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.)

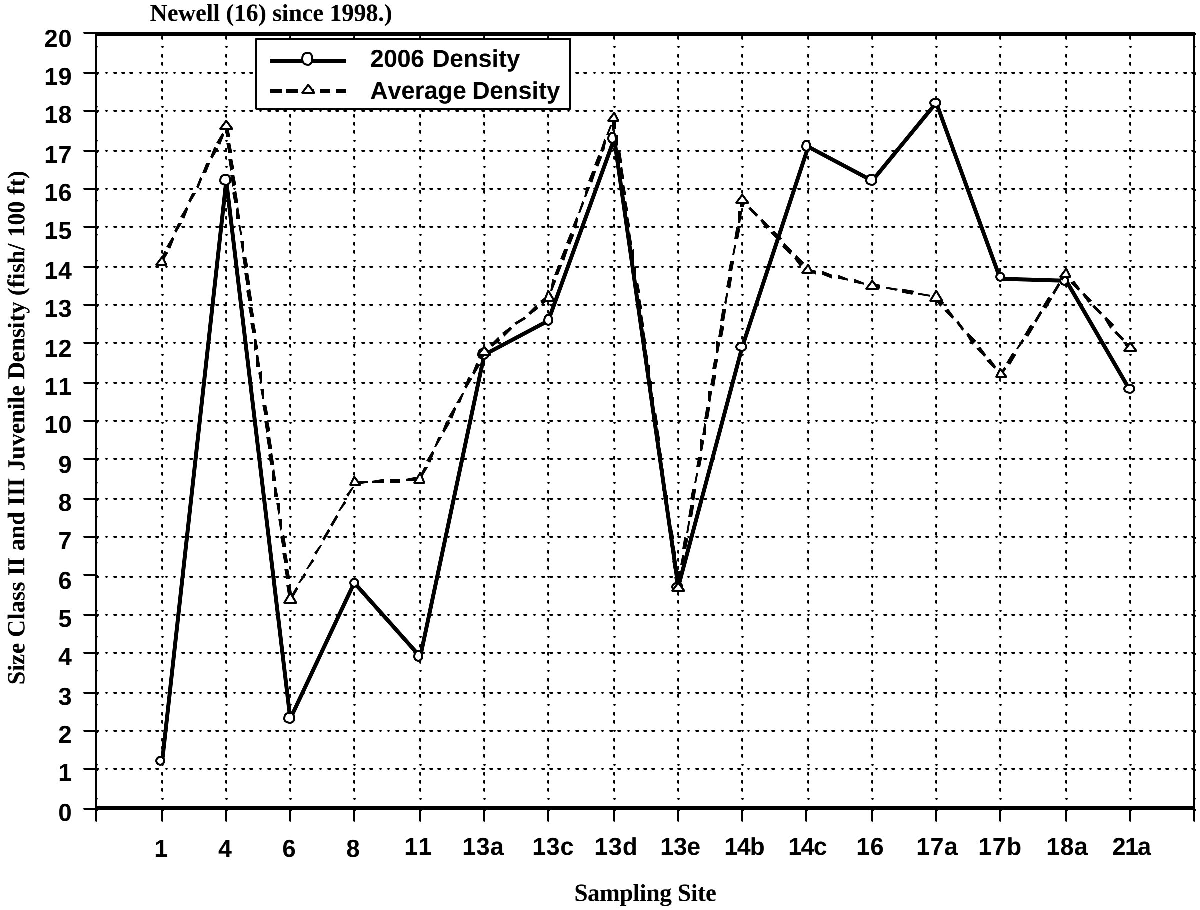


Figure 4. Juvenile Steelhead Site Densities for Size Class II and III Fish in Soquel Creek in 2006 Compared to the 9- or 10-Year Average Density. (Fifth year of sampling above Girl Scout Falls I (21) and 6th below Hester Creek (19).)

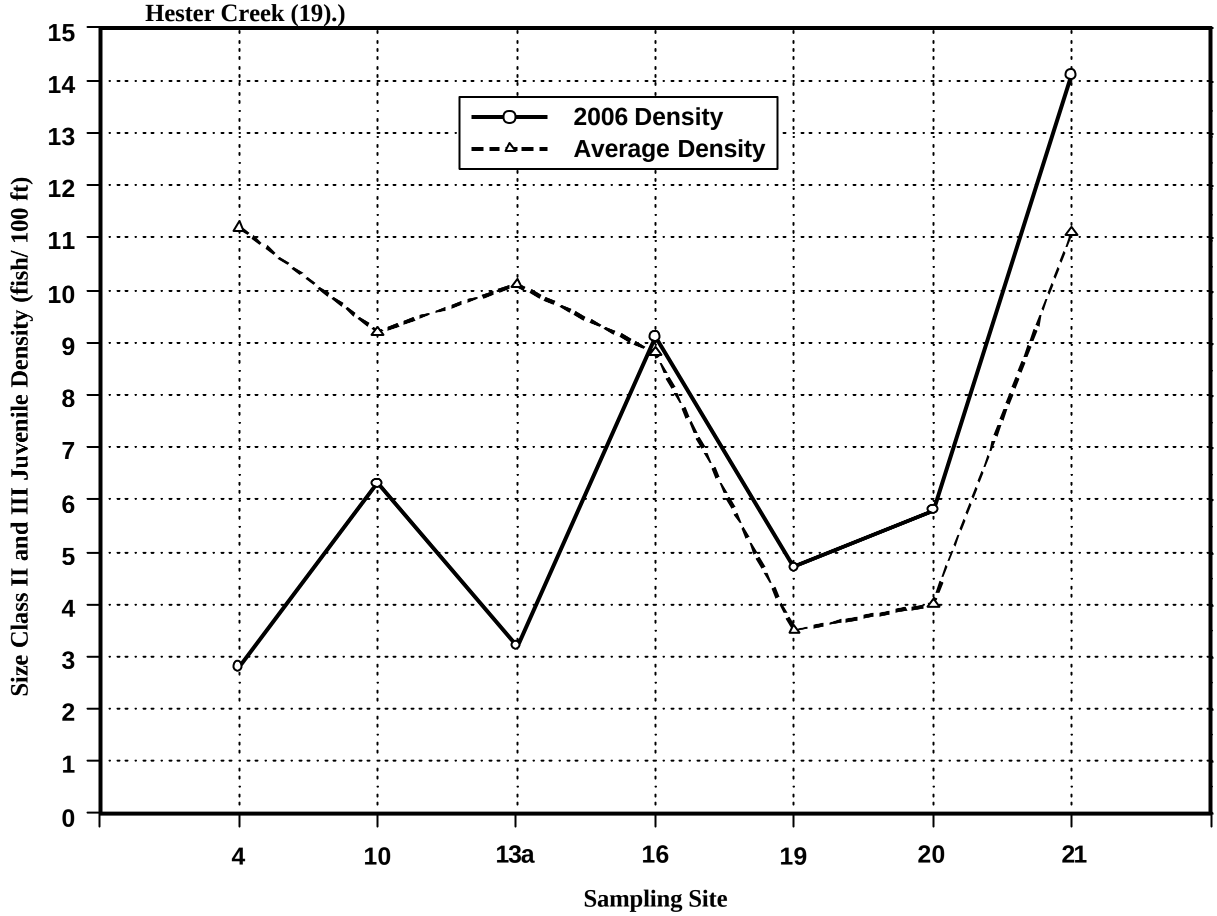


Figure 6. Juvenile Steelhead Site Densities for Size Class II and III Fish in Aptos and Valencia Creeks in 1981 and 2006.

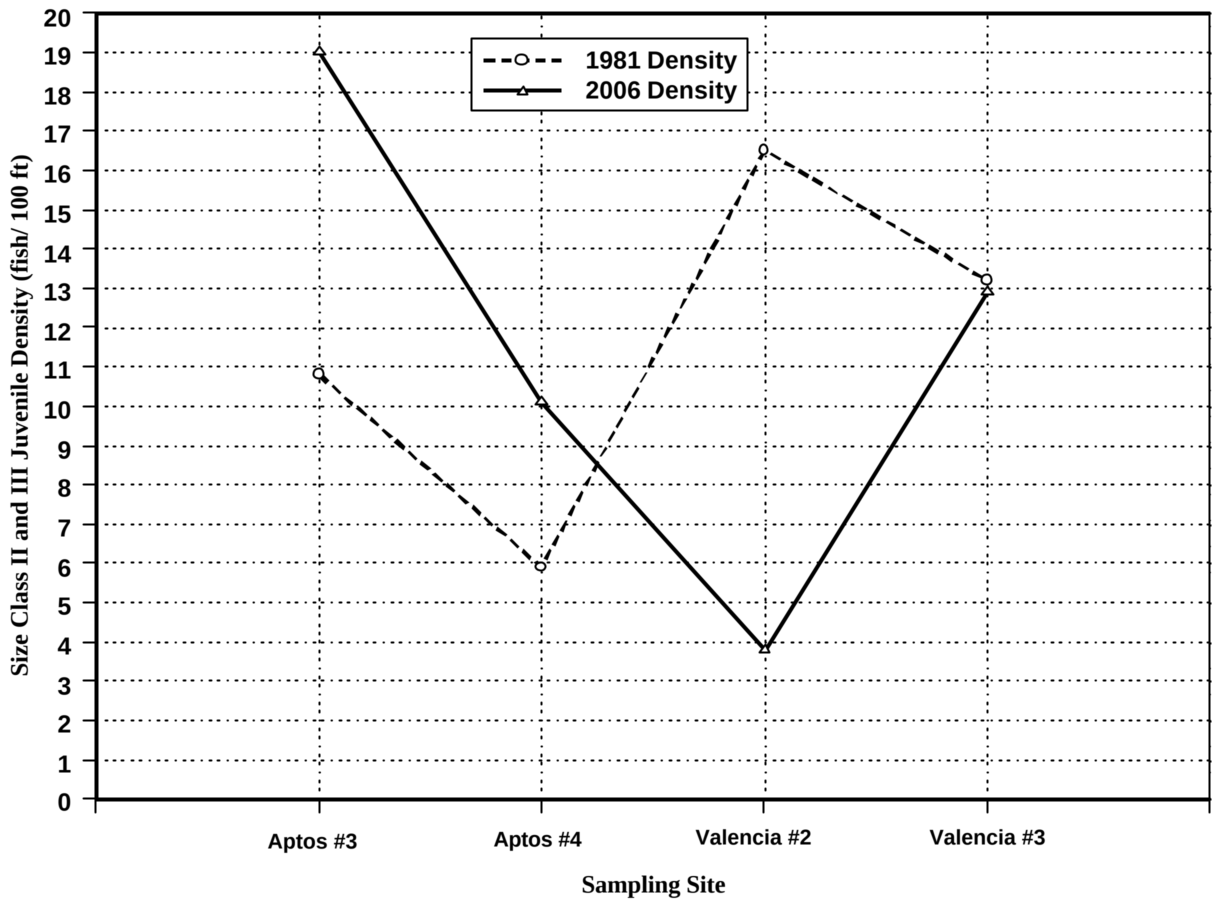
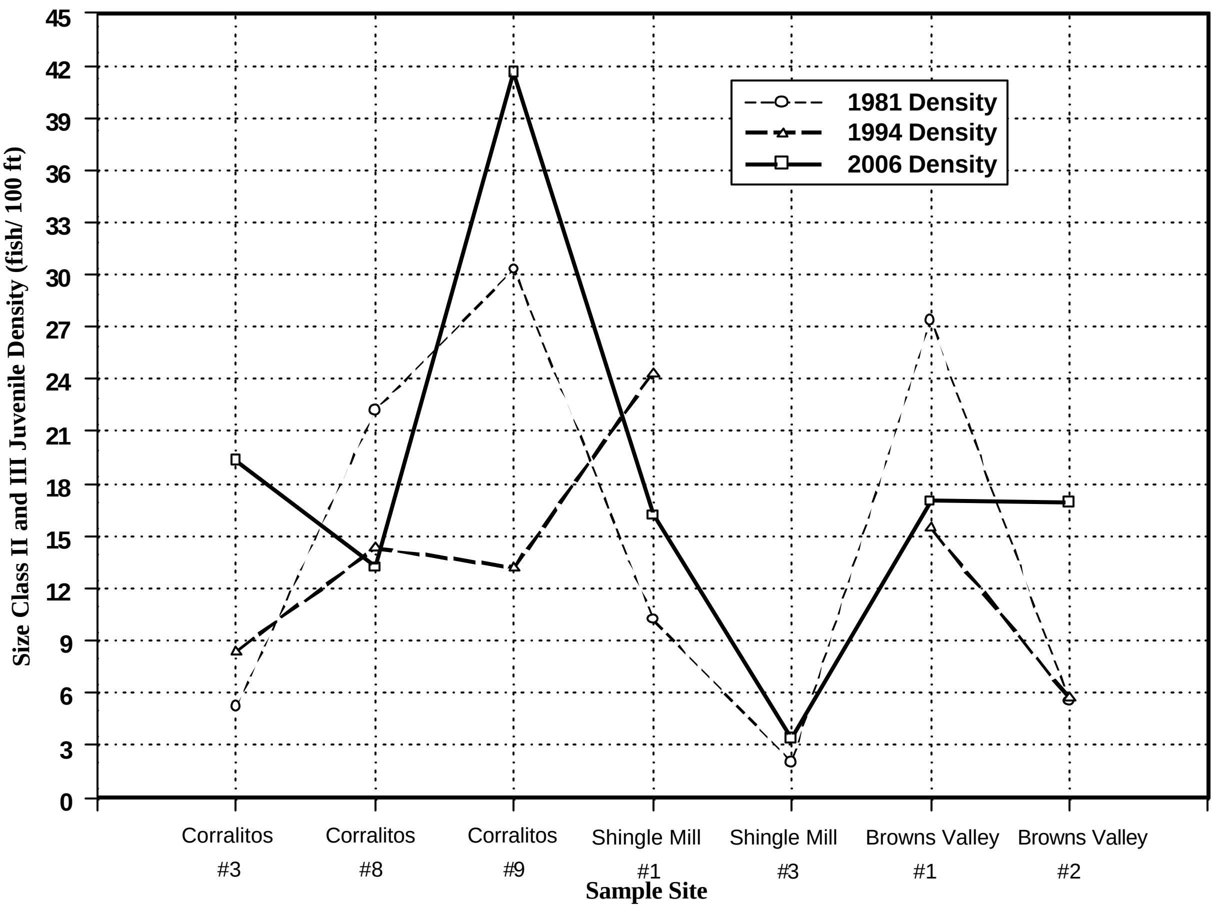


Figure 8. Juvenile Steelhead Site Densities for Size Class II and III Fish in Corralitos, Shingle Mill and Browns Valley Creeks in 1981, 1994 and 2006.



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 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 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

<u>Steelhead Density Comparisons with Other Central Coast Streams.</u> 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.