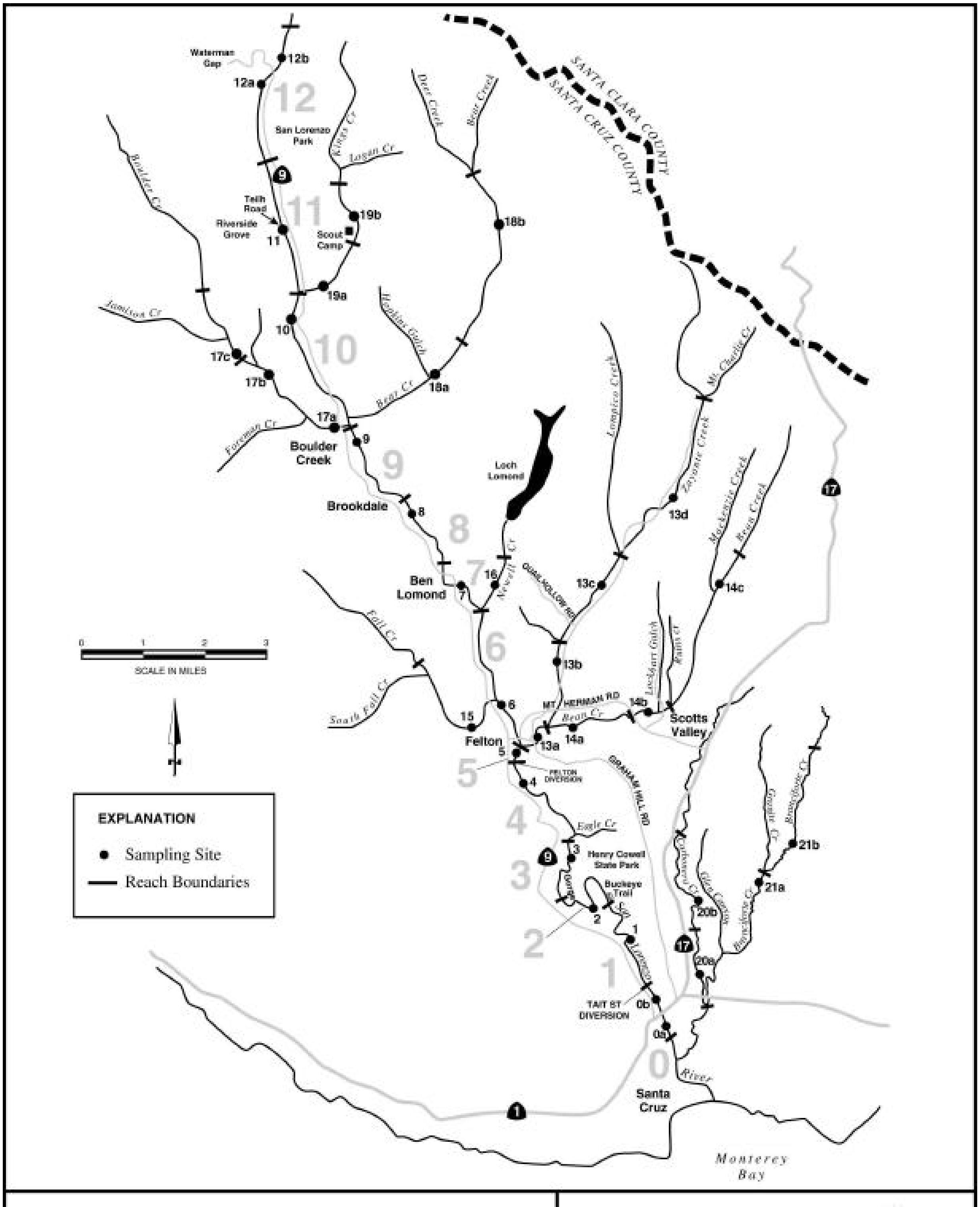
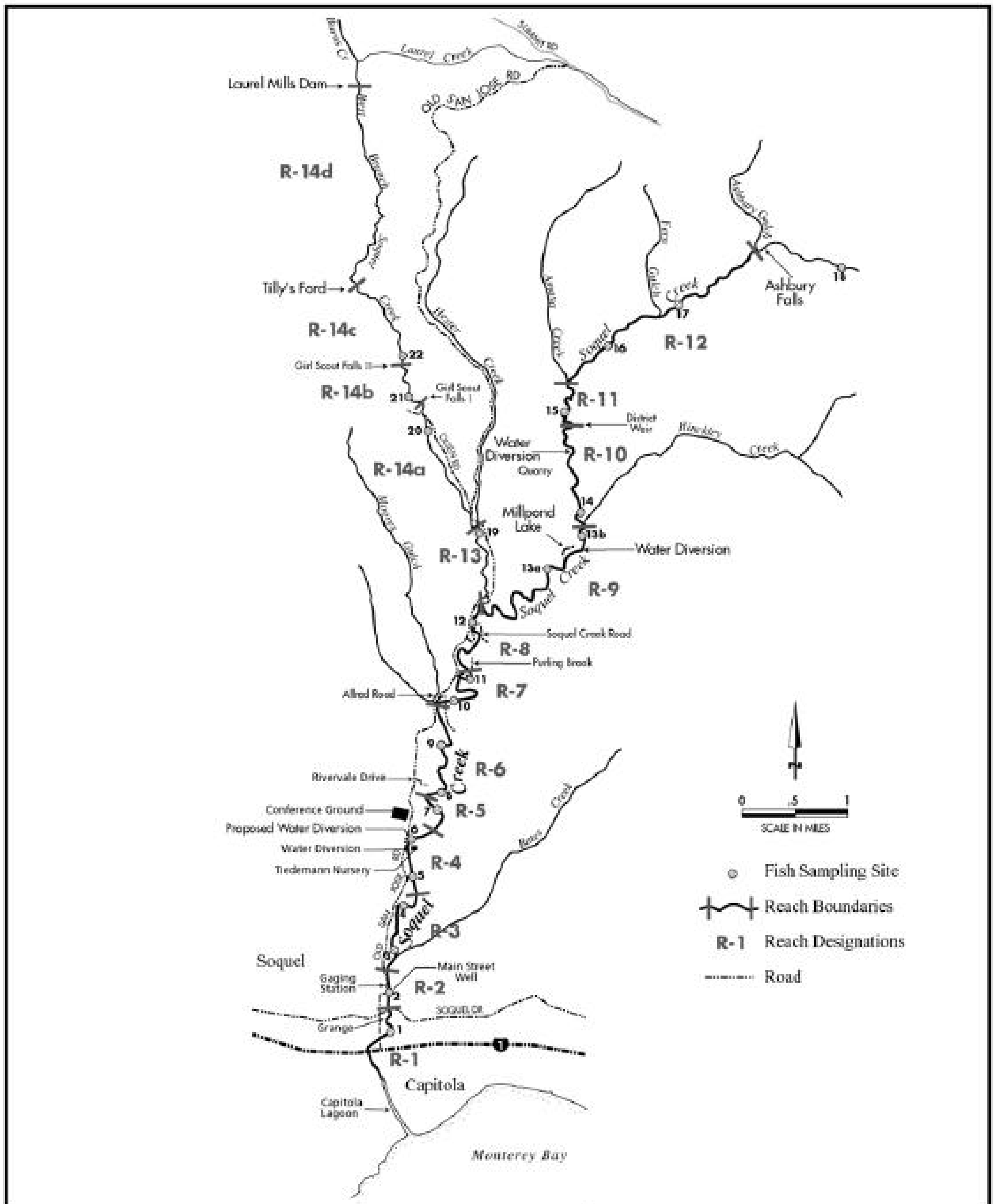


Figure 1. Santa Cruz County Watersheds.



APPENDIX A, FIGURE 2 Reach & Site Designations in the San Lorenzo River Drainage
June 2001

D.W. ALLEY & Associates
P.O. Box 200
Brookdale, CA 95007

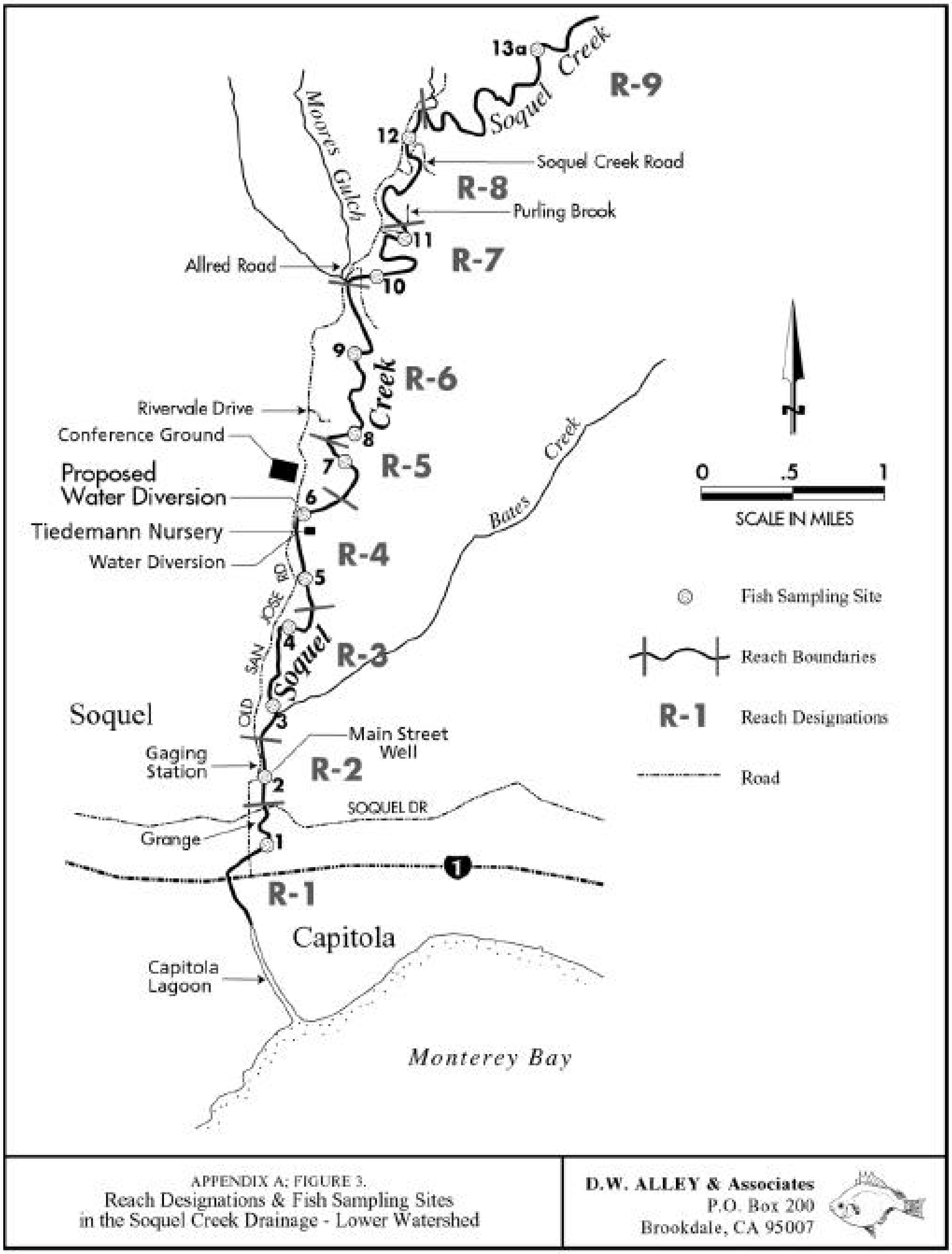


APPENDIX A; FIGURE 2.
Reach Designations & Fish Sampling Sites
in the Soquel Creek Drainage

D.W. ALLEY & Associates
P.O. Box 200
Brookdale, CA 95007

Figure 3. Soquel Creek Watershed.

Figure 4. Lower Soquel Creek (Reaches 1–8 on Mainstem).



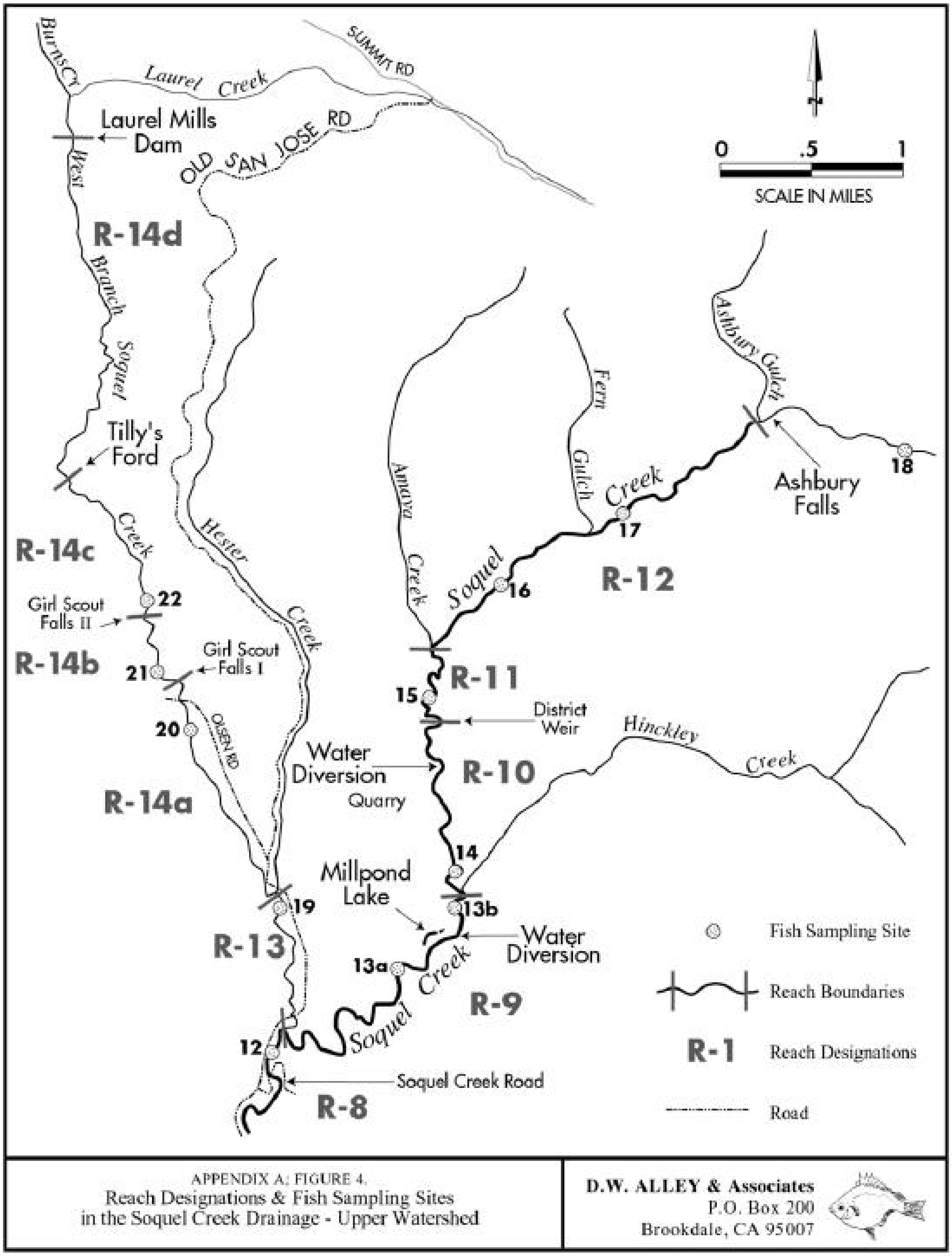


Figure 5. Upper Soquel Creek Watershed (East and West Branches).

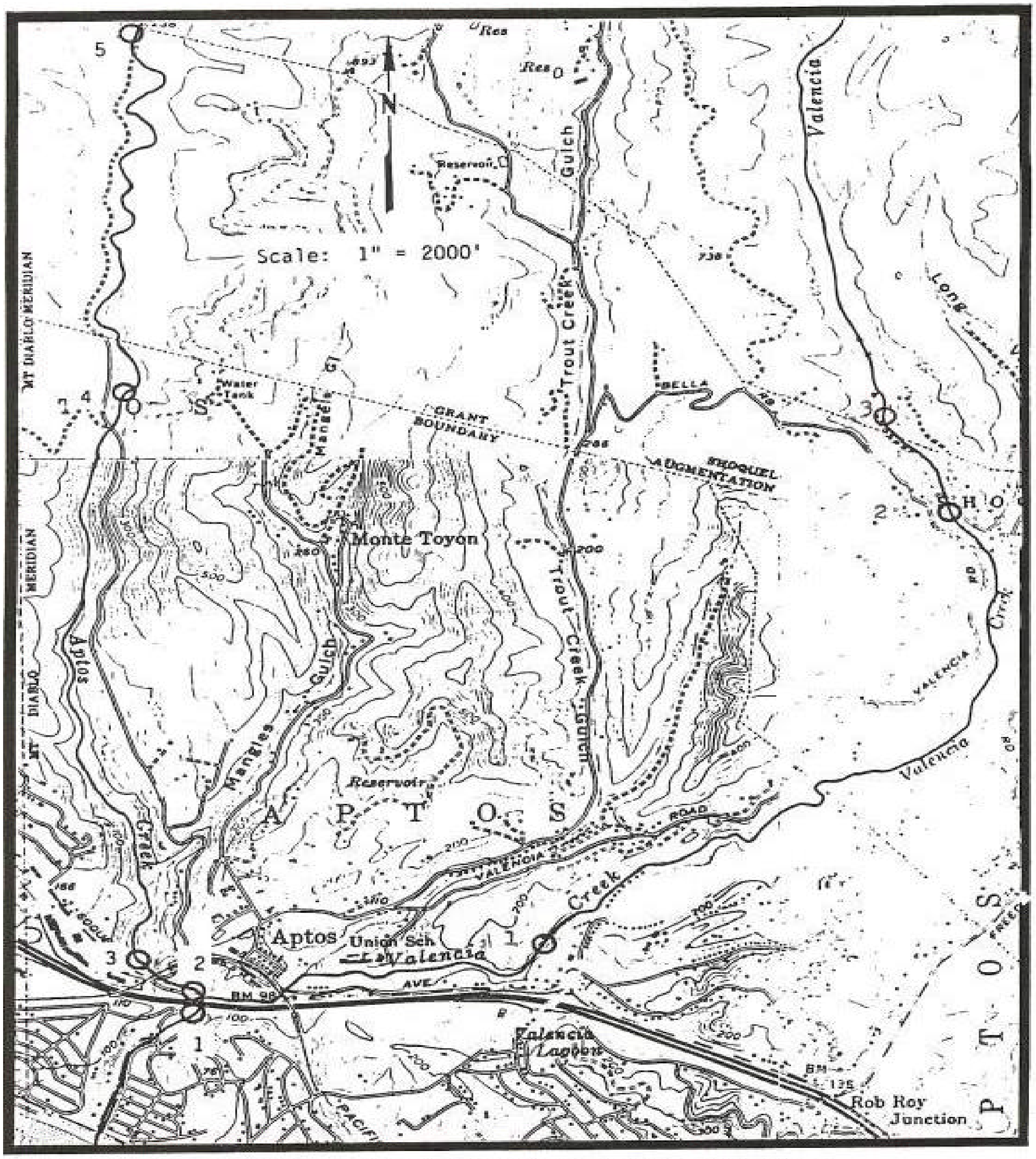


Figure 17. Fish sampling sites on Aptos Creek and Valencia Creek.

63

Figure 6. Map from Smith (1982) with Site #3 designation on Valencia Creek at 2006 location.

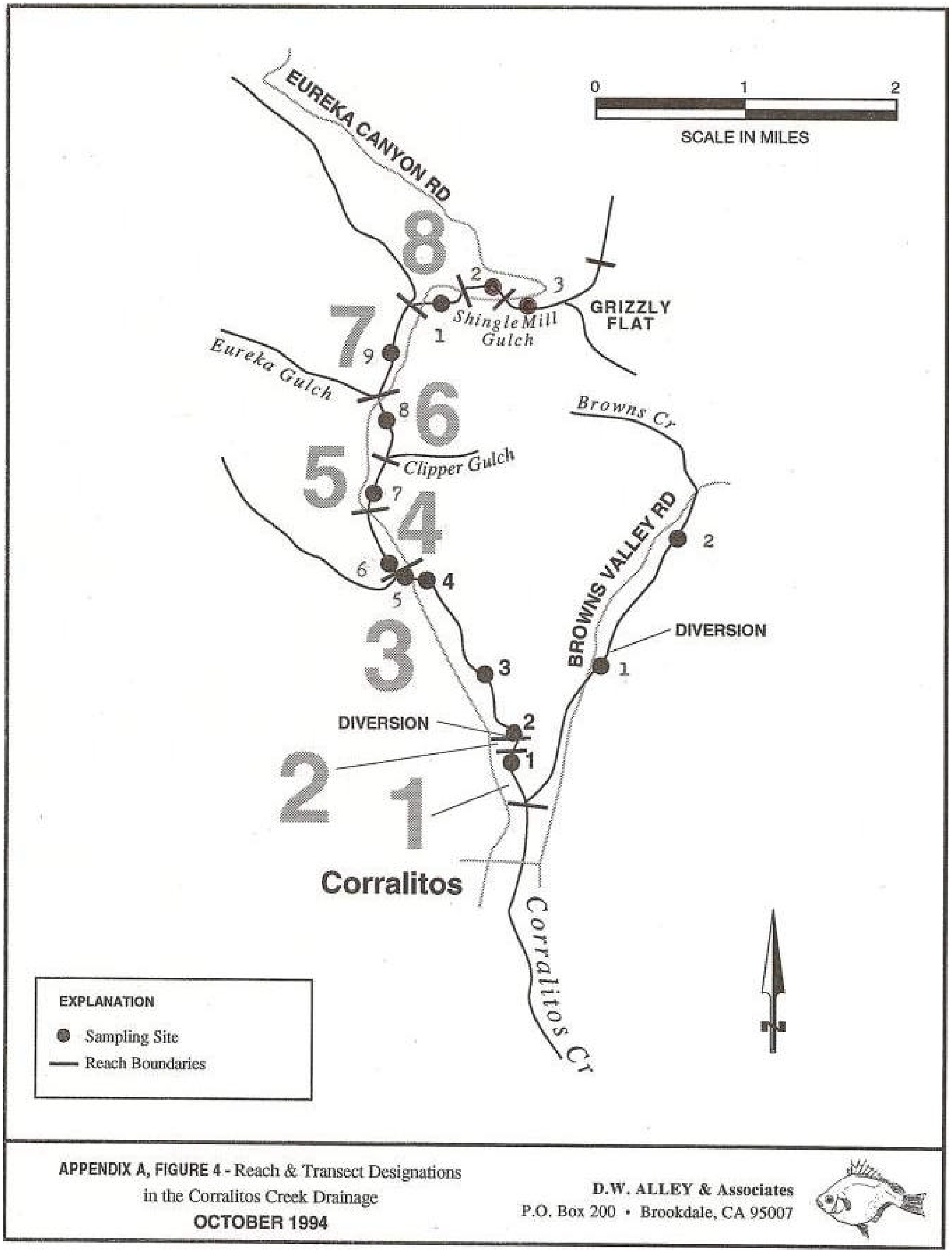


Figure 7. Corralitos Sub-Watershed to the Pajaro River Watershed.

APPENDIX B. Summary of Catch Data for Sampling Sites.

ORDER OF DATA ORGANIZATION IN THIS APPENDIX

The summary sheets for each sampling site were provided first as steelhead/coho sampling forms. Then the field data sheets for each sampling site were provided. The order of sampling sites corresponded to the numerical order presented in Tables 1-4 in the methods section.

EXPLANATION OF STEELHEAD/COHO SALMON SAMPLING FORMS

Electrofishing and snorkeling data were presented for each sampling site. All data pertained to steelhead because no coho salmon were captured in 2006. Snorkeled habitat is denoted. For electrofishing data, it was presented in successive passes. For underwater visual censusing data, fish counts for replicate passes were presented as passes. Density estimates for each electrofished habitat were obtained by the depletion method and regression analysis. Density estimates for mainstem pool habitats that were visually censused in 2006 were obtained by using the maximum number of steelhead seen per pass. Densities were so low in 2006 that there was little chance of counting the same fish twice, and it was very possible to miss fish on certain passes.

For each pass, steelhead were divided into age and size class categories. YOY and 1+ refer to age classes. C-1, C-2 and C-3 refer to Size Classes 1, 2 and 3. For the data presented by pass, C-2 includes Size Classes 2 and 3 combined. Only in the population estimates are these two size classes differentiated.

Site densities at the bottom of the summary data forms were obtained by dividing total estimated number of fish in each size/age category by the total length of stream that was censused.

Steelhead Sampling Results

Date: 09Sep06/06Oct06 Stream: SLR Sampled by: Alley, Steiner, Kittleson, Reis, Wheeler

Sampling Site: 1 (Paradise Park) Water Temperature and Times: 70.0 F @ 1531 hr, 9Aug06. (Air temp. 86 F)

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#11 Riffle 77 ft	3	0	0	3	1	0	0	1	1	0	0	1	5	0	0	5	0	5
#12 Run 96 ft	1	0	0	1	1	0	0	1	0	0	0	0	2	0	0	2	0	2
#10 Pool Snorkel 567 ft	1	0	0	1	2	0	0	2	1	0	0	1	2	0	0	1	1	2
All Habitats Combined 740 ft													9	0	0	8	1	9

Length of Stream Sampled (ft): 740 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.0122/ 0
2003-2006
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0 /0.0122

Steelhead Sampling Results

Date: 09Sep06/06Oct06 **Stream:** SLR **Sampled by:** Alley, Steiner, Kittleson, Reis, Wheeler

Sampling Site: 4 (Henry Cowell Park) **Water Temperature and Times:** 65.0 F @ 1017 hr, 10Aug06. (Air temp. 68 F)

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#13 (partial) Riffle 66 ft	17	1	4	20	14	0	2	16	5	0	1	6	50.2	1	8	48.2	9.6	58.8
#14 (partial) Run 54 ft	3	1	0	2	1	0	0	1	1	0	0	1	5.7	1	0	5.7	0	6.7
#15 Pool Snorkel 298 ft	0	0	2	2	2	0	2	4	0	0	1	1	2	0	2	2	2	4
All Habitats Combined 418 ft													57.9	2	10	55.9	11.6	69.5

Length of Stream Sampled (ft): 418 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.1385/0.0048

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0239/0.1615

Steelhead Sampling Results

Date: 17Sep06/11Sep06 **Stream:** SLR **Sampled by:** Alley, Steiner, Wheeler, Kittleson

Sampling Site: 6 (below Fall Creek) **Water Temperature and Times:** 69.5 F @ 1556 hr, below Fall Creek confluence. 71 F @ 1603 hr above Fall Creek confluence, 10Aug06.

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#5 Riffle 62 ft	12	6	0	6	6	4	0	2	4	2	0	2	26.3	15.6	0	11.3	0	26.9
#8 Run 66 ft	8	5	0	3	6	3	0	3	4/2	3/2	0/0	1/0	20	13	0	7	0	20
#16 Short Pool Snorkel 122 ft	4	1	2	5	5	1	2	6	8	1	3	11	9	1	3	10	1	12
#18 Long Pool Snorkel 1,133 ft	3	1	1	3	0	0	0	0	1	0	1	2	3	1	1	3	0	4
All Habitats Combined 1383 ft													58.3	30.6	4	31.3	1	62.9

Length of Stream Sampled (ft): 1383 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.0422/.0221

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0029/0.0234

Steelhead Sampling Results

<u>Date:</u> 17Sep06/11Sep06 <u>Stream:</u> SLR <u>Sampled by:</u> Alley, Steiner, Kittleson, Wheeler

<u>Sampling Site:</u> 8 (below Clear Creek) <u>Water Temperature and Times:</u> 63 F @ 1250hr, 15Aug06. (Air temp. 70 F)

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#9 Riffle 80 ft	32	15	4	21	8	8	1	1	3	3	0	0	43.6	29.6	5.1	17	5	51.6
#10 Run 55 ft	11	9	1	3	10	10	0	0	1	1	0	0	22	20	1	3	0	23
#14 Short Pool snorkel 162 ft	6	0	2	8	3	0	1	4	1	0	2	3	6	0	2	7	1	8
#22 Long Pool snorkel 329 ft	0	0	1	1	1	0	2	3	1	0	1	2	1	0	2	3	0	3
All Habitats Combined 626 ft													72.6	49.6	10.1	30	6	85.6

Length of Stream Sampled (ft): 626 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.1160/0.0792

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0161/ 0.0575

Steelhead Sampling Results

Date: 2Sep06 **Stream:** SLR **Sampled by:** Alley, Steiner, Wheeler
Sampling Site: 11 (above Teihl Rd) **Water Temp. and Times:** 64 F @ 1605 hr, 15Aug06.(Air temp. 71 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#16 Run- 71 ft	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1
#18 Riffle 21 ft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
#17 Pool 48 ft	1	0	2	3	0	0	0	0	0	0	0	0	1	0	2	2	1	3
#19 Pool 124 ft	1	0	2	3	0	0	0	0	0	1	0	1	2	0	2	2	2	4
Pools Combined 172 ft													3	0	4	4	3	7
All Habitats Combined 264 ft													4	0	4	5	3	8

Length of Stream Sampled (ft):_264 ft_______

Young-of-the-Year / Size Class 1 per Foot of Stream:_0.0152/ 0______

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream:__0.0152/ 0.0303__

Steelhead Sampling Results

Date: 1Sep06 **Stream:** Zayante **Sampled by:** Alley, Steiner, Reis
Sampling Site: 13a (below Bean Creek) **Water Temperature and Times:** 61 F @ 1349hr, 18Aug06. (Air temp. 70 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#5 Riffle 45 ft	9	8	0	1	5	1	0	4	1	1	0	0	16.9	10	0	5	0	15
#6 Pool 93 ft	2	0	2	4	1	0	2	3	0	0	0	0	3	0	4	7	0	7
#16 Pool 64 ft	7	1	2	8	2	0	1	3	1	0	0	1	10.3	1	3.3	11.6	1	13.6
#18 Run 60 ft	2	0	1	3	2	1	0	1	3/1	1/1	0/0	2/0	8	3	1	6	0	9
All Habitats Combined 262 ft													38.2	14	8.3	29.6	1	44.6

2003-2007
Length of Stream Sampled (ft): 262 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.1458/ .0534

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0317/ 0.1168

Steelhead Sampling Results

Date: 5/6Sep06 **Stream:** Zayante **Sampled by:** Alley, Steiner, Reis

Sampling Site: 13c (below Lompico Ck) **Water Temp. and Times:**

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#30 Riffle/ Step-run 51 ft	16	4	2	14	9	3	1	7	2	0	0	2	30.7	8.8	3.3	23.3	2.2	34.3
#27 Pool 102 ft	4	2	0	2	1	0	0	1	0	0	0	0	5.1	2	0	3	0	5
#29 Pool 156 ft	8	3	0	5	5	2	0	3	3	2	0	1	16	7	0	9	0	16
Pools Combined 258 ft													21.4	9	0	12	0	21
#28 Run 38 ft	5	0	0	5	1	0	0	1	1	1	0	0	7.2	1	0	6.1	0	7.1
All Habitats Combined 347 ft													59.3	18.8	3.3	41.4	2.2	62.4

Length of Stream Sampled (ft): 347 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.1709/ 0.0542

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0095/ 0.1256

Steelhead Sampling Results

Date: 9Sep06 **Stream:** Zayante **Sampled by:** Alley, Steiner, Wheeler
Sampling Site: 13d (below Mt.Charlie) **Water Temp. and Times:** 63 F @ 1842hr, 18Aug06. (Air temp. 70 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#26 Step-run (partial) 25 ft	15	9	1	7	8	8	0	0	0	0	0	0	23	17	1	7	0	24
#20 Pool 67 ft	31	24	0	7	5	5	0	0	7/ 4	6/ 4	0/ 0	1/ 0	47	39	0	8	0	47
#25 Pool 55 ft	25	19	1	7	4	2	0	2	2	2	0	0	31	23	1	8.3	1	32.3
Pools Combined 122 ft													78	62	1	16.3	1	79.3
#18 Riffle 14 ft	2	2	0	0	1	1	0	0	2/ 0	1/ 0	0/ 0	1/ 0	5	4	0	1	0	5
#19 Run 20 ft	15	11	1	5	0	0	0	0	2/ 0	1/ 0	0/ 0	1/ 0	17	12	1	6	0	18
All Habitats Combined 181 ft													123	95	3	30.3	1	126.3

Length of Stream Sampled (ft): 181 ft
2003-2008
Young-of-the-Year / Size Class 1 per Foot of Stream: 0.6796/ 0.5249

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0166/ 0.1729

Steelhead Sampling Results

Date: 6Sep06 **Stream:** Lompico **Sampled by:** Alley, Steiner, Kittleson, Collins
Sampling Site: 13e (below turnout) **Water Temp. and Times:** 60.5 F @ 1257hr, 21Aug06. (Air temp. 70 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#36 Riffle 14 ft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
#35 Pool 77 ft	22	18	1	5	3	2	0	1	3	3	0	0	28	23.1	1	6.1	0	29.2
#38 Pool 50 ft	7	7	2	2	3	3	0	0	5/0	2/0	0/0	3/0	15	12	2	5	0	17
Pools Combined 127 ft													43	35.1	3	11.1	0	46.2
#37 Run 19 ft	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0	1
#43 Step-run 51 ft	6	6	1	1	1	1	0	0	0	0	0	0	7.1	7.1	1	1	0	8.1
All Habitats Combined 211 ft													51.1	43.2	4	12.1	0	55.3

Length of Stream Sampled (ft): 211 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.2422/ 0.2047

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0190/ 0.0573

Steelhead/Coho Salmon Sampling Results

Date: 12Sep06 Stream: Bean Ck Sampled by: Alley, Steiner, Heady
Sampling Site: 14b (below Lockhart Gu.) Water Temp.and Times:

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#57 Riffle 22 ft	1	0	1	2	1	0	0	1	1	0	0	1	3	0	1	4	0	4
#48 Pool 105 ft	12	0	2	14	0	0	0	0	1/ 0	0/ 0	1/ 1	2/ 1	13	0	4	16	1	17
#59 Pool 76 ft	8	1	0	7	1	1	0	0	1	0	0	1	10	2	0	8.4	0	10.4
Pools Combined 181 ft													23	2	4	24.4	1	27.4
#58 Run 44 ft	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1
All Habitats 247 ft													27	3	5	28.4	1	32.4

Length of Stream Sampled (ft): 247 ft
Young-of-the-Year/ Size Class 1 per Ft of Stream: 0.1093/ 0.0121
Yearlings and 2+/ Size Classes 2 and 3 per Ft of Stream: 0.0202/ 0.1190

Steelhead/ Coho Salmon Sampling Results

Date: 1Sep06 **Stream:** Bean Ck **Sampled by:** Alley, Steiner, Wheeler
Sampling Site: 14c (above Mackenzie Gu.) **Water Temp. and Times:** 61 F 1353hr, 17Aug06. (Air temp. 69 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#37 Riffle 36 ft	6	6	0	0	0	0	0	0	0	0	0	0	6	6	0	0	0	6
#34 Pool 68 ft	31	21	3	13	20	16	1	5	5	4	0	1	66.7	52.6	4.2	20.1	0	72.7
#39 Pool 71 ft	23	21	6	8	8	8	3	3	2	1	0	1	41	31.7	3.3	12.6	0	44.3
Pools Combined 139 ft													107.7	84.3	7.5	32.7	0	117
#38 Run 16 ft	2	2	0	0	1	1	0	0	0	0	0	0	3	3	0	0	0	3
All Habitats Combined 191 ft													116.7	93.3	7.5	32.7	0	126

Length of Stream Sampled (ft): 191 ft
Young-of-the-Year / Size Class 1 per Foot of Stream: 0.6110/ 0.4885
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0414/ 0.1712

Steelhead Sampling Results

Date: 7Sep06 Stream: Newell Sampled by: Alley, Steiner
Sampling Site: 16 Water Temp. and Times: 60 F @ 1517hr. 17Aug06. (Air temp. 68 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#24 Riffle 14 ft	2	2	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	2
#21 Pool 75 ft	14	4	7	17	1	0	1	2	2	1	0	1	17	6	8.1	17.8	2	25.8
#28 Pool 92 ft	8	5	3	6	4	2	1	3	2	0	0	2	16	7.5	4.2	9.6	3.6	20.7
Pools Combined 167 ft													33	13.5	12.3	27.4	5.6	46.5
#23 Run 48 ft	6	3	0	3	2	1	0	1	2/1	2/1	0	0	11	7	0	4	0	11
All Habitats Combined 229 ft													46	22.5	12.3	31.4	5.6	59.5

Length of Stream Sampled (ft): 229 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.2009/ .0983

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0537/ 0.1616

Steelhead Sampling Results

Date: 08Sep06 **Stream:** Boulder **Sampled by:** Alley, Steiner, Reis
Sampling Site: 17a (above Highway 9) **Water Temp. and Times:** 61 F @ 1406hr. 16Aug06. (Air temp. 71 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#2 Riffle 55 ft	13	6	3	10	6	1	0	5	3	2	0	1	24.6	10.1	3	15.5	2.2	27.8
#5 Pool 148 ft	4	2	2	4	6	4	1	3	3	3	0	0	13	9	3	6	1	16
#7 Run 69 ft	11	8	1	4	4	2	0	2	3	1	0	2	19.8	11.2	1	7	1	19.2
#6 Step-run 32 ft	14	5	7	16	4	2	3	5	1	0	0	1	19.5	7.5	10.8	18.6	4.1	30.2
All Habitats Combined 304 ft													76.9	37.8	17.8	47.1	8.3	93.2

Length of Stream Sampled (ft):_304 ft_______

Young-of-the-Year / Size Class 1 per Foot of Stream:_0.2530/0.1243_____

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream:__0.0586/ 0.1822_

Steelhead Sampling Results

Date: 8Sep06 **Stream:** Boulder **Sampled by:** Alley, Steiner, Kittleson, Reis
Sampling Site: 17b (Bracken Brae) **Water Temp. and Times:** 60 F @ 1500 hr, 16Aug06. (Air temp. 66 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#20 Run 27 ft	9	4	0	5	4	3	0	1	0	0	0	0	13	7	0	6	0	13
#24 Riffle 27 ft	11	7	0	4	3	3	0	0	1	1	0	0	15.3	11.8	0	4	0	15.8
#19 Pool 69 ft	30	25	1	6	13	12	0	1	0	0	0	0	46.6	40.8	1	7.1	0	47.9
#21 Pool 68 ft	28	21	1	8	4	3	0	1	0	0	0	0	32.3	24.2	1	9.1	0	33.3
Pools Combined 137 ft													78.9	65	2	16.2	0	81.2
All Habitats Combined 191 ft													107.2	83.8	2	26.2	0	110

Length of Stream Sampled (ft): 191 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.5613/0.4387

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0105/ 0.1372

Steelhead Sampling Results

Date: 7Sep06 **Stream:** Bear **Sampled by:** Alley, Steiner, Heady
Sampling Site: 18a (above and below Hopkins Gu) **Water Temp. and Times:** 63 F @ 1111hr, 11Aug06. (Air temp. 69 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#6 Riffle 20 ft	18	15	0	3	1	1	0	0	2	2	0	0	21	18	0	3	0	21
#5 Pool 76 ft	32	22	2	12	5	1	0	4	2	2	0	0	38.9	25	2	14	2	41
#10 Pool 131 ft	34	26	1	9	10	8	0	2	7	6	0	1	53.3	44	1	12.1	0	56.1
Pools combined 207 ft													92.2	69	3	26.1	2	97.1
#7 Run 32 ft	16	13	0	3	1	0	0	1	2/0	2/0	0/0	0/0	19	15	0	4	0	19
All Habitats Combined 259 ft													132.2	102	3	33.1	2	137.1

Length of Stream Sampled (ft): 259 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.5097/ 0.3938

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0157/ 0.1355

Steelhead Sampling Results

Date: 20Sep06 **Stream:** Branciforte **Sampled by:** Alley, Steiner, Reis
Sampling Site: 21a (below Granite Ck) **Water Temp. and Times:** 60 F @ 1455 hr, 15Aug06. (Air temp. 68 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#5 Riffle-run 45 ft	7	3	0	4	3	3	0	0	1	1	0	0	11.8	7	0	4	0	11
#8 Pool 38 ft	13	6	0	7	10	5	0	5	1	0	0	1	30.4	14.6	0	16	0	30.6
#10 Pool 124 ft	12	8	0	4	4	4	0	0	3	3	0	0	24.5	18.5	0	4	0	22.5
Pools Combined 162 ft													54.9	33.1	0	20	0	53.1
#7 Run 34 ft	5	4	0	1	2	1	0	1	0	0	0	0	7	5	0	2	0	7
All Habitats Combined 241 ft													73.7	45.1	0	26	0	71.1

Length of Stream Sampled (ft):_241 ft___

Young-of-the-Year / Size Class 1 per Foot of Stream:_0.3058/ 0.1871_____

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream:__0 / 0.1079_

Steelhead/ Coho Salmon Sampling Results

Date: 20Sep06 Stream: Soquel Sampled by: Alley, Steiner, Reis
Sampling Site: 4 Adjacent Flower Field. Water Temp. and Times: 67 F @ 1658 hr

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#8 Run 27 ft	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1
#7 Riffle 70 ft	2	0	0	2	2	0	0	2	0	0	0	0	4	0	0	4	0	4
#4 Pool 191 ft	1	0	2	3	1	0	0	1	0	0	0	0	2	0	2	2	2	4
All Habitats Combined 288 ft													7	1	2	6	2	9

Length of Stream Sampled (ft): 288 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.0243/ 0.0035
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0069/ 0.0278

Steelhead/ Coho Salmon Sampling Results

Steelhead/ Coho Salmon Sampling Results

Date: 21Sep06 **Stream:** Soquel **Sampled by:** Alley, Steiner, Reis
Sampling Site: 10 (Above Allred) **Water Temp. and Times:** 65 F @ 1428 hr, 22Aug06 (air temp. 73 F)

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#15 Run Partial 88 ft	5	5	0	0	1	0	0	1	0	0	0	0	6	5	0	1	0	6
#13 Pool 128 ft	13	6	1	8	3	1	0	2	0	0	0	0	16.4	7.1	1	9.3	1	17.4
#14 Riffle 28 ft	4	1	0	3	1	0	0	1	1	1	0	0	6.3	2	0	4	0	6
All Habitats Combined 244 ft													28.7	14.1	1	14.3	1	29.4

Length of Stream Sampled (ft): 244 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.1176/ 0.0578
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0041/ 0.0627

Steelhead/ Coho Salmon Sampling Results

Date: 21Sep06 Stream: E. Branch Soquel Sampled by: Alley, Steiner, Wheeler
Sampling Site: 13a (Adjacent Millpond) Water Temp. and Times: 68 F @ 1815 hr, 22Aug06 (air temp. 66 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#26 Riffle 29 ft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
#29 Run 58 ft	1	0	2	3	1	0	0	1	0	0	0	0	2	0	2	4	0	4
#30 Pool 140 ft	4	0	0	4	1	0	0	1	0	0	0	0	5.1	0	0	5.1	0	5.1
#31-32 Pool 61 ft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pools Combined 201 ft													5.1	0	0	5.1	0	5.1
All Habitats Combined 288 ft													7.1	0	2	9.1	0	9.1

Length of Stream Sampled (ft): 288 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.0247/ 0

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0069/ 0.0316

Steelhead/ Coho Salmon Sampling Results

Date: 22Sep06 Stream: E. Br. Soquel Sampled by: Alley, Steiner, Wheeler
Sampling Site: 16 (Below Long Ridge Rd) Water Temp. and Times: 63 F@ 1500 hr, 23Aug06; (air temp. 74.5 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#7 Pool 75 ft	47	41	3	9	13	13	0	0	3	3	0	0	64.4	58.9	3	9	0	67.9
#9 Pool 111 ft	29	26	6	9	10	9	0	1	6	5	0	1	47.8	42.3	6	10	1	53.3
Pools Combined 186 ft													112.2	101.2	9	19	1	121.2
#11 Run 39 ft	26	23	0	3	6	6	0	0	0	0	0	0	32.8	29.9	0	3	0	32.9
#6 Riffle 29 ft	18	18	0	0	2	2	0	0	2	2	0	0	22	22	0	0	0	22
All Habitats Combined 254 ft													167	153.1	9	22	1	176.1

Length of Stream Sampled (ft): 254 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.6575/ 0.6028
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0354/ 0.0906

Steelhead/ Coho Salmon Sampling Results

Date: 25Sep06 **Stream:** W. Br. Soquel **Sampled by:** Alley, Steiner, Wheeler
Sampling Site: 19 (below Hester) **Water Temp. and Times:**

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#2 Riffle-run 65 ft	9	3	1	7	4	3	0	1	0	0	0	0	14.1	6	1	7.1	1	14.1
#1 Pool 100 ft	5	0	0	5	0	0	0	0	0	0	0	0	5	0	0	5	0	5
#3 Pool 138 ft	2	2	0	0	2	1	0	1	2/0	2/0	0	0	6	5	0	1	0	6
Pools Combined 238 ft													11	5	0	6	0	11
All Habitat 303 ft													25.1	11	1	13.1	1	25.1

Length of Stream Sampled (ft):_303 ft______
Young-of-the-Year / Size Class 1 per Foot of Stream:_0.0828/ 0.0363____
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream:__0.0033/ 0.0465

Steelhead/ Coho Salmon Sampling Results

Date: 22Sep06 Stream: W. Br. Soquel Sampled by: Alley, Steiner, Wheeler
Sampling Site: 20 (Below Olsen Rd Bridge) Water Temp. and Times: 60.5 F @ 1040 hr, 23Aug06. (Air temp. 61 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#6 Riffle 34 ft	6	4	0	2	2	2	0	0	1	1	0	0	9.4	8	0	2	0	10
#4 Run 19 ft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
#5 Pool 103 ft	20	14	1	7	4	4	0	0	0	0	0	0	24.1	18.7	1	7	0	25.7
All Habitats Combined 156 ft													33.5	26.7	1	9	0	35.7

Length of Stream Sampled (ft): 156 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.2147/ 0.1712

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0064/ 0.0577

Steelhead/ Coho Salmon Sampling Results

Date: 03Oct06 Stream: W. Br. Soquel Sampled by: NOAA Fisheries (Freund/ Sogard)
Sampling Site: 21 (Above GS Falls I) Water Temp. and Times:

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
All Habitats* 328 ft	116	78	4	42	11	7	0	4	13	13	0	0	140	98.7	4	46.2	0	144.9
All Habitats Combined 328 ft													140	98.7	4	46.2	0	144.9

Length of Stream Sampled (ft): 328 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.4268/ 0.3009

Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0122/ 0.1408

*Sampling site was 328 ft (100 m) of continuous stream channel that included 2 partial pools (one at lower boundary and one at upper boundary), 2 complete pools and 3 riffles. It did not include run or step-run habitat. Location was 800 feet downstream of Girl Scout Falls II.

Steelhead/ Coho Salmon Sampling Results

Date: 25Sep06 **Stream:** W.Br. Soquel **Sampled by:** Alley, Steiner, Kittleson, Wheeler **Sampling Site:** 22 (Above G.S. Falls II) **Water Temp. and Times:**

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass/ Fourth Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#15 Step-run 59 ft	7	5	0	2	1	1	0	0	1	1	0	0	9	7.2	0	2	0	9.2
#19 Step-run-riffle 14 ft	2	2	0	0	1	1	0	0	0	0	0	0	3	3	0	0	0	3
Step-runs Combined 73 ft													12	10.2	0	2	0	12.2
#16 Pool 147 ft	6	3	4	7	0	0	0	0	1	0	0	1	7	3	4	6	2	11
#17-18 Pool 63 ft	2	1	2	3	0	0	0	0	0	0	0	0	2	1	2	3	0	4
#20 Pool 90 ft	2	1	5	6	3	2	0	1	1	0	0	1	6	3	5	7.1	1	11.1
Pools Combined 300 ft													15	7	11	16.1	3	26.1
All Habitats Combined 446 ft													27	17.2	11	18.1	3	38.3

Length of Stream Sampled (ft):_446 ft_____
Young-of-the-Year / Size Class 1 per Foot of Stream:_0.0605/ 0.0386
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream:__0.0247/ 0.0473

Steelhead/ Coho Salmon Sampling Results

Date: 26Sep06 **Stream:** Aptos **Sampled by:** Alley, Steiner, Reis
Sampling Site: 3 (Adj. County Park) **Water Temp. and Times:** 58 F@ 1320 hr, 18Aug06; (air temp. 66 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#27 Pool 76 ft	13	5	2	10	4	1	1	4	2	1	0	1	19.7	7.2	3.3	14.8	1.1	23.1
#31 Pool 74 ft	12	3	5	14	6	2	0	4	2	2	0	0	22.3	7	5	17.7	1	25.7
Pools Combined 150 ft													42	14.2	8.3	32.5	2.1	48.8
#32 Run 89 ft	13	2	0	11	2	0	0	2	1	0	0	1	16	2	0	14	0	16
#28 Riffle 27 ft	4	2	0	2	1	1	0	0	0	0	0	0	5	3	0	2	0	5
All Habitats Combined 266 ft													63	19.2	8.3	48.5	2.1	69.8

Length of Stream Sampled (ft): 266 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.2368/ 0.0722
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0312/ 0.1902

Steelhead/ Coho Salmon Sampling Results

Date: 26Sep06 **Stream:** Aptos **Sampled by:** Alley, Steiner, Reis
Sampling Site: 4 (Above Steel Bridge) **Water Temp. and Times:** 59 F@ 1400 hr, 22Aug06; (air temp. 72 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#25 Pool 138 ft	35	30	2	6	13	11	1	3	7	7	0	0	58.8	51.8	3.3	9	1	61.8
#28 Pool 66 ft	10	9	3	4	4	2	1	3	2	2	1	1	17.3	13.5	5.7	9.1	1.3	23.9
Pools Combined 204 ft													76.1	65.3	9	18.1	2.3	85.7
#26 Riffle 49 ft	11	7	0	4	5	4	0	1	1	1	0	0	18.4	13.7	0	5.1	0	18.8
#27 Run 28 ft	7	5	0	2	1	1	0	0	1	1	0	0	9	7.2	0	2	0	9.2
#29 Step-run 22 ft	3	0	0	3	0	0	0	0	0	0	0	0	3	0	0	3	0	3
All Habitats Combined 303 ft													106.5	86.2	9	28.2	2.3	116.7

Length of Stream Sampled (ft): 303 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.3515/ 0.2845
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0297/ 0.1007

Steelhead/ Coho Salmon Sampling Results

<u>Date:</u> 27Sep06 <u>Stream:</u> Valencia <u>Sampled by:</u> Alley, Steiner, Kittleson, Reis
<u>Sampling Site:</u> 2 (below road xing) <u>Water Temp. and Times:</u> 60 F@ 1620 hr, 16Aug06; (air temp. 68 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#51 Pool 39 ft	5	5	4	4	3	3	1	1	0	0	1	1	9.3	9.3	6.3	5.3	1	15.6
#53 Pool 19 ft	3	3	0	0	1	1	0	0	0	0	0	0	4.2	4.2	0	0	0	4.2
#55 Pool 28 ft	5	5	0	0	3	3	0	0	1	1	0	0	10.5	10.5	1	1	0	11.5
Pools Combined 86 ft													24	24	7.3	6.3	1	31.3
#54 Run 94 ft	14	14	2	2	3	3	0	0	2	2	0	0	19.2	19.2	2	2	0	21.2
#56 Run 43 ft	11	11	0	0	3	3	0	0	1	1	0	0	15.3	15.3	0	0	0	15.3
Runs Combined 137 ft													34.5	34.5	2	2	0	36.5
#48 Riffle 24 ft	2	2	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	2
All Habitats Combined 247 ft													60.5	60.5	9.3	8.3	1	69.8

Length of Stream Sampled (ft): 247 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.2449/ 0.2449
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0377/ 0.0377

Steelhead/ Coho Salmon Sampling Results

Date: 276Sep06 Stream: Valencia Sampled by: Alley, Steiner, Kittleson
Sampling Site: 3 (Above road xing) Water Temp. and Times: 60 F@ 1710 hr, 18Aug06; (air temp. 67 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#41 Pool 51 ft	10	10	5	5	1	1	1	1	0	0	0	0	11.1	11.1	6.1	5.1	1	17.2
#44 Pool 20 ft	3	3	4	4	3	3	0	0	0	0	1	1	6	6	5	5	0	11
#46 Pool 66 ft	5	5	8	8	4	4	2	2	0	0	0	0	11.6	11.6	10.3	10.3	0	21.9
Pools Combined 71 ft													28.7	28.7	21.4	20.4	1	50.1
#43 Run 35 ft	4	4	3	3	2	2	0	0	0	0	0	0	6	6	3	3	0	9
#40 Riffle 17 ft	4	4	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	4
All Habitats Combined 189 ft													38.7	38.7	24.4	23.4	1	63.1

Length of Stream Sampled (ft): 189 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.2048/ 0.2048
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.1291/ 0.1291

Steelhead/ Coho Salmon Sampling Results

Date: 29Sep06 Stream: Corralitos Sampled by: Alley, Steiner, Wheeler
Sampling Site: 3 (above Colinas Drive) Water Temp. and Times: 59 F@ 1338 hr, 29Aug06; (air temp. 65 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#6 Pool 77 ft	21	9	2	14	7	2	0	5	4/2	2/2	0/0	2/0	43	15	2	19	2	36
#9 Pool 151 ft	22	16	15	21	4	2	4	6	5	3	2	4	32.1	21.3	21.4	28	4.2	53.5
Pools Combined 228 ft													56.1	36.3	33.4	47	6.2	89.5
#5 Run 38 ft	14	11	0	3	0	0	0	0	0	0	0	0	14	11	0	3	0	14
#7 Riffle 52 ft	7	3	0	4	1	1	1	1	0	0	0	0	8	4.2	1	5.1	0	9.3
All Habitats Combined 318 ft													78.1	51.5	34.4	55.1	6.2	112.8

Length of Stream Sampled (ft):_318 ft____

Young-of-the-Year / Size Class 1 per Foot of Stream:_0.2456/ 0.1619__
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream:__0.1082/ 0.1928

Steelhead/ Coho Salmon Sampling Results

Date: 29Sep06 **Stream:** Corralitos **Sampled by:** Alley, Steiner, Wheeler
Sampling Site: 8 (above Clipper Gu) **Water Temp. and Times:** 60 F@ 1812 hr, 29Aug06; (air temp. 69 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#44 Pool 41 ft	15	9	3	9	2	2	0	0	2	2	0	0	19	13.5	3	8	1	22.5
#47 Pool 102 ft	45	38	4	11	14	13	1	2	3	2	0	1	64	55.3	5.1	10	4	69.3
Pools Combined 143 ft													83	68.8	8.1	18	5	91.8
#45-46 Step-run 58 ft	13	8	0	4	2	1	0	1	1	0	0	1	16	9.1	0	6.3	0	15.4
#49 Riffle 28 ft	2	2	1	1	1	1	0	0	1	1	0	0	4	4	1	1	0	5
All Habitats Combined 229 ft													103	81.9	9.1	25.3	5	112.2

Length of Stream Sampled (ft): 229 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.4498/ 0.3576
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0397/ 0.1323

Steelhead/ Coho Salmon Sampling Results

Date: 02Oct06 Stream: Corralitos Sampled by: Alley, Steiner, Kittleson, Wheeler
Sampling Site: 9 (above Eureka Gu) Water Temp. and Times: 61 F@ 1433 hr, 28Aug06; (air temp. 71 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#51 Pool 31 ft	23	9	1	15	1	0	1	2	1	0	0	1	25	9	2	17	1	27
#53 Pool 31 ft	15	11	4	8	5	3	0	2	3	2	0	1	24.3	16.5	4	10.2	1	27.7
Pools Combined 62 ft													49.3	25.5	6	27.2	2	54.7
#50 Step-run 107 ft	51	31	6	26	21	13	1	9	6	4	2	4	83.2	51.4	10.1	39.9	1	92.3
All Habitats Combined 169 ft													132.5	76.9	16.1	67.1	3	147

Length of Stream Sampled (ft):_169 ft____

Young-of-the-Year / Size Class 1 per Foot of Stream:_0.7840/ 0.4550__
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream:__0.0953/ 0.4160

Steelhead/ Coho Salmon Sampling Results

Date: 02Oct06 Stream: Shingle Mill Sampled by: Alley, Steiner, Kittleson, Wheeler Sampling Site: 1 (below 2nd Road xing) Water Temp. and Times: 58 F@ 1310 hr, 23Aug06; (air temp. 65 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#40 Pool 20 ft	3	2	4	5	0	0	0	0	0	0	0	0	3	4	5	4	1	7
#43 Pool 52 ft	15	9	7	13	2	2	0	0	2	2	0	0	19	13.5	7	8	5	26.5
Pools Combined 72 ft													22	15.5	12	12	6	33.5
#39 Step-run 61 ft	14	11	1	4	1	1	0	0	2/1	0/0	0/0	2/1	18	12	1	7	0	19
#41 Step-run 34 ft	2	2	2	2	0	0	0	0	0	0	0	0	2	2	2	2	0	4
Step-runs Combined 95 ft													20	14	3	9	0	23
All Habitats Combined 167 ft													42	29.5	27	15	6	56.5

Length of Stream Sampled (ft): 167 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.2514/ 0.1766
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0898/ 0.1617

Steelhead/ Coho Salmon Sampling Results

Date: 02Oct06 Stream: Shingle Mill Sampled by: Alley, Steiner, Kittleson, Wheeler Sampling Site: 3 (above 3rd road xing) Water Temp. and Times: 60 F@ 1815 hr, 22Aug06; (air temp. 68 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#46 Pool 47 ft	8	8	3	3	0	0	0	0	0	0	0	0	8	8	3	3	0	11
#44 Pool 34 ft	4	4	1	1	1	1	0	0	2/0	2/0	0/1	0/1	7	7	2	2	0	9
Pools Combined 81 ft													15	15	5	5	0	20
#45 Run 13 ft	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1
#47 Run 53 ft	7	7	0	0	4	4	0	0	0	0	0	0	12.6	12.6	0	0	0	12.6
Runs Combined 66 ft													13.6	13.6	0	0	0	13.6
All Habitats Combined 147 ft													28.6	28.6	5	5	0	33.6

Length of Stream Sampled (ft): 147 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.1946/ 0.1946
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0340/ 0.0340

Steelhead/ Coho Salmon Sampling Results

Date: 28Sep06 Stream: Browns Valley Sampled by: Alley, Steiner, Wheeler
Sampling Site: 1 (below diversion dam) Water Temp. and Times: 57 F@ 1520 hr, 25Aug06; (air temp. 63 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#5 Pool 56 ft	59	53	4	10	18	17	1	2	2	2	0	0	81.7	74.7	5.1	12.2	0	86.9
#9 Pool 77 ft	41	27	3	17	8	4	3	7	6	4	0	2	55.4	35.1	6	25.6	2.1	62.8
Pools Combined 133 ft													137.1	109.8	11.1	37.8	2.1	149.7
#6 Run-riffle 106 ft	74	70	0	4	14	12	0	2	8	8	0	0	96.2	90	0	6.7	0	96.7
#4 Riffle-partial 41 ft	32	32	1	1	3	3	0	0	2	2	0	0	37	37	1	1	0	38
All Habitats Combined 280 ft													270.3	236.8	12.1	45.5	2.1	284.4

Length of Stream Sampled (ft): 280 ft

Young-of-the-Year / Size Class 1 per Foot of Stream: 0.9661/ 0.8457
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream: 0.0432/ 0.1700

Steelhead/ Coho Salmon Sampling Results

Date: 28Sep06 Stream: Browns Valley Sampled by: Alley, Steiner, Wheeler
Sampling Site: 2 (above diversion dam) Water Temp. and Times: 59 F@ 1548 hr, 28Aug06; (air temp. 69 F).

Habitat type & Length (ft)	First Pass				Second Pass				Third Pass				Number Est. / Density Est. per ft					
	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	YOY	C-1	1+	C-2	C-3	Total
#15 Pool 59 ft	47	36	2	13	19	19	0	0	9	8	0	1	80.8	72.1	2	14.2	0	86.3
#17 Pool 46 ft	32	28	2	6	7	6	1	2	2	1	0	1	41.4	35.4	3.3	8.4	1	44.8
Pools Combined 105 ft													122.2	107.5	5.3	22.6	1	131.1
#14 Run 23 ft	21	20	0	1	2	1	0	1	2	2	0	0	25	23	0	2	0	25
#16 Step-run 32 ft	10	7	0	3	2	1	0	1	0	0	0	0	12.2	8.1	0	4.2	0	12.3
#13 Riffle 28 ft	9	9	0	0	4	4	0	0	3	2	0	1	18.7	16.6	0	1	0	17.6
All Habitats Combined 188 ft													178.1	155.2	5.3	29.8	1	186

Length of Stream Sampled (ft):_188 ft____

Young-of-the-Year / Size Class 1 per Foot of Stream:_0.9473/ 0.8255__
Yearlings and 2+ / Size Classes 2 and 3 per Foot of Stream:__0.0282/ 0.1691

APPENDIX C. Habitat and Fish Sampling Data With Size Histograms.