D.W. ALLEY & Associates aquatic biology

# 2012 SUMMARY REPORT− Juvenile Steelhead Densities in the San Lorenzo, Soquel, Aptos and Corralitos Watersheds, Santa Cruz County, CA

**Good Escape Cover in Mainstem San Lorenzo River – Headwater Waterman Gap Reach**


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# A. EXECUTIVE SUMMARY

In fall 2012, 4 Santa Cruz County watersheds were sampled for juvenile steelhead to compare juvenile abundance and habitat conditions with past years. Watersheds included the San Lorenzo River, Soquel Creek, Aptos Creek and Corralitos Creek. Both Aptos and Pajaro Lagoons were also sampled. Thanks to local water agencies and municipalities, we have sampled the San Lorenzo annually since 1994 except for 2002. We have sampled Soquel Creek annually since 1997 and in 1994. Our annual sampling of Aptos and Corralitos creeks began in 2006, with previous sampling of Corralitos in 1994.

***i. Steelhead Abundance in All Watersheds***

WY2012 streamflows in spring and early summer were near the median streamflow statistic after a mostly dry, mild winter that provided only one stormflow that approached bankfull. Storms came mostly late in the wet season in March and April to provide higher baseflows afterwards than would be expected from such a dry year, though less than previous wet WY2011 that had much above median flows. Since only one significant stormflow occurred prior to March in January 2012, most steelhead spawning was likely late and resulted in more young-of-the-year (YOY) than in 2011 but left primarily small YOY to be sampled in the fall. Because of the mild 2011-2012 winter, yearling survival was higher than in previous wet winters with higher densities than fall 2011, despite being recruited from some of the smallest 2011 YOY densities recorded in our long term monitoring.

Rearing habitat quality declined at the majority of sites due to decreased streamflow (less food), shallower habitat and sometimes less escape cover. Exceptions were sites where more instream wood had accumulated to greatly increase escape cover or where streamside vegetation scoured deeper pool habitat. Soon-to-smolt abundance ratings in many sites were shifted from “Fair” into the “Good” and “Very Good” ranges, despite the low proportion of YOY reaching Size Class II in usually fast-growth sites (**Table S-1**). This was due to the high proportion of yearlings in the Size Class II and III categories in 2012 and soon-to-smolt average lengths of 102 mm Standard Length (SL) or greater.

**Table S-1. Summary of Sampling Site Ratings in 2006−2012, based on Potential Smolt-Sized Densities.**

| Year | Very Poor | Poor | Below Avg | Fair | Good | Very Good |
|---|---|---|---|---|---|---|
| **2006 (n=34)** | 1 | 6 | 5 | 11 | 10 | 1 |
| **2007 (n=37)** | 5 | 2 | 12 | 12 | 6 | 0 |
| **2008 (n=36)** | 5 | 6 | 9 | 10 | 6 | 0 |
| **2009 (n=37)** | 2 | 4 | 11 | 13 | 6 | 1 |
| **2010 (n=39)** | 0 | 1 | 9 | 16 | 12 | 1 |
| **2011 (n=37)** | 1 | 2 | 7 | 18 | 8 | 1 |
| **2012 (n=38)** | 2 | 1 | 6 | 9 | 17 | 3 |

2012 abundance of YOY was generally below average in the San Lorenzo. YOY abundance was near average or greater in the other 3 watersheds, except for much below average densities in middle Corralitos and upper East Branch Soquel. The wide variation in YOY densities within watersheds, with high densities at some sites and low densities at others relative to the long term average, indicated that there were insufficient numbers of late adult spawners to saturate habitat after sporadic spawning effort. Adult fish passage opportunities were limited during the mild 2011-2012 winter with few storm events, and spawning access to sites in the upper mainstem San Lorenzo, upper Zayante Creek, upper East Branch Soquel and upper Corralitos Creek may have been impeded except for one storm in January and 15 March−15 April, late in the spawning season.

Total density for all sizes of juvenile steelhead combined were 1) below average at most sites in the San Lorenzo, 2) near average in Soquel Creek except very low in upper East Branch (in the Soquel Demonstration State Forest), 3) above average in upper Aptos Creek, and 4) near average in Corralitos Creek except above average at lower sites and below average at a middle site that remained heavily sedimented from fire impacts. Average or above average total densities were maintained by above average densities of small YOY and yearlings that survived the mild winter.

***ii. Steelhead Abundance in the San Lorenzo River Watershed***

In the lower and middle mainstem in fall 2012, overall habitat quality declined at most replicated sampling sites primarily due to decreased baseflow and shallower fastwater habitat. There was generally less or similar escape cover, fine sediment and embeddedness compared to 2011. The exception was the lowermost site between the levees where rearing habitat improved despite less streamflow. All replicated tributary reaches and sites had reduced habitat quality primarily due to reduced baseflow and generally shallower pool habitat. Escape cover in pools improved or was similar at a majority of tributary sites. A relatively low percentage of YOY reached Size Class II in 2012 due to late spawning combined with median baseflows early in the growing season and below median baseflows later in the summer in the usually fast-growth sites of the lower mainstem and sometimes fast-growth sites of the middle mainstem and lower Zayante Creek.

YOY abundance in the mainstem was below average at 6 of 8 sites and greater than in 2011 at 5 of 7 replicated sites. YOY abundance in tributaries was below average at 6 of 13 sites and greater than in 2011 at 10 of 12 replicated sites. One YOY chinook salmon (*Oncorhynchus tshawytscha*) was captured at lower Zayante Site 13a from within a large wood cluster. With a milder 2012 winter, fewer redds were destroyed and less small YOY were washed away. However, there were likely insufficient adult spawners to saturate the watershed with eggs and new YOY. Below average YOY densities led to continued below average total juvenile abundance at mainstem sites and the majority of tributary sites.

Yearling densities at mainstem sites were similarly low in 2012 as they have been since 2000 and were slightly below average, consistent with low recruitment from the smallest YOY densities ever detected, in 2011. Yearling densities at tributary sites were below average at 10 of 12 sites but higher than in 2011 at 9 of 12 sites, after a mild winter that increased yearling survival and despite low recruitment from the small 2011 YOY population.

Densities of larger Size Class II and III steelhead are most important because they will soon smolt and contribute to the adult return. Densities of Size Class II and III steelhead at mainstem sites were below average at 6 of 7 sites in 2012 and less than in 2011 at 4 of 7 sites. Size Class II and III abundance in tributaries was below average at 8 of 12 sites and less than in 2011 at 10 of 12 sites. This stemmed from generally low yearling densities and few YOY reaching Size Class II. Eight of 21 sites sampled had "Good" soon-to-smolt ratings (3 Zayante sites, middle Bean, Fall, middle Boulder, lower Branciforte and uppermost mainstem in Waterman Gap (likely resident component)). Two sites had "Very Good" ratings (lowermost mainstem and upper Branciforte (likely with resident component)). Two middle mainstem sites had "Very Poor" ratings in fastwater habitat. The upper mainstem site near Teihl Road had a "Poor" rating, which increases the probability of difficult passage impediments, such as the old dam abutment and concrete apron immediately downstream of that site.

***iii. Steelhead Abundance in the Soquel Creek Watershed***

All reaches had lower summer baseflow in 2012 than 2011, although from mid-March to mid-May the streamflow was above the median flow statistic due to late spring storms. This provided sufficiently high food levels in spring and early summer for a proportion of the late-spawned YOY to reach Size Class II, though not as many as in 2011. Of the 4 reaches and 3 sampling sites compared, 2 of 4 reaches had improved habitat compared to 2009 (greater baseflow and pool depth), while the 3 replicated sites had habitat improvement compared to 2011. This was due to increased escape cover despite generally shallower habitat and less streamflow.

Young-of-the-year (YOY) abundance was near average at 6 of 7 sites, except at Site 16 on the East Branch in the SDSF. There, it was much below average. Apparently, there were too few late spawners to saturate spawning habitat in the upper East Branch during the wet period, 15 March−15 April.

Densities of Size Class II and III steelhead were above average by more than 30% at 4 of 7 sites. This occurred due to 1) sufficient baseflow to allow a proportion of YOY to reach Size Class II in mainstem reaches, 2) average YOY densities in the fast-growth reaches of the mainstem, and 3) relatively high yearling survival and density in the upper East Branch, with high yearling survival and near average densities elsewhere. Soon-to-smolt density ratings improved at 3 of 7 sites to "Good" at Site 10 (above Moores Gulch) and Site 16 (SDSF) and "Fair" at Site 1 (Capitola). Only West Branch Site 19 declined to a "Below Average" rating due to reduced yearling density. Fewer yearlings inhabited the site because of a loss of instream wood and escape cover over the winter. East Branch Site 13a remained in the "Good" range, while Sites 4 and 12 remained "Fair."

The 2012 juvenile steelhead population in Soquel Lagoon was an estimated 220, which was the lowest estimate in 20 years of population estimates and much less than the 20-year average of 1,595. It was about 30% of the 2011 estimate (**Alley 2013**). The 2012 population size fit the typical pattern expected for wetter years when less spawning occurs near the lagoon and lagoon numbers are down, although WY2012 was actually a drier year, having late storms.

***iv. Steelhead Abundance in the Aptos Creek Watershed***

Habitat quality declined in Aptos Creek in 2012. Although lower Aptos Reach 2 had higher baseflow and slightly deeper pool habitat compared to 2009 habitat typing results, it had much less escape cover. In comparing upper Aptos Site #4 in Nisene Marks between 2012 and 2011, it had lower baseflow and suffered sedimentation with substantial shallowing of pools and increased percent fines, though more wood had accumulated to create more escape cover.

YOY abundance was below average in lower Aptos Site #3 and was much above average in upper Aptos Site #4. In the Aptos system, the continued below average YOY density at the lower Aptos site is attributable to sporadic spawning effort by a potentially small adult steelhead population. The lagoon's 2012 juvenile population estimate (140) was only a third the size of the 2011 estimate (423), indicating lower YOY production in the lower watershed than the previous year.

Abundance of larger juveniles (Size Classes II and III => 75 mm SL) was near average at both Aptos sites. This was accomplished at lower Site 3 due to above average yearling density and sufficiently high baseflow in late spring and early summer to allow 30% of the YOY to reach Size Class II. It occurred at the upper site because yearling survival and density were also above average and despite that YOY did not grow into Size Class II as they do in wetter years. Soon-to-smolt ratings were "Good" at both sites due to retention of yearlings that averaged more than 102 mm SL. Yearling densities were above average despite low recruitment from an apparently small YOY population in 2011.

Aptos Lagoon/Estuary was sampled twice in September for steelhead and tidewater goby. Based on recapture data, the 2012 steelhead population estimate was 140, approximately 1/3 the 2011 estimate of 423. Juvenile steelhead were large and represented a significant portion of the soon-to-smolt sized steelhead in the watershed. The estuary was very saline during sampling, with temperature and salinity stratification and good oxygen concentrations throughout. Only the upper 0.5 meter had near freshwater conditions. The diminished number indicated that fewer steelhead likely spawned in the lower watershed than in 2011. Tidewater gobies were captured on each day, indicating a small population was sustaining itself despite artificial breaching during March that drained the estuary and likely artificial breaching before fall sampling.

### ***v. Steelhead Abundance in the Corralitos Creek Sub-Watershed and Pajaro Lagoon***

Net changes in habitat quality were inconsistent in various reaches and sites. Improvement occurred at the lowermost Site #1 on Corralitos Creek, upper Corralitos Reach 7 (Site #9) and upper Browns Site #2. Improved escape cover were positive changes at these sites. However, the two middle reaches in Corralitos (3 and 5/6), along with both Shingle Mill sites and lower Browns Site #1, declined in habitat quality. Decreased baseflow and shallower pool depths contributed to the declines. With reduced baseflow and continuing sediment abundance, pool depth declined in all 3 habitat-typed reaches in Corralitos Creek and at all sites sampled except Corralitos Site #3. Fine sediment and embeddedness were either similar to 2011 or worse in 2012 except for less sediment at Corralitos Site #1. So, Corralitos Creek has not recovered from the fire of 2008, and added sedimentation was occurring in

Browns Creek. On a positive note, during a wood survey in December in Corralitos Creek after bankfull stormflow, spawning gravel appeared more abundant than in recent years since the fire.

With regard to adult steelhead passage above the Corralitos Creek diversion dam between Corralitos Sites #1 and #3, passage conditions through the fish ladder should have been adequate during the protracted rainy season of 15 March−15 April. YOY densities of nearly 40 fish/ 100 feet above the dam at Site #3 (above average YOY density) and Site #9 indicated that adults negotiated the fish ladder to spawn upstream.

As in other watersheds, YOY density increased at 6 of 8 sites in 2012. However, YOY density was only notably above average at the 2 lower Corralitos sites and lower Shingle Mill Site #1. With late spawning and reduced baseflow, very few YOY grew into Size Class II, as had occurred at all but Shingle Mill sites in 2011.

As in other watersheds, yearling densities in 2012 increased at all sites except those in Shingle Mill (6 of 8 sites). Yearling densities were either near average or above average at 7 of 8 sites in 2012. Spring stormflows were apparently mild enough to reduce yearling mortality or failed to allow yearlings to grow sufficiently to leave early or be flushed out, unlike what probably occurred in 2011.

In 2012, Size Class II densities were substantially above average at 2 of 8 sites (Corralitos Site #3 above the dam and upper Browns Site #2 above the dam) due to high yearling densities there. The other 6 sites had near average or below average densities. This was similar to the pattern of higher yearling densities at upper sites in San Lorenzo tributaries and upper East Branch Soquel. Size Class II densities increased at 4 of 8 sites in the Corralitos sub-watershed in 2012 compared to 2011, with increases at the lower 2 Corralitos sites and the 2 Browns Creek sites.

No steelhead were captured during sampling of Pajaro Lagoon in early October, though water quality conditions at that time were not prohibitive for the species. Tidewater goby were present and most abundant at a site that was 3 miles upstream of the beach berm.

## B. INTRODUCTION

***i. Scope of Work***
In fall 2012, 4 Santa Cruz County watersheds were sampled for juvenile steelhead to primarily compare juvenile abundance with past years and habitat conditions at sampling sites and in limited habitat typed segments with those in 2011. Results from steelhead and habitat monitoring are used to guide watershed management and planning (including implementation of public works projects) and enhancement projects for species recovery. Refer to maps in **Appendix A** that delineate reaches and sampling sites. Tables and figures referenced in this summary report and not included may be found in **Appendix B**, the detailed analysis report. Hydrographs of all previous sampling years are included in **Appendix E**.

***ii. Study Area***
***San Lorenzo River.*** The mainstem San Lorenzo River and 8 tributaries were sampled at 21 sites (8 mainstem and 13 tributary sites). Sampled tributaries included Branciforte, Zayante, Lompico, Bean, Fall, Newell, Boulder and Bear creeks. Six half-mile segments were habitat typed in the San Lorenzo system to assess habitat conditions and select habitats of average quality to sample for fish density. For the remaining 15 sites, the 2011 sites were replicated for fish sampling, and depth and cover measurements were made at all sampling sites.

***Soquel Creek.*** Soquel Creek and its branches were sampled at 7 sites (4 mainstem and 3 Branch sites). Four half-mile segments were habitat typed to assess habitat conditions and select habitats of average quality to sample for fish density. For the remaining 3 sites, the 2011 sites were replicated for fish sampling, and depth and cover measurements were made at all sampling sites.

***Aptos Creek.*** Aptos Creek was sampled at two stream sites and in the estuary/lagoon. The lower Aptos reach was habitat typed in a half-mile segment to assess habitat conditions and select habitats of average quality to sample for fish density. For the upper Aptos reach, the 2011 site was replicated for fish sampling, and depth and cover measurements were made at all sampling sites.

***Corralitos Creek.*** In the Corralitos sub-watershed of the Pajaro River drainage, fish sampling included 4 sites in Corralitos Creek, 2 sites in Shingle Mill Gulch and 2 sites in Browns Creek, along with 3 associated half-mile reach segments habitat typed in Corralitos Creek upstream of the diversion dam. Depth and cover measurements were made at all sampling sites.

## C. METHODS

***i. Habitat Assessment***
Refer to the Detailed Analysis Appendix B for more information. Section M-6 in Appendix B describes methods of assessing change in rearing habitat quality. Monitored watersheds included the San Lorenzo, Soquel, Aptos and Corralitos, a sub-watershed of the Pajaro River. Maps of sampling sites, habitat typed segments and reaches contained in **Appendix A** are provided below.

In the San Lorenzo and Soquel watersheds since 1998 and in the Aptos and Corralitos watersheds since 2006, half-mile reach segments were habitat-typed using a modified CDFG Level IV habitat inventory method in mainstem and tributary reaches; with fish sampling sites chosen within each segment based on average habitat conditions. See sampling methods in **Appendix B** for more details. 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, substrate composition and tree canopy. Additional data were collected for escape cover, however, to better quantify it.

***ii. Fish Sampling***

Prior to 2006 juvenile steelhead abundance was estimated by reach. An index of juvenile steelhead population size was estimated by reach and by watershed in the San Lorenzo and Soquel drainages. Indices of adult steelhead population size were also calculated from indices of juvenile population size. Prior to 2006, estimated reach density and fish production could be compared between years and between reaches because fish densities by habitat type were extrapolated to reach density and an index of reach production with habitat proportions within reaches factored in. Since 2006, indices of juvenile population size per watershed were no longer possible because the number of sampling sites had been reduced. Santa Cruz County staff decided in 2006 that indices of juvenile reach production were no longer useful.

Since 2006, fish abundance at sampling sites of average habitat quality in previously determined reach segments of 4 Santa Cruz County watersheds (San Lorenzo, Soquel, Aptos and Corralitos) have been compared to past years' abundances. Comparisons go back to 1997 in the San Lorenzo and Soquel watersheds, 2006 in the Aptos watershed and 1981 in the Corralitos sub-watershed, although consecutive years began in 2006. The proportion of habitat types sampled at each site within a reach was kept similar between years so that site fish densities could be compared between years in each reach. However, site fish density did not necessarily reflect fish densities for entire reaches because the habitat proportions sampled were not exactly similar to the habitat proportions of the reach. In most cases, habitat proportions at sites were roughly similar to habitat proportions in reaches because sampling sites were more or less continuous and lengths of each habitat type were roughly similar to others within reaches. However, in reaches where pools are less common, such as Reach 12a on the East Branch of Soquel Creek and Reach 2 in lower Valencia Creek, a higher proportion of pool habitat was sampled than exists in these respective reaches. More pool habitat was sampled because larger yearlings, almost exclusively utilize pool habitat in small streams, and changes in yearling densities in pools are the most important to monitor. In these two cases, site densities of yearlings were higher than reach densities.

Electrofishing was used to measure steelhead abundance at sampling sites. Captured juvenile steelhead were grouped into two juvenile age classes and three size classes. 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 in 3 passes, a fourth pass was performed, and the fish captured in 4 passes were assumed to be a total count in the habitat. Electrofishing mortality rate has been approximately 1% 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 catch data in the lower and middle mainstem reaches included in **Appendix C**, underwater censusing of deeper pools was incorporated into density estimates with electrofishing data from more shallow habitats.

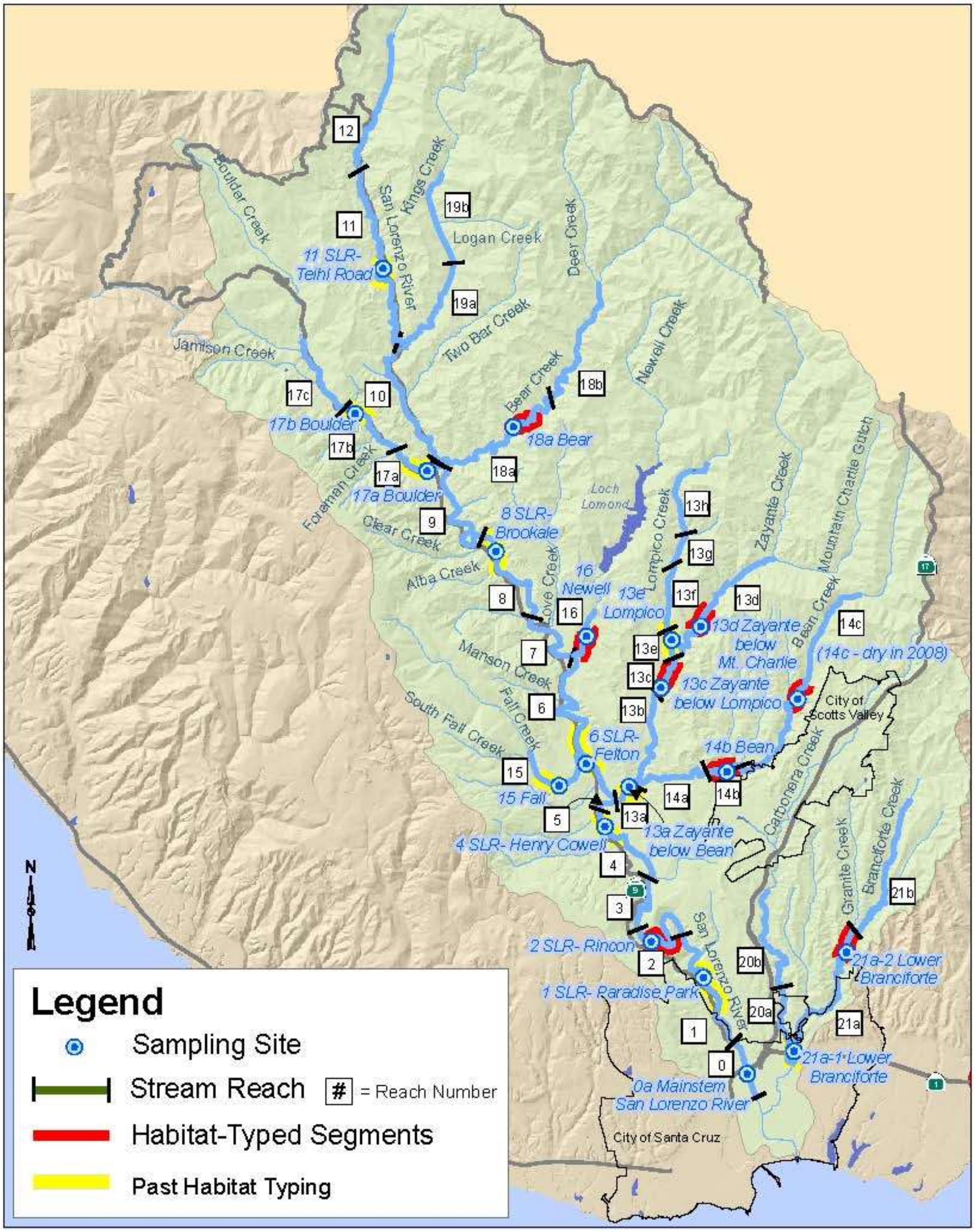



**Figure A-2. San Lorenzo River Watershed.**

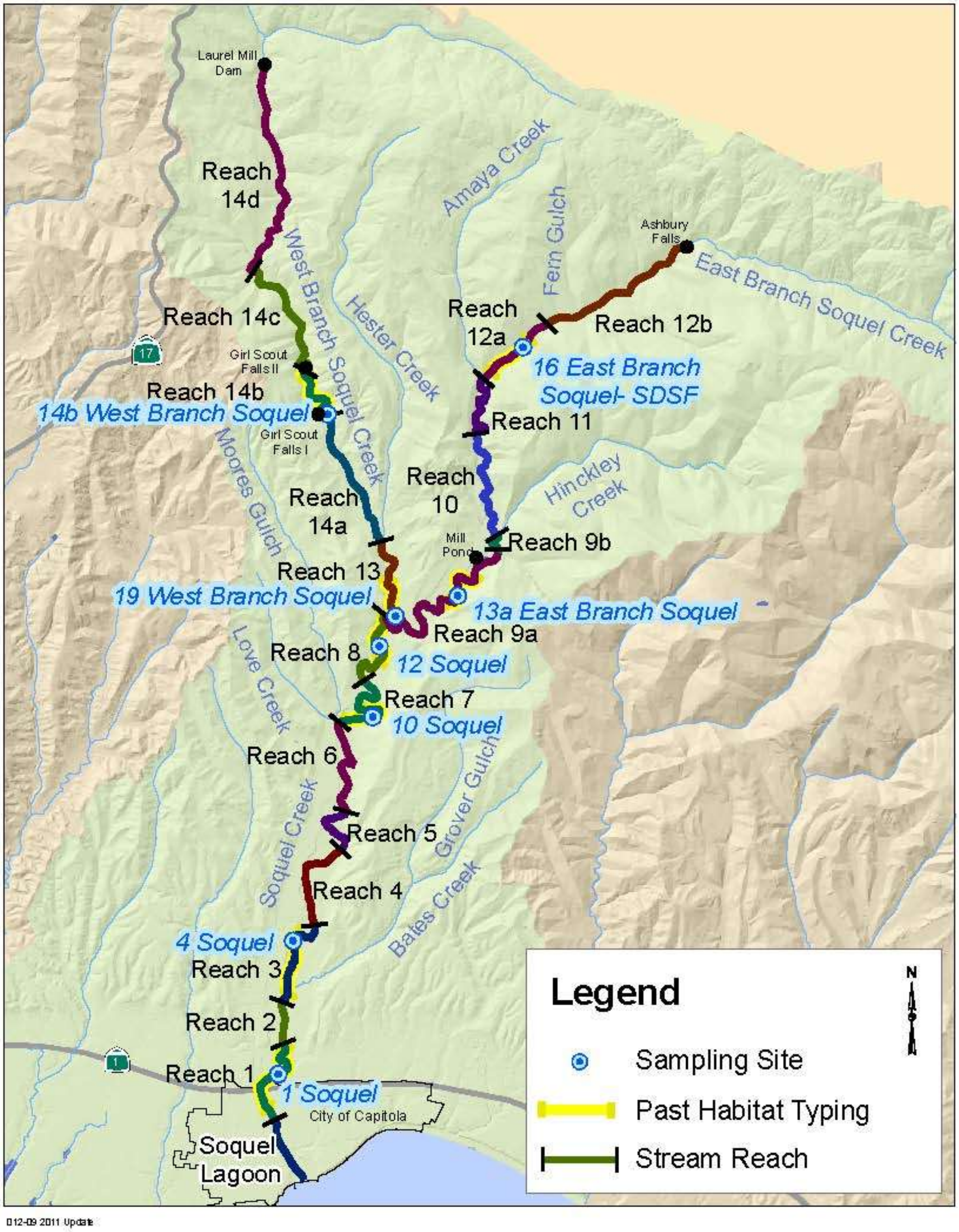
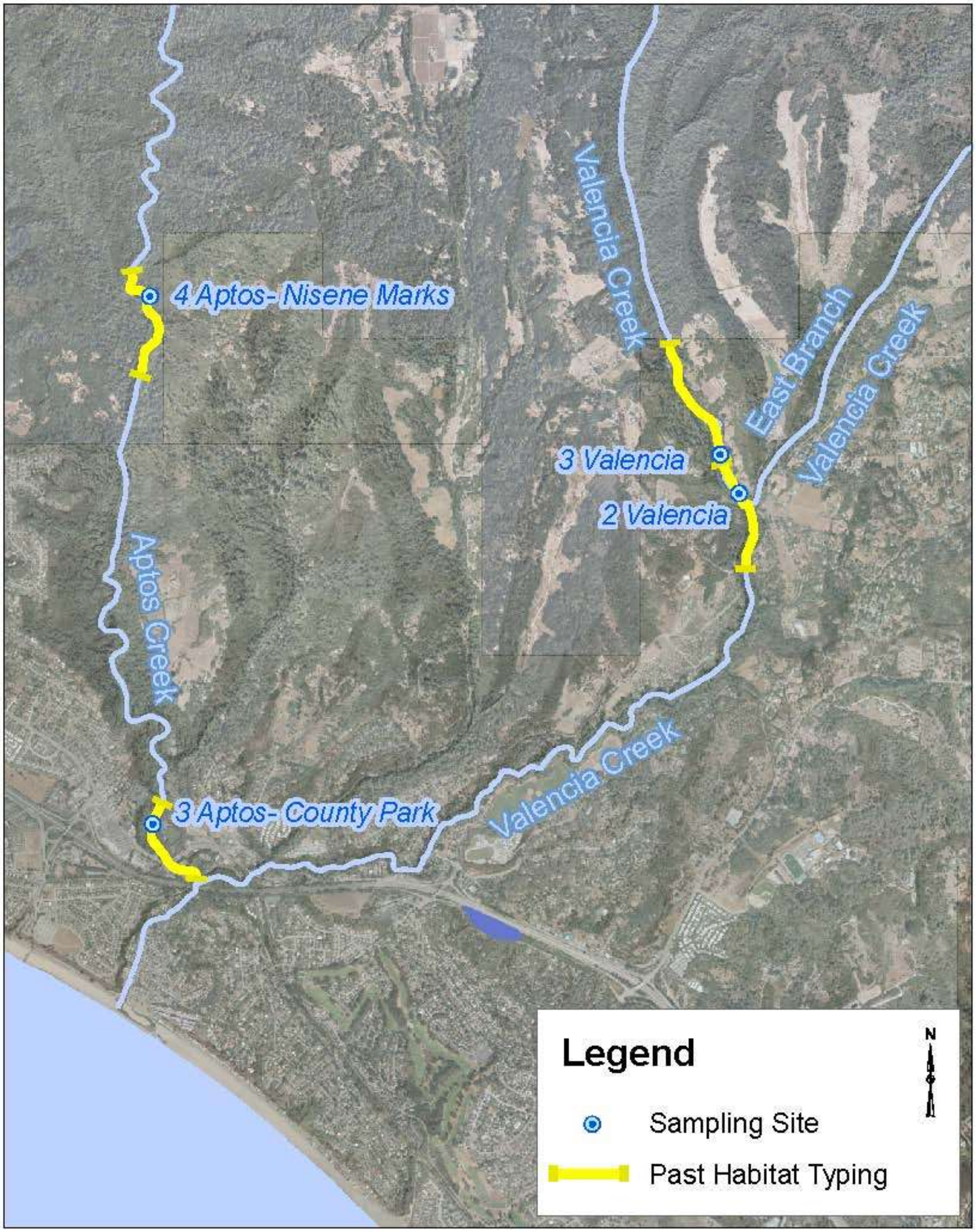



**Figure A-3. Soquel Creek Watershed.**




012-09 2011 Update

**Figure A-6. Aptos Creek Watershed.**

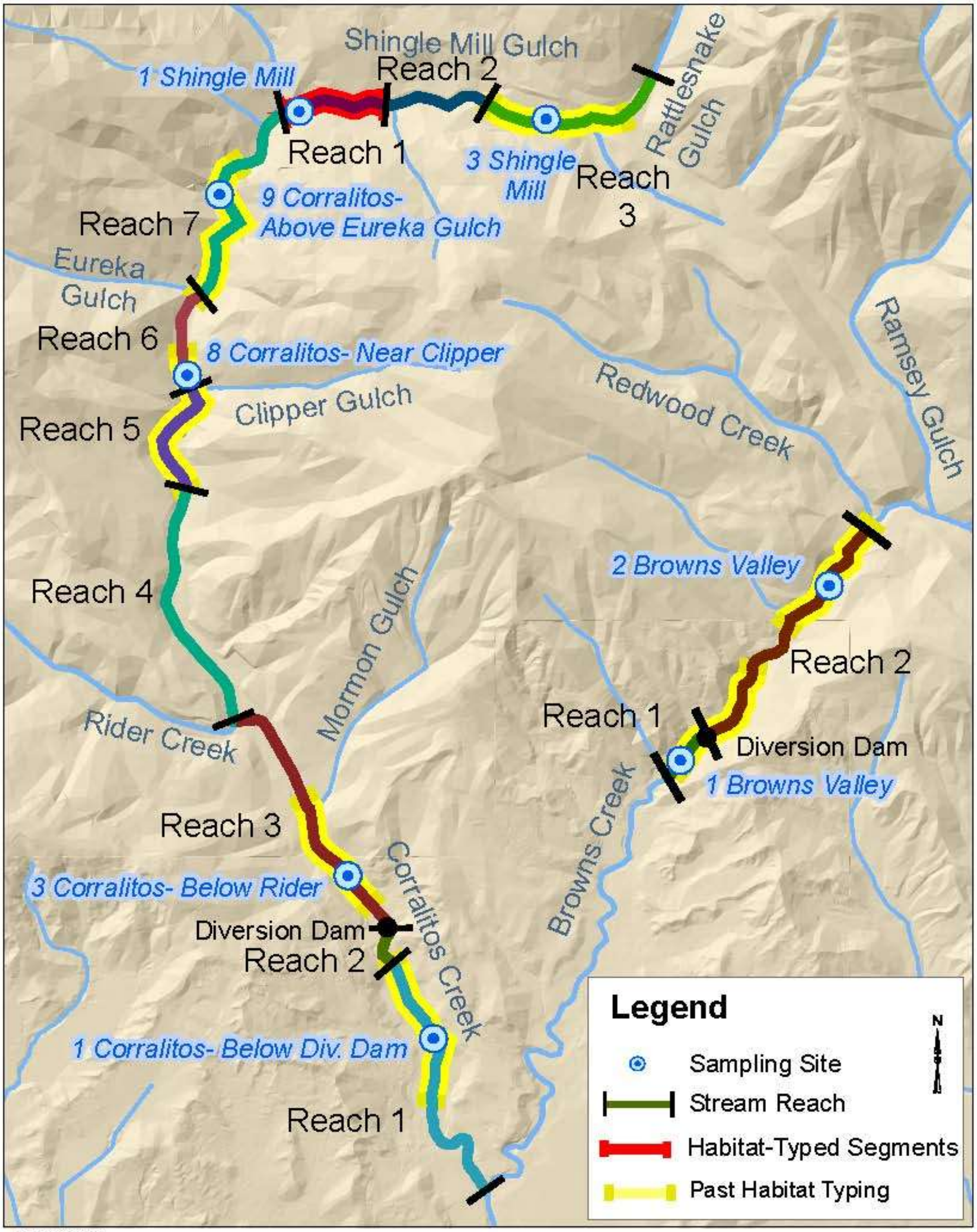



**Figure A-7. Corralitos Creek Sub-Watershed.**

# D. RESULTS

Figures and tables contained in this summary report were extracted from the detailed analysis found in Appendix B.

***i. Steelhead Abundance and Habitat Conditions in All Watersheds***

1. WY2012 streamflows in spring and summer were near the median flow statistic until August, when they declined. They were lower than in WY2011, which had much above median flows. Except for one stormflow in January, the wet season was protracted to a one-month period, 15 March−April 15, in which one of 3 stormflows approached the bankfull level. Streamflow comparisons between years were made for 5-month averages (May through September) expressed in ***Figure B-41 in Appendix B***.

2. Rearing habitat quality declined at the majority of sites due to decreased streamflow (less food), shallower habitat and sometimes less escape cover. Exceptions were sites where more instream wood had accumulated to greatly increase escape cover or where streamside vegetation scoured deeper pool habitat.

3. 2012 abundance of YOY was generally below average in the San Lorenzo. YOY abundance was near average or greater in the other 3 watersheds, except for much below average densities in middle Corralitos and upper East Branch Soquel.

4. The wide variation in YOY densities within watersheds, with high densities at some sites and low densities at others relative to the long term average, indicated that there were insufficient numbers of late adult spawners to saturate habitat after sporadic spawning effort.

5. Adult fish passage opportunities were limited during the mild 2011-2012 winter with few storm events, and spawning access to sites in the upper mainstem San Lorenzo, upper Zayante Creek, upper East Branch Soquel and upper Corralitos Creek may have been impeded except for one storm in January and 15 March−15 April, late in the spawning season.

6. Following the mild winter of WY2012, which likely had no bankfull stormflows, yearling survival was higher than in previous wet winters, and densities were near average or above in all but the San Lorenzo watershed. This was despite yearlings being recruited from the smallest 2011 YOY densities recorded from the San Lorenzo and Soquel watersheds in our long term monitoring.

7. Soon-to-smolt abundance ratings (Size Class II and III steelhead) in many sites were shifted from “Fair” into the “Good” and “Very Good” ranges, despite the low proportion of YOY reaching Size Class II in usually fast-growth sites (**Table S-1**). This was due to the high proportion of yearlings in the Size Class II and III categories in 2012 and average soon-to-smolt lengths of 102 mm Standard Length (SL) or greater (**Tables S-1, S-2 and S-3 below**).

**8.** Total density for all sizes of juvenile steelhead combined were 1) below average at most sites in the San Lorenzo, 2) near average in Soquel Creek except much below average in the Soquel Demonstration State Forest (SDSF), 3) above average in upper Aptos Creek, and 4) highly variable about the average in the Corralitos/Browns Creek complex. Sites with average or above average total densities had above average or above densities of small YOY and/or yearlings that survived the mild winter.

Figure B-42. Averaged Mean Monthly Streamflow for May – September in the San Lorenzo and Soquel Watersheds, 1997-2012.

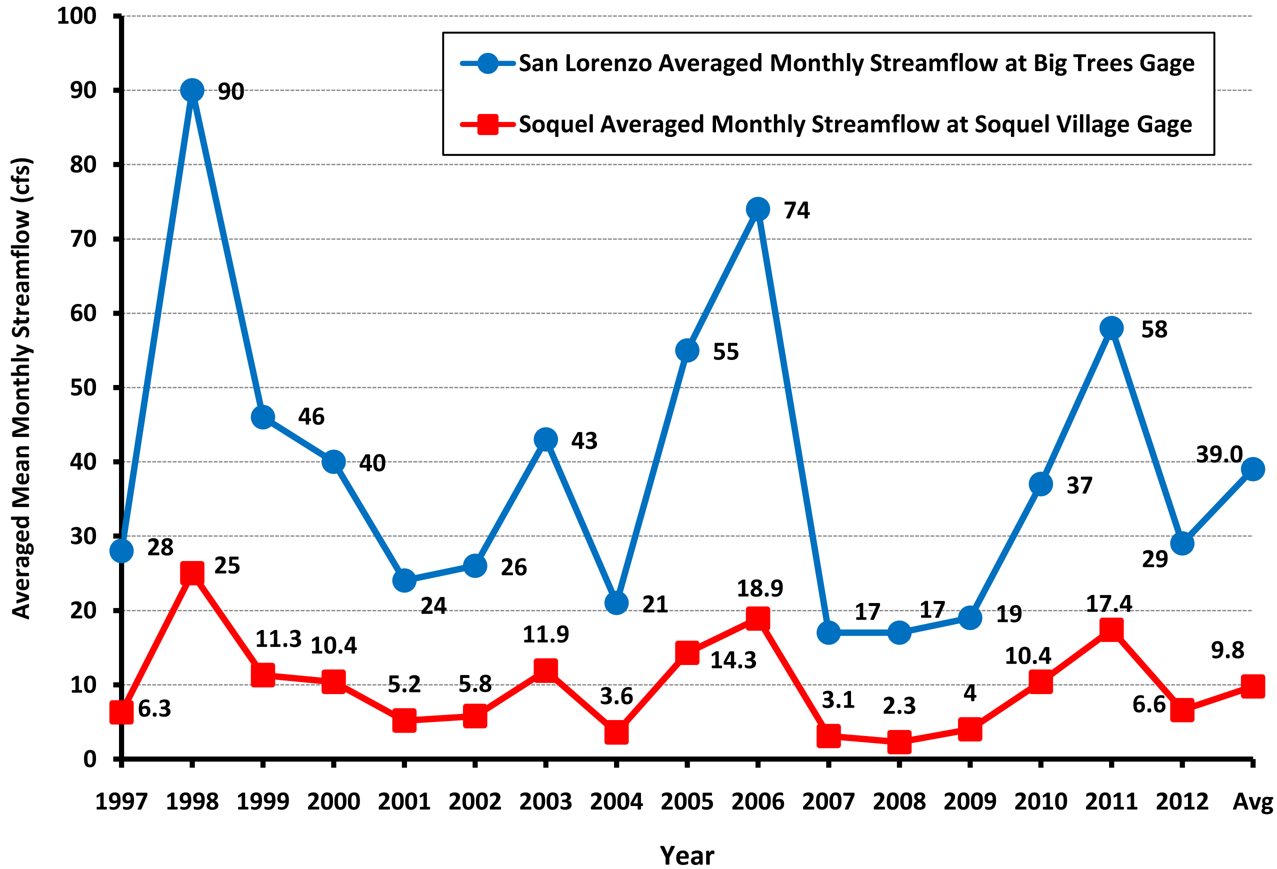


**Table S-1. Summary of Sampling Site Ratings in 2006–2012, based on Potential Smolt-Sized Densities.**

| Year | Very Poor | Poor | Below Avg | Fair | Good | Very Good |
|---|---|---|---|---|---|---|
| **2006 (n=34)** | 1 | 6 | 5 | 11 | 10 | 1 |
| **2007 (n=37)** | 5 | 2 | 12 | 12 | 6 | 0 |
| **2008 (n=36)** | 5 | 6 | 9 | 10 | 6 | 0 |
| **2009 (n=37)** | 2 | 4 | 11 | 13 | 6 | 1 |
| **2010 (n=39)** | 0 | 1 | 9 | 16 | 12 | 1 |
| **2011 (n=37)** | 1 | 2 | 7 | 18 | 8 | 1 |
| **2012 (n=38)** | 2 | 1 | 6 | 9 | 17 | 3 |

**Table S-2. Rating of Steelhead Rearing Habitat For Small, Central Coastal Streams.***
**(From Smith 1982.)**

**1.Very Poor- less than 2 potential smolt-sized** fish per 100 ft of stream.**

**2.Poor*** - from 2 to 4 " " "**

**3.Below Average - 4 to 8 " " "**

**4.Fair - 8 to 16 " " "**

**5.Good - 16 to 32 " " "**

**6.Very Good - 32 to 64 " " "**

**7.Excellent - 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.

** Potential 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.

***The average standard length for potential smolt-sized fish was calculated for each site. If the average was less than 89 mm SL, then the density rating according to density alone was reduced one level. If the average was more than 102 mm SL, then the rating was increased one level.

**Table S-3. 2011 Sampling Sites Rated by Potential Smolt-Sized Juvenile Density (=>75 mm SL) and Average Smolt Size, with Physical Habitat Change since 2011.** (Red denotes ratings of 1 and 2 or negative habitat change; italicized purple denotes ratings of 5 and 6. Methods for habitat change in M-6 of Appendix B).

| Site | Multi-Year Avg. Potential Smolt Density Per 100 ft (Years of data) | 2012 Potential Smolt Density (per 100 ft)/ Avg Smolt Size (mm) | 2012 Smolt Numeric Rating | Symbolic Rating (1 to 7) | Physical Habitat Change by Reach or Site Since 2009/2011 |
|---|---|---|---|---|---|
| *Low. San Lorenzo #0a* | *7.4 (n=3)* | *26.9/ 135 mm* | *7* | ******* | Site Positive |
| Low. San Lorenzo #1 | 10.2 (n=11) | 7.6/ 119 mm | 4 | **** | Site Negative |
| Low. San Lorenzo #2 | 17.1 (n=10) | 6.6/ 111 mm | 4 | **** | Reach Negative |
| Low. San Lorenzo #4 | 16.0 (n=11) | 8.9/ 87 mm | 3 | *** | Site Negative |
| Mid. San Lorenzo #6 | 4.6 (n=14) | 3.3/ 86 mm | 1 | * | Site Negative |
| Mid. San Lorenzo #8 | 6.8 (n=14) | 2.0/ 81 mm | 1 | * | Site Negative |
| Up. San Lorenzo #11 | 6.8 (n=14) | 2.9/ 101 mm | 2 | ** | Reach Negative |
| *Up. San Lorenzo #12b* | *11.6 (n=7)* | *11.3/ 112 mm* | *5* | ***** | No Data |
| *Zayante #13a* | *11.1 (n=14)* | *14.2/ 107 mm* | *5* | ***** | Site Negative |
| *Zayante #13c* | *14.5 (n=14)* | *20.0/ 90 mm* | *5* | ***** | Site Negative |
| *Zayante #13d* | *15.6 (n=14)* | *8.6/ 127 mm* | *5* | ***** | Site Negative |
| Lompico #13e | 6.7 (n=7) | 2.3/ 127 mm | 3 | *** | Site Negative |
| *Bean #14b* | *12.6 (n=15)* | *10.1/ 122 mm* | *5* | ***** | Site Negative |
| Bean #14c | 9.5 (n=12) | 5.2/ 120 mm<br>Went Dry | 4 | **** | Site Negative |
| *Fall #15* | *13.8 (n=10)* | 13.0/ 113 mm | *5* | ***** | Site Negative |
| Newell #16 | 14.1 (n=9) | 7.3/ 93 mm | 3 | *** | Site Negative |
| Boulder #17a | 11.8 (n=15) | 7.2/ 131 mm | 4 | **** | Site Negative |
| *Boulder #17b* | *10.7 (n=15)* | *10.6/ 104 mm* | *5* | ***** | Site Negative |
| Bear #18a | 11.0 (n=15) | 4.1/ 115 mm | 4 | **** | Reach Negative |
| *Branciforte #21a-2* | *9.8 (n=12)* | *12.3/ 114 mm* | *5* | ***** | Site Negative |
| *Branciforte #21b* | *15.1(n=6)* | *27.3/ 96 mm* | *6* | ****** | No Data |
| Soquel #1 | 4.1 (n=15) | 4.0/ 115 mm | 4 | **** | Site Negative |
| Soquel #4 | 9.4 (n=16) | 11.1/ 101 mm | 4 | **** | Site Positive |
| *Soquel #10* | *8.8 (n=16)* | *16.0/ 94 mm* | *5* | ***** | Reach Negative |
| Soquel #12 | 8.1 (n=15) | 13.1/ 93 mm | 4 | **** | Site Positive |
| *E. Branch Soquel #13a* | *10.8 (n=16)* | *18.6/ 94 mm* | *5* | ***** | Site Positive |
| *E. Branch Soquel #16* | *10.3 (n=16)* | *13.8/ 105 mm* | *5* | ***** | Reach Negative |
| W. Branch Soquel #19 | 6.8 (n=12) | 6.1/ 91 mm | 3 | *** | Reach Negative |
| *Aptos #3* | *10.9 (n=8)* | *11.6/ 103 mm* | *5* | ***** | Reach Negative |
| *Aptos #4* | *10.5 (n=8)* | *9.6/ 120 mm* | *5* | ***** | Site Negative |
| *Corralitos #1* | *9.6 (n=6)* | *8.7/ 108 mm* | *5* | ***** | Site Positive |
| Corralitos #3 | 9.3 (n=9) | 24.2/ 114 mm | 6 | ****** | Reach Negative |
| Corralitos #8 | 12.8 (n=9) | 9.4/ 100 mm | 4 | **** | Reach Negative |
| *Corralitos #9* | *19.4 (n=9)* | *12.7/ 105 mm* | *5* | ***** | Reach Positive |
| Shingle Mill #1 | 11.2 (n=9) | 4.2/ 101 mm | 3 | *** | Site Negative |
| Shingle Mill #3 | 5.2 (n=9) | 5.7/ 91 mm | 3 | *** | Site Negative |
| *Browns Valley #1* | *15.8 (n=9)* | *17.6/ 98 mm* | *5* | ***** | Site Negative |
| *Browns Valley #2* | *13.2 (n=9)* | *20.2/ 97 mm* | *5* | ***** | Site Positive |

***ii. Steelhead Abundance and Habitat Conditions in the San Lorenzo River Watershed***

1. ***In the lower and middle mainstem***, habitat quality declined at most replicated sampling sites and habitat-typed Reach 2 primarily due to decreased baseflow (less food), shallower fastwater habitat and usually less escape cover. However, there was much deeper pool habitat and escape cover at the lower most Site 0a (**Tables S-3 above and B-13b below**). With late spawning and reduced baseflow in spring and summer, food was insufficient to allow as high a proportion of YOY to reach Size Class II by fall as in 2011 (***Figure B-17*** *below*; ***size histograms in Appendix D***).

2. ***All tributary reaches*** had lower spring baseflows than 2011 (**Hydrograph** below), creating lower quality habitat in spring and summer 2012 with a lower proportion of YOY reaching Size Class II.

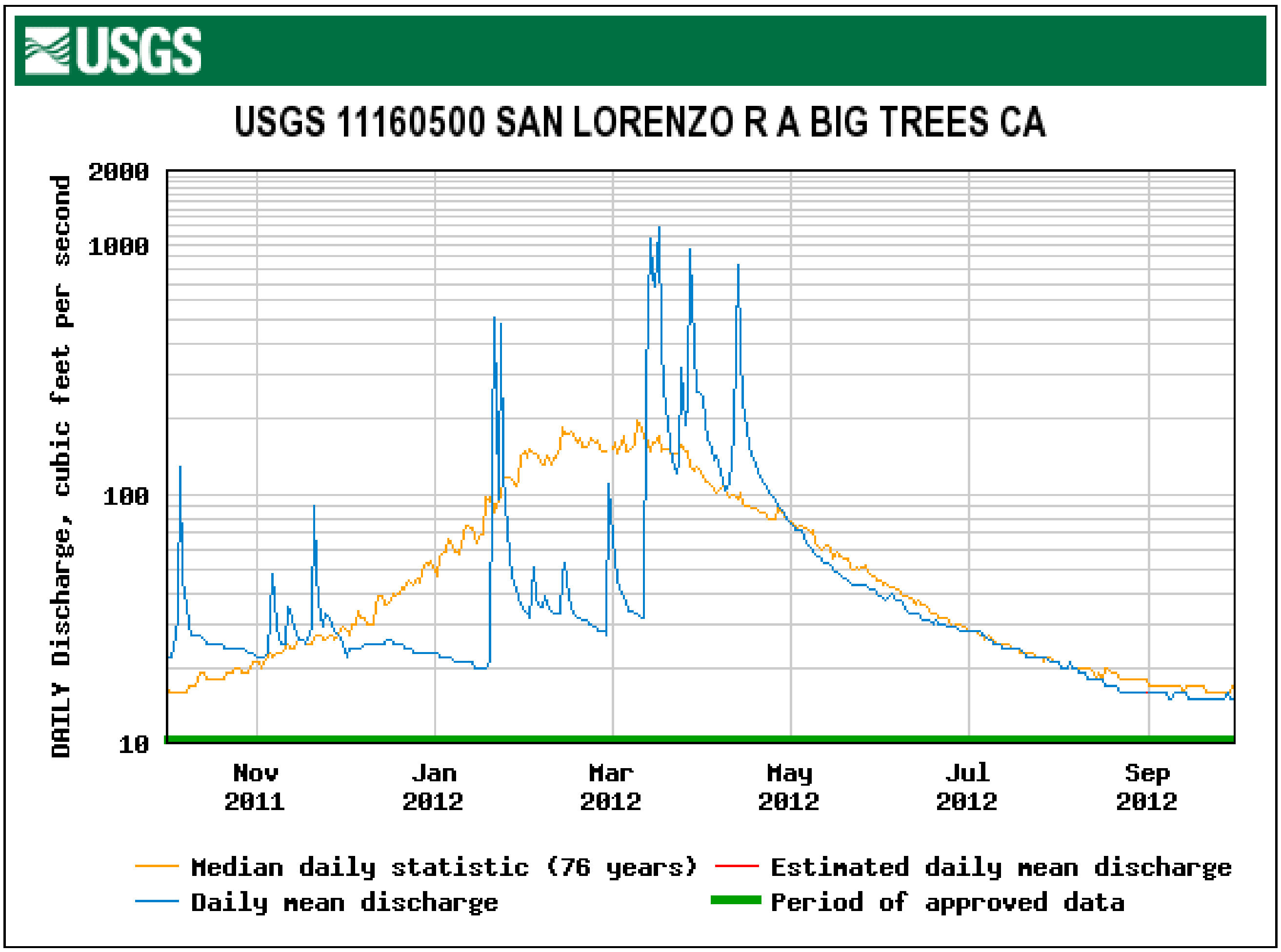
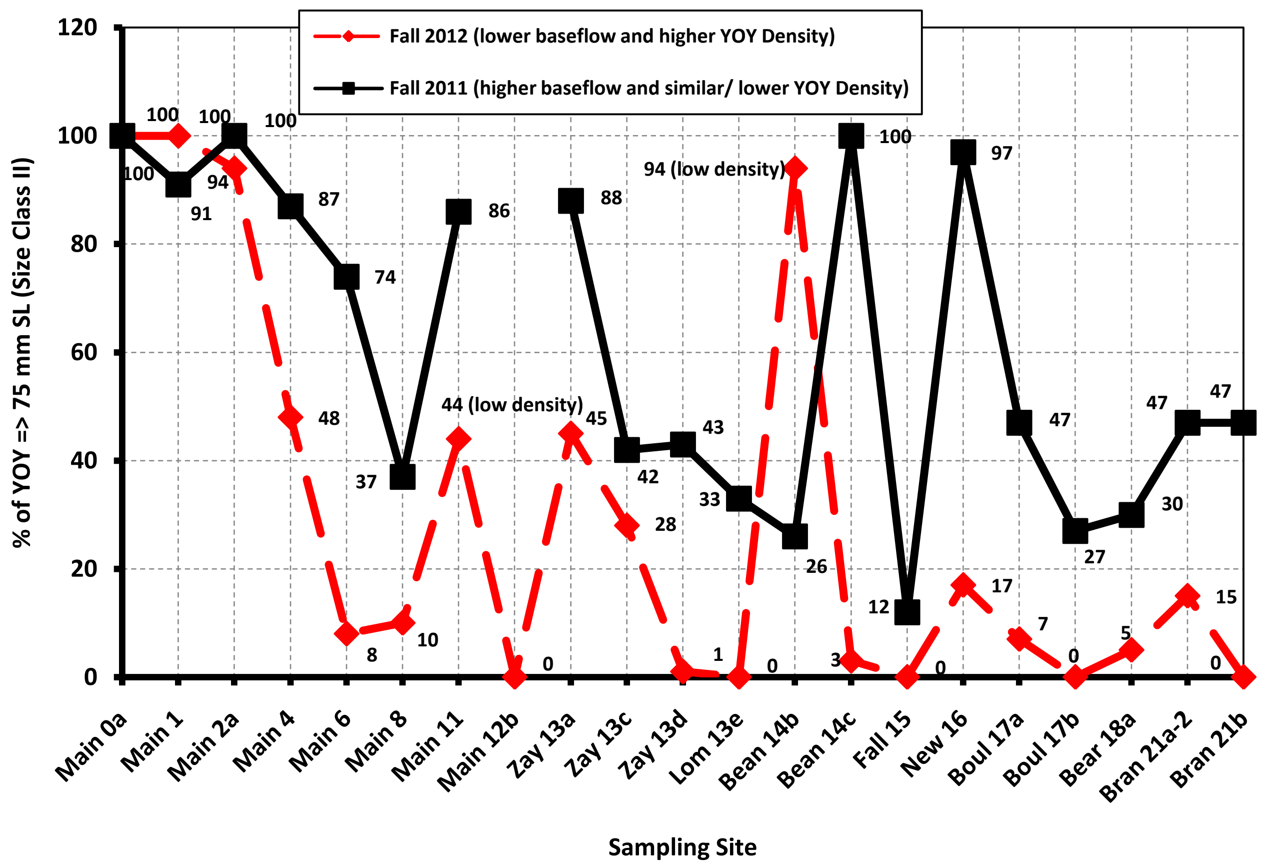


Figure B-17. Percent of Young-of-the-Year Steelhead in Size Class II (=>75 mm SL) at San Lorenzo River Sites in 2012 and 2011.




3. ***In San Lorenzo River tributaries***, of the 4 reaches with segments habitat typed, habitat quality declined only in 3 since 2010 or 2011 (reduced streamflow, shallower pools and less escape cover in Zayante 13d, Bean 14b and Bear 18a) and one improved since 2001 (reduced fine sediment and embeddedness in Branciforte 21b) (**Table B-13b** below; ***Tables 6a, 7, 8, 12a, 13a and 13b in Appendix B***).

4. ***In San Lorenzo tributaries where sampling sites were evaluated,*** only Branciforte 21a-2 had improved habitat quality (deeper pools, less fine sediment and embeddedness and more pool escape cover (***Tables 6b, 12b and 13b in Appendix B***)). All sites had reduced baseflow. Most had shallower pool habitat. Changes in fine sediment, embeddedness and pool escape cover varied between sites. Spring and early summer growth conditions were less favorable than in the wetter 2011, as indicated by the lower percent of YOY reaching Size Class II in 2012 (***Figure B-17*** *above*).

5. ***YOY densities in the mainstem*** were higher at 5 of 7 sites compared to 2011, despite reduced habitat quality in most reaches and sites, but were below average at 7 of 8 sites (***Tables 18 in Appendix B; Figure B-2*** below).

6. ***YOY densities in tributaries*** increased at 8 of 12 sites compared to 2011 and were below average at 8 of 13 sites (***Table 23 in Appendix B; Figure B-2*** below) (statistically significant). Late spawning created more and smaller YOY in 2012. The highest YOY density was found at middle Boulder 17b, which had a large wood cluster for escape cover. YOY densities were also high at upper Branciforte 14c. However, this site went dry by October. (Lines drawn between data points do not imply changes in density between sites.)

7. One YOY chinook salmon (*Oncorhynchus tshawytscha*) was captured at lower Zayante Site 13a from within a large wood cluster.

8. ***Yearling densities*** were similar or slightly less at mainstem sites between years (***Table 19 in Appendix B***) and higher at 9 of 12 tributary sites in 2012 compared to 2011 (***Table 24 in Appendix B***), indicating that more survived to spend another season after a milder winter However, yearling densities were mostly below average because they were recruited from the smallest 2011 YOY densities recorded during our long term monitoring (***Figure B-3*** *below*).

9. ***Densities of important larger Size Class II and III steelhead*** (=>75 mm SL; soon-to-smolt) ***at mainstem sites*** were higher in 2012 at 4 of 7 mainstem sites (***Table 21 in Appendix B; Table B-40 and Figure B22*** *below*) but still below average at 6 of 8 sites (***Figure B-4*** *below*).

10. ***Size Class II and III abundance in tributaries*** were less than 2011 at 10 of 12 repeated sites (***Table B-40 and Figure 24*** *below*) because a smaller proportion of YOY reached Size Class II (***Figure B-17*** *above*). Densities were below average at 8 of 13 sites (2 of which only slightly below average) (***Table 25 in Appendix B; Figures B-4*** *below*).

11. ***Total densities*** at most sites were below average (***Figure B-1*** *below)*, though they generally increased over 2011 densities at mainstem and tributary sites (statistically significant) (***Tables 17 and 21 in Appendix B***; ***Figures 21 and 23*** *below*). Total densities were below average because YOY and yearling densities were below average.

**Table B-13b. Habitat Change in the SAN LORENZO MAINSTEM AND TRIBUTARIES.**

| Reach Comparison or (Site Only) | Fall Baseflow (Most Import. Parameter) | Pool Depth / Fastwater Habitat Depth in Mainstem below Boulder Cr. | Fine Sediment | Embed-dedness | Pool Escape Cover/ Fastwater Habitat Cover in Mainstem below Boulder Creek | Overall Habitat Change |
|---|---|---|---|---|---|---|
| (Mainstem 0a) | − | + / − | + | + | + | + (despite low flow) |
| (Mainstem 1) | − | NA / − | Similar | + | /− | − |
| Mainstem 2 | − | − / Similar | Similar | Similar | /− | − |
| (Mainstem 4) | − | NA / − | Similar | Similar | /− | − |
| (Mainstem 6) | − | NA / − | Similar | − (run) | /− | − |
| (Mainstem 8) | − | NA / − | − (run) | − (run) | /Similar | − |
| (Mainstem Near Teihl 11) | − | + | + | − | Similar | − (due to low flow) |
| (Zayante 13a) | − | Similar | + (pool) − (run) | Similar | + | − (due to low flow) |
| (Zayante 13c) | − | Slightly − | Similar | − | + | − (due to low flow) |
| Zayante 13d | − | − | + | Similar | − | − |
| (Lompico 13e) | − | − | Similar | + | + (slightly) | − |
| Bean 14b | − | Slightly + | + | − | − | − |
| (Bean 14c) | − (Went dry In 2012) | − | + | + | Similar | − |
| (Fall 15) | − | − | − | − | + | − |
| (Newell 16) | − | − | − | + | + | − |
| (Boulder 17a) | − | − | − | − (riffle) | − | − |
| (Boulder 17b) | − | Slightly + | Similar | Similar | + | − (due to low flow) |
| Bear 18a | − | − | Similar | − | − | − |
| (Branciforte 21a-2) | − | + | + | + | + | + |
| Branciforte 21b | − Compared to 2001 | NA | + Compared to 2001 | + Comp. to 2001 | NA | + (despite lower flow) |

***NA = Not available.**

**Figure B-2. Young-of-the-Year Steelhead Site Densities in the San Lorenzo River in 2012 Compared to Average Density. (Averages based on 5 to 15 years of data.)**

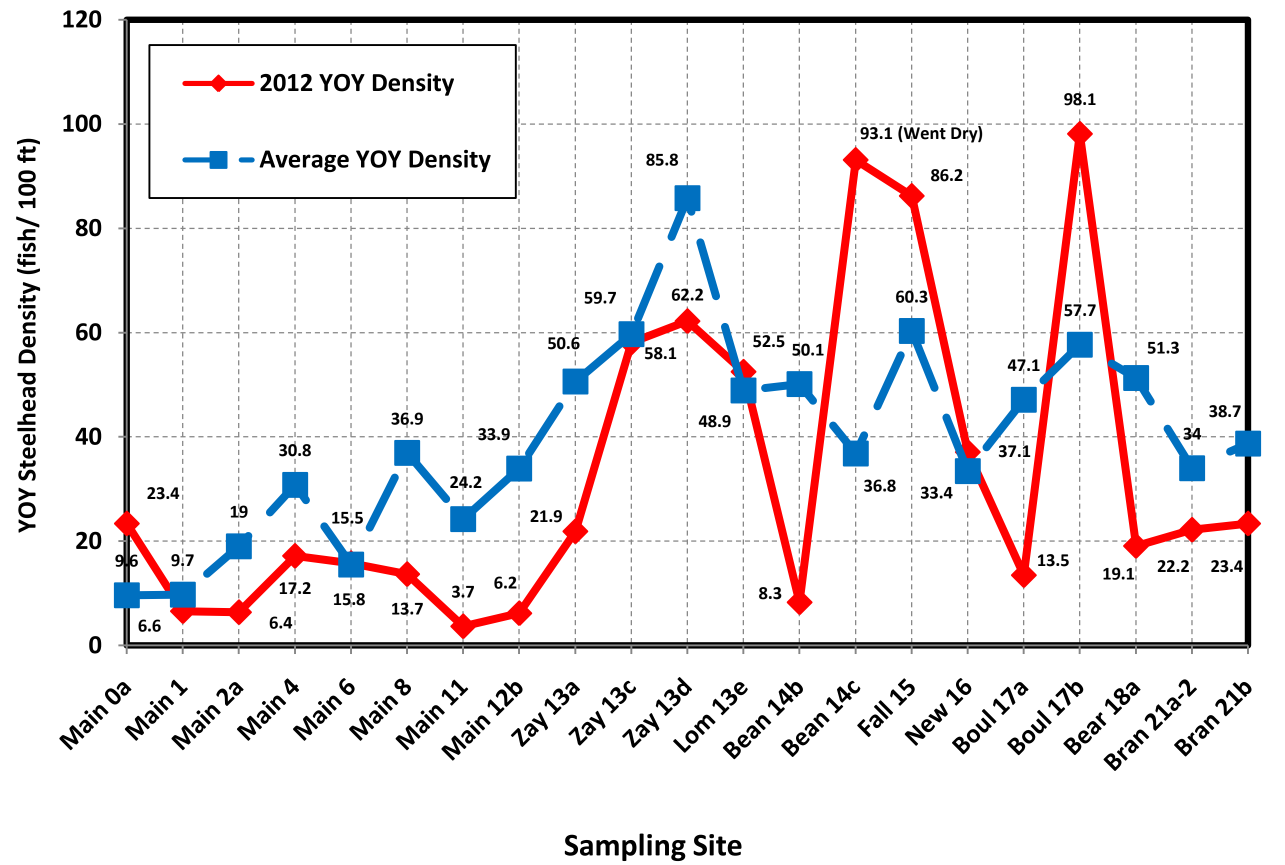


**Figure B-3. Yearling and Older Steelhead Site Densities in the San Lorenzo River in 2012 Compared to Average Density. (Averages based on 5 to 15 years of data.)**

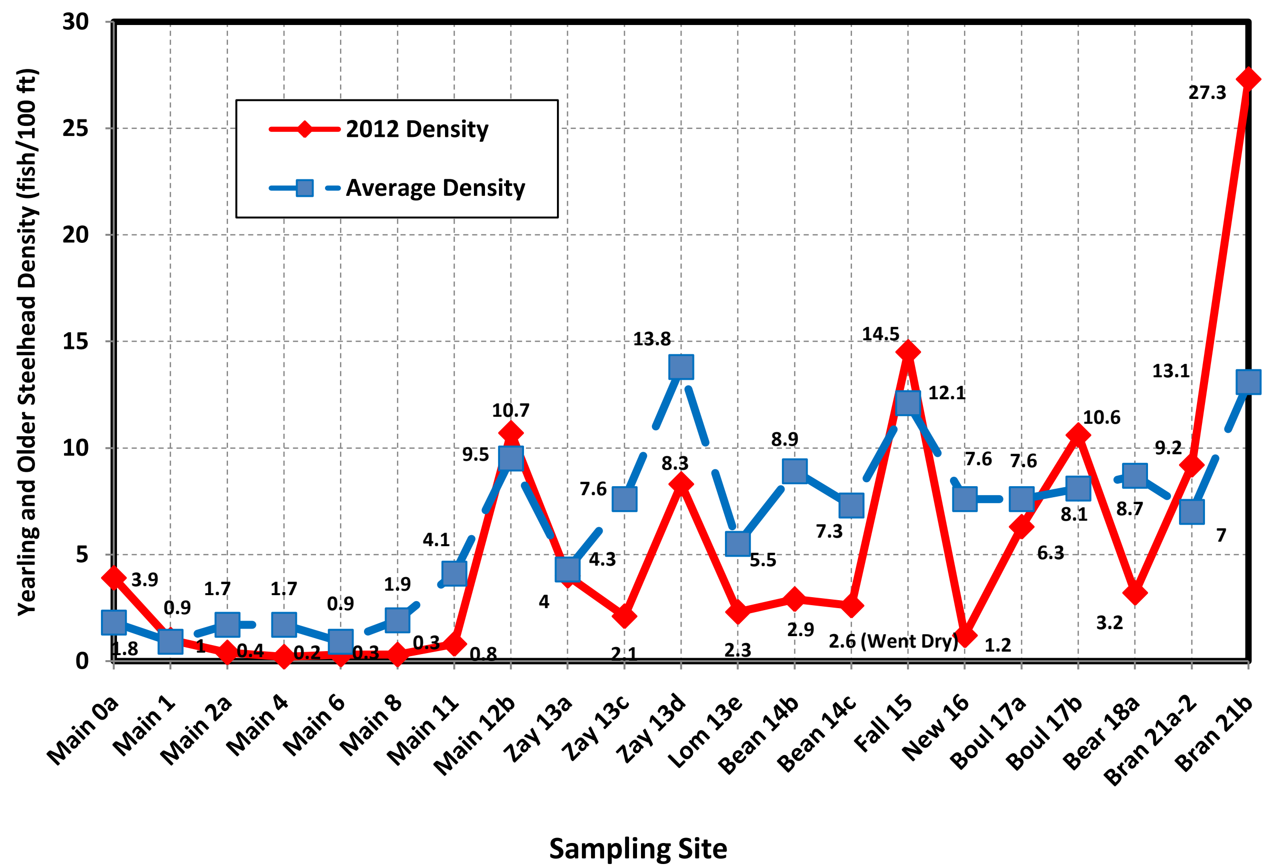


**Table B-40. 2012 Sampling Sites Rated by Potential Smolt-Sized Juvenile Density (=>75 mm SL) and Their Average Size in Standard Length Compared to 2011, with Physical Habitat Change from 2011 Conditions.**

(Red denotes ratings of 1−3 (as in Table S-3) and negative habitat change and italicized purple denotes ratings of 5−7. Methods for habitat change in M-6 of Appendix B.)

| Site | 2012 Potential Smolt Density (per 100 ft)/ Avg Pot. Smolt Size SL (mm) | 2012 Smolt Rating (With Size Factored In) | 2011 Potential Smolt Density (per 100 ft)/ Avg Pot. Smolt Size SL (mm) | 2011 Smolt Rating (With Size Factored In) | Physical Habitat Change by Reach/Site Since 2011 |
|---|---|---|---|---|---|
| **Low. San Lorenzo #0a** | **26.9/ 135 mm** | ***Very Good*** | **2.1/ 124 mm** | **Below Average** | + |
| **Low. San Lorenzo #1** | **7.6/ 119 mm** | **Fair** | **2.6/ 148 mm** | **Below Average** | − |
| **Low. San Lorenzo #2** | **6.6/ 111 mm** | **Fair** | **11.2/ 142 mm** | ***Good*** | − |
| **Low. San Lorenzo #4** | **8.9/ 87 mm** | **Below Average** | **3.7/ 103 mm** | **Below Average** | − |
| **Mid. San Lorenzo #6** | **3.3/ 86 mm** | **Very Poor** | **5.3/ 85 mm** | **Poor** | − |
| **Mid. San Lorenzo #8** | **2.0/ 81 mm** | **Very Poor** | **3.4/ 82 mm** | **Very Poor** | − |
| **Up. San Lorenzo #11** | **2.9/ 101 mm** | **Poor** | **7.9/ 84 mm** | **Poor** | − |
| **Up. San Lorenzo #12b** | **11.3/ 112 mm** | ***Good*** | **No data** | **No data** | **No data** |
| **Zayante #13a** | **14.2/ 107 mm** | ***Good*** | **4.8/ 116 mm** | **Fair** | − |
| **Zayante #13c** | **20.0/ 90 mm** | ***Good*** | **29.2/ 95 mm** | ***Good*** | − |
| **Zayante #13d** | **8.6/ 127 mm** | ***Good*** | **11.7/ 97 mm** | **Fair** | − |
| **Lompico #13e** | **2.3/ 127 mm** | **Below Average** | **7.8/ 95 mm** | **Below Average** | − |
| **Bean #14b** | **10.1/ 122 mm** | ***Good*** | **7.4/ 127 mm** | **Fair** | − |
| **Bean #14c** | **5.2/ 120 mm**<br>**Went Dry** | Fair<br>**Went Dry** | **8.8/ 104 mm** | ***Good*** | − |
| **Fall #15** | **13.0/ 113 mm** | ***Good*** | **14.7/ 115 mm** | ***Good*** | − |
| **Newell #16** | **7.3/ 93 mm** | **Below Average** | **13.1/ 99 mm** | **Fair** | − |
| **Boulder #17a** | **7.2/ 131 mm** | **Fair** | **10.6/ 101 mm** | **Fair** | − |
| **Boulder #17b** | **10.6/ 104 mm** | ***Good*** | **13.6/ 106 mm** | ***Good*** | − |
| **Bear #18a** | **4.1/ 115 mm** | **Fair** | **9.4/ 98 mm** | **Fair** | − |
| **Branciforte #21a-2** | **12.3/ 114 mm** | ***Good*** | **13.6/ 100 mm** | **Fair** | − |
| **Branciforte #21b** | **27.3/ 96 mm** | ***Very Good*** | **No data** | **No data** | **No data** |
| **Soquel #1** | **4.0/ 115 mm** | **Fair** | **2.7/ 135 mm** | **Below Average** | − |
| **Soquel #4** | **11.1/ 101 mm** | **Fair** | **5.3/ 118 mm** | **Fair** | + |
| **Soquel #10** | **16.0/ 94 mm** | ***Good*** | **5.8/ 107 mm** | **Fair** | − |
| **Soquel #12** | **13.1/ 93 mm** | Fair | **5.6/ 109 mm** | **Fair** | + |
| **East Branch Soquel #13a** | **18.6/ 94 mm** | ***Good*** | **10.1/ 112 mm** | ***Good*** | + |
| **East Branch Soquel #16** | **13.8/ 105 mm** | ***Good*** | **15.4/ 100 mm** | **Fair** | − |
| **West Branch Soquel #19** | **6.1/ 91 mm** | **Below Average** | **16.9/ 95 mm** | **Fair** | − |
| **Aptos #3** | **11.6/ 103 mm** | ***Good*** | **7.1/ 101 mm** | **Below Average** | − |
| **Aptos #4** | **9.6/ 120 mm** | ***Good*** | **16.7/ 104 mm** | ***Very Good*** | − |
| **Corralitos #1** | **8.7/ 108 mm** | ***Good*** | **7.6/ 100 mm** | **Fair** | + |
| **Corralitos #3** | **24.2/ 114 mm** | ***Very Good*** | **6.6/ 123 mm** | **Fair** | − |
| **Corralitos #8** | **9.4/ 100 mm** | **Fair** | **12.3/ 109 mm** | ***Good*** | − |
| **Corralitos #9** | **12.7/ 105 mm** | ***Good*** | **14.5/ 104 mm** | ***Good*** | + |
| **Shingle Mill #1** | **4.2/ 101 mm** | **Below Average** | **7.0/ 100 mm** | **Below Average** | − |
| **Shingle Mill #3** | **5.7/ 91 mm** | **Below Average** | **8.0/ 98 mm** | **Fair** | − |
| **Browns #1** | **17.6/ 98 mm** | ***Good*** | **14.2/ 100 mm** | **Fair** | − |
| **Browns #2** | **20.2/ 97 mm** | ***Good*** | **13.3/ 101 mm** | **Fair** | + |

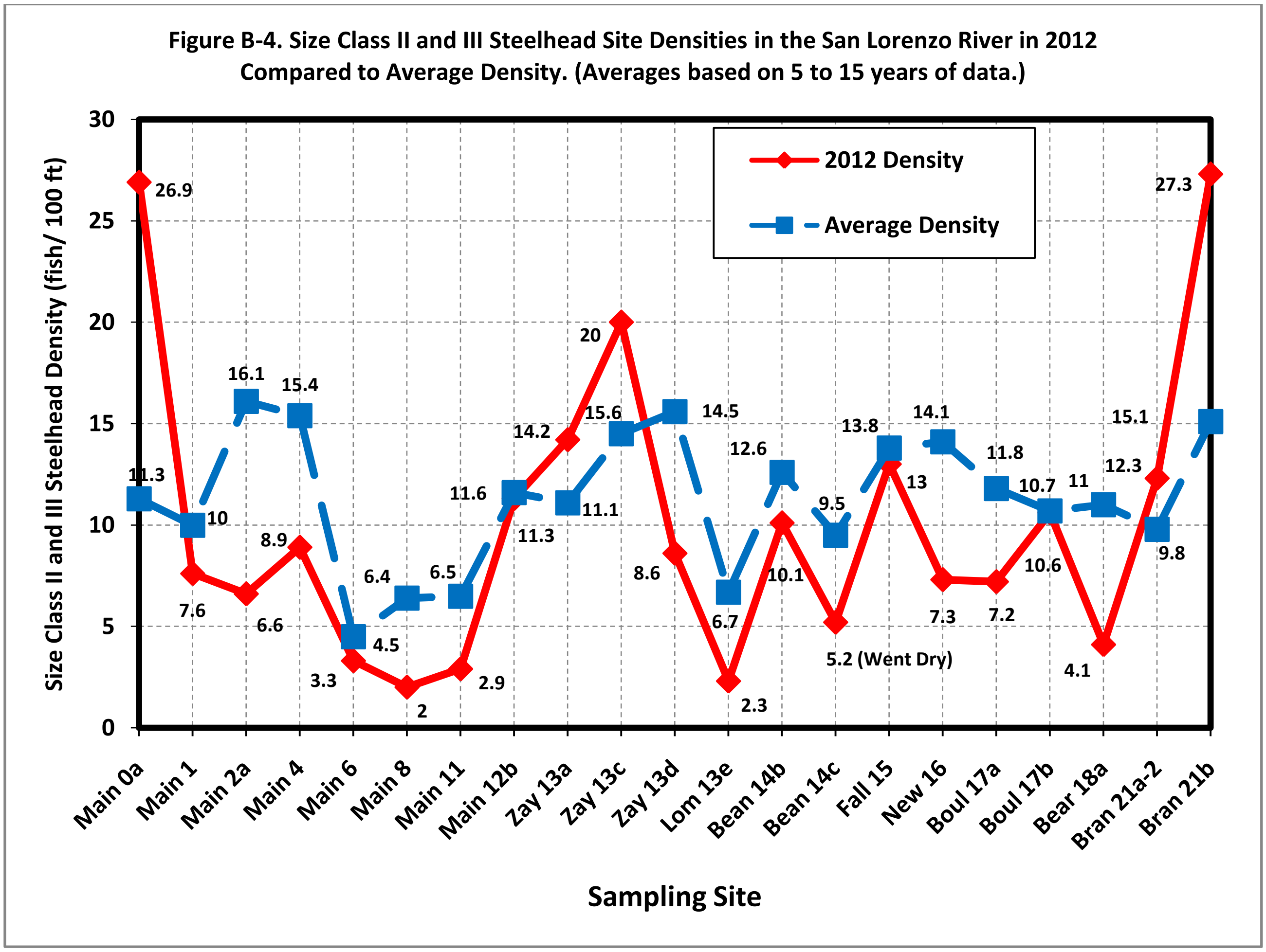


Figure B-4. Size Class II and III Steelhead Site Densities in the San Lorenzo River in 2012
Compared to Average Density. (Averages based on 5 to 15 years of data.)
2012 Density
Average Density
Size Class II and III Steelhead Density (fish/ 100 ft)
Sampling Site
0
5
10
15
20
25
30
Main 0a
Main 1
Main 2a
Main 4
Main 6
Main 8
Main 11
Main 12b
Zay 13a
Zay 13c
Zay 13d
Lom 13e
Bean 14b
Bean 14c
Fall 15
New 16
Boul 17a
Boul 17b
Bear 18a
Bran 21a-2
Bran 21b
26.9
11.3
7.6
10
16.1
6.6
15.4
8.9
3.3
4.5
2
6.4
2.9
6.5
11.6
11.3
14.2
11.1
20
15.6
14.5
8.6
6.7
2.3
12.6
10.1
9.5
5.2 (Went Dry)
13.8
13
14.1
7.3
11.8
7.2
10.7
10.6
11
4.1
12.3
15.1
9.8
27.3

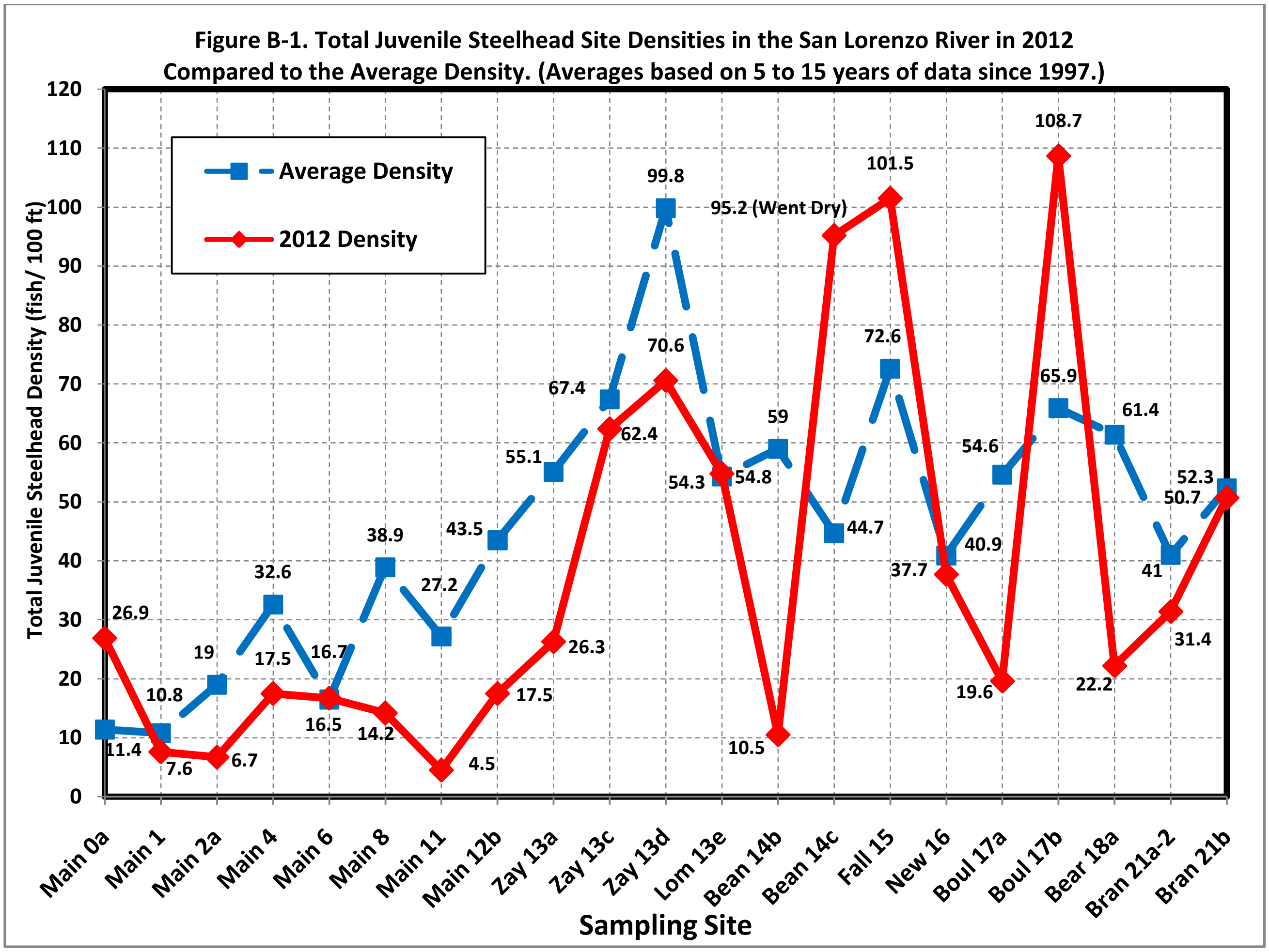


Figure B-1. Total Juvenile Steelhead Site Densities in the San Lorenzo River in 2012
Compared to the Average Density. (Averages based on 5 to 15 years of data since 1997.)
Average Density
2012 Density
Total Juvenile Steelhead Density (fish/ 100 ft)
Sampling Site
Main 0a
Main 1
Main 2a
Main 4
Main 6
Main 8
Main 11
Main 12b
Zay 13a
Zay 13c
Zay 13d
Lom 13e
Bean 14b
Bean 14c
Fall 15
New 16
Boul 17a
Boul 17b
Bear 18a
Bran 21a-2
Bran 21b
95.2 (Went Dry)

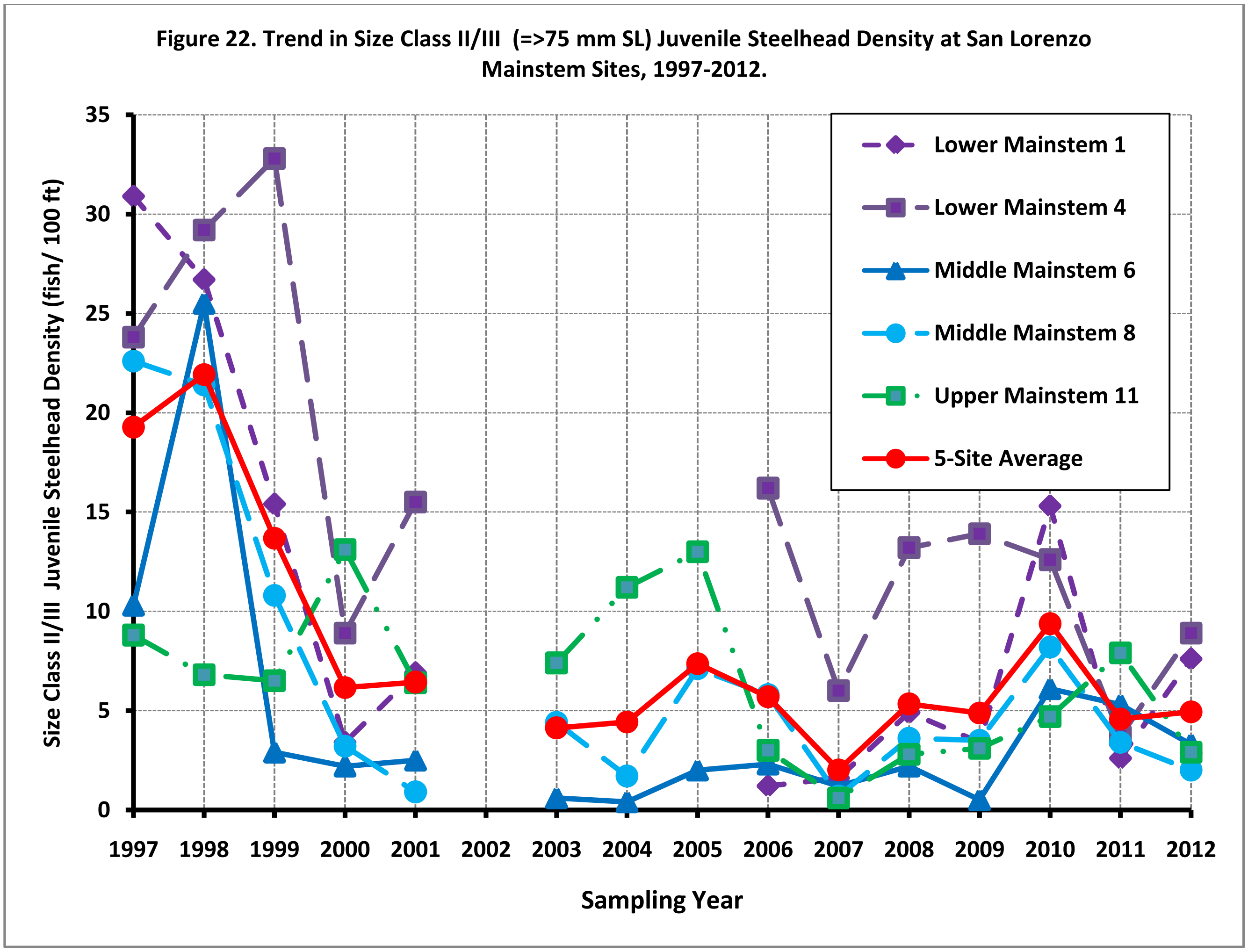
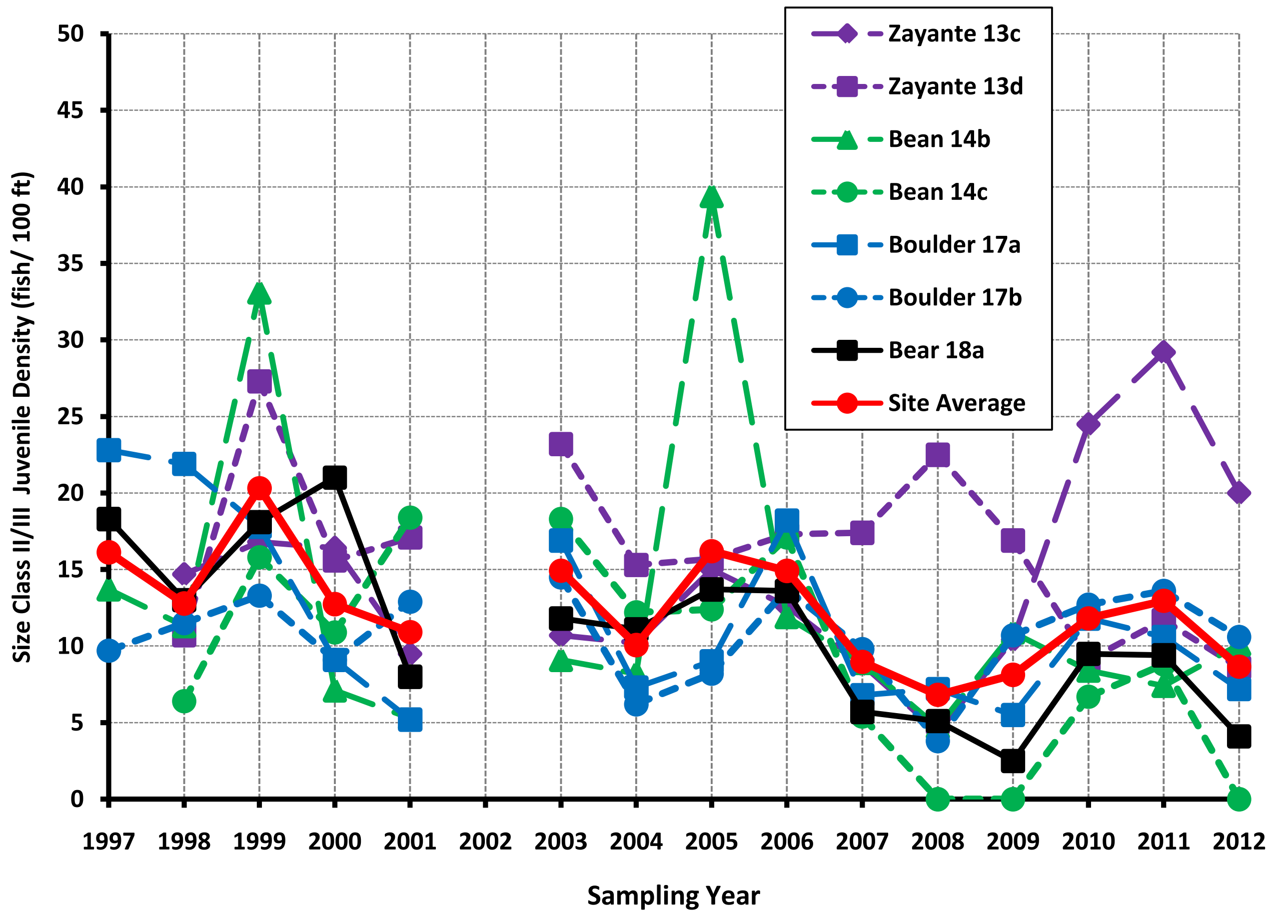


Figure 22. Trend in Size Class II/III (=>75 mm SL) Juvenile Steelhead Density at San Lorenzo Mainstem Sites, 1997-2012.
Size Class II/III Juvenile Steelhead Density (fish/ 100 ft)
0
5
10
15
20
25
30
35
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Sampling Year
Lower Mainstem 1
Lower Mainstem 4
Middle Mainstem 6
Middle Mainstem 8
Upper Mainstem 11
5-Site Average

**Figure B-24. Trend in Size Class II/III (=>75 mm SL) Juvenile Steelhead Density at San Lorenzo Tributary Sites, 1997-2012.**



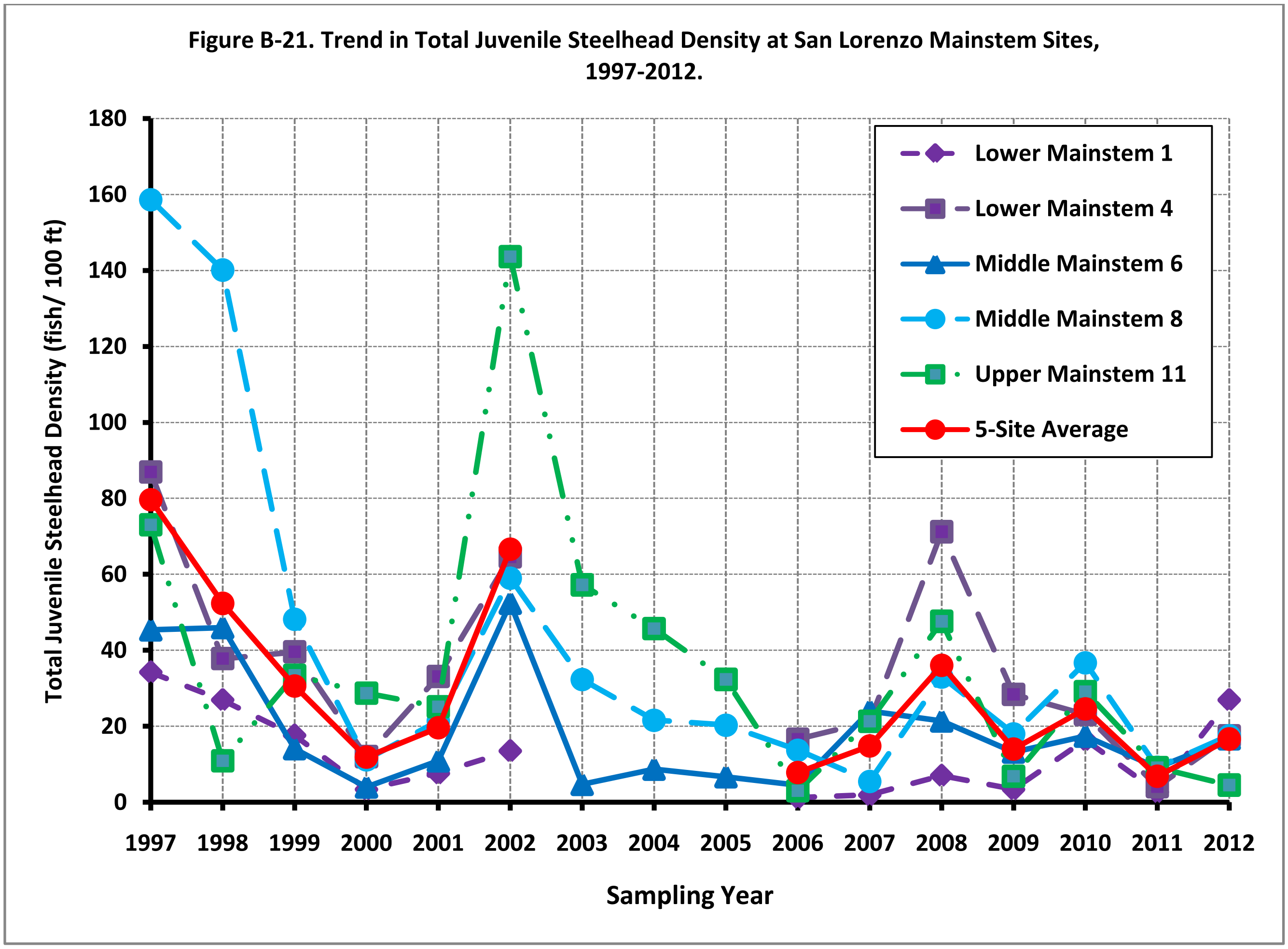
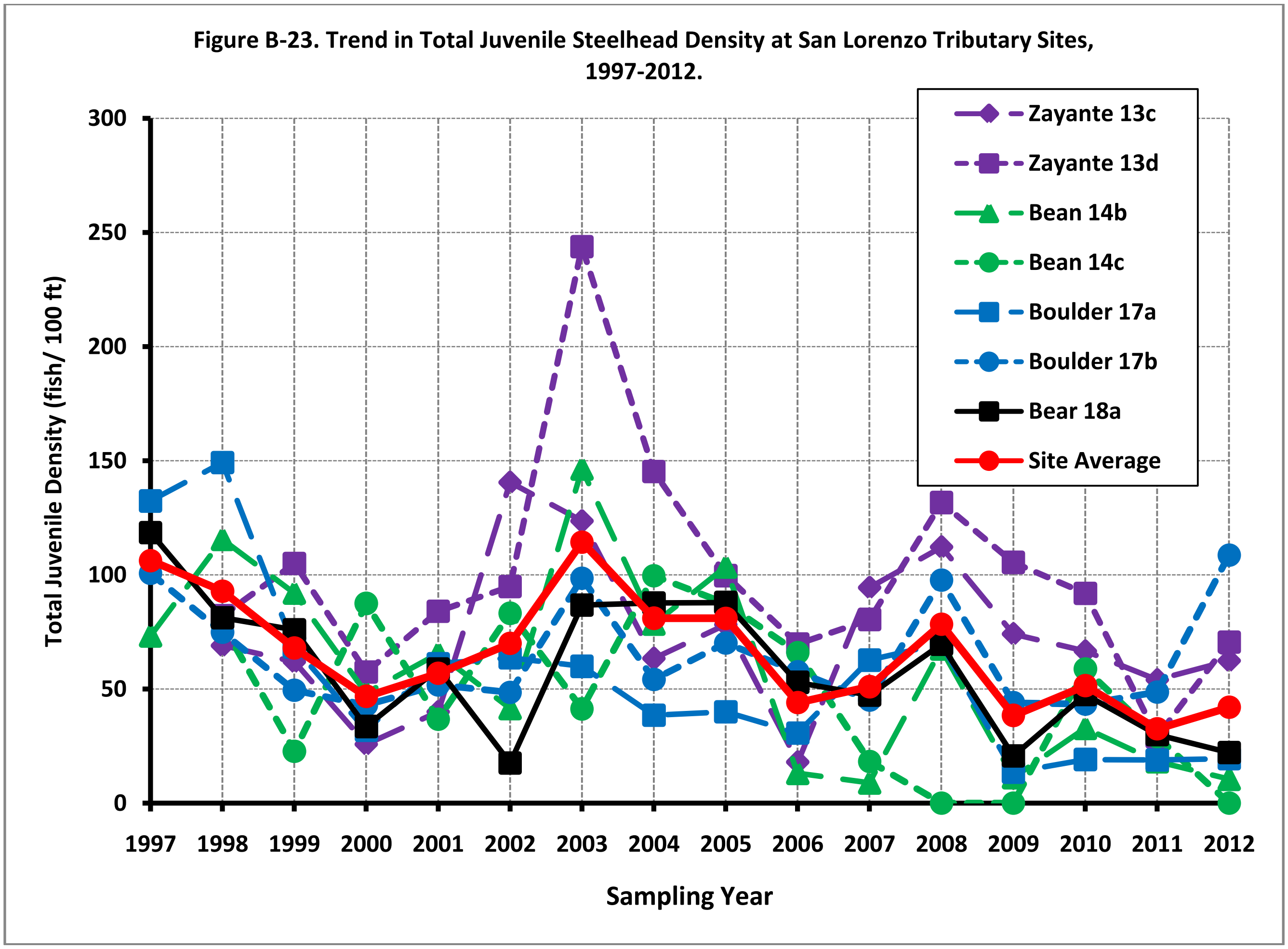


Figure B-21. Trend in Total Juvenile Steelhead Density at San Lorenzo Mainstem Sites, 1997-2012.
Total Juvenile Steelhead Density (fish/ 100 ft)
180
160
140
120
100
80
60
40
20
0
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Sampling Year
Lower Mainstem 1
Lower Mainstem 4
Middle Mainstem 6
Middle Mainstem 8
Upper Mainstem 11
5-Site Average




***iii. Steelhead Abundance in the Soquel Creek Watershed***

1. All reaches had lower spring and summer baseflow in 2012 than 2011 (**Soquel Creek Hydrograph** below). Flow was slightly above the median flow statistic until mid-May due to the late spring storms, but declined below the median flow by August. This provided moderate food levels for YOY growth in spring and early summer of 2012.

2. A pattern developed in the East Branch and upper mainstem with reduced pool depth in reaches and sites and reduced escape cover in reaches habitat typed. This may have resulted from sedimentation from erosion at the massive, still active Highland Way slide. Two of the 4 reaches (Reaches 1 and 13) had improved habitat compared to 2009 due to higher baseflow and deeper pool habitat. Two reaches had reduced habitat quality (Reach 7 compared to 2009 conditions and Reach 12a compared to 2011 conditions, with reduced pool depth and escape cover and more embeddedness). All 3 replicated sites (#4, #12 and #13a) had improved habitat compared to 2011 due to increased escape cover from less embedded boulders or larger instream wood clusters (***Table B-15e** below*)

3. As was the pattern in the San Lorenzo watershed, ***total and YOY densities*** in 2012 increased from 2011 at all 7 sites (statistically significant) (***Tables 26 and 27 in Appendix B***). However, the pattern of 2012 juvenile densities compared to average densities in Soquel Creek was different from the San Lorenzo in that total and YOY densities were near average at 5 of 7 sites instead of mostly below average, except at East Branch Site 16 in the SDSF where they were much below average (***Figures B-5 and B-6*** *below*). This was the second year in a row in which YOY and total densities at Site 16 were alarmingly low, as indicated by the trend in total densities (***Figure B-25*** *below*). Spawning was likely focused downstream of this site during the late stormflow period, 15 March−15 April.

4. Apparently, there were insufficient late spawners to seed the SDSF site with YOY in 2012, after the 16 March storm. The 16 March peak stormflow was likely somewhat above bankfull in magnitude (2,360 cfs at Soquel Village) and may have reduced YOY survival from earlier spawners.

5. Yearling densities were near average at 6 of 7 sites, with much above average density at Site 16 in the SDSF (***Figure B-7*** *below*), where YOY densities were very low. The mild winter had allowed relatively higher yearling survival at this site.

6. With ***yearling densities*** higher in 2012 than 2011 at 4 of 7 sites and a higher density of YOY's at all sites with a portion growing into Size Class II at some sites (***Figure B-18*** *below*), the trend in Size Class II and III densities rebounded in 2012 to 2010 levels, on average (***Figure B-26*** *below*).

7. 2012 densities of ***Size Class II and III juveniles*** were above average at 5 of 7 sites and greater than in 2011 at 5 of 7 sites (***Table 30 in Appendix B; Figure B-8*** *below*), unlike in the San Lorenzo watershed where the majority of tributary sites had below average densities that were less than in 2011.

8. ***Soon-to-smolt density ratings*** improved at 3 of 7 sites to "Good" at Site 10 (above Moores Gulch) and Site #16 (SDSF) and "Fair" at Site #1 (Capitola) (***Table B-40*** *above*). This was due to retention of yearlings after a mild winter and sufficient baseflow for some of the average density of YOY to reach Size Class II in the lower mainstem.

9. The 2012 juvenile steelhead population in Soquel Lagoon was an estimated 220, which was the lowest estimate in 20 years of population estimates and much less than the 20-year average of 1,595. It was about 30% of the 2011 estimate (**Alley 2013**). The 2012 population size fit the typical pattern expected for wetter years when less spawning occurs near the lagoon and lagoon numbers are down, although WY2012 was actually a drier year having late storms.

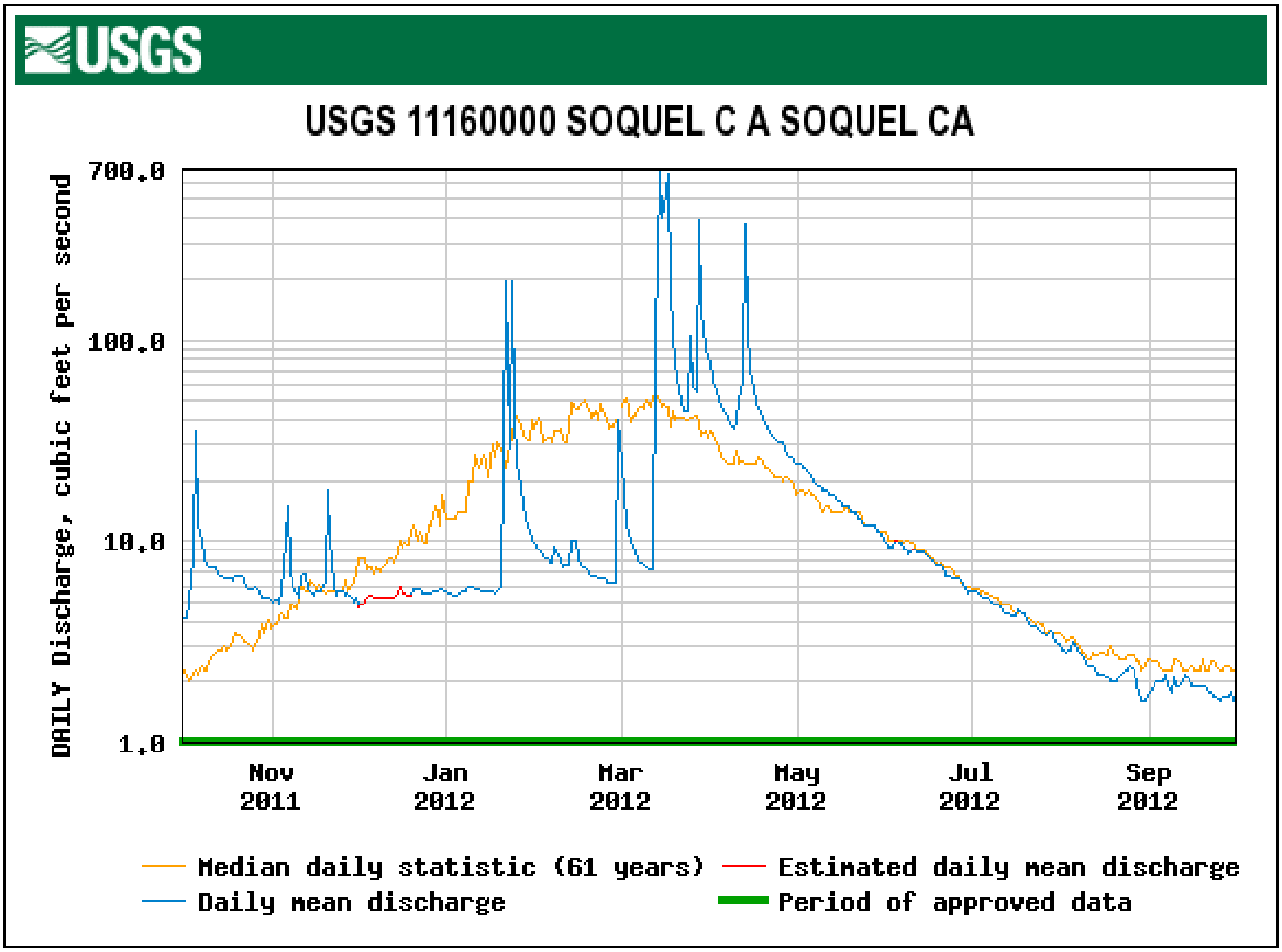



**Table B-15e. Habitat Change in SOQUEL CREEK WATERSHED Reaches (2009 to 2012 or 2011-2012) or Replicated Sites, Otherwise (2011 to 2012; in parenthesis).**

| Reach Comparison or (Site Only) | Baseflow | Pool Depth | Fine Sediment | Embeddedness | Pool Escape Cover | Overall Habitat Change |
|---|---|---|---|---|---|---|
| Reach 1 | + | + | Similar | – | – | + (Compared to 2009) |
| Site 4 (Reach 3a) | – | + | – | – (Runs Only) | + (large) | + |
| Reach 7 | + | – | + | – | – | – (Compared to 2009) |
| Site 12 (Reach 8) | – | – | Similar | – | + (Wood Cluster) | + (due to wood) |
| Site 13a (Reach-9a)-East Br. | – | – | + | + | + (Wood Cluster) | + (due to wood) |
| Reach 12a In SDSF- East Br. | + | – | Similar | – (Riffles Only) | – (large decrease) | – (Compared to 2011) |
| Reach 13 West Branch | + | + | Similar | Similar | Similar | + (Compared to 2009) |

* NA = Not available.

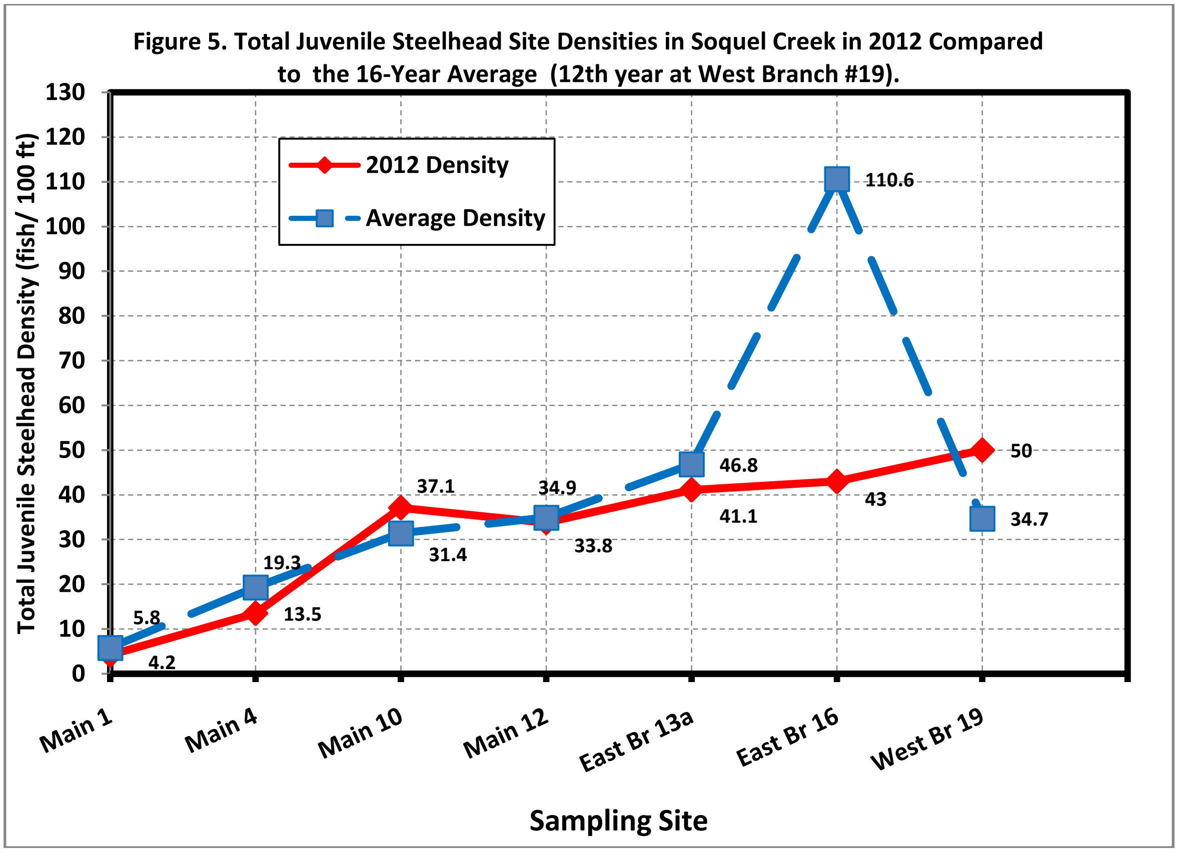


Figure 5. Total Juvenile Steelhead Site Densities in Soquel Creek in 2012 Compared to the 16-Year Average (12th year at West Branch #19).
Total Juvenile Steelhead Density (fish/ 100 ft)
2012 Density
Average Density
130
120
110
100
90
80
70
60
50
40
30
20
10
0
110.6
50
46.8
37.1
34.9
41.1
43
34.7
31.4
33.8
19.3
13.5
5.8
4.2
Main 1
Main 4
Main 10
Main 12
East Br 13a
East Br 16
West Br 19
Sampling Site

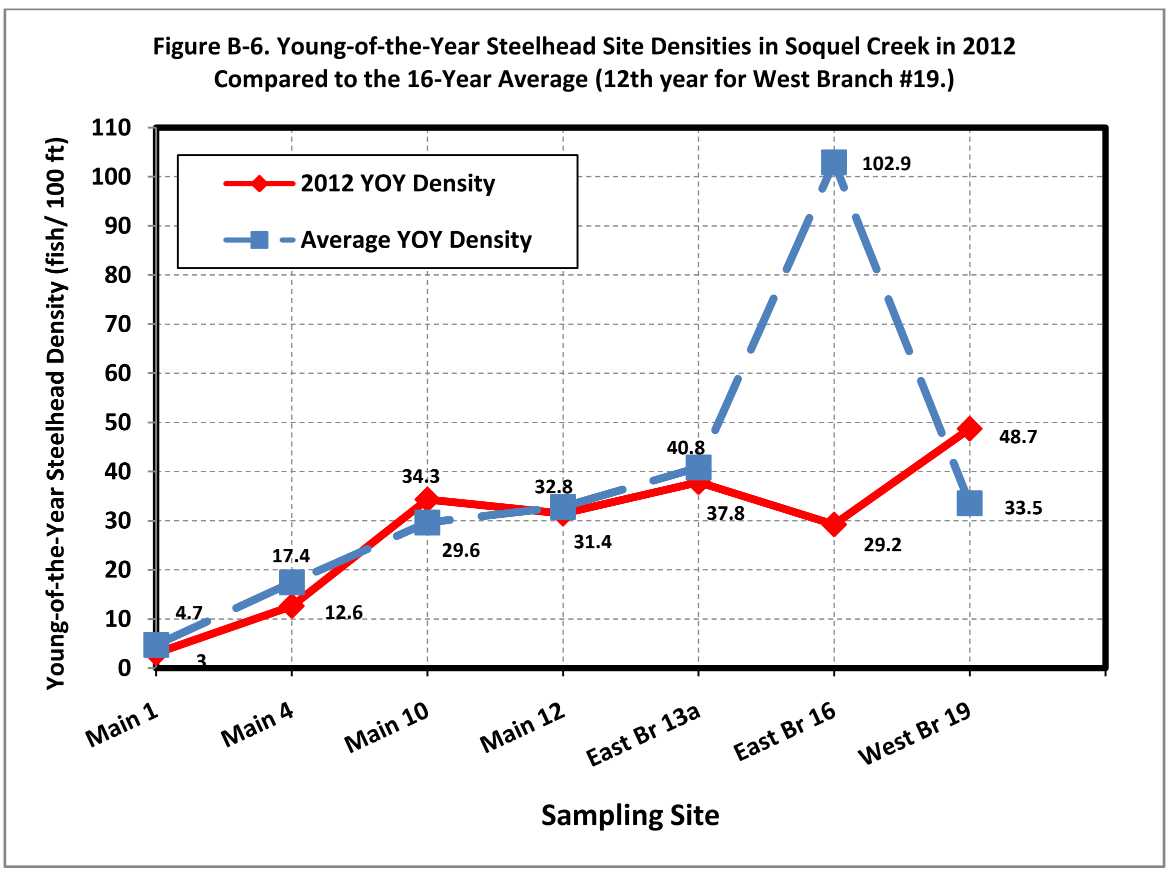


Figure B-6. Young-of-the-Year Steelhead Site Densities in Soquel Creek in 2012 Compared to the 16-Year Average (12th year for West Branch #19.)
Young-of-the-Year Steelhead Density (fish/ 100 ft)
2012 YOY Density
Average YOY Density
110
100
90
80
70
60
50
40
30
20
10
0
102.9
48.7
40.8
34.3
32.8
37.8
33.5
29.6
31.4
29.2
17.4
12.6
4.7
3
Main 1
Main 4
Main 10
Main 12
East Br 13a
East Br 16
West Br 19
Sampling Site

**Figure B-25. Trend in Total Juvenile Steelhead Density at Soquel Creek Sites, 1997-2012.**

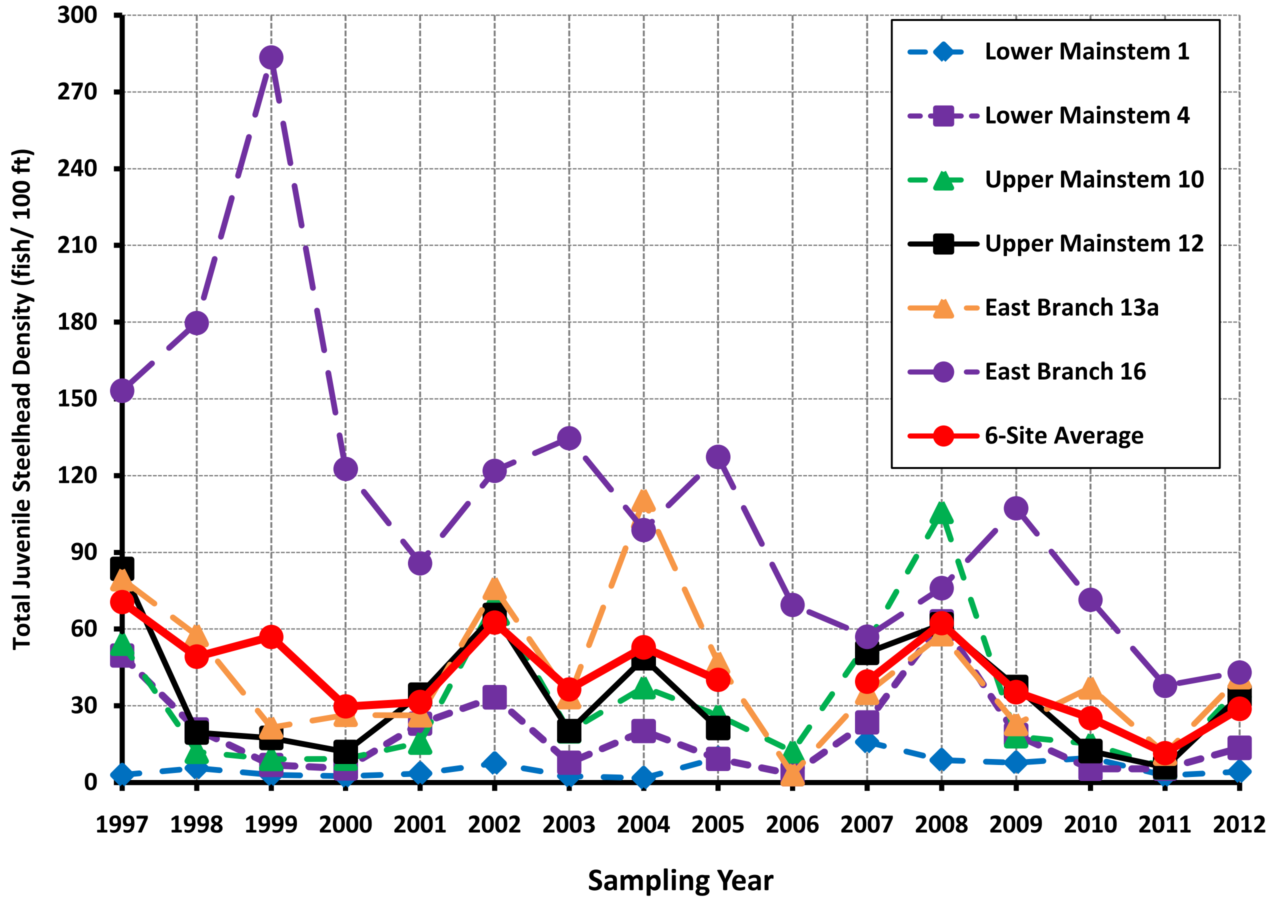


Figure B-7. Yearling and Older Steelhead Site Densities in Soquel Creek in 2012 Compared to Average Density . (Averages based on 16 years of data; 12th year for West Branch Site 19).

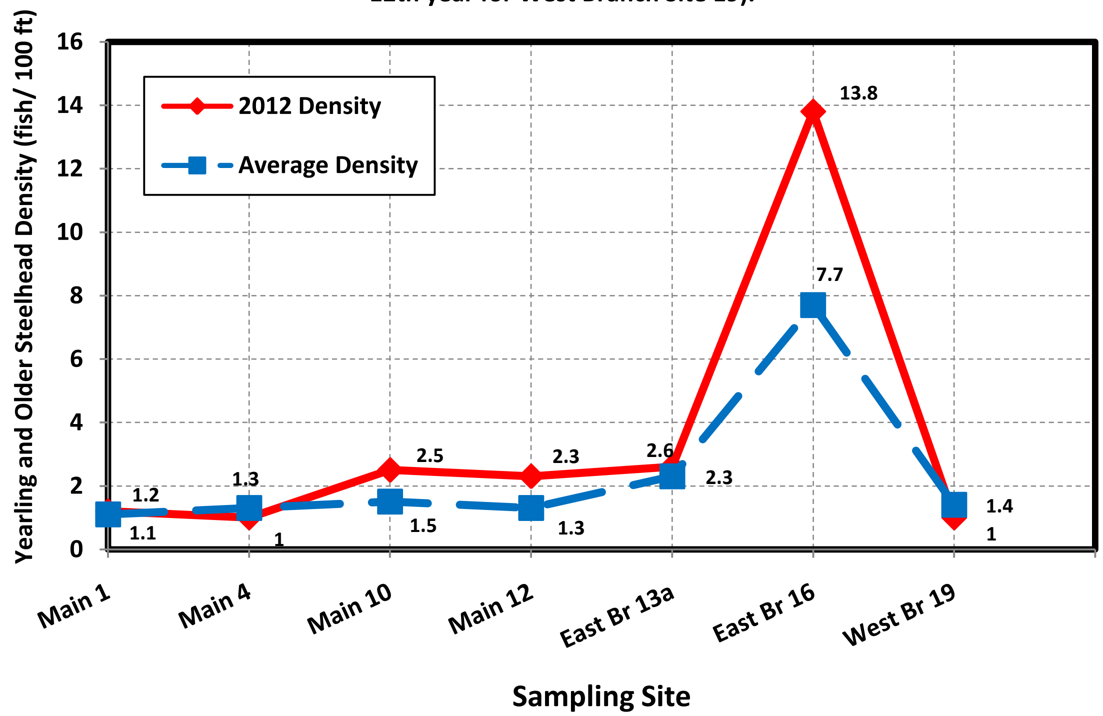
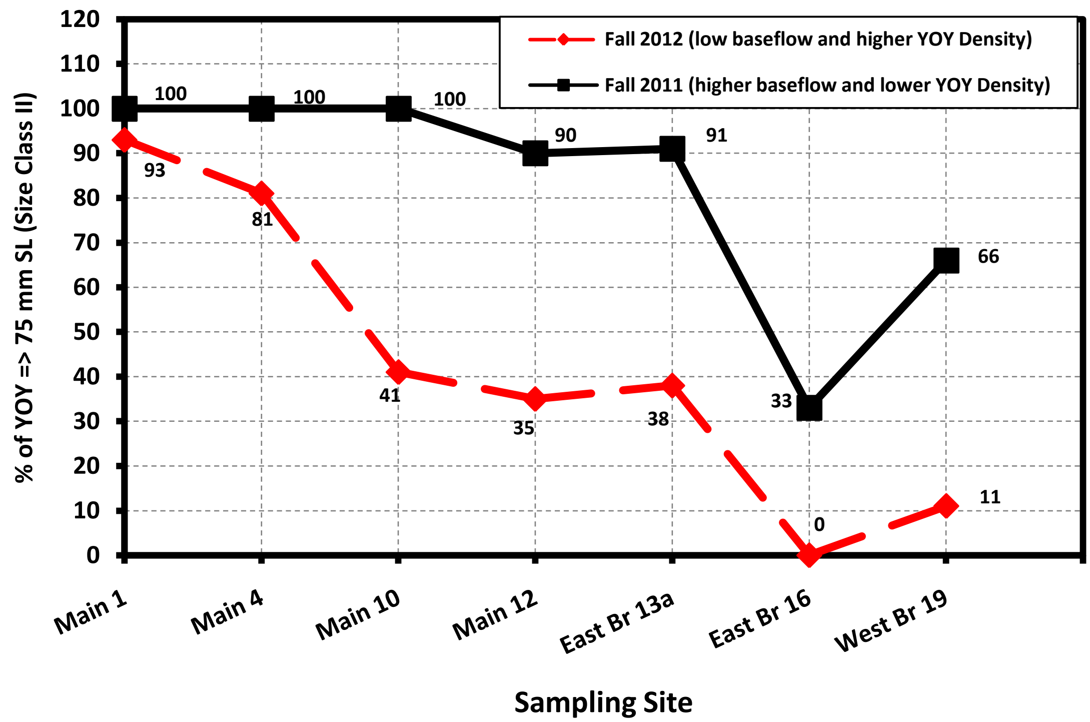


Figure B-18. Percent of Young-of-the-Year Steelhead in Size Class II (=>75 mm SL) at Soquel Creek Sites in 2012 and 2011.



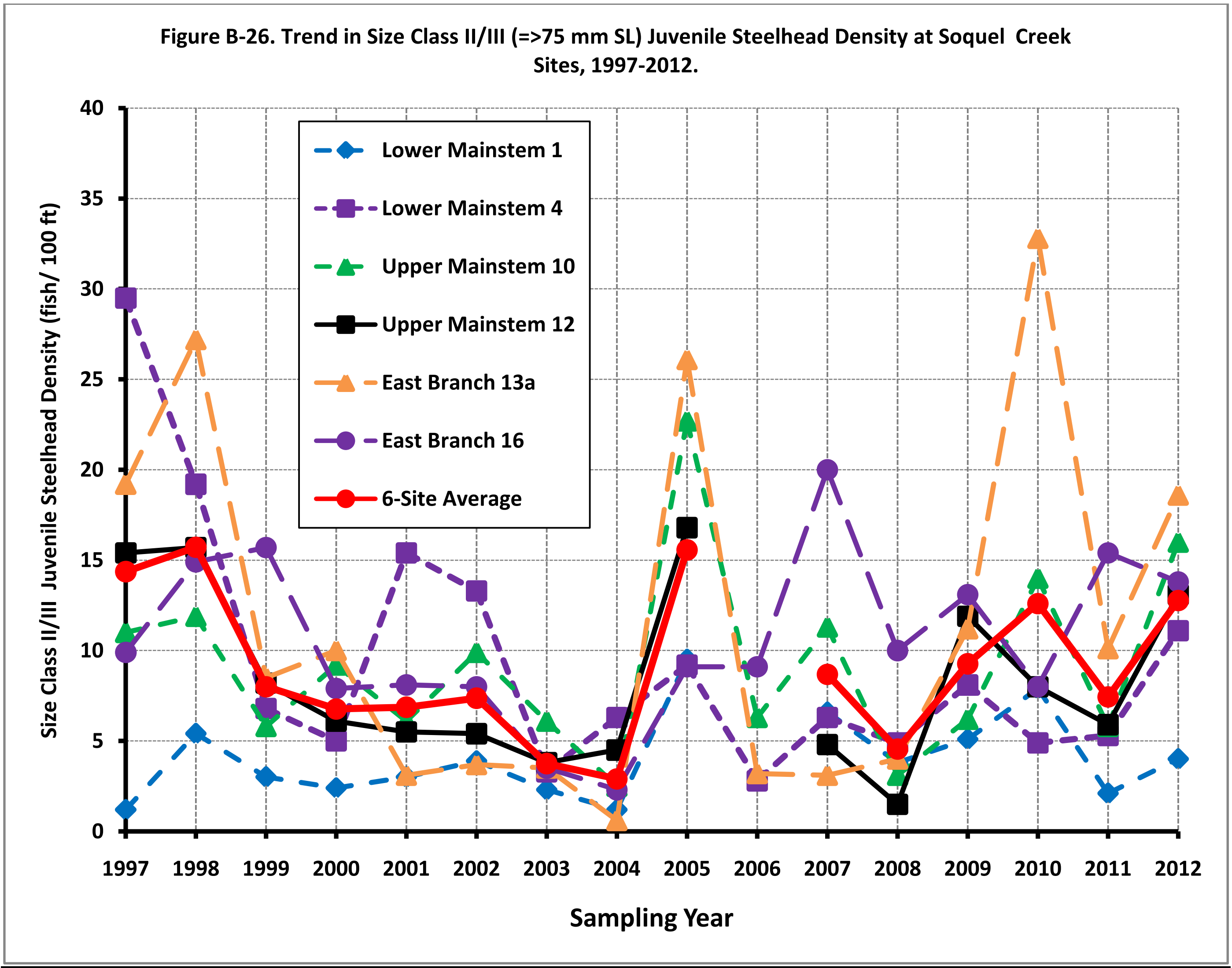
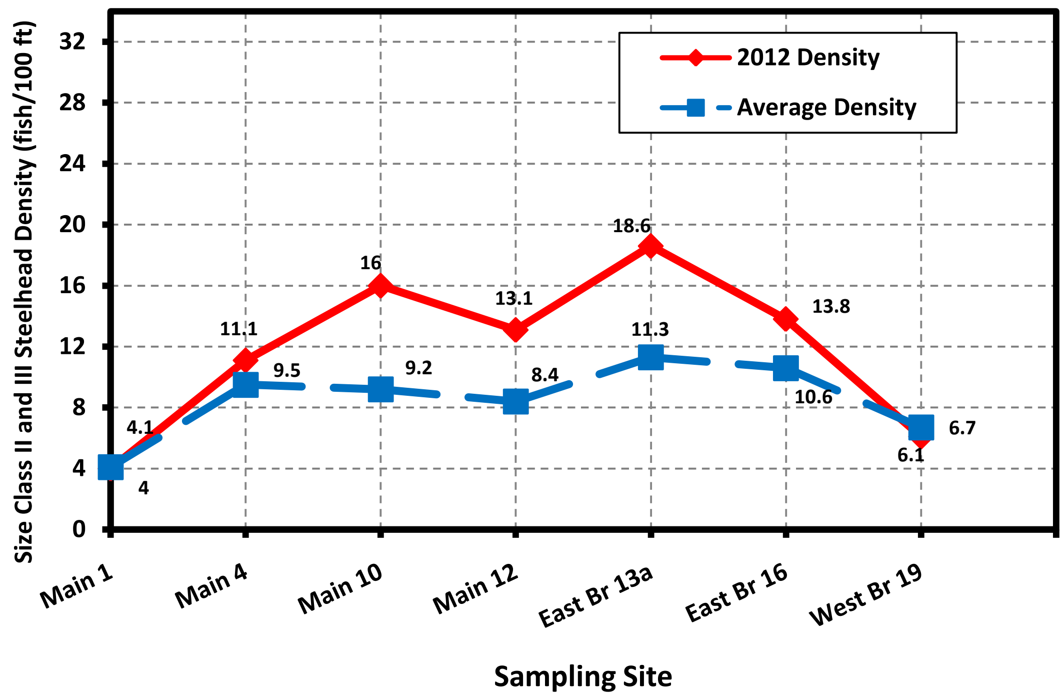


Figure B-26. Trend in Size Class II/III (=>75 mm SL) Juvenile Steelhead Density at Soquel Creek Sites, 1997-2012.
Size Class II/III Juvenile Steelhead Density (fish/ 100 ft)
40
35
30
25
20
15
10
5
0
Lower Mainstem 1
Lower Mainstem 4
Upper Mainstem 10
Upper Mainstem 12
East Branch 13a
East Branch 16
6-Site Average
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Sampling Year

Figure B-8. Size Class II and III Steelhead Site Densties in Soquel Creek in 2012 Compared to the 16-Year Average (12 th year for West Branch #19.)




## *iv. Steelhead Abundance in the Aptos Creek Watershed*

1. Based on hydrographs from stream gages in other watersheds (***Figures 33-41 in Appendix B***), it is likely that this watershed also had similarly lower baseflow in 2012 compared to 2011, probably near the median baseflow in spring and early summer, followed by slightly less than the median statistic for streamflow. This provided less food and slower growth rate in all reaches in 2012 compared to the 2 previous wetter years. Measured streamflow in fall in Aptos Creek confirmed significantly lower baseflow in 2012 than 2011 (***Table 5b in Appendix B***).

2. ***Habitat quality*** deteriorated at the lower Reach 2 in Aptos Creek from 2009, despite higher baseflow, due to much less escape cover (***Table B-16c** below*). The upper Aptos Reach 3 in Nisene Marks likely had reduced habitat quality compared to 2011, based on conditions at Site #4. Baseflow was less, pool depth decreased substantially and fine sediment increased. The one improvement at Site #4 was more escape cover with more instream wood.

3. ***YOY and yearling densities*** increased at both sites in 2012 (***Tables 32–33 in Appendix B***). YOY and yearling densities were above average at Site #4, while at Site #3 the YOY density was below average and the yearling density was above average (***Figures B-10 and B-11** below*). Yearling densities were above average despite low recruitment from an apparently

small YOY population in 2011.

4. As in other watersheds, YOY were smaller than in 2011 after a late spawn in 2012 with likely better survival. Yearlings survived better than in 2011, after a milder winter and more stayed another season. Less YOY growth in 2012 was indicated by the lower percent of YOY reaching Size Class II compared to the wetter year of 2011 at both Aptos sites (***Figure B-19*** *below*).

5. With the higher retention of yearlings, the ***Size Class II and III densities*** were near average at both sites (***Table 35 in Appendix B; Figure B-11***). However, the reduced baseflow compared to 2011 did not allow YOY's to reach Size Class II at Site #4 in 2012, and Size Class II densities were much higher at that site in 2011 because such a high percentage of YOY reached Size Class II that year.

6. Smolt ratings were "Good" at both sites due to retention of yearlings that averaged more than 102 mm SL (***Table B-40*** *above*).

7. The ***total juvenile abundance*** went up at both sites compared to 2011, consistent with the YOY abundance pattern (***Figure B-27*** *below*). Total juvenile densities were below average at lower Site 3 and above average at upper Site 4 (***Figure B-9*** *below*).

8. Aptos Lagoon/Estuary was sampled twice in September for steelhead and tidewater goby. Based on recapture data, the 2012 steelhead population estimate was 140, approximately 1/3 the 2011 estimate of 423. Juvenile steelhead were large (median size + 155-159 mm SL on both days) and represented a significant portion of the soon-to-smolt sized steelhead in the watershed (***Figure B-43*** *below*). The estuary was very saline during sampling, with temperature and salinity stratification and good oxygen concentrations throughout. Only the upper 0.5 meter had near freshwater conditions. The diminished number indicated that fewer steelhead likely spawned in the lower watershed than in 2011. Totals of 68 and 71 tidewater gobies were captured on each day, respectively, indicating a small population sustaining itself despite artificial breaching during March that drained the estuary and likely artificial breaching just prior to fall sampling.

**Table B-16c. Habitat Change in APTOS Reaches (2009 to 2012) AND CORRALITOS WATERSHED Reaches (2011 to 2012) and Replicated Sites (2011 to 2012; in parenthesis).**

| Reach Comparison or (Site Only) | Baseflow | Pool Depth | Fine Sediment | Embeddedness | Pool Escape Cover | Overall Habitat Change |
|---|---|---|---|---|---|---|
| Aptos 2 | + (compared to 2009) | + (slightly) | Similar | Similar | – (large) | – |
| (Aptos 4) | – | – | – | Similar | + | – (Site) |
| (Corralitos 1) | – | + | + | Similar | + | + (Site) |
| Corralitos 3 | – | – | – | – | – | – |
| Corralitos 5/6 | – | – | Similar | Similar | + | – |
| Corralitos 7 | – | – | Similar | Similar | + | + (due to more cover) |
| (Shingle Mill 1) | – | – | NA (Construction Turbidity in 2011) | NA (Construction Turbidity in 2011) | + | – (Site) |
| (Shingle Mill 3) | – | – | Similar | Similar | – | – (Site) |
| (Browns 1) | – | – | – | – | + | – (Site) |
| (Browns 2) | – | – | Similar | – | + | + (due to more cover) |

*** NA = Not Available.**

Figure B-10. Young-of-the-Year Steelhead Site Densties in Aptos Creek in 2012, with an 8-Year Average (1981; 2006-2012).

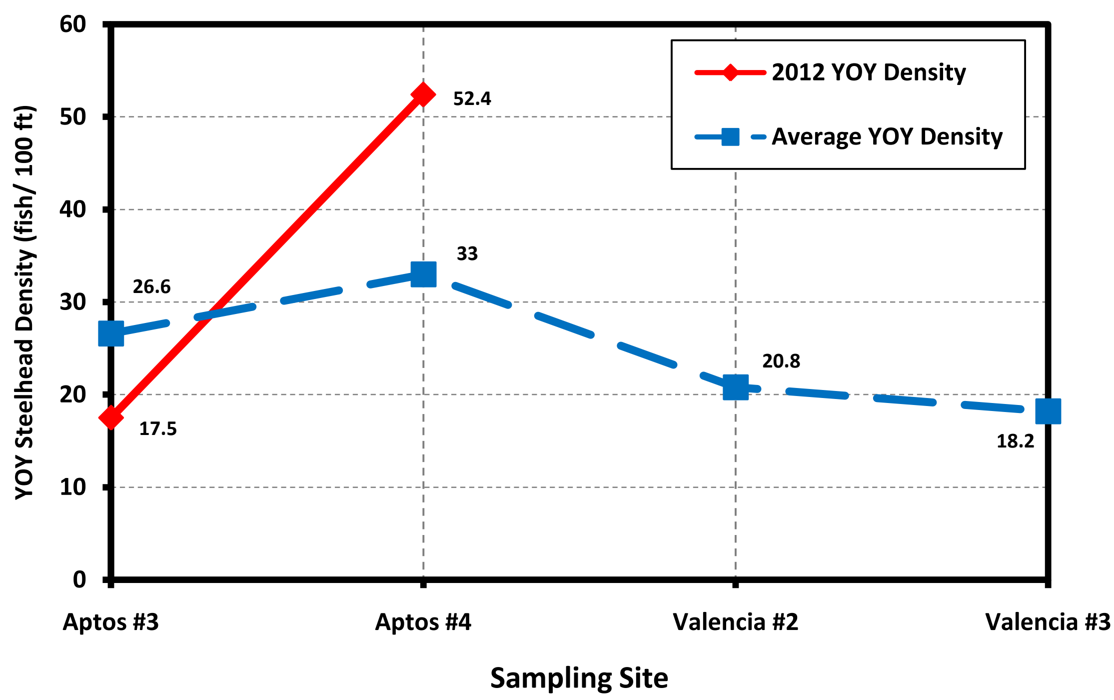



Figure B-11. Yearling and Older Juvenile Steelhead Site Densities in Aptos Creek in 2012, with an 8-Year Average (1981; 2006-2012).

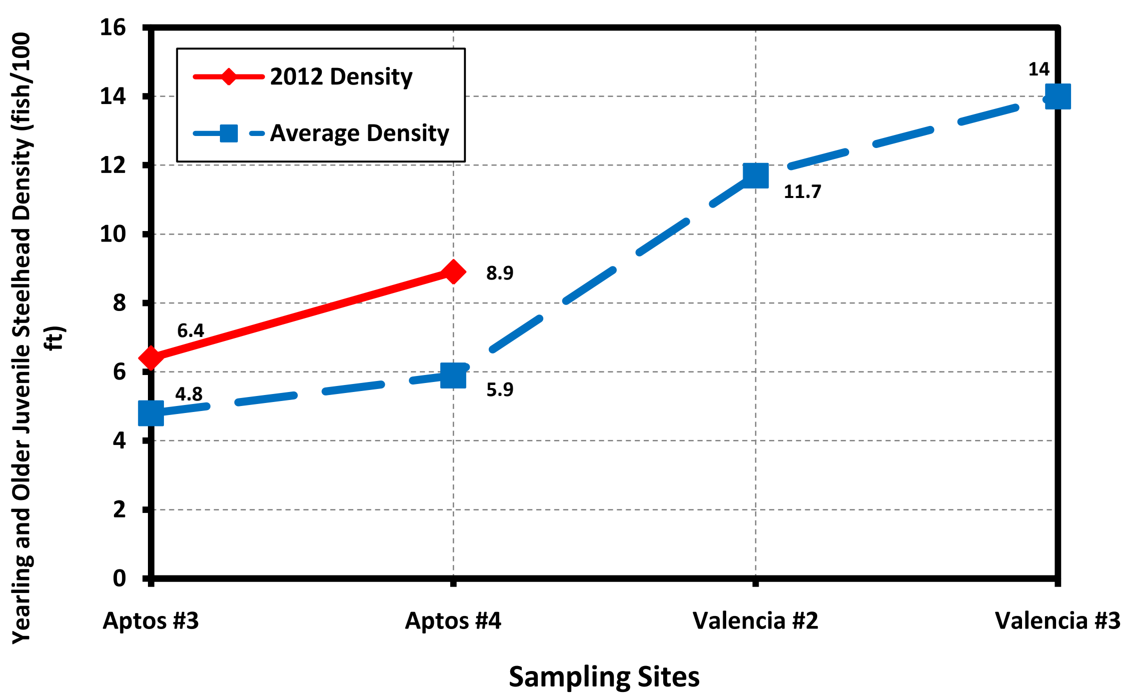


Figure B-19. Percent of Young-of-the-Year Steelhead in Size Class II (=>75 mm SL) at Aptos Creek Sites in 2012 and 2011.

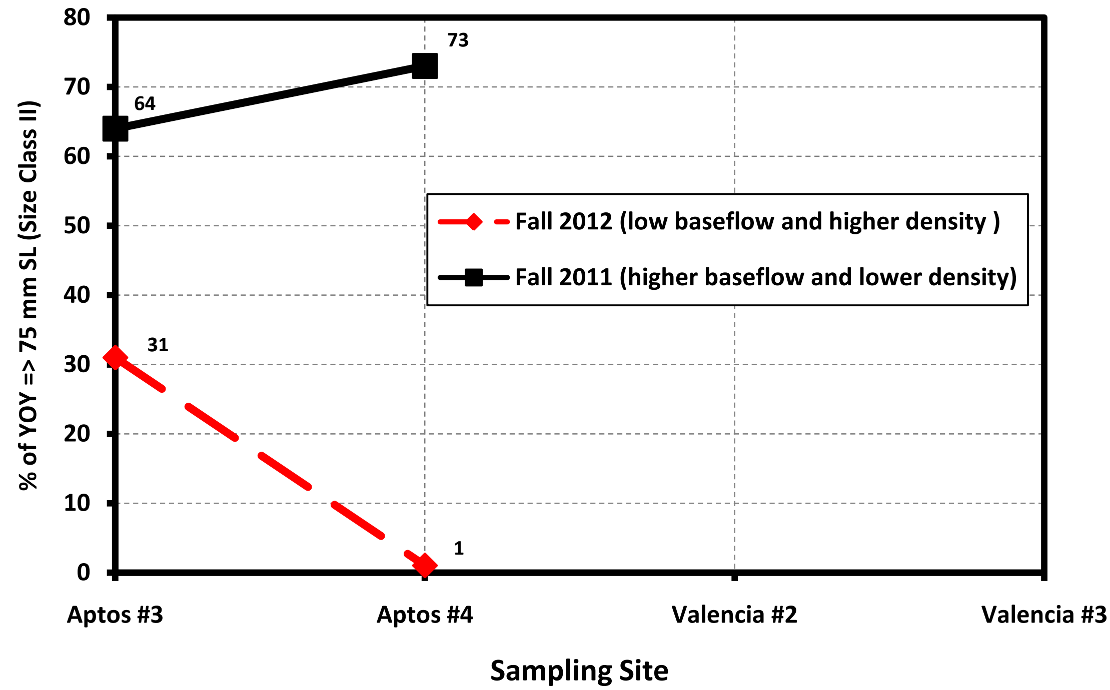



Figure B-12. Size Class II and III Steelhead Site Densities in Aptos and Valencia Creeks in 2012, with an 8-Year Average (1981; 2006-2012).

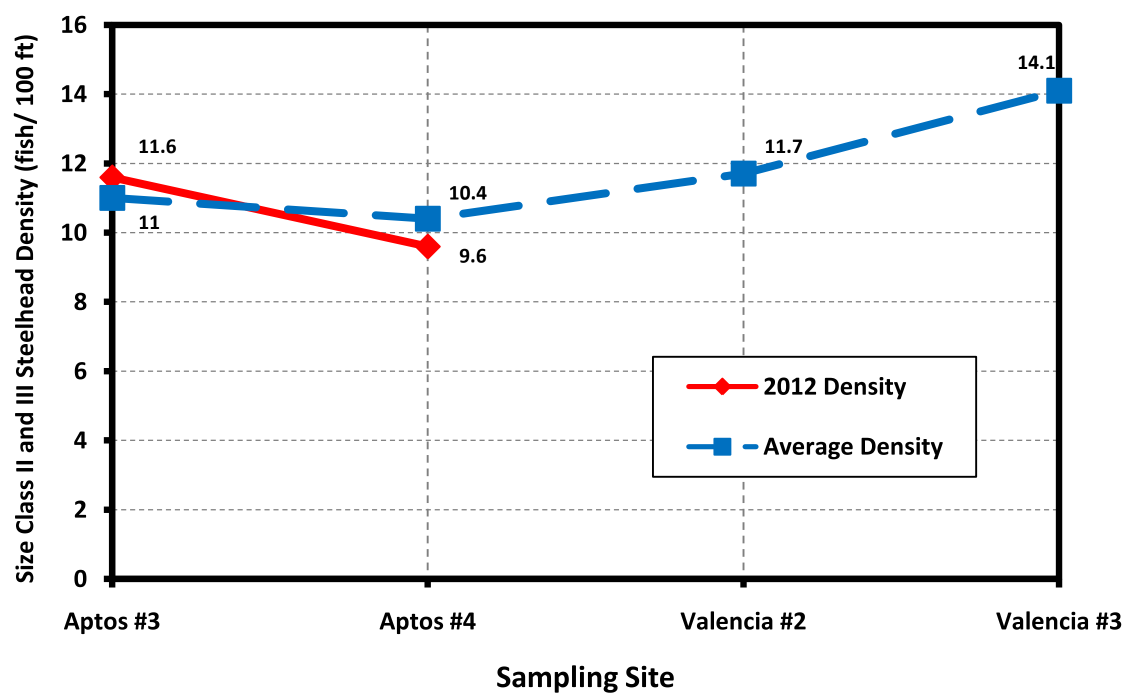


Figure B-27. Trend in Total Juvenile Steelhead Density in Aptos and Valencia Creek Sites, 2006-2012

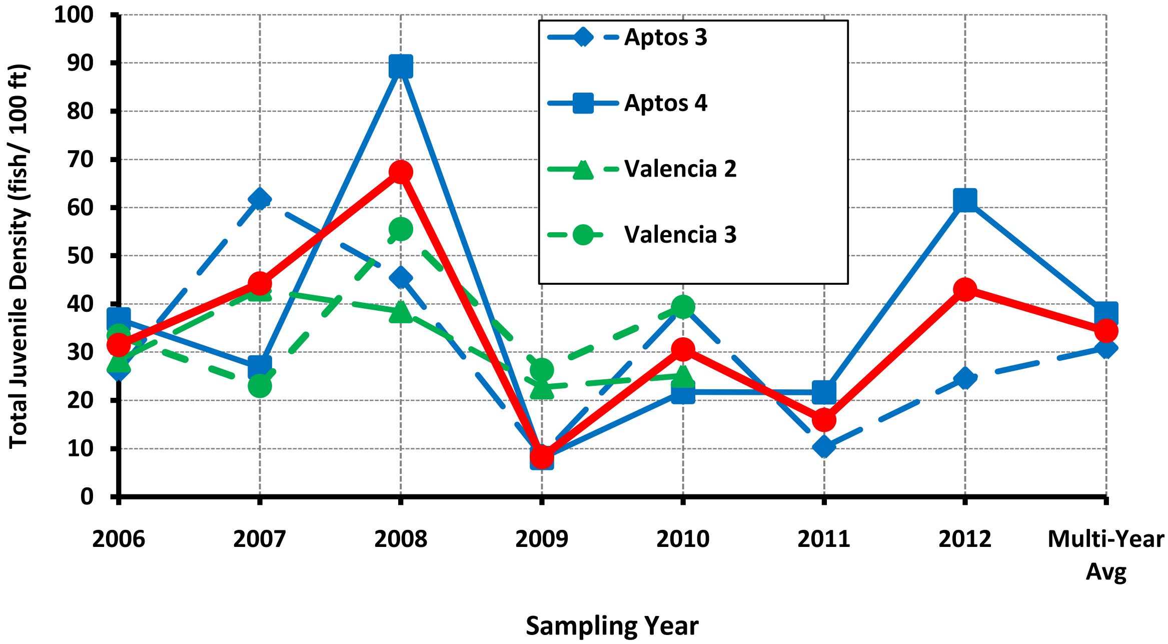



Figure B-9. Total Juvenile Steelhead Site Densities in Aptos Creek in 2012, with an 8-Year Average (1981; 2006-2012).

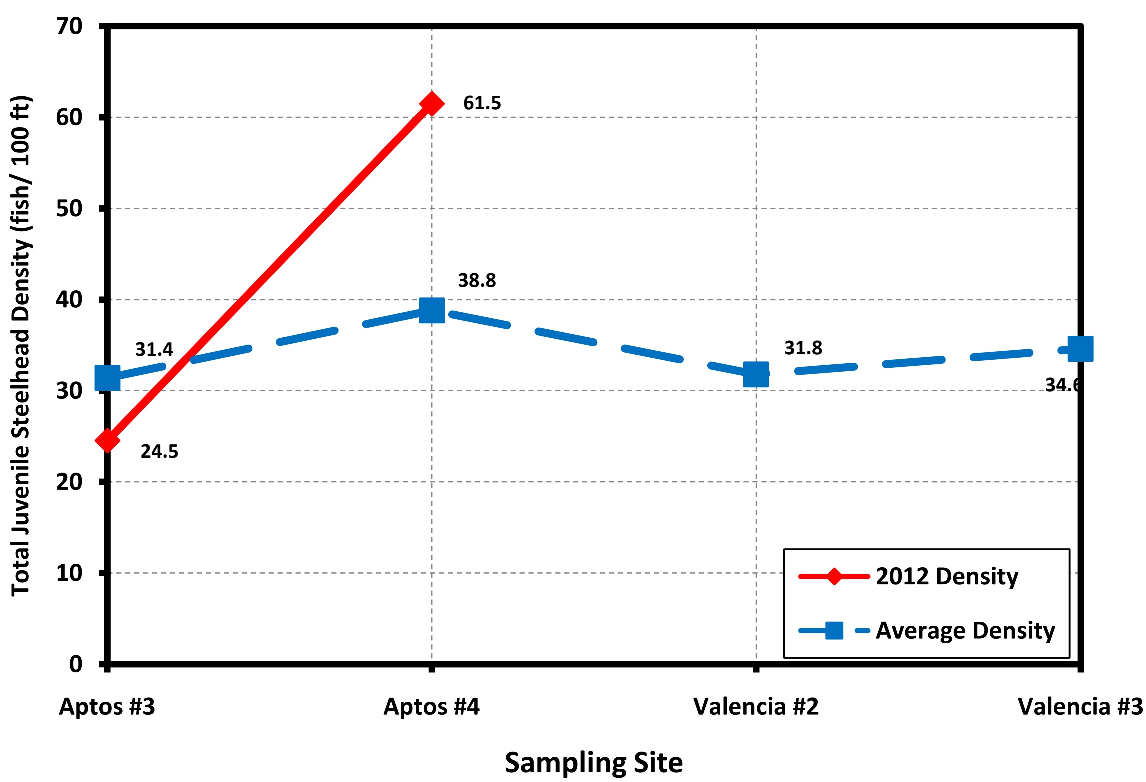


**Figure B-43. Size Frequency Histogram of Juvenile Steelhead Captured on 20 and 27 September 2012 in Aptos Lagoon/Estuary.**

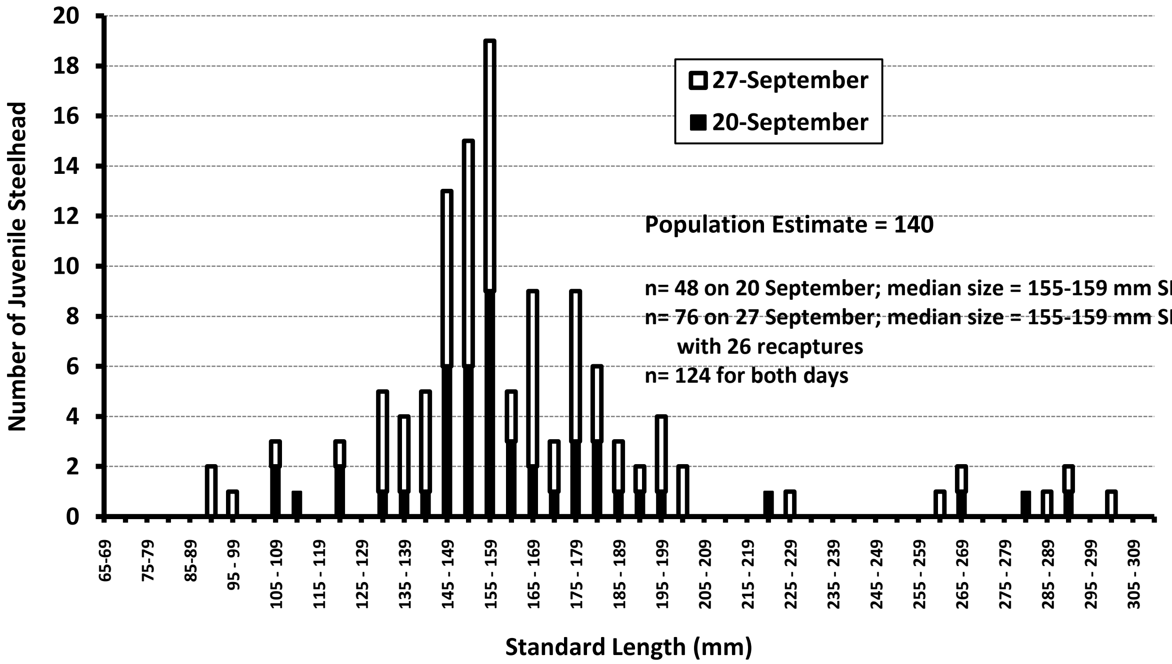
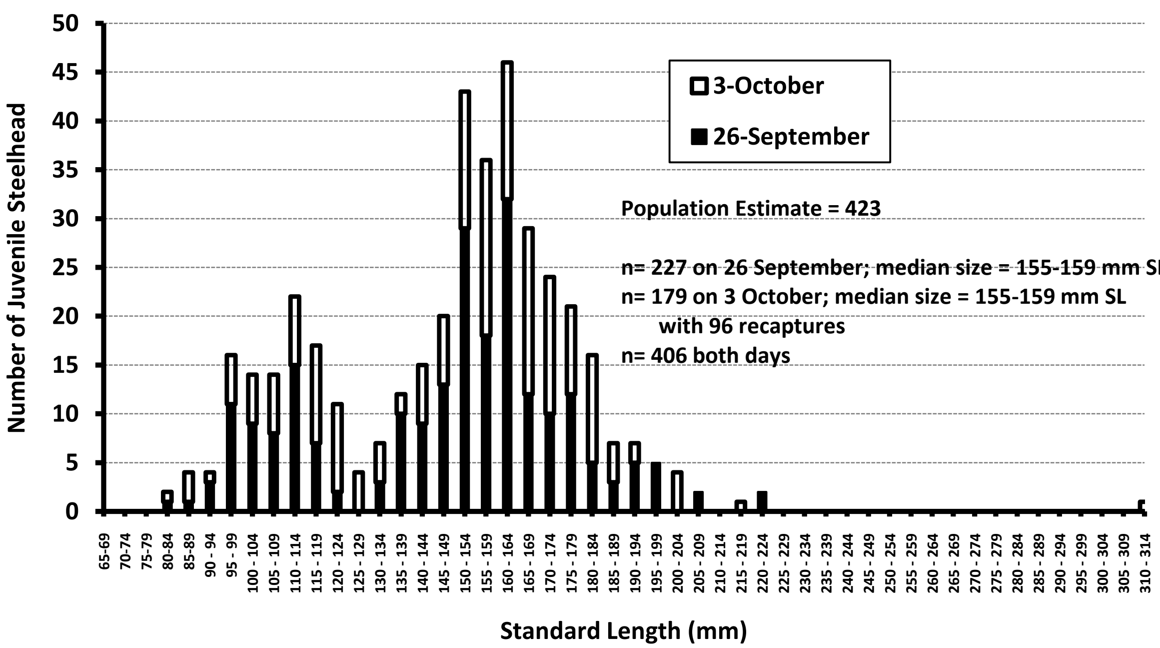
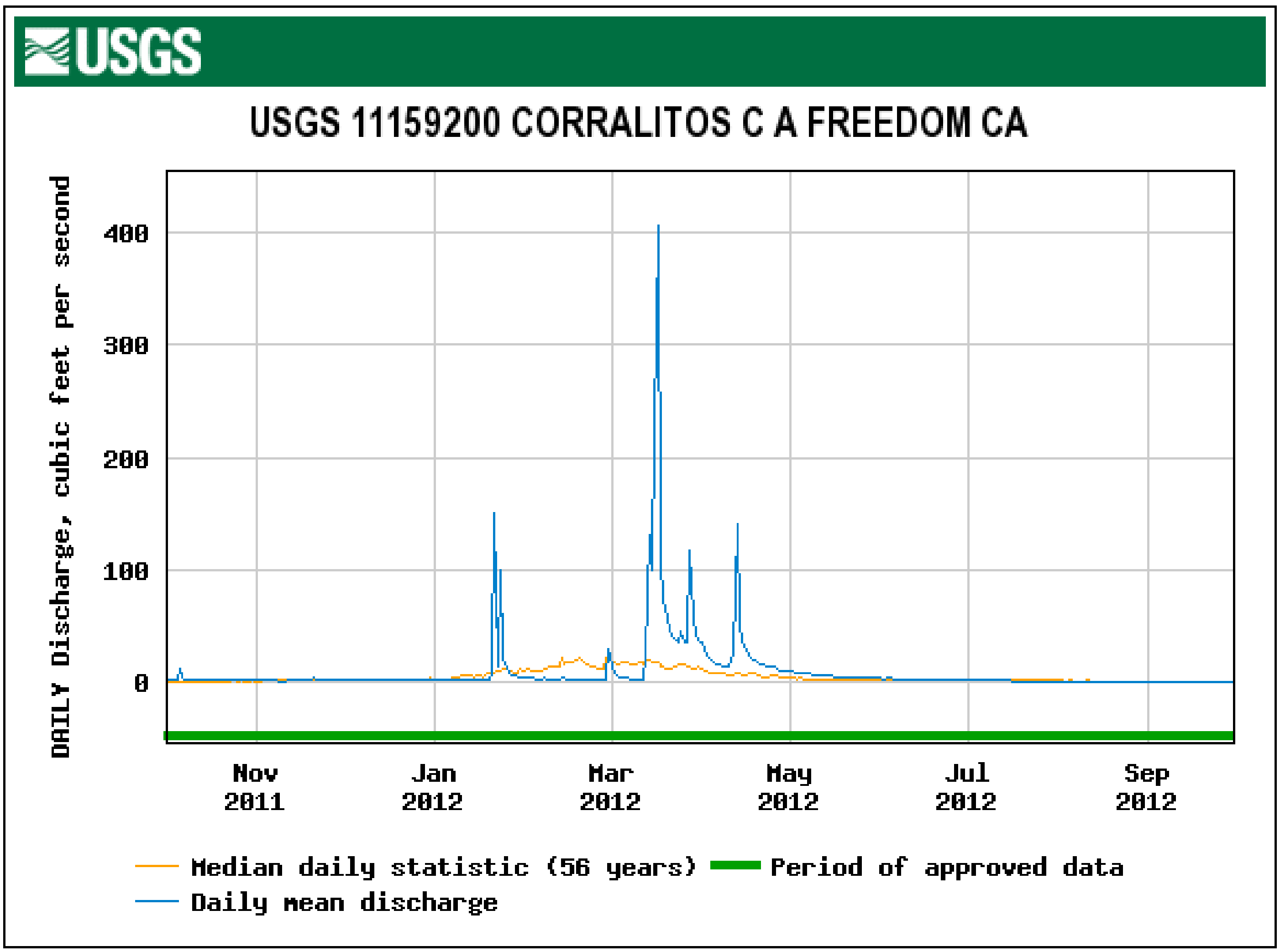


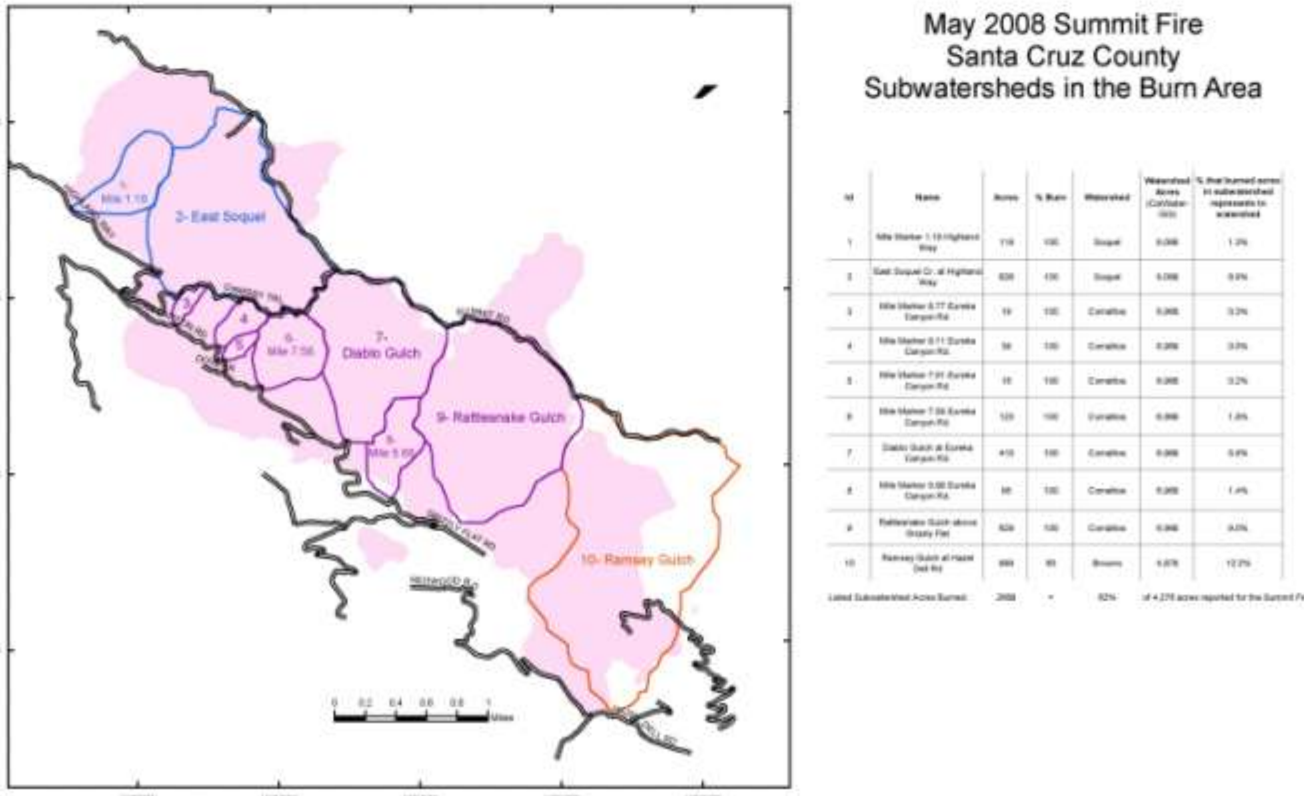

**Figure B-44. Size Frequency Histogram of Juvenile Steelhead Captured on 26 September and 3 October 2011 in Aptos Lagoon/Estuary.**



*__v. Steelhead Abundance in the Corralitos Creek Sub-Watershed__*

**1.** Net changes in ***habitat quality*** were inconsistent in various reaches and sites. Improvement occurred at the lowermost Site #1 on Corralitos Creek, upper Corralitos Reach 7 (Site #9) and upper Browns Site #2. Improved escape cover were positive changes at these sites. However, the two middle reaches in Corralitos (3 and 5/6), along with both Shingle Mill sites and lower Browns Site #1, declined in habitat quality. Decreased baseflow and shallower pool depths contributed to the declines. With reduced baseflow and continuing sediment abundance, pool depth declined in all 3 habitat-typed reaches in Corralitos Creek and at all replicated sites except Site #1. Fine sediment and embeddedness were either similar to 2011 or worse in 2012 except for less sediment at Corralitos Site #1. So, Corralitos Creek has not recovered from the fire of 2008, and added sedimentation was occurring in Browns Creek. On a positive note, during wood survey work in December in Corralitos Creek after bankfull stormflow, spawning gravel appeared more abundant than in recent years since the 2008 fire (***Table B-16c*** *above* ***and Tables 16a-b in Appendix B***).






2. As in other watersheds, ***YOY density*** increased at 6 of 8 sites in 2012. However, YOY density was only notably above average at the 2 lower Corralitos sites and lower Shingle Mill Site #1 (***Table 32 in Appendix B and Figure B-14*** below). With late spawning and reduced baseflow, very few YOY grew into Size Class II, unlike the much higher proportion in 2011 in all but Shingle Mill sites in 2011 (***Figure B-20*** *below*).

3. As was the pattern in other watersheds, ***yearling densities*** in 2012 increased at all sites except those in Shingle Mill Gulch (6 of 8 sites) (***Table 33 in Appendix B***). Yearling densities were either near average or above average at 7 of 8 sites in 2012 (***Figure B-15*** *below*). Spring stormflows were apparently mild enough to reduce yearling mortality or failed to allow yearlings to grow sufficiently to leave early or be flushed out, unlike what probably occurred in 2011.

4. In 2012, ***Size Class II densities*** were notably above average at 2 of 8 sites due to high yearling densities there (***Figures B-16 and B-31*** *below* ***and Table 35 in Appendix B, Table S-3*** *below*). The other 6 sites had near average or below average densities. This was similar to the pattern of higher yearling densities at upper sites in San Lorenzo tributaries and upper East Branch Soquel. Size Class II densities increased at 4 of 8 sites in the Corralitos sub-watershed in 2012, with increases at the lower 2 Corralitos sites and the 2 Browns Creek sites (***Table B-40*** *below*).

5. Four of 8 sites had improved ***soon-to-smolt ratings*** to “Good” at Corralitos #1, Browns #1 and Browns #2 and “Very Good” at Corralitos #3 due to increased yearling survival/retention (***Table B-40*** *below*). The two Shingle Mill sites had “Below Average” ratings, with the upper site being down-graded in 2012. Corralitos #8 in the still highly sedimented reach below Eureka Gulch also declined from “Fair” to “Below Average” because of low yearling density and poor pool habitat.

6. ***Total juvenile densities*** in 2012 followed a similar pattern to YOY densities, with them increasing at 7 of 8 sites compared to 2011 (***Table 31 in Appendix B***). Total 2012 densities increased considerably above average at the two lower Corralitos sites and somewhat above average at lower Shingle Mill Site #1 and both Browns Creek sites (***Figures B-13 and B-29*** *below).*

7. As in other watersheds, the adult spawning steelhead population entering the watershed when passage flows were available in March and April may have been small in 2012. This may have lead to insufficient reproduction to saturate reaches with redds and egg production after the spring stormflows passed.

8. With regard to adult steelhead passage above the Corralitos Creek diversion dam between Corralitos Sites #1 and #3, passage conditions through the fish ladder should have been adequate during the protracted rainy season of 15 March−15 April. YOY densities of nearly 40 fish/ 100 feet above the dam at Site #3 (above average YOY density) and Site #9 indicated that adults negotiated the fish ladder to spawn upstream.

9. No steelhead were captured during sampling of Pajaro Lagoon in early October, though water quality conditions at that time were not prohibitive for the species. Tidewater goby were present and most abundant at a site that was 3 miles upstream of the beach berm.

Figure B-14. Young-of-the-Year Steelhead Site Densities in Corralitos, Shinglemill and Browns Creeks in 2012, with a 9-Year Average (1981; 1994; 2006-2012).

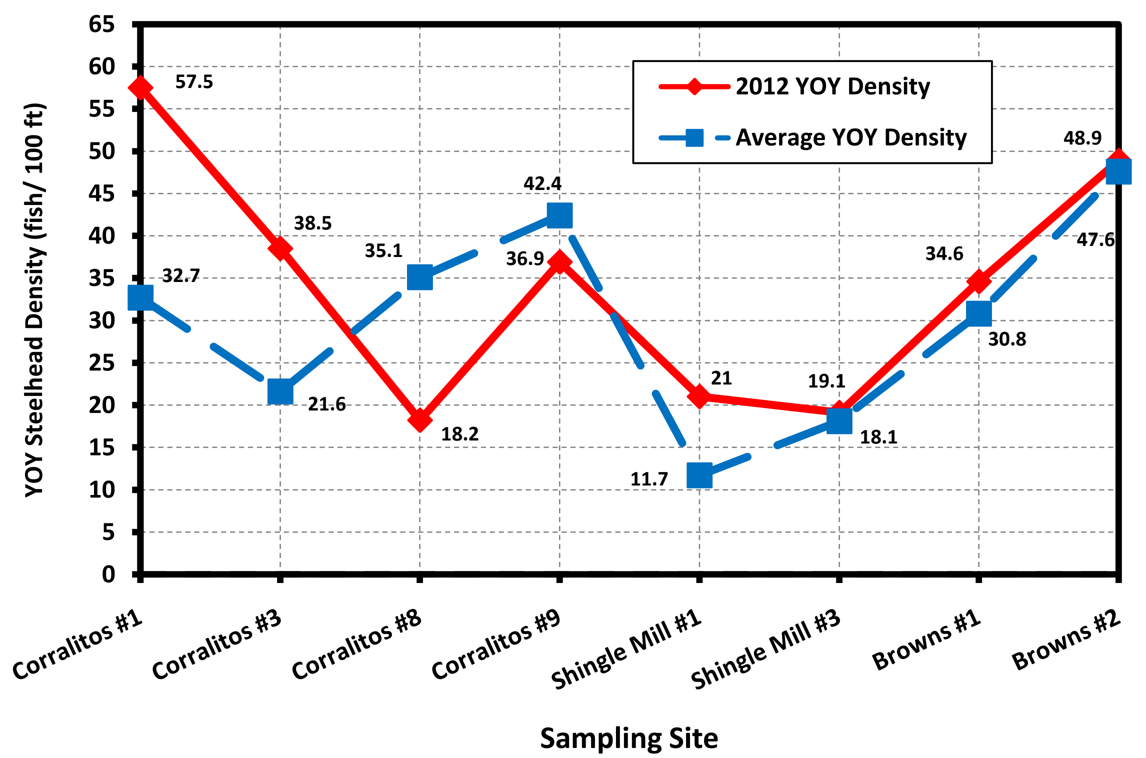



Figure B-20. Percent of Young-of-the-Year Steelhead in Size Class II (=>75 mm SL) at Corralitos Watershed Sites in 2012 and 2011.

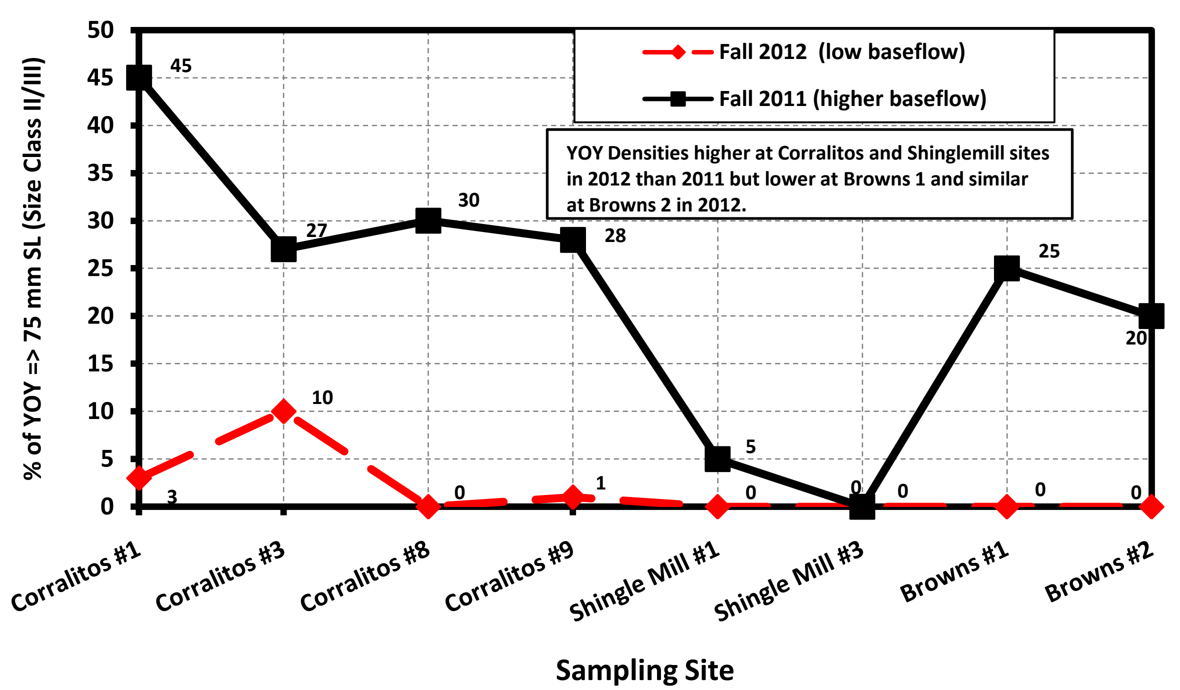


**Figure B-15. Yearling and Older Steelhead Site Densities in Corralitos, Shingle Mill and Browns Creeks in 2012, with a 9-Year Average (1981; 1994; 2006-2012).**

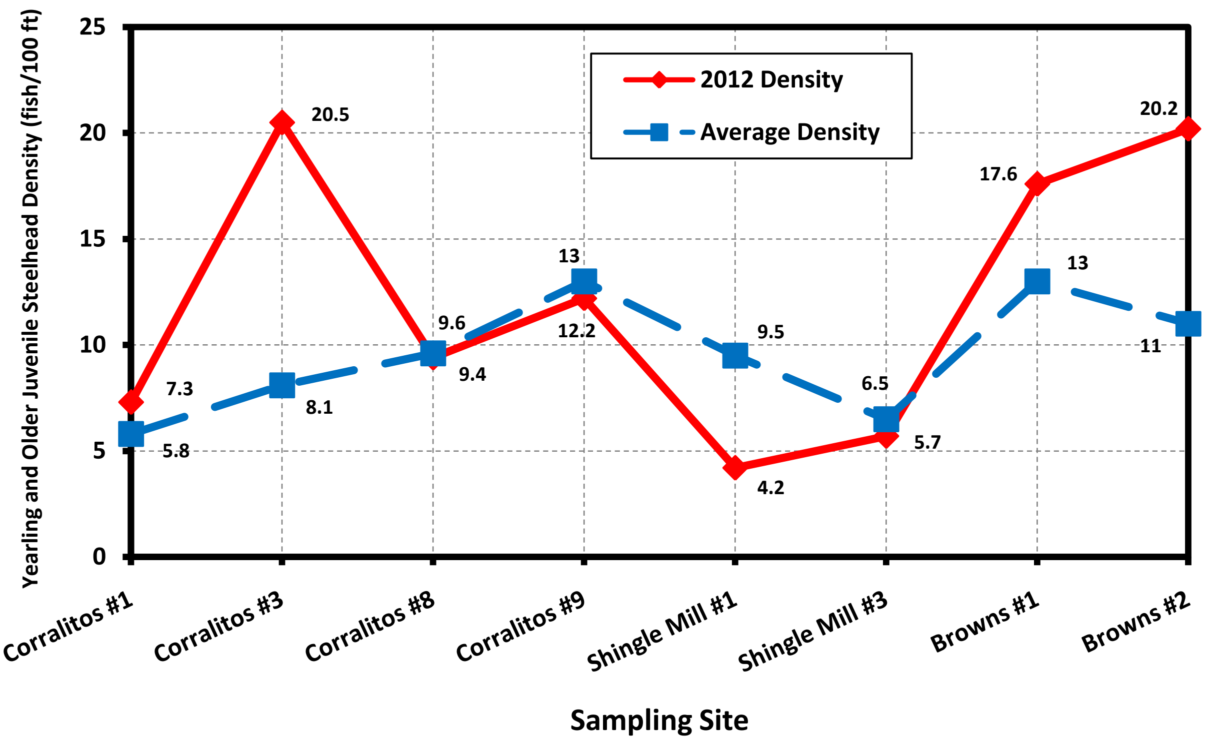


Figure B-16. Size Class II and III Steelhead Site Densities in Corralitos, Shingle Mill and Browns Creeks in 2012, with a 9-Year Average (1981; 1994; 2006-2012).

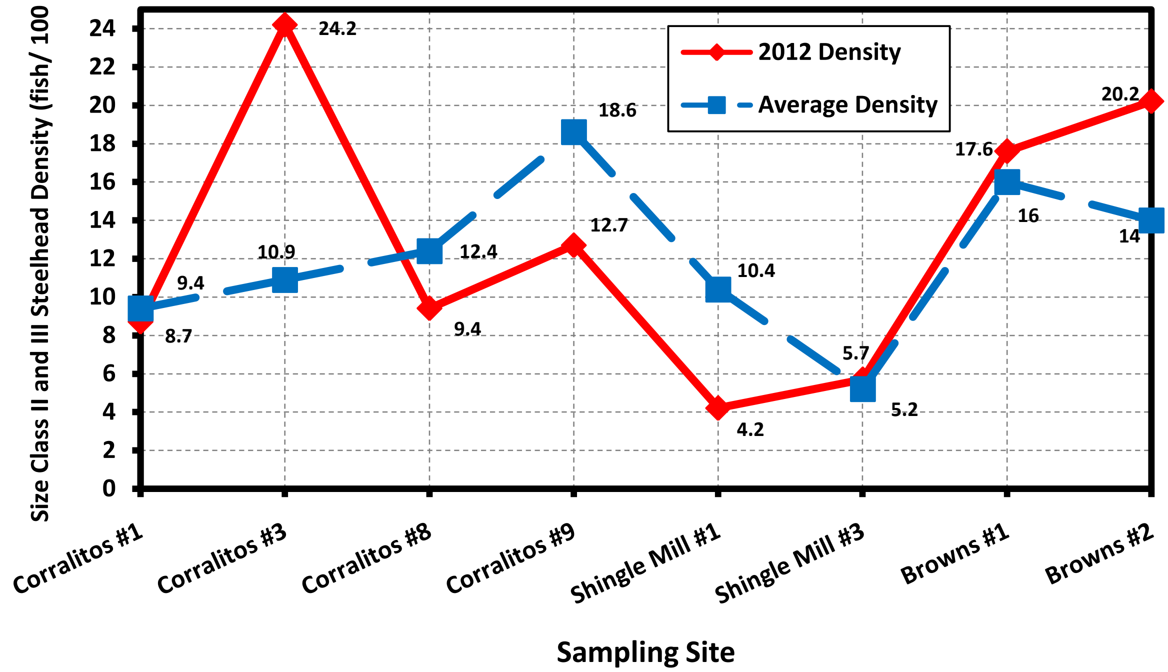



Figure B-31a. Trend by Year in Size Class II/III Juveniles Steelhead Density at Corralitos Creek Sites, 2006-2012.

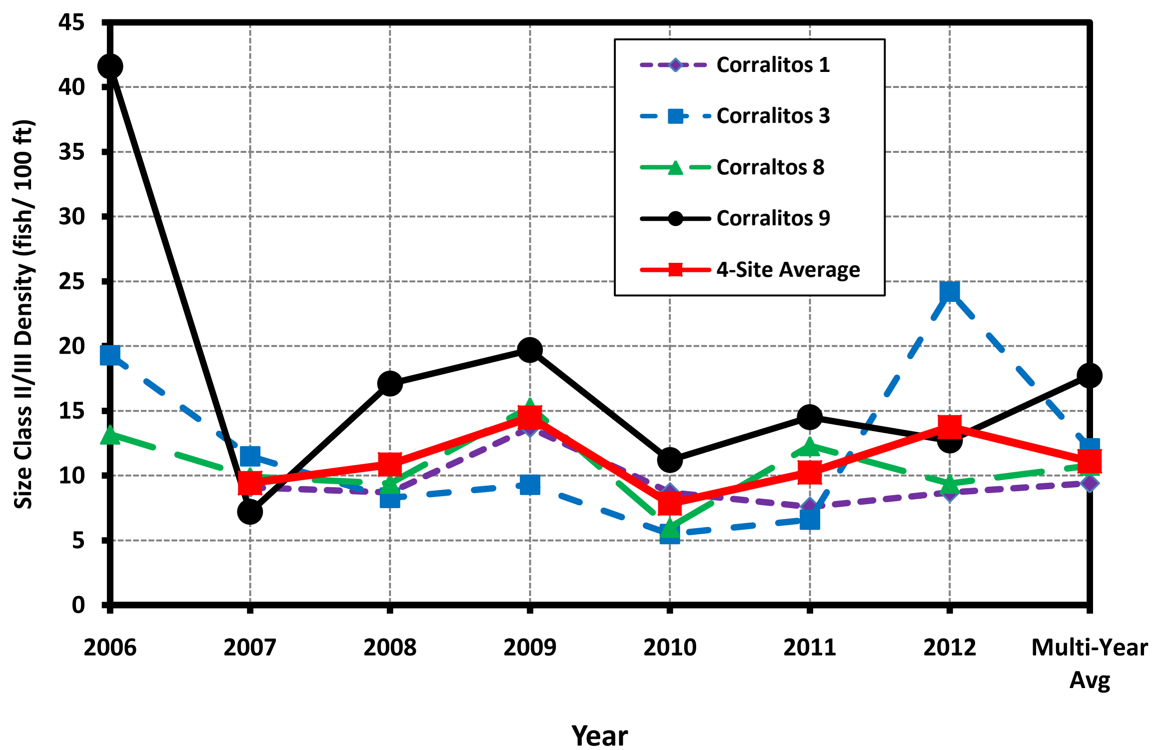


**Table S-3. 2012 Sampling Sites Rated by Potential Smolt-Sized Juvenile Density (=>75 mm SL) and Average Smolt Size, with Physical Habitat Change since 2011.** (Red denotes ratings of 1 and 2 or negative habitat change; italicized purple denotes ratings of 5 and 6. Methods for habitat change in M-6 of Appendix B).

| Site | Multi-Year Avg. Potential Smolt Density Per 100 ft (Years of data) | 2012 Potential Smolt Density (per 100 ft)/ Avg Smolt Size (mm) | 2012 Smolt Numeric Rating | Symbolic Rating (1 to 7) | Physical Habitat Change by Reach or Site Since 2009/2011 |
|---|---|---|---|---|---|
| *Low. San Lorenzo #0a* | *7.4 (n=3)* | *26.9/ 135 mm* | *7* | ******* | Site Positive |
| Low. San Lorenzo #1 | 10.2 (n=11) | 7.6/ 119 mm | 4 | **** | Site Negative |
| Low. San Lorenzo #2 | 17.1 (n=10) | 6.6/ 111 mm | 4 | **** | Reach Negative |
| Low. San Lorenzo #4 | 16.0 (n=11) | 8.9/ 87 mm | 3 | *** | Site Negative |
| Mid. San Lorenzo #6 | 4.6 (n=14) | 3.3/ 86 mm | 1 | * | Site Negative |
| Mid. San Lorenzo #8 | 6.8 (n=14) | 2.0/ 81 mm | 1 | * | Site Negative |
| Up. San Lorenzo #11 | 6.8 (n=14) | 2.9/ 101 mm | 2 | ** | Reach Negative |
| *Up. San Lorenzo #12b* | | *11.3/ 112 mm* | *5* | ***** | No Data |
| *Zayante #13a* | *11.1 (n=14)* | *14.2/ 107 mm* | *5* | ***** | Site Negative |
| *Zayante #13c* | *14.5 (n=14)* | *20.0/ 90 mm* | *5* | ***** | Site Negative |
| *Zayante #13d* | *15.6 (n=14)* | *8.6/ 127 mm* | *5* | ***** | Site Negative |
| Lompico #13e | 6.7 (n=7) | 2.3/ 127 mm | 3 | *** | Site Negative |
| *Bean #14b* | *12.6 (n=15)* | *10.1/ 122 mm* | *5* | ***** | Site Negative |
| Bean #14c | 9.5 (n=12) | 5.2/ 120 mm<br>Went Dry | 4 | **** | Site Negative |
| *Fall #15* | *13.8 (n=10)* | 13.0/ 113 mm | *5* | ***** | Site Negative |
| Newell #16 | 14.1 (n=9) | 7.3/ 93 mm | 3 | *** | Site Negative |
| Boulder #17a | 11.8 (n=15) | 7.2/ 131 mm | 4 | **** | Site Negative |
| *Boulder #17b* | *10.7 (n=15)* | *10.6/ 104 mm* | *5* | ***** | Site Negative |
| Bear #18a | 11.0 (n=15) | 4.1/ 115 mm | 4 | **** | Reach Negative |
| *Branciforte #21a-2* | *9.8 (n=12)* | *12.3/ 114 mm* | *5* | ***** | Site Negative |
| *Branciforte #21b* | *15.1(n=6)* | *27.3/ 96 mm* | *6* | ****** | No Data |
| Soquel #1 | 4.1 (n=15) | 4.0/ 115 mm | 4 | **** | Site Negative |
| Soquel #4 | 9.4 (n=16) | 11.1/ 101 mm | 4 | **** | Site Positive |
| *Soquel #10* | *8.8 (n=16)* | *16.0/ 94 mm* | *5* | ***** | Reach Negative |
| Soquel #12 | 8.1 (n=15) | 13.1/ 93 mm | 4 | **** | Site Positive |
| *E. Branch Soquel #13a* | *10.8 (n=16)* | *18.6/ 94 mm* | *5* | ***** | Site Positive |
| *E. Branch Soquel #16* | *10.3 (n=16)* | *13.8/ 105 mm* | *5* | ***** | Reach Negative |
| W. Branch Soquel #19 | 6.8 (n=12) | 6.1/ 91 mm | 3 | *** | Reach Negative |
| *Aptos #3* | *10.9 (n=8)* | *11.6/ 103 mm* | *5* | ***** | Reach Negative |
| *Aptos #4* | *10.5 (n=8)* | *9.6/ 120 mm* | *5* | ***** | Site Negative |
| *Corralitos #1* | *9.6 (n=6)* | *8.7/ 108 mm* | *5* | ***** | Site Positive |
| Corralitos #3 | 9.3 (n=9) | 24.2/ 114 mm | 6 | ****** | Reach Negative |
| Corralitos #8 | 12.8 (n=9) | 9.4/ 100 mm | 4 | **** | Reach Negative |
| *Corralitos #9* | *19.4 (n=9)* | *12.7/ 105 mm* | *5* | ***** | Reach Positive |
| Shingle Mill #1 | 11.2 (n=9) | 4.2/ 101 mm | 3 | *** | Site Negative |
| Shingle Mill #3 | 5.2 (n=9) | 5.7/ 91 mm | 3 | *** | Site Negative |
| *Browns Valley #1* | *15.8 (n=9)* | *17.6/ 98 mm* | *5* | ***** | Site Negative |
| *Browns Valley #2* | *13.2 (n=9)* | *20.2/ 97 mm* | *5* | ***** | Site Positive |

**Table B-40. 2012 Sampling Sites Rated by Potential Smolt-Sized Juvenile Density (=>75 mm SL) and Their Average Size in Standard Length Compared to 2011, with Physical Habitat Change from 2011 Conditions.**

(Red denotes ratings of 1−3 (as in Table S-3) and negative habitat change and italicized purple denotes ratings of 5−7. Methods for habitat change in M-6 of Appendix B.)

| Site | 2012 Potential Smolt Density (per 100 ft)/ Avg Pot. Smolt Size SL (mm) | 2012 Smolt Rating (With Size Factored In) | 2011 Potential Smolt Density (per 100 ft)/ Avg Pot. Smolt Size SL (mm) | 2011 Smolt Rating (With Size Factored In) | Physical Habitat Change by Reach/Site Since 2011 |
|---|---|---|---|---|---|
| Low. San Lorenzo #0a | 26.9/ 135 mm | *Very Good* | 2.1/ 124 mm | Below Average | + |
| Low. San Lorenzo #1 | 7.6/ 119 mm | Fair | 2.6/ 148 mm | Below Average | − |
| Low. San Lorenzo #2 | 6.6/ 111 mm | Fair | 11.2/ 142 mm | *Good* | − |
| Low. San Lorenzo #4 | 8.9/ 87 mm | Below Average | 3.7/ 103 mm | Below Average | − |
| Mid. San Lorenzo #6 | 3.3/ 86 mm | Very Poor | 5.3/ 85 mm | Poor | − |
| Mid. San Lorenzo #8 | 2.0/ 81 mm | Very Poor | 3.4/ 82 mm | Very Poor | − |
| Up. San Lorenzo #11 | 2.9/ 101 mm | Poor | 7.9/ 84 mm | Poor | − |
| Up. San Lorenzo #12b | 11.3/ 112 mm | *Good* | No data | No data | No data |
| Zayante #13a | 14.2/ 107 mm | *Good* | 4.8/ 116 mm | Fair | − |
| Zayante #13c | 20.0/ 90 mm | *Good* | 29.2/ 95 mm | *Good* | − |
| Zayante #13d | 8.6/ 127 mm | *Good* | 11.7/ 97 mm | Fair | − |
| Lompico #13e | 2.3/ 127 mm | Below Average | 7.8/ 95 mm | Below Average | − |
| Bean #14b | 10.1/ 122 mm | *Good* | 7.4/ 127 mm | Fair | − |
| Bean #14c | 5.2/ 120 mm | Fair<br>Went Dry | 8.8/ 104 mm | *Good* | − |
| Fall #15 | 13.0/ 113 mm | *Good* | 14.7/ 115 mm | *Good* | − |
| Newell #16 | 7.3/ 93 mm | Below Average | 13.1/ 99 mm | Fair | − |
| Boulder #17a | 7.2/ 131 mm | Fair | 10.6/ 101 mm | Fair | − |
| Boulder #17b | 10.6/ 104 mm | *Good* | 13.6/ 106 mm | *Good* | − |
| Bear #18a | 4.1/ 115 mm | Fair | 9.4/ 98 mm | Fair | − |
| Branciforte #21a-2 | 12.3/ 114 mm | *Good* | 13.6/ 100 mm | Fair | − |
| Branciforte #21b | 27.3/ 96 mm | *Very Good* | No data | No data | No data |
| Soquel #1 | 4.0/ 115 mm | Fair | 2.7/ 135 mm | Below Average | − |
| Soquel #4 | 11.1/ 101 mm | Fair | 5.3/ 118 mm | Fair | + |
| Soquel #10 | 16.0/ 94 mm | *Good* | 5.8/ 107 mm | Fair | − |
| Soquel #12 | 13.1/ 93 mm | Fair | 5.6/ 109 mm | Fair | + |
| East Branch Soquel #13a | 18.6/ 94 mm | *Good* | 10.1/ 112 mm | *Good* | + |
| East Branch Soquel #16 | 13.8/ 105 mm | *Good* | 15.4/ 100 mm | Fair | − |
| West Branch Soquel #19 | 6.1/ 91 mm | Below Average | 16.9/ 95 mm | Fair | − |
| Aptos #3 | 11.6/ 103 mm | *Good* | 7.1/ 101 mm | Below Average | − |
| Aptos #4 | 9.6/ 120 mm | *Good* | 16.7/ 104 mm | *Very Good* | − |
| Corralitos #1 | 8.7/ 108 mm | *Good* | 7.6/ 100 mm | Fair | + |
| Corralitos #3 | 24.2/ 114 mm | *Very Good* | 6.6/ 123 mm | Fair | − |
| Corralitos #8 | 9.4/ 100 mm | Fair | 12.3/ 109 mm | *Good* | − |
| Corralitos #9 | 12.7/ 105 mm | *Good* | 14.5/ 104 mm | *Good* | + |
| Shingle Mill #1 | 4.2/ 101 mm | Below Average | 7.0/ 100 mm | Below Average | − |
| Shingle Mill #3 | 5.7/ 91 mm | Below Average | 8.0/ 98 mm | Fair | − |
| Browns #1 | 17.6/ 98 mm | *Good* | 14.2/ 100 mm | Fair | − |
| Browns #2 | 20.2/ 97 mm | *Good* | 13.3/ 101 mm | Fair | + |

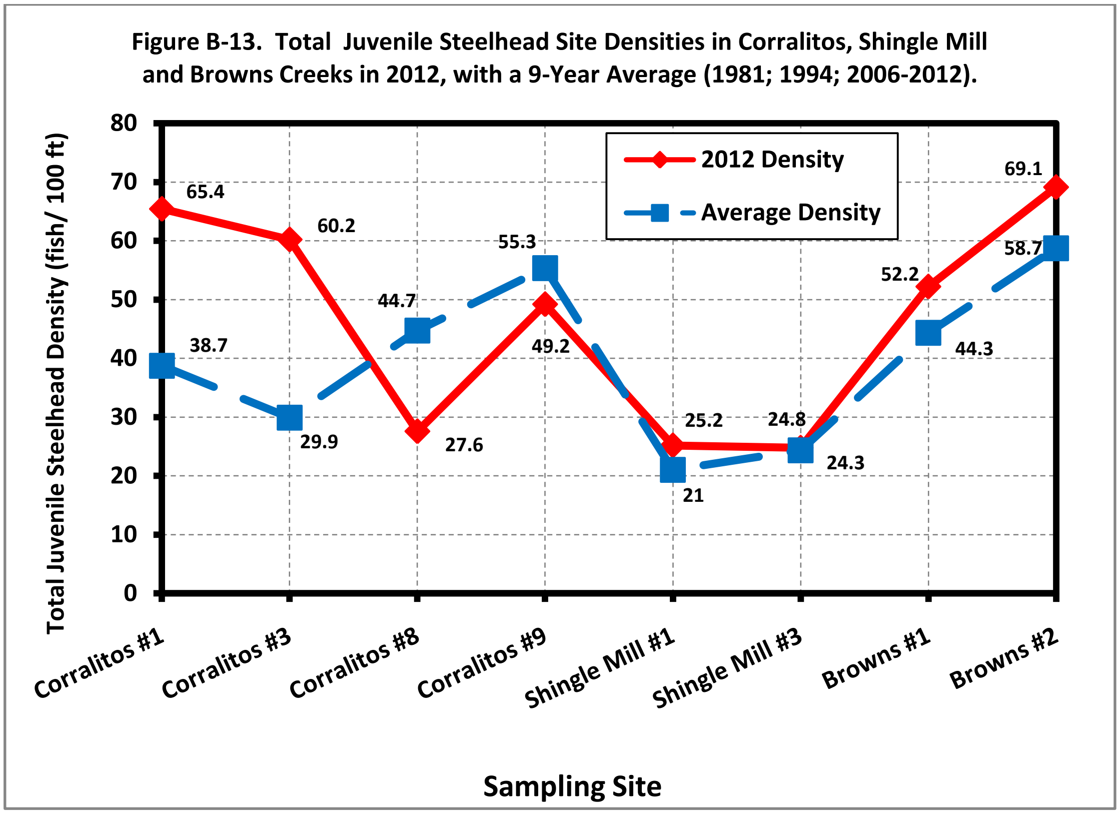
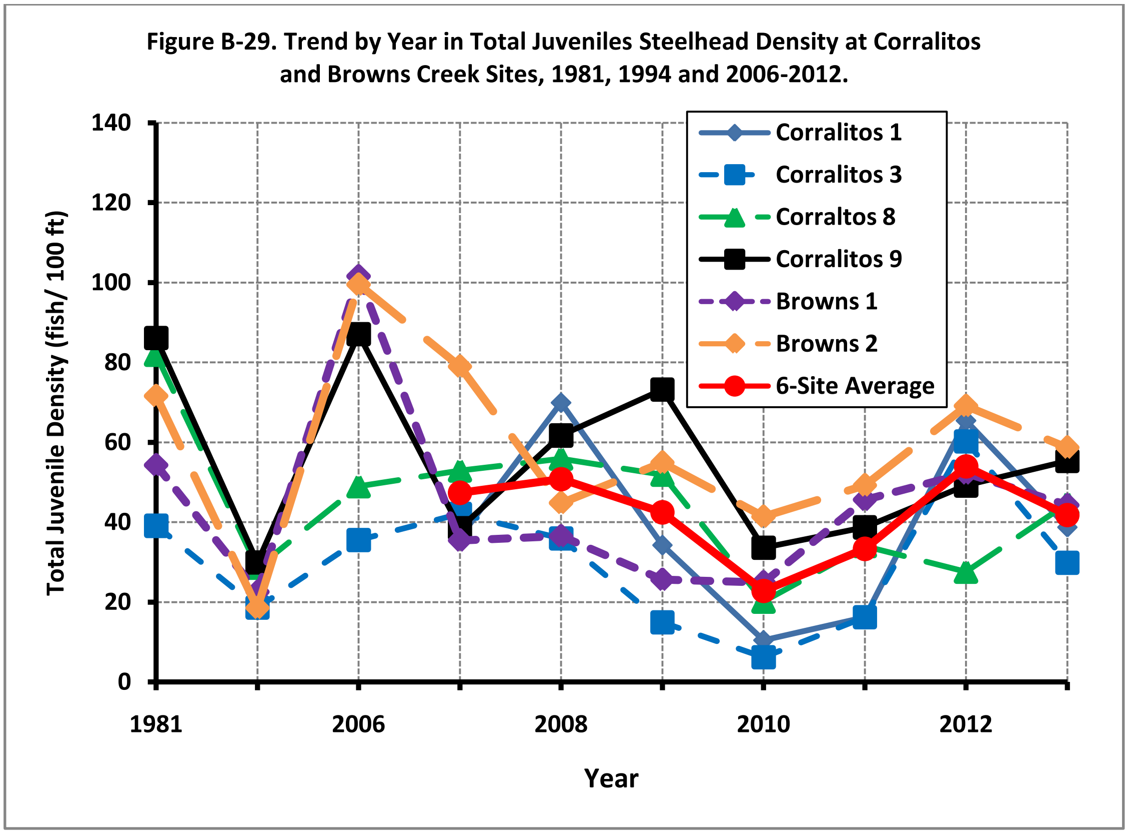


Figure B-13. Total Juvenile Steelhead Site Densities in Corralitos, Shingle Mill and Browns Creeks in 2012, with a 9-Year Average (1981; 1994; 2006-2012).
2012 Density
Average Density
Total Juvenile Steelhead Density (fish/ 100 ft)
80
70
60
50
40
30
20
10
0
65.4
60.2
27.6
49.2
25.2
24.8
52.2
69.1
38.7
29.9
44.7
55.3
21
24.3
44.3
58.7
Corralitos #1
Corralitos #3
Corralitos #8
Corralitos #9
Shingle Mill #1
Shingle Mill #3
Browns #1
Browns #2
Sampling Site




# E. MANAGEMENT RECOMMENDATIONS

1. Retain more large, instream wood throughout all four watersheds under study. More instream wood will promote scour, deepen pools, create patches of coarser spawning gravel and provide escape cover for juvenile steelhead rearing and overwinter yearling survival. The goal is to increase steelhead spawning success and juvenile production to at least the level seen in the late 1990's.

2. Retain more winter storm runoff in Scotts Valley and Felton to reduce stormflow flashiness that causes streambank erosion and sedimentation, leading to poor spawning and rearing conditions in the mainstem. Better storm runoff retention will also increase winter recharge of aquifers to increase spring and summer baseflow, which will increase YOY steelhead growth into Size Classes II and III in the lower mainstem.

3. Support efforts to capture high winter stormflows in the San Lorenzo River for conjunctive use with the Soquel Creek Water District to rest the Soquel Creek groundwater aquifer and to recharge the Santa Margarita aquifer in the San Lorenzo watershed. The goal is to increase spring/summer baseflow steelhead growth rate and densities of soon-to-smolt sized juveniles in both watersheds.

4. The San Lorenzo Lagoon provides important steelhead habitat in the watershed. Support efforts to allow the sandbar to form naturally, allow enough stream inflow to convert the lagoon to freshwater as quickly as possible and deter artificial summer breaching.

5. Along Bean Creek, perform educational outreach and better water conservation and winter storage (reduce summer well pumping). The goal is to maintain surface streamflow in the heavily used steelhead reach above MacKenzie Creek confluence, which was lost in 2007−2009 and 2012. This reach was also used by coho salmon in 2005.

6. In Fall Creek, notch the fallen old-growth Douglas fir across the channel to improve adult passage.

7. In Fall Creek, seal the leakage under the concrete weirs at the San Lorenzo Valley Water District diversion structure. Reduce the jump heights through the first and last of 4 weirs and remove debris as needed to prevent blockage.

8. In Lompico Creek, YOY production widely fluctuates, indicating problems with adult passage and spawning success. Investigate passage issues in the lower reaches including the bedrock cascade above the fish ladder and the abandoned flashboard dam spillway between the ladder and the sampling site. Continue to maintain the fish ladder.

9. In Branciforte Creek, prioritize and remove/modify man-made structures that create adult steelhead passage impediments.

10. In Soquel Creek, develop better water management and conservation, with the goal of reducing spring and early summer water diversion/pumpage and maximize baseflow. With increased baseflows, growth rate and densities of soon-to-smolt sized juvenile steelhead will likely increase. Educational outreach to capture and store more winter rains should be directed to streamside landowners, agriculturalists and nurseries.

11. Improve adult steelhead passage at Girl Scout Falls II on the West Branch to allow steelhead passage to 4 additional miles of habitat on a regular basis.

12. Perform erosion control at the Highland Way slide on the East Branch to reduce chronic sedimentation from that site.

13. We recommended that Aptos Lagoon be closely monitored for unauthorized sandbar breaching, juvenile abundance and water quality. Individuals who illegally breach the sandbar in summer should be prosecuted.

14. Develop an Aptos Lagoon management plan which protects residential and commercial property, as well as the important fishery value of the lagoon with minimal sandbar manipulation.

15. In the Corralitos Creek watershed (especially in the Eureka Gulch sub-watershed), identify the sources of sedimentation stemming from the Summit Fire and institute erosion control and revegetation measures to reduce future sedimentation.

16. Carry out a study to examine the passability of the Pajaro drainage to out-migrant smolts and in-migrant adult steelhead to and from the Corralitos sub-watershed. If passability proves to be difficult in drier years, develop a program of well pumping, water diversion and aquifer recharge that is compatible with successful steelhead migration.

17. The sandbar at the mouth of the Pajaro River should be allowed to close naturally as flows decline in the summer. Artificial breaching should be prohibited in summer.

18. Spatial heterogeneity should be protected in the Pajaro Lagoon/estuary. Slackwater areas with overhanging riparian vegetation should be allowed to form to provide rearing and breeding habitat for tidewater goby during the dry season. Tule beds are valuable rearing habitat and provide winter refuge. Natural training of the Pajaro River outlet channel to the east, as occurs at other local creek mouths, results in a long lateral extent of the summer lagoon to the east of Watsonville Slough. This is significant summer habitat along the beach berm for tidewater goby and arrow goby.

19. Emergency breaching of the Pajaro River sandbar for flood control should be minimized. Breaching should be done so that lagoon draining is as slow as possible and with a maximum residual backwater depth in the estuary after draining. Breaching at high tide will encourage this. Pursue projects that will reduce the need for emergency breaching.

20. Add County streamflow monitoring sites that would better supplement the fishery work. Add sites in Fall, Bean and Boulder creeks near fish sampling sites, as well as more mainstem San Lorenzo sites below Kings, Boulder, Love and Fall Creek confluences. Measurements in the fall, as well as ones in early summer are important.

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# APPENDIX A. WATERSHED MAPS.


**Figure 1. Santa Cruz County Watersheds.**

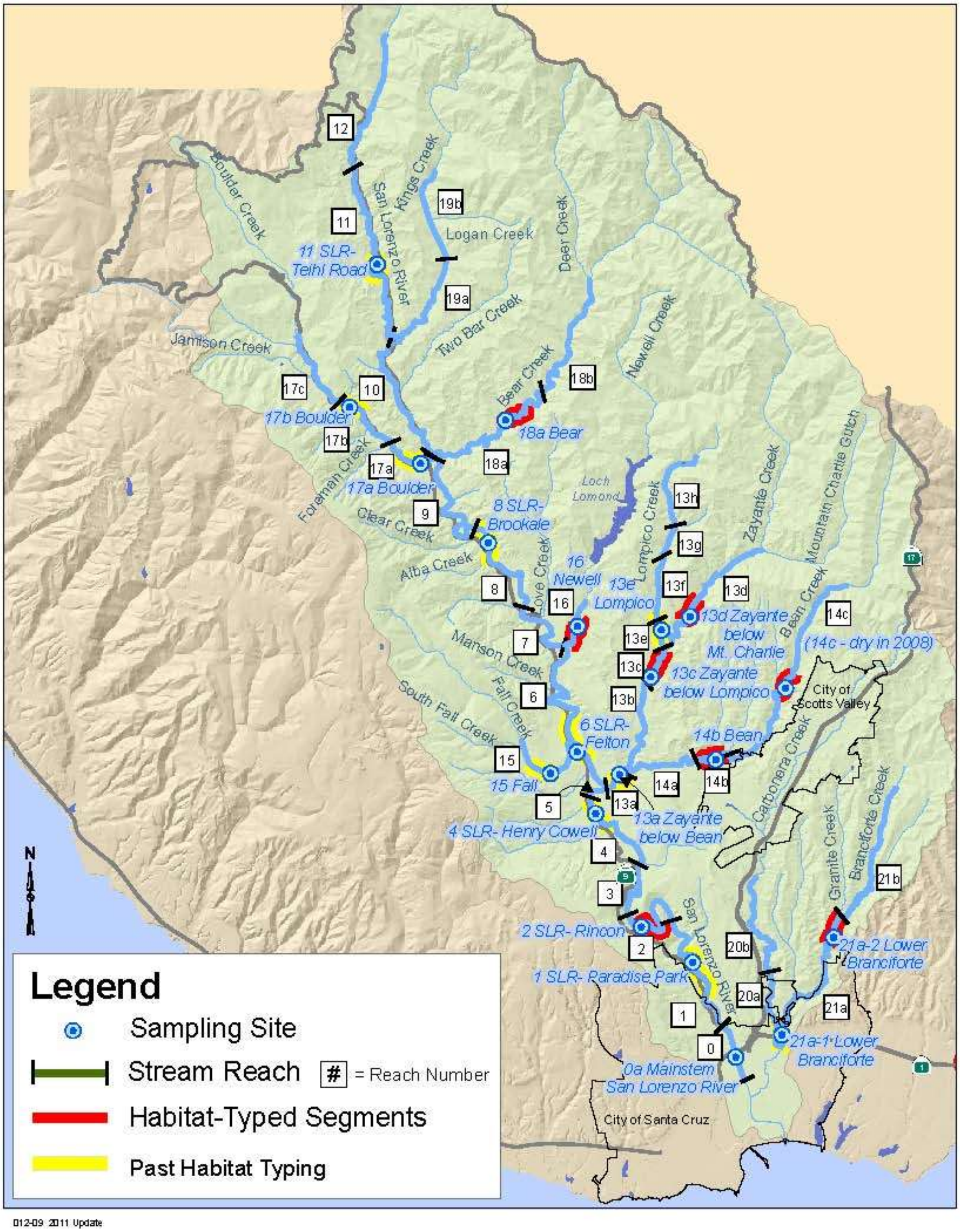
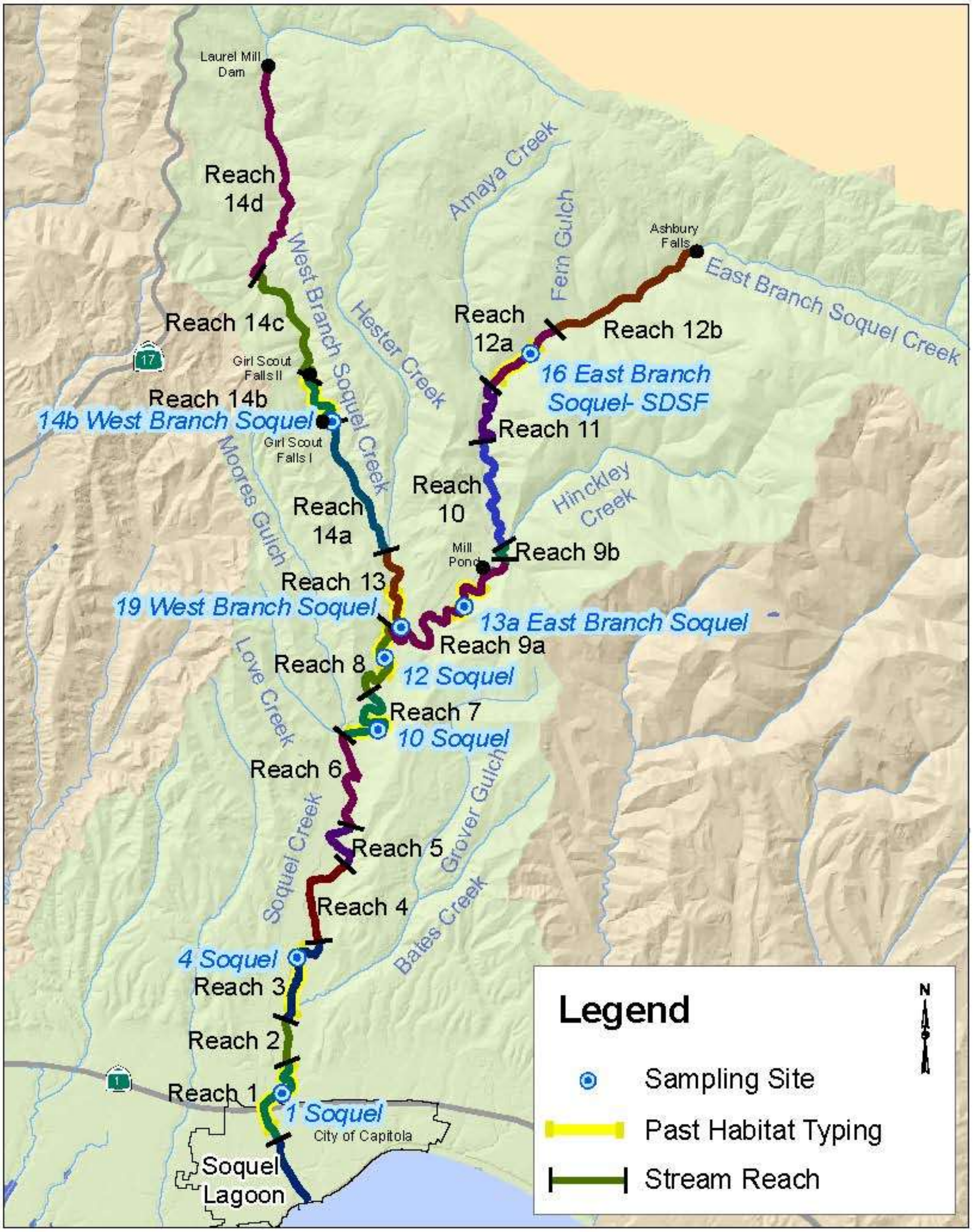



**Figure 2. San Lorenzo River Watershed− Sampling Sites and Reaches.**



012-09 2011 Update

**Figure 3. Soquel Creek Watershed.**

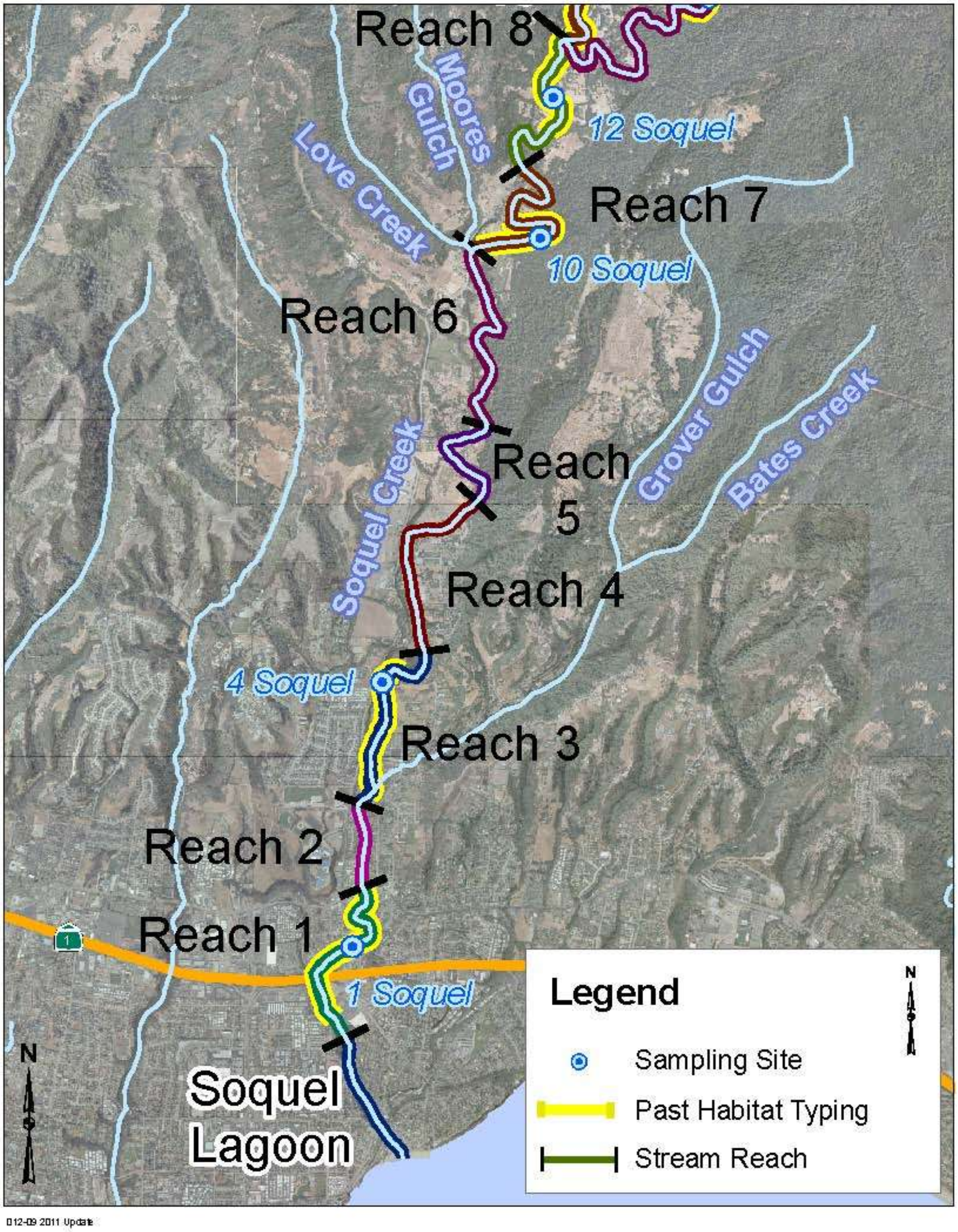
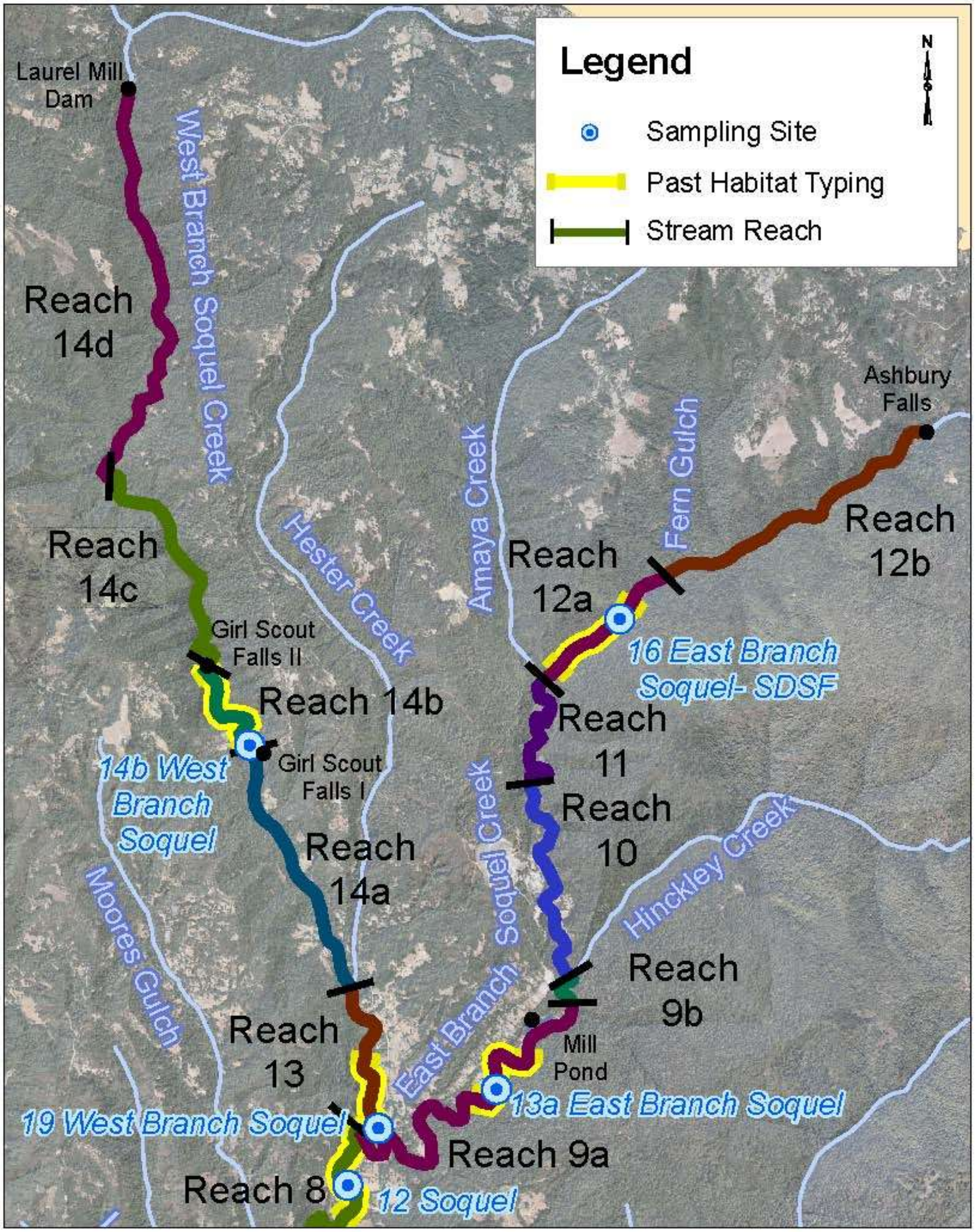



**Figure 4. Lower Soquel Creek (Reaches 1–8 on Mainstem).**




012-09 2011 Update

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

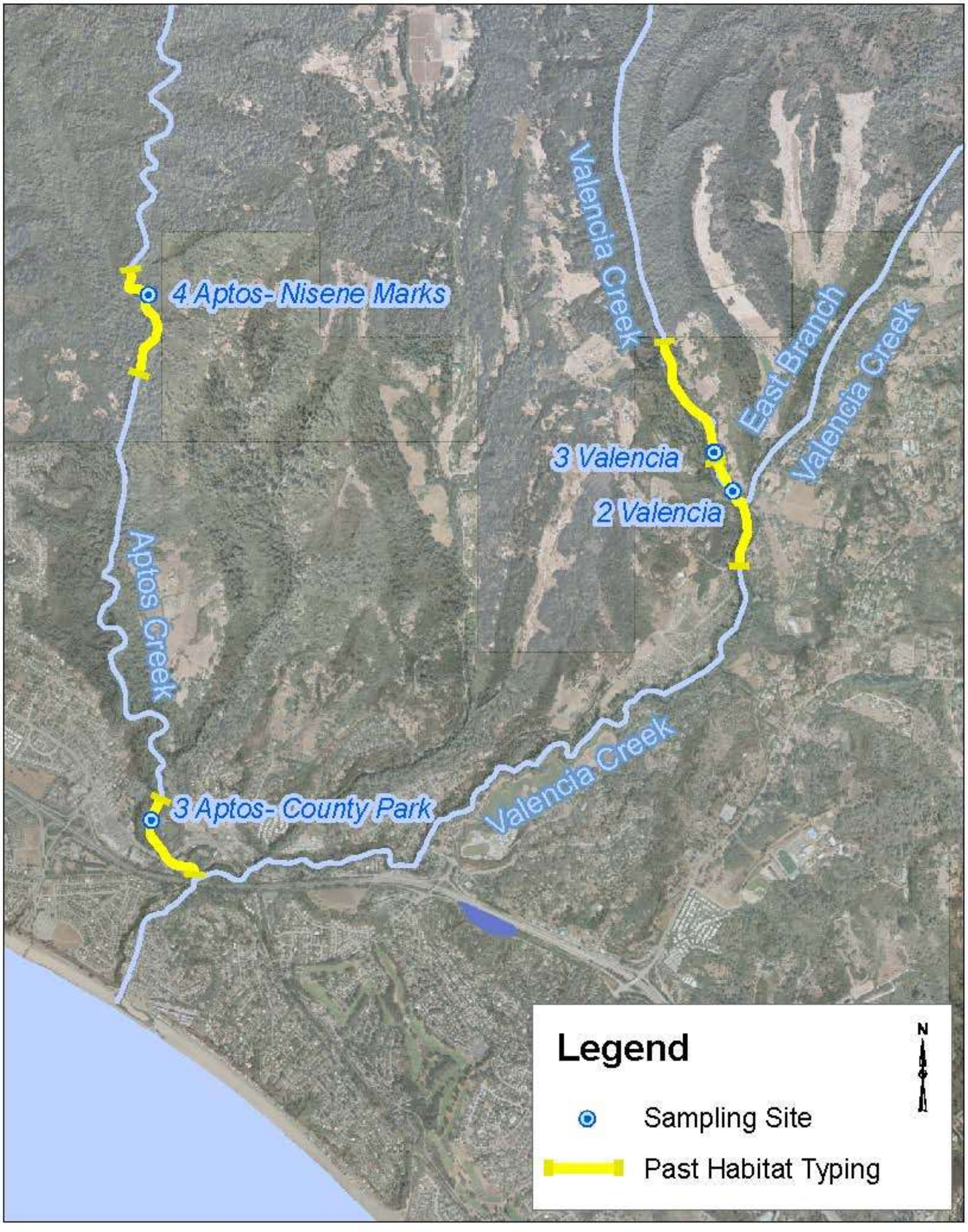



**Figure 6. Aptos Creek Watershed.**

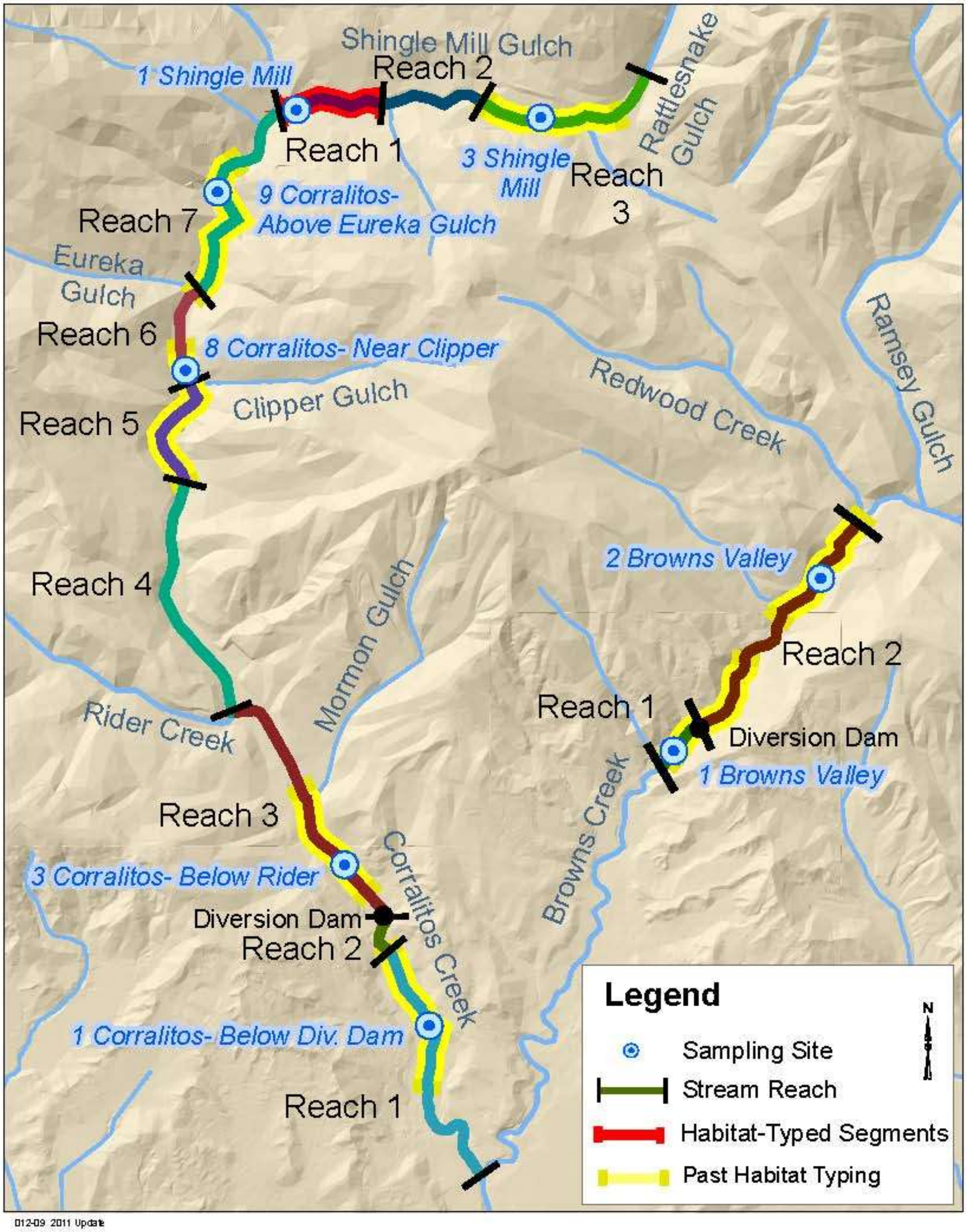



**Figure 7. Upper Corralitos Creek Sub-Watershed of the Pajaro River Watershed.**

# APPENDIX B. DETAILED ANALYSIS OF 2012 STEELHEAD MONITORING IN THE SAN LORENZO, SOQUEL, APTOS AND CORRALITOS WATERSHEDS

**(Provided electronically in a separate PDF file.)**

# APPENDIX C.  SUMMARY OF 2012 CATCH DATA AT SAMPLING SITES.

**(Provided electronically in Excel files.)**

# APPENDIX D. HABITAT AND FISH SAMPLING DATA WITH SIZE HISTOGRAMS.

**(Provided electronically in a separate PDF file.)**

# APPENDIX E. HYDROGRAPHS OF SAN LORENZO, SOQUEL AND CORRALITOS WATERSHEDS.

**(Provided electronically in a separate PDF file.)**