



**2025 SUMMARY REPORT– Juvenile Steelhead Densities and Indices of Juvenile Production in the San Lorenzo, Soquel and Aptos Watersheds, Santa Cruz County, CA**



**Barker's Dam, a Migrational Impediment, Perched on Bedrock along the San Lorenzo River, Downstream of the Boulder Creek Confluence. March, 2014.**

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**Cities of Santa Cruz and Capitola, Soquel Creek Water District, San Lorenzo Valley Water District, Scotts Valley Water District, and the County of Santa Cruz**

**(Sampling for Tidewater Goby under USFWS Endangered Species Recovery Permit TE-793645-5)**

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## A. ABSTRACT

The two stormflows exceeding bankfull in the San Lorenzo River (SLR) in February 2025 and smaller stormflows in December and March in all 3 watersheds provided adult steelhead spawning access to our uppermost sampling sites, with young-of-the-year (YOY) juveniles present. However, bankfull stormflows may have scoured out or smothered some spawning redds, leading to reduced egg survival with significant sediment transport in these sandy watersheds. This likely led to reduced YOY densities. Baseflow in Water Year 2025 was below the median flow statistic at the beginning of the dry season and near median baseflow later in the dry season after two previous years of relatively higher baseflow. In 2025, this brought reduced habitat quality and fish food supply, resulting in slower juvenile steelhead growth rate and smaller YOY in all three watersheds. With a lower baseflow in 2025, depth in pool and fastwater habitat decreased aquatic insect area and generally reduced fish habitat quality.

Habitat depth declined in 2025 throughout the Mainstem SLR sites except at headwater Site 12b in Waterman Gap. The mainstem streambed at sampling sites was mostly similar in percent fine sediment and embeddedness compared to 2024. Escape cover improved at the Mainstem sites where embeddedness decreased or where overhanging streamside vegetation increased. At tributary sites, pool habitat depth was sometimes similar to 2024 but mostly shallower. Tributary pools had either similar or improved percent sediment, embeddedness and escape cover. Boulder Creek showed some recovery from the 2020 CZU fire with less embeddedness in pool and run/step-run habitat and much improved pool escape cover at Lower Boulder Site 17a. There were less percent fines in pools and runs in upper Boulder Reach 17b. Fall Creek had not shown recovery from the CZU fire. Considerable sediment was still moving through Fall Creek, without improvement in percent fines or embeddedness in pools, riffles and runs, which contributed to shallower habitat and reduced escape cover in fastwater habitat upstream of the fish ladder. Escape cover had not changed in Fall Creek pools from 2024 to 2025.

Soquel Creek had a WY2025 hydrograph similar to the San Lorenzo drainage, with stormflows at the same frequency and with similar intensity. One February stormflow exceeded bankfull in Soquel Creek, and a second February stormflow and one in mid-March, all 3 sufficient to provide adult spawning access to our uppermost sampling sites. The February bankfull flow was sufficient to scour redds or smother them to reduce egg survival, especially in this sand-laden watershed, particularly in the Mainstem downstream of Moores Gulch. In 2025, all habitat-typed reaches in the Mainstem and Branches had habitat decline due to reduced baseflow (less food) and water depth. In the Mainstem, Reaches 3a and 7 had similar percent fines and embeddedness to previous years, but improved with increased pool escape cover. Lowermost Mainstem Reach 1 had similar habitat conditions to 2024 except shallower depth. Sampling sites in other reaches had similar percent fines and embeddedness with habitat declined due to reduced baseflow and reduced pool escape cover. The lower West Branch habitat declined from increased riffle embeddedness but pool escape cover remained constant. The lower East Branch declined due to increased fine sediment and reduced escape cover in pools. A plant nursery and former surface water diverter from Mainstem Soquel Creek closed downstream of Moores Gulch in 2023. This continued to enhance summer baseflow in Soquel Creek in 2025 compared to earlier years.

Aptos Creek likely had a WY2025 hydrograph similar to that in the Soquel drainage, with stormflows at the same frequency. These stormflows likely provided adequate adult steelhead spawning access, with YOY steelhead present at uppermost sampling sites. Egg survival may have been reduced after the one February stormflow likely exceeded bankfull due to redd scour and/or smothering with sand, especially in lower Aptos and all of sandy Valencia Creek. Overall habitat conditions declined in the Aptos Creek and Valencia Creek arms primarily due to reduced baseflow (less food). But other habitat conditions improved in pools of lower Aptos (increased maximum pool depth, less fine sediment, and more escape cover). Compared to 2022, conditions also improved in pools of upper Aptos Reach 4 (increased depth and more escape cover), but pools had more fine sediment. In the Valencia Creek, pool habitat at lower Site 2 worsened

from reduced baseflow (less food) and other decreased pool habitat conditions (much shallower, continued high percent fines/ embeddedness and reduced escape cover). Habitat conditions declined at upper Site 3 with reduced baseflow and reduced pool escape cover. Site 3 improvements included greater pool maximum depth and reduced pool embeddedness, although percent fines remained high.

In 2025, total and YOY steelhead densities were below average at most sites in the San Lorenzo and Soquel watersheds and at lower sites in Aptos/Valencia Creek. Size Class II/III densities (soon-to-smolt juveniles) were mostly below average in all 3 watersheds. Commonly used terms are defined in the glossary. The lower Fall Creek Site 15a had much above average Size Class II/III density primarily due to yearling retention, while middle Zayante 13c and lower Branciforte 21a-2 had much below average densities compared to multi-year averages for those sites. While all sites in Soquel had below average Size Class II/III densities, in the Aptos watershed the upper Valencia Site 3 was above average. The only statistically significant differences between 2025 and 2024 juvenile densities were declines in yearlings and Size Class II/III in the SLR and declines in yearlings in Soquel Creek. In 2025, longterm trends in total density (consisting mostly of YOY) declined modestly in the SLR and Soquel, while longterm trends in Size Class II/III density declined substantially. Size Class II/III densities and production indices tracked well with the 5-month (May-September) baseflow average in both watersheds, with declines consistent with reduced baseflow. However, in Aptos Creek, the production index did not track with the baseflow metric and increased despite decreased baseflow. In all 3 watersheds in 2025, a smaller portion of YOY grew into the larger size class than in the previous two higher baseflow years. But in Aptos, yearling densities were above average at 3 of 4 sites to cause overall Size Class II/III densities to increase in 2025. In comparing 2025 production indices to 2024 values under higher baseflow conditions, in the SLR it declined from 19,045 to 9,303 in 2025 for 17 reaches. In Soquel it declined from 3,856 to 1,843 in 2025 for 8 reaches. In Aptos it increased from 582 to 698 in 2025 in 4 half-mile segments. The average body length of juveniles captured at San Lorenzo sites fit the pattern of smaller size in lower baseflow years. Smith (2015) found from analyzing scales from down-migrant steelhead smolts that 98% were at least 60 mm SL at their first annulus, indicating that YOY which did not reach that size their first growing season did not survive to smolt and return as adults. Smith also found that most (97%) of yearling smolts (YOY the previous fall when we sample) were 76 mm SL or larger at their first scale annulus (the mark on the scale where growth stopped in winter). Bond (2006) found from scale analysis of returning adults to Scott Creek that nearly all were >125 mm FL (approx. 115 mm SL) when they entered the ocean as smolts, and 56% were =>200 mm FL (approx. 180 mm SL). He found that estuary residence was critical for smolts to reach these large sizes because stream down-migrants to the estuary averaged only 92 mm TL (approx. 84 mm SL).

The juvenile steelhead population estimate for freshwater-converted Aptos Lagoon was relatively low at 85 (11-year average = 235; median = 184). Tidewater gobies were detected in the lagoon. Water quality conditions were good due to freshwater conversion.

## B. INTRODUCTION

### *i. Scope of Work*

In fall 2025, three Santa Cruz County watersheds were sampled for juvenile steelhead to primarily compare juvenile abundance at multiple stratified sites to assess annual trends and compare habitat conditions with those in 2024 at sampling sites and with past years in selected reaches. The three watersheds were the San Lorenzo, Soquel and Aptos drainages (**Figures 1–3**). Results of salmonid sampling and habitat monitoring guide watershed management and planning (including implementation of Public Works projects) and enhancement for species recovery. The Santa Cruz County Environmental Health website <http://sceeh.com/steelhead.aspx> has the database and sampling site photos. Hydrographs of previous sampling years are also available. Methods of data collection and tables of habitat conditions and steelhead density since 1997 are available upon request, and earlier reports that include the methods are available at the county website. Sampling sites represented average habitat conditions regarding

escape cover and water depth within reaches, based on systematic and consistent habitat typing of ½-mile segments within designated reaches. Commonly used terms are defined in the glossary.

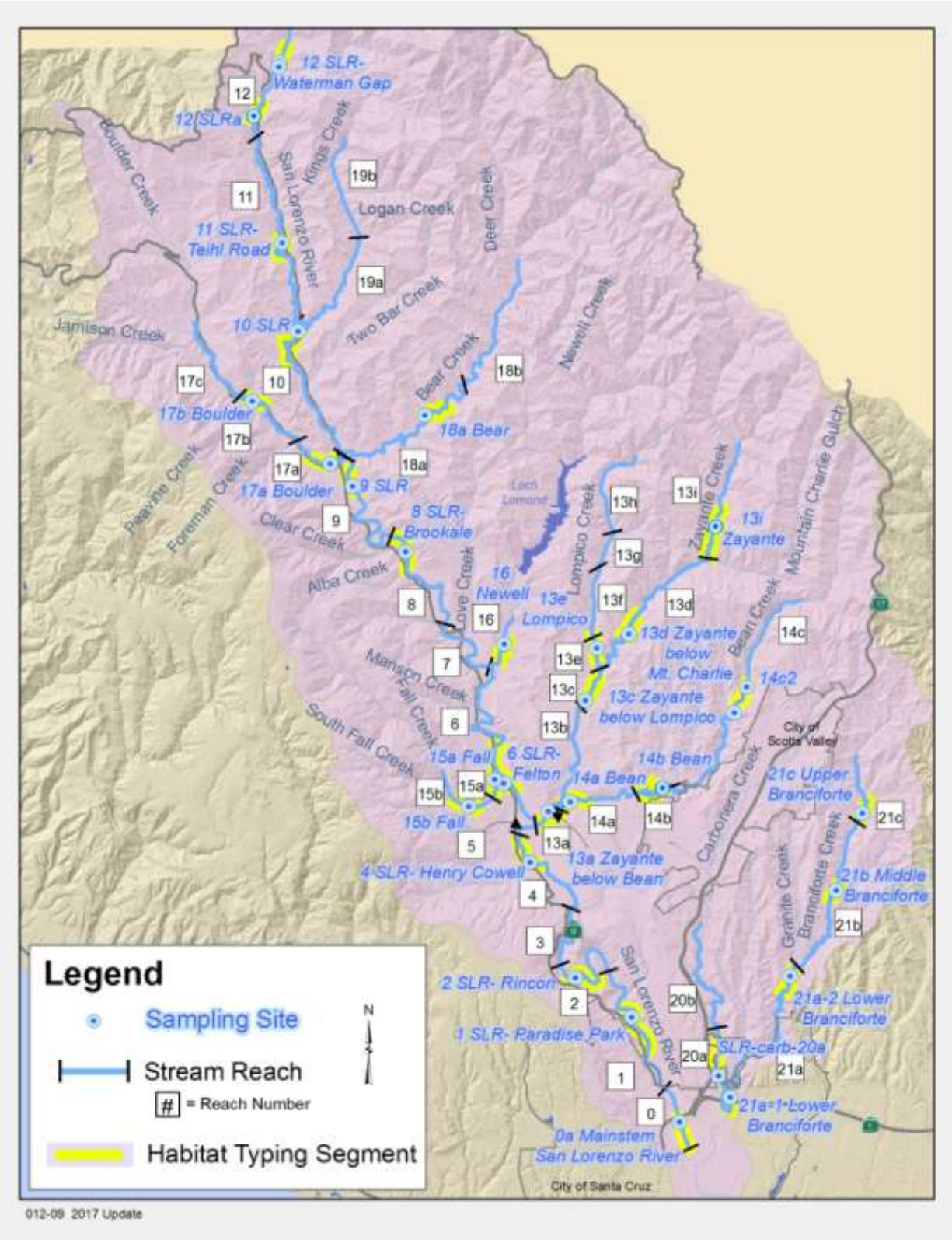
## ***ii. Study Area***

***San Lorenzo River.*** The Mainstem San Lorenzo River and 8 tributaries were sampled at 26 sites (10 Mainstem and 16 tributary sites) (**Figure 1**). Tributaries included Branciforte, Zayante, Bean, Fall, Newell, Boulder and Bear creeks. Eight 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 18 sites, the 2024 site locations were replicated for fish sampling. Steelhead density data for Newell Creek Site 16 was provided by the City of Santa Cruz. Depth, cover, percent fines, embeddedness, percent tree canopy and water temperature were measured at sampling sites.

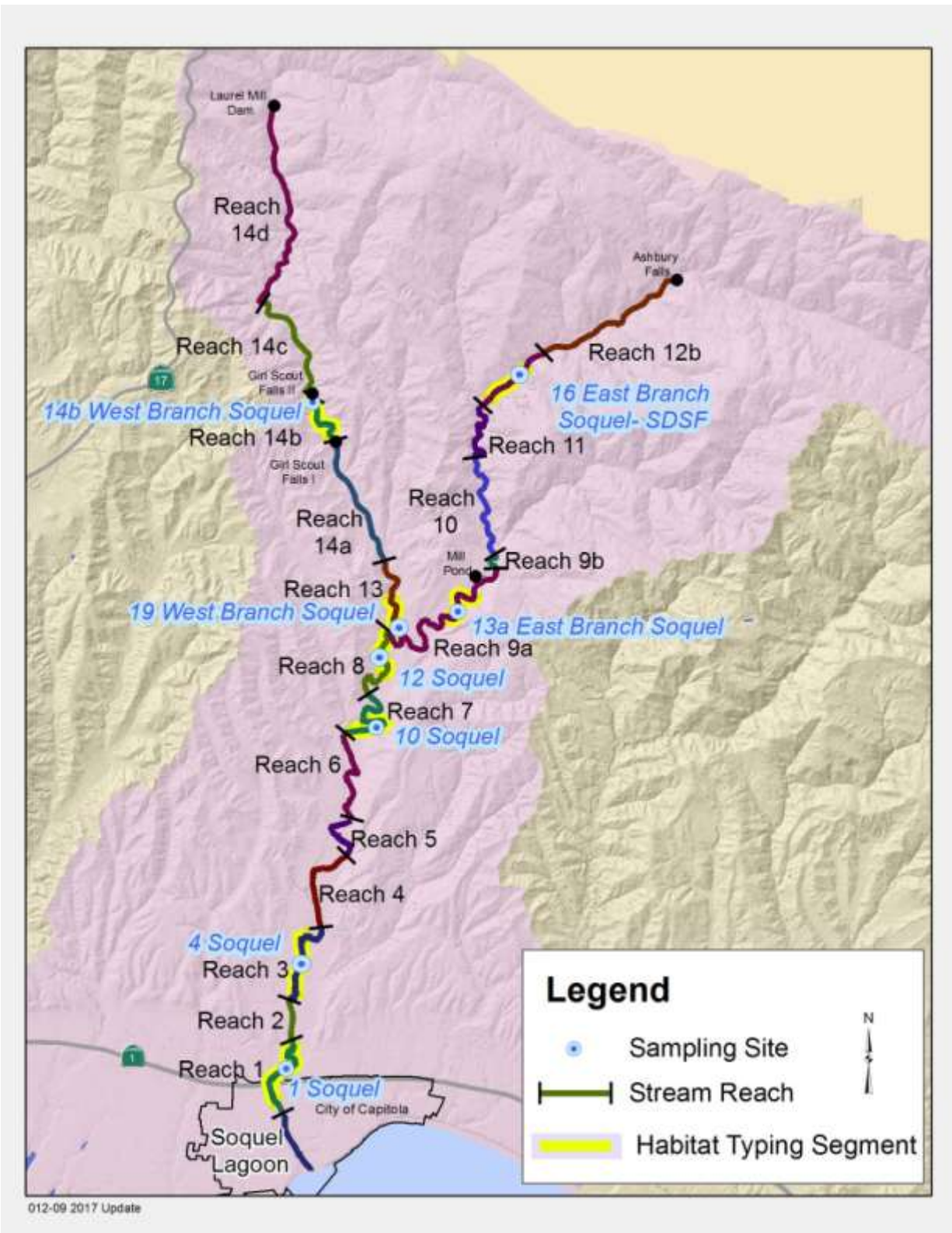
***Soquel Creek.*** Soquel Creek and its branches were sampled at 9 sites (5 Mainstem and 4 branch sites), Site 6 in Reach 4 added in 2020 after a 15-year break. Five half-mile segments were habitat typed to assess habitat conditions and select habitats of average quality to sample for fish density (**Figure 2**). For the remaining 4 sites, the 2024 sites were replicated for fish sampling. Depth, cover, percent fines, embeddedness, percent tree canopy and water temperature were measured at sampling sites.

***Aptos Creek and Lagoon/Estuary.*** Aptos watershed was sampled for steelhead at two Aptos and two Valencia creek sites, as well as at the estuary (**Figure 3**). After habitat typing of Aptos Creek segments 3 and 4 sites were chosen for sampling and the other two sites in Valencia Creek were replicated at 2024 locations. Depth, cover, percent fines, embeddedness, percent tree canopy and water temperature were measured at all sampling sites. Water quality conditions were measured during lagoon sampling. In the lagoon, a steelhead population estimate was made with a mark and recapture effort on 2 days in late September and early October, using a beach seine with a central bag. A fine-meshed seine was used to sample for tidewater gobies.

***Pajaro River Lagoon/Estuary.*** Pajaro River Estuary was sampled in early October for steelhead and tidewater goby, using a large beach seine with a central bag for steelhead and a smaller, fine-meshed beach seine for tidewater goby. Water quality conditions were measured during sampling. Results are presented in a separate report to the Santa Cruz County flood control district and available upon request.



**Figure 1. San Lorenzo River Watershed– Sampling Sites and Reaches.**



**Figure 2. Soquel Creek Watershed.**



**Figure 3. Aptos Creek Watershed.**

## C. RESULTS

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

1. The two stormflows that exceeded bankfull in the SLR at Big Trees Gage in February (4,000+ and 6,000+ cubic feet/second (cfs)) and likely the 2 stormflows in December greater than 300 cfs and one in March that approached 400 cfs provided adult steelhead spawning access to our upstream sites, all having YOY steelhead when sampled. Bankfull discharge (streamflow in the 1.3 –2 year recurrence interval) at Big Trees Gage was likely in the 3,500- 4,500 cfs range (1.3 year recurrence interval of 2,800 cfs; 1.5 year recurrence interval of 4,300 cfs, based on the flood flow frequency analysis using the Gumbell Extreme Value Method for 60 years of data from 1937 through 1996) (Alley 2000). The February bankfull stormflows may have scoured out or smothered some spawning redds, leading to reduced egg survival with significant sediment transport in this sandy watershed. This likely led to reduced YOY densities. High baseflow provides relatively good rearing habitat for juvenile steelhead and enhanced food supply (insect drift). A lower proportion of YOY reached Size Class II in 2025 than in the previous two higher baseflow years. The adult salmonid trap operated on Scott Creek yielded an estimated adult steelhead escapement of 115 (Avg. = 185), which was an improvement over the 43

adult estimate for 2024 (lowest in the 22-year program (**Figure 11**) (**J. Kiernan, NOAA Fisheries, pers. comm.**)). The below average 2025 Scott Creek steelhead return may indicate a below average number of adult spawners returning to the San Lorenzo drainage over the 2024-2025 spawning season, as well. Adult steelhead passage and spawning conditions were likely near average. But egg survival may have been reduced after the 2 greater than bankfull stormflows in February, and passage may have been difficult during the storm-less January but adequate otherwise. Smaller stormflows in April and May encouraged yearlings to smolt to the Bay. Streamflow dropped below 100 cfs at Big Trees Gage before mid-April and stayed near median baseflow from mid-June throughout the dry season to mid-October (30 cfs declining to 15 cfs during the period), providing relatively median-level rearing habitat for juvenile steelhead that survived the winter. This baseflow was noticeably less than the previous 2023 and 2024 dry seasons. Streamflow measured at Paradise Park was 15.7 cfs on 11 October 2025 (19.8 cfs on 10 October 2024) (**Table 1**). Tributary baseflows measured in October before any fall stormflows were similar to or slightly less than in 2024. October streamflow in Fall Creek below the SLVWD diversion was higher in 2025 than 2024. Fish sampling in 2025 was completed prior to any fall stormflow.

2. With reduced baseflow, habitat depth declined in 2025 throughout the mainstem SLR except at headwater Site 12b in Waterman Gap (**Table 13b; Figure 6b**). The relatively mild 2025 winter with limited high stormflows resulted in SLR mainstem streambed with mostly similar percent fine sediment and embeddedness compared to 2024 except less embeddedness in the Rincon Reach 2 riffles, Site 6 below the Fall Creek confluence and pools at Site 10 below Kings Creek confluence. Site 1 at Paradise Park was more sedimented and more embedded than 2024. Escape cover improved in the Mainstem where embeddedness decreased or where overhanging streamside vegetation increased (Site 0a between the levees, at Site 1 in Paradise Park, Rincon Reach 2, Brookdale Site 8, Site 11 at Teihl Road and Site 12b in Waterman Gap) (**Table 13b; Figure 6a**). A milder winter brought more overhanging willows and streamside sedges that provided cover. In 2025, one of 10 mainstem sites were rated between “good,” 3 sites were rated “fair,” 2 sites were rated “below average,” 3 sites were rated “poor” and one was rated “very poor” (Site 9) with regard to habitat quality based on soon-to-smolt densities and fish size (**Table 2**). Tables of habitat measurements are available in the detailed analysis report upon request.
3. In SLR tributaries, habitat depth in 2025 was either similar to 2024 or mostly shallower (**Table 13b; Figure 7b**). Pools were similar or improved in 2025 with regard to percent sediment, embeddedness and escape cover. Improved escape cover occurred in upper Zayante Reach 13d, lower and middle Bean Reaches 14a and 14b, Boulder Creek Site 17a and lower Branciforte Site 21a-2 below Granite Creek (**Table 13b; Figure 7a**). Decreased escape cover occurred in pools of lower and upper Zayante Sites 13a and 13i, lower Bear Reach 18a and upper Bear Site 18b and upper Branciforte Reach 21b. Boulder Creek showed some recovery from the 2020 CZU fire with less embeddedness in pool and run/step-run habitat and much improved pool escape cover at Lower Boulder Site 17a and less percent fines in pools and runs in upper Boulder Reach 17b. Fall Creek still lacked recovery from the CZU fire. Considerable sediment was still moving through Fall Creek, without improvement in percent fines or embeddedness, which contributed to shallower habitat and reduced escape cover in fastwater habitat upstream of the fish ladder. The Fall Creek riparian corridor was subject to considerable foot traffic with bare forest floor common along the stream margin. In 2025, two of 16 tributary sites were rated “good” with regard to habitat quality based on soon-to-smolt densities and fish size (**Table 2**). At tributary sites, 5 sites were rated “fair.” Six sites were rated “below average.” One site was related “poor” and 2 sites were rated “very poor” (Zayante 13c, which in many years has near the highest soon-to-smolt density, and lower Branciforte 21 a-2). Embeddedness increased substantially at Zayante Sit 13c in 2025 from 2024 (**Table 2**), indicating that sedimentation had increased without sufficient scour to move sediment out of riffles and tails of pools, though pool depth did not lessen by September 2025 when measured.
4. A lower proportion of YOY reached Size Class II ( $\Rightarrow$ 75 mm Standard Length (SL)) in 2025 than in the

previous two higher baseflow years. YOY steelhead that grow into Size Class II their first summer are more likely to smolt the following spring than those that do not, instead of spending two growing seasons in freshwater and risking higher mortality before migrating to the Monterey Bay. Relatively higher baseflow year brings improved fastwater habitat for steelhead with faster water velocity and more surface area. Higher baseflow increases aquatic insect habitat and drift rate due to with higher water velocity through riffles, runs and heads of pools to accelerate the conveyor belt of food to juvenile steelhead and faster growth rate. Juvenile steelhead densities at the heads of pools generally increase in the lower San Lorenzo River Mainstem during higher baseflow years. With reduced baseflow in 2025, few juvenile steelhead were observed at the heads of mainstem pools.

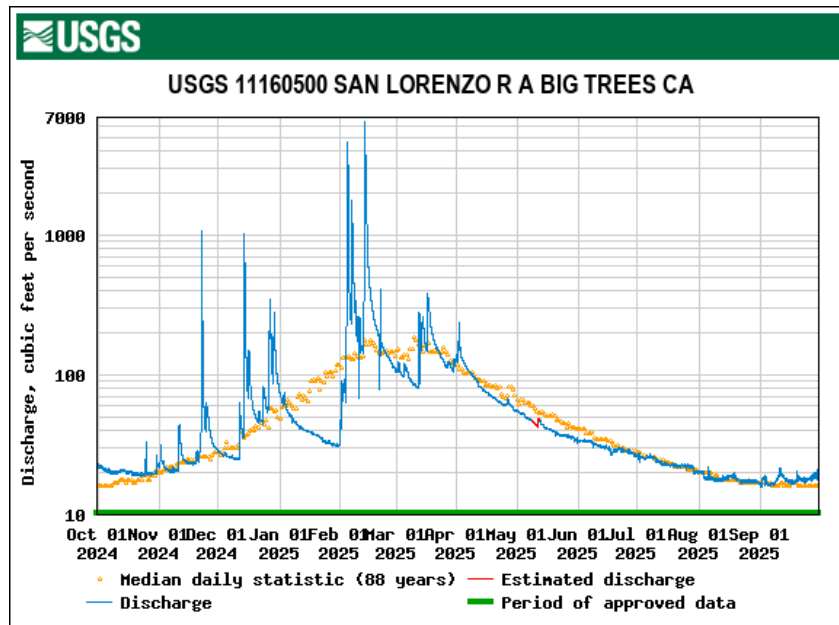
5. Spawning success was evident at all Mainstem and tributary sites in 2025. SLR total and YOY juvenile densities at Mainstem sites were below average at 9 of 10 sites except much above average at Site 11, while averaging 13.2 total juveniles/100 ft in 2025 (16.5 in 2024) (**Figures 8 and 9**). The 2025 average Mainstem YOY density was 10.9/100 ft (13.5 in 2024; 14.4 in 2023). Year classes and size classes are defined in the glossary. Upper Site 12b in Waterman Gap (above the problematic adult passage impediment at the Highway 9 culvert) had much below average total and YOY densities (more than 20 fish/100 ft less than average), possibly indicating continued adult passage difficulty despite recent work on the impediment. Tables of fish densities are available in the detailed analysis report upon request.
6. At SLR Mainstem sites and tributary sites, total and YOY juvenile densities were below average at most sites in 2025 (for total density- 9 of 10 Mainstem sites and 14 of 16 tributary sites (**Figure 8**); for YOY density- 9 of 10 Mainstem sites and 13 of 16 tributary sites (**Figure 9**)). At SLR Mainstem sites, total densities averaged 13/100 ft in 2025 (16.5/100 ft in 2024). At SLR tributary sites, the 2025 total density was 34/100 ft (also 34/100 ft in 2024). In 2025, the 26-site average total juvenile density was 25/100 ft (27 in 2024; 38 in 2023). The modest decline in total site densities in 2025 (drier year) from 2024 (wetter year) was not statistically significant (**Table 8; page 72**).
7. In 2025, the 26-site average YOY density in 2025 was 21/100 ft (also 21/100 ft in 2023 and 2024). Differences in YOY site densities between 2024 and 2025 were not statistically significant (**Table 8**). In 2025, YOY density at Zayante 13c was more than 40 YOY/100 ft less than the multi-year average. YOY densities were at least 20 YOY/100 ft less than the multi-year average at Zayante 13d, Bean 14b, Boulder 17b and Bear 18a. The 2025 average YOY density at Mainstem sites was 11/100 ft (13.5/100 ft in 2024). Compared to 2024, 2025 YOY densities were similar at Mainstem sites downstream of Kings Creek confluence (**Figure 10**). In the upper Mainstem, YOY density was much higher in 2025 at Site 11 near Teihl Road but much less at 12b in Waterman Gap. The average YOY density at tributary sites was 28 /100 ft (26/100 ft in 2024). Generally in 2025 on the lower gradient eastside of the watershed, YOY densities were higher at upper tributary sites than at downstream sites, indicating adequate spawning access to more headwater sites (**Figure 10**). On the higher gradient west side in 2025 as in 2024, YOY densities were higher at lower tributary sites than upstream sites, possibly indicating less spawning activity at more headwater sites. Regarding tributary sites in 2025 compared to 2024, YOY densities were higher at the lower one of 4 Zayante sites, at all Bean sites (especially upper 14c-2), both Fall sites (especially lower 15a) and both Boulder sites (especially upper 17b). They were also higher at the upper Bear 18b site. A substantial decline was in middle Zayante 13c. In 2025, Smith (**pers. comm.**) found in Gazos Creek that channel habitat was similar to 2024 and remained highly sedimented from 2020 CZU fire impacts. Mean YOY steelhead density remained high in 2025 (38.5/100 ft) (density in 2024- 33.2 /100 ft, which was nearly tripled, compared to 2023). He found in Waddell Creek that average YOY steelhead density was slightly improved to 7.7/100 ft and not much different from the dismal results in 2024 (4.8/100 ft) and 2023 (3.2/100 ft). The three downstream sites had improved in 2024 since the CZU fire, but no further improvements were evident in 2025. He did not sample Scott Creek in 2025.

8. The decline in yearling site densities in 2025 from 2024 was statistically significant (**Table 8**). Yearling densities were small and near average at the lower 5 Mainstem sites downstream of Fall Creek in 2025, with very below average densities at the next 3 sites upstream sites and near average densities near Teilh Road and Waterman Gap (some possibly older residents) (**Figure 12**). Regarding tributary sites, yearling densities were below average at 11 of 16 sites in 2025. Densities were near or above average at 5 sites, with the most notable and highest above average density at lower Fall 15a. The most notable near absence of yearlings was at Zayante 13c below Lompico Creek and lower Branciforte 21a-2. Smith (**pers. comm.**) found average yearling density in Gazos Creek to decrease in 2025 (3.8/100 ft) compared to 2024 (7/100 ft) and 2023 (7.5/100 ft). He found that average yearling density remained very low in Waddell Creek in 2025 (0.6/100 ft) compared to 2024 (1.1/100 ft) and 2023 (1.4/100 ft).
9. The decline in site densities of Size Class II/III ( $\Rightarrow$  75 mm SL) in 2025 from 2024 was very statistically significant (**Table 8**). Size Class II/III ( $\Rightarrow$  75 mm SL) densities were below average at the lower 9 of 10 Mainstem sites and average at the Waterman Gap site (some likely residents) (**Figure 13**). In tributaries, densities were below average at 13 of 16 sites, most notably at Zayante 13c, which typically has high densities. Site densities in 2025 were less than half the average at Mainstem sites 0a, 2, 6, 8, and 9 (5 sites of 10) and at tributary sites Zayante 13c, Zayante 13d, Bean 14b, Newell 16, Bear 18a and Branciforte 21a-2 (6 sites of 16). The 26-site average Size Class II/III density in 2025 was 6/100 ft (11/100 ft in 2024). The 2025 site densities were less than in 2024 at 25 of 26 sites, the one exception being lower Fall 15a (**Figure 14**). The 2025 Mainstem average density was 4/100 ft (8/100 ft in 2024). The 2025 tributary average density was 7/100 ft (13/100 ft in 2024). The portion of YOY reaching Size Class II decreases in drier years, and the average size of captured fish at each site is less in drier years unless most storms come late, as in 2019. Since most juvenile steelhead at sites are YOY, their size greatly influences the average size of juveniles at a site. Average steelhead size at sites in drier years (lower baseflow) is consistently less than in wetter years (higher baseflow) unless few YOY are present or spawning is primarily late after late storms of wet years (**Figure 21**). Food supply (insect drift) increases in wetter years because the higher baseflow creates more fastwater area where most aquatic insects are produced (wider channels) and faster water velocity at heads of pools as insects drift at faster water velocity through riffles, runs and heads of pools than in drier years. In drier years, baseflow is insufficient to grow as many YOY into Size Class II. Sites with the highest potential to grow YOY into Size Class II in any year are the 4 Mainstem sites downstream of Zayante Creek confluence, lower and middle Zayante 13a and 13c and Newell 16. In wet years with relatively high baseflow, the potential greatly increases at these sites and in the middle Mainstem. In 2025 with near median baseflow from mid June to mid October, more than 50% of the captured YOY steelhead reached Size Class II at Mainstem Sites 0a, 1 and 2. A third of the YOY reached Size Class II at Mainstem Site 4 below Zayante Creek. Less than 10% reached Size Class II at middle Mainstem Sites 6-9. At lower Zayante 13a, 20% of the YOY reached Size Class II. Only a very few YOY reached Size Class II at Sites 11, 12b, Zayante 13c (unusually low steelhead density in 2025), Fall 15a, Newell 16, Boulder 17a and Bear 18b. At the remaining 10 of 16 tributary sites, no captured YOY reached Size Class II except one steelhead at upper Bean 14c-2. By contrast in 2024 with higher baseflow, 100% of captured YOY reached Size Class II at Mainstem Sites 0a, 1 and 2. At Site 4 it was 90%. At Sites 6-9 it was 30%. At lower Zayante 13a it was 75%.
10. The average 5-site Mainstem trend in total density increased slightly in 2025 (**Figure 15**; 16 total fish/100 ft; 28-year average of 22.5) The mainstem trend for soon-to-smolt ( $\Rightarrow$  75 mm SL; Size Class II/III) density decreased considerably in 2025 (drier year) from 2024 (wetter year) (**Figure 17**; 4 Class II/III fish/100 ft; 28-year average of 7). The average 7-site tributary trend in average total density decreased slightly in 2025 (**Figure 16**; 31 fish/100 ft; 28-year average of 54). The tributary trend in average Size Class II/III density greatly decreased in 2025 (**Figure 18a**; 5 fish/100 ft; 28-year average of 11). Trends in densities of these larger juveniles follow similar upward fluctuations

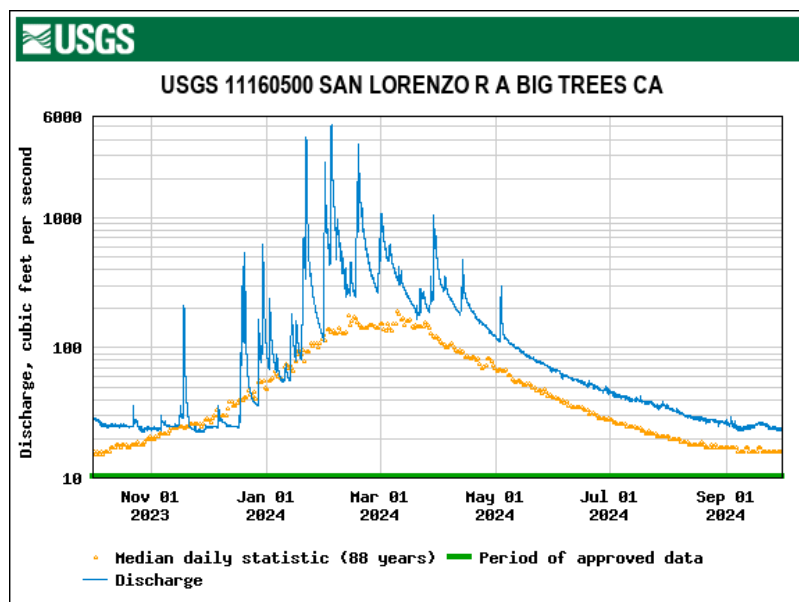
through the wet years and downward fluctuations through dry years in the SLR and Soquel watersheds (**Figure 18b**), and somewhat less so for the Aptos/Valencia watershed where annual summer baseflow fluctuates less than in the larger watersheds. Densities of Size Class II/III steelhead typically increase in wetter years with faster YOY growth rate with more YOY reaching Size Class II and decrease in drier years with slower growth rate. The density of these larger fish that will soon smolt is more important than the total juvenile steelhead density. Relevant here is that Smith (**2015**) found from scale analysis of a random sample of 404 down migrant steelhead smolts trapped in spring of 1987 and 1989 (both dry springs during drought years), he found that 61% of the smolts had reared the previous year as YOY in high flow areas, like the Mainstem San Lorenzo River, and down-migrated as yearling smolts (“YOY’s” the previous fall when we do our sampling). Most (97%) of these yearling smolts were 76 mm SL or larger at their first scale annulus (the mark on the scale where growth stopped in winter). Of the 39% of smolts that down-migrated as 2-year olds (“yearlings” the previous fall when we sample), a third were larger than 80 mm SL at their first annulus, and also may have reared in the faster-growth portions of the watershed. Although the tributaries are important spawning areas and have more juvenile steelhead, the major smolt-producing area was primarily the Mainstem of the San Lorenzo River during these drought years. Also of interest, almost all of the smolts (98%; 396 of 404) were larger than 60 mm SL at their first annulus. It follows that most small YOY less than 60 mm SL (which may be a majority of tributary steelhead, especially in low baseflow, drier years) apparently don’t survive winters and don’t become smolts. In wetter years, with higher spring streamflow and baseflow during the dry season in the Mainstem of the San Lorenzo, more YOY fish are able to reach smolt size in their first year of rearing. Bond (**2006**) found from scale analysis and back calculation of 350+ returning adults to Scott Creek (2002-2005) that nearly all were >125 mm FL (approx. 115 mm SL) when they entered the ocean as smolts, and 56% were =>200 mm FL (approx. 180 mm SL). He found that estuary residence was critical for smolts to reach these large sizes because stream down-migrants to the estuary averaged only 92 mm TL (approx. 84 mm SL) in 2004 when s a fine-meshed net was used in his smolt trap.

11. Most juvenile steelhead in the San Lorenzo River watershed are small YOY fish in tributaries and other slow growth areas. Based on numbers of fish, some biologists erroneously consider the tributaries to be the most important steelhead producers, and discount the warmer Mainstem of the San Lorenzo River where juveniles grow faster and larger, especially downstream of Zayante Creek confluence.
12. For Size Class II/III juveniles, annual average site densities positively tracked with the 5-month (May-September) baseflow average at the Big Trees USGS gage for 1997-2025 (**Figures 19a-b**). Importantly, production indices for these larger juveniles also track well with the 5-month baseflow average for 2010-2025 (**Figure 20a**), with the 2025 index (9,303) less than half the 2024 index (19,045). The same positive tracking of fluctuating production index and fluctuating baseflow is evident for Mainstem reaches, specifically, with production in 6 Mainstem reaches (**Figure 20b**) sometimes contributing more than half of the index that includes 6 Mainstem and 11 tributary reaches. Therefore, densities and production estimates of important Size Class II/III fish were relatively low and consistent with relatively low baseflow.
13. **Two factors may explain the below average YOY densities at most sites in 2025.** One factor may have been **low adult returns**, which we have evidence of in Scott Creek in 2025 from which to extrapolate (**Figure 11**). A second factor was likely **poor egg survival during a winter having 2 above bankfull stormflows that could either scour out redds or smother them with sediment**. Similar to our below average YOY densities in Soquel Creek and the San Lorenzo drainage, Smith (**pers. comm.**) found continued low YOY densities in Waddell Creek, which was significantly damaged by the 2020 CZU fire. However, 2025 YOY densities in the smaller Gazos Creek remained high as in 2024 after a milder winter.

14. **YOY that survived as of swim-up fry living in the gravel and avoided mortality during high stormflows experienced less food and slower growth in 2025 compared to wetter years.** This was because 2025 baseflow was lower, below median flow in the early dry season and near median after June. The average fish length at selected sites (dominated by YOY's) in 2025 was typical of other lower baseflow years and less than in wetter years (**Figure 21**). Only 2019 did not fit the pattern of larger juveniles in higher baseflow years. This was likely because storms were late that year and successful steelhead spawning may have been delayed, giving YOY's less growing time before sampling. There were high densities of small YOY that year.



**Figure 4a. The WY2025 Streamflow for the USGS Big Trees Gage on the San Lorenzo River at Felton, CA.**



**Figure 4b. The WY2024 Streamflow for the USGS Big Trees Gage on the San Lorenzo River at Felton, CA.**

Figure 5. Averaged Mean Monthly Streamflow for May – September in the San Lorenzo and Soquel Watersheds, 1997-2025.

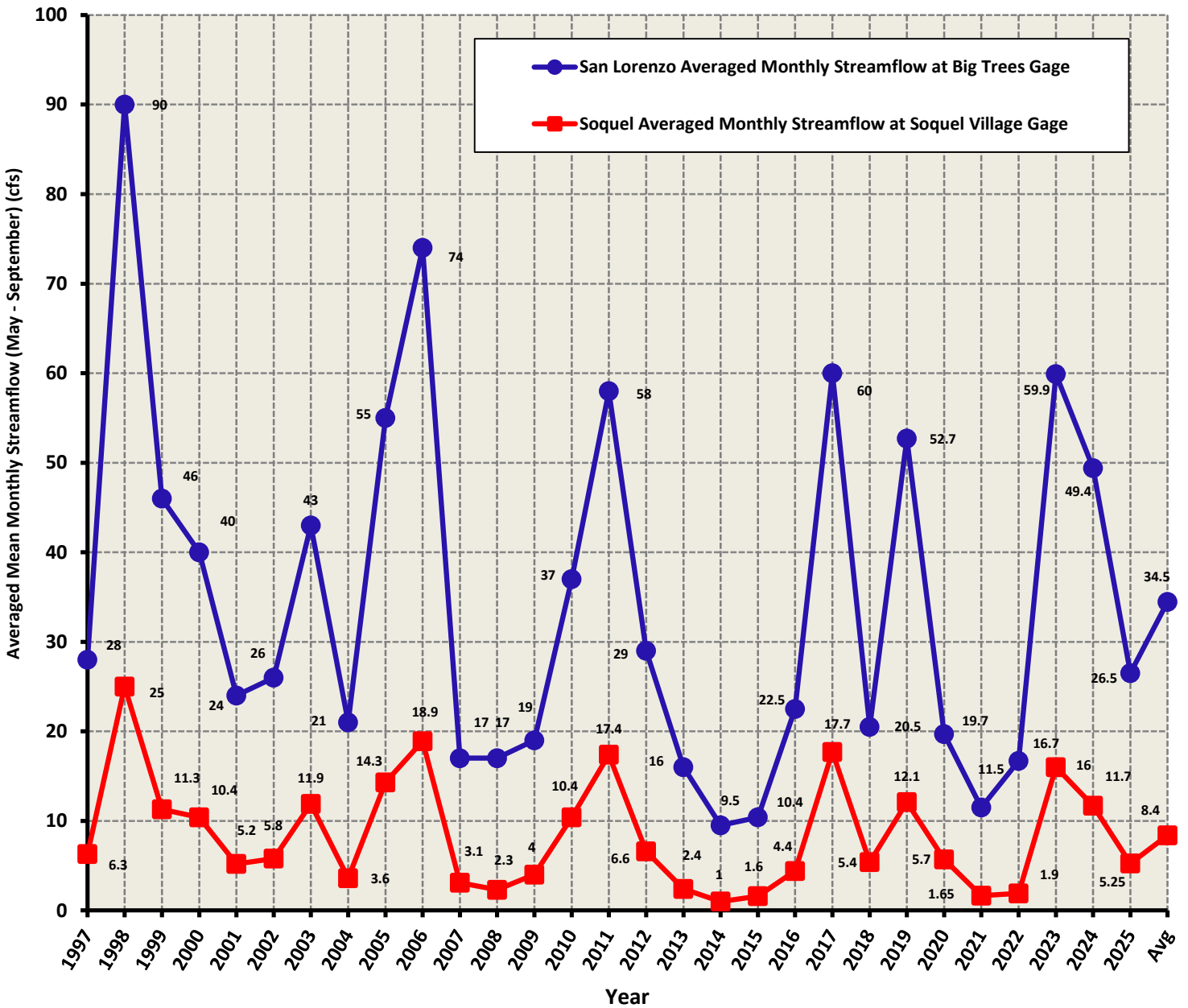


Figure 5. Average Mean Monthly Streamflow, May – September, San Lorenzo and Soquel Watersheds, 1997-2025.

**Table 1. Fall STREAMFLOW (cubic feet/ sec) measured by D.W. ALLEY & Associates at SAN LORENZO sampling sites before fall storms (or in 2011, 2022 and 2025 when baseflow had resumed after an early storm) and at the USGS Gages at Big Trees (Felton) and Santa Cruz..**

Site # / Location	1998/1999	2000	2001	2005	2006	2010	2011*	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022**	2023	2024	2025***
0a- Santa Cruz						5.5 2 Oct	12 23 Sep	5.2 19 Oct	5.6 23 Oct	1.2 19 Oct	2.4 8 16 Oct	8.8 6 Oct	14 12 Oct	8.7 12 Oct	15.2 12 Oct	8.9 12 Oct	3.8 16 Oct	8.8 16 Oct	17.4 10 Oct	12.6 10 Oct	11.4 11 Oct
1- SLR/ Paradise Park	34.3/ 26.2	21. 7	19.6		26. 2	18.7	27.6	17. 2	12.9	8.0	7.8 1		22.6	13.5	22.8	13.1	9.65	13.7	27.3	19.8	15.7
2- SLR/ Rincon	/	21. 1	17.2																		
4-SLR/ Henry Cowell	32.7/ 23.3	21. 8	15.5		24. 1																
5-SLR Big Trees Gage	27.0/ 21.0	22. 0	13.0	21.0	27. 0	15.1	24.8	15. 9	11.2	6.41	6.1 9	12. 2 6 Oct	21.4	12.1	18.1	11.8	9.8	13.4 14 Oct	25.6 10 Oct	20.2 10 Oct	18.3 11 Oct
6- SLR/ Below Fall	23.4/ 12.8	11. 6	9.4	18.9	14. 3					3.7	3.2 5	6.9 9	12.9	6.68							
8- SLR/ Below Clear	10.3/ 4.9	4.2	3.1	7.1	6.4	4.0		2.8	1.7	0.95	1.1 1	2.3 5	4.71	2.61	4.53	2.41	1.54	3.85	7.04	4.67	4.40
9- SLR/ Below Boulder	7.2/ 3.5		3.0	5.8						0.80	0.8 8	1.8 2	4.02	1.43	4.36						
10- SLR/ Below Kings	/	3.0	1.1	1.3	1.4																
11- SLR/ Teihl Rd	1.7/ 0.8	0.8	0.4	1.5		0.94	1.10	0.4 0	0.38	0.13	0.2 1		1.07	0.35	0.87	0.24	0.17	0.28	1.00	0.64	0.70
12a-b SLR/ Lower Waterman	1.0/ 0.7								0.33	0.10	0.2 2		0.85	0.39	0.78	0.32	0.17	0.20	0.93	0.71	0.61
13a/ Zayante below Bean	8.5 6.3	5.2	4.7	7.4	7.8 *	4.9	7.2	4.4	3.9	3.2	2.9		8.27	4.04	5.96	4.64	3.05	3.95	8.21	5.44	5.29
14b/Bean below Lockhart G	1.1/ 1.1	1.0	1.1	1.0	1.1						0.6 2										
14c-Bean above MacKenzie						0.03	0.11	Dry	Dry	Dry	Dry	Dry	0.07	Dry	Wet	Dry	Dry	Dry	Trickl e	Trickl e	Dry
14c-2/Bean above MacKenzie														0.02	0.06	0.02	Part Dry	Part Dry	0.13	0.08	0.07
15a-b/ Fall	3.4/ 2.2 Above Div.	1.7 Ab ove Div	1.7 Above Div							1.0 below div. Bal	0.3 2 Bel div Bal	1.3 9 Bel o div.	2.80 Bel div.	1.00 Bel div.		1.01 Below div	0.61 Below div	1.33 Below Div	2.80 Below Div	2.22 Below Div	2.84 Below Div
16/ Newell		0.5 1				1.2	0.92	0.7 8	0.78	0.08	0.0 4		1.05	0.87		1.07 SCW D	0.29 (SCW D)	0.96 (SCW D)	1.18 (SCW D)	1.01 (SCW D)	
17a/ Boulder	2.2 1.1	1.1	1.0	1.6	1.7	1.6	2.2	1.1	1.1	0.76 Bal	0.6 6 Bal	1.3 9 Bal	1.76	0.94	1.45	1.24	1.00	1.81	2.82	1.89	1.6
18a/ Bear above Hopkins G	/	0.6 1	0.34	0.90	1.1	0.68	1.3	0.2 3	0.16	0.03	0.0 2		0.90	0.21	0.70	0.10	0.06	0.175	1.32	0.84	0.53
21a-2/ Branciforte	0.80					0.44	0.81	0.3 2	0.29		0.1 3			0.37	0.38	0.29	0.18	0.44	0.38	0.42	0.30

\*Streamflow measured in 2011 after early October stormflow that elevated baseflow.

\*\*Streamflow was measured in mid-October 2022 after September stormflow that elevated baseflow.

\*\*\* Streamflow was measured in October 2025 after early October stormflow that elevated baseflow.

**Table 2. 2025 Sampling Sites Rated by Soon-to-Smolt (next Spring) Juvenile Density (=>75 mm Standard Length (SL)) and Average Soon-to-Smolt Size, with Physical Habitat Change in 2025 since Previous Reach or Site Measurements.** (Number of @ symbols refers to Smith ratings 1-7 listed after this table. Red denotes ratings of 1–3 below average or negative habitat change; purple denotes ratings of 5–7 above average. Average size affects rating along with fish length. Methods for assessing habitat change are in detailed analysis reports available upon request.)

Site	Multi-Year Avg. Smolt (next Spring) Density Per 100 ft/ Avg Smolt (next Spring) SL (since 2006.)	2025 Smolt (next Spring) Density (per 100 ft)/ Avg Smolt (next Spring) SL	2025 Symbolic Rating* (1 to 7)	2024 Smolt (next Spring) Density (per 100 ft)/ Avg Smolt (next Spring) SL	Physical Habitat Change by Reach/Site (Since 2024 unless Specified)
Low. San Lorenzo #0a	7.0/ 125 mm	2.0/ 188 mm	@@@ Below Average	7.1/ 146 mm	Site –
Low. San Lorenzo #1	7.4/ 109 mm	4.7/ 105 mm	@@@@ Fair	5.4/ 122 mm	Site –
Low. San Lorenzo #2	12.3/ 104 mm	4.6/ 117 mm	@@@@ Fair	9.2/ 115 mm	Reach –
Low. San Lorenzo #4	12.8/ 90 mm	10.0/ 90 mm	@@@@ Fair	17.3/ 94 mm	Site –
Mid. San Lorenzo #6	3.4/ 95 mm	1.1/ 108 mm	@@ Poor	3.8/ 102 mm	Site –
Mid. San Lorenzo #8	4.5/ 96 mm	0.2/ 114 mm	@@ Poor	5.8/ 87 mm	Site –
Mid. San Lorenzo #9	4.8/ 92 mm	1.0/ 81 mm	@ Very Poor	3.4/ 102 mm	Site –
Up. San Lorenzo #10	5.0/ 101 mm	2.6/ 91 mm	@@ Poor	5.7/ 101 mm	Site –
Up. San Lorenzo #11	5.8/ 108 mm	4.5/ 100 mm	@@@ Below Average	11.3/ 100 mm	Site –
Up. San Loren #12b	11.9/ 106 mm	11.8/ 103 mm	@@@@@ Good	12.1/ 100 mm	Site –
Zayante #13a	8.6/ 100 mm	11.6/ 87 mm	@@@ Below Average	22.7/ 100 mm	Site –
Zayante #13c	14.3/ 92 mm	1.9/ 85 mm	@ Very Poor	19/ 87 mm	Site –
Zayante #13d	15.9/ 100 mm	6.4/ 100 mm	@@@ Below Average	16.5/ 103 mm	Reach –
Zayante #13i	9.5/ 103 mm	11.1/ 99 mm	@@@@ Fair	20.4/ 93 mm	Site –
Bean #14a	4.2/ 94 mm	3.4/ 94 mm	@@ Poor	4.5/ 82 mm	Reach + Compared to 2018
Bean #14b	10.1/ 106 mm	4.0/ 127 mm	@@@@ Fair	5.9/ 114 mm	Reach –
Bean #14c-2	8.7/ 109 mm	6.4/ 114 mm	@@@@ Fair	15.2/ 105 mm	Site –
Fall #15a	9.8/ 96 mm	17.1/ 90 mm	@@@@@ Good	14.1/ 104 mm	Site –
Fall #15b	10.8/ 105 mm	6.7/ 104 mm	@@@@ Fair	11.5/ 99 mm	Reach –
Newell #16	11.8/ 99 mm	NA	NA	15/ 108 mm	Site –
Boulder #17a	10.4/ 105 mm	6.1/ 98 mm	@@@ Below Average	11.8/ 104 mm	Site –
Boulder #17b	9.5/ 98 mm	8.1/ 107 mm	@@@@@ Good	10.7/ 115 mm	Reach – Compared to 2023
Bear #18a	8.1/ 100 mm	4.0/ 99 mm	@@@ Below Average	10.4/ 90 mm	Reach – Compared to 2023

Site	Multi-Year Avg. Smolt (next Spring) Density Per 100 ft/ Avg Smolt (next Spring) SL (since 2006.)	2025 Smolt (next Spring) Density (per 100 ft)/ Avg Smolt (next Spring) SL	2025 Symbolic Rating* (1 to 7)	2024 Smolt (next Spring) Density (per 100 ft)/ Avg Smolt (next Spring) SL	Physical Habitat Change by Reach/Site (Since 2024 unless Specified)
Bear #18b	10.1/ 102 mm	6.8/ 107 mm	@@@ Below Average	9.65/ 107 mm	Site -
Branciforte #21a-2	7.7/ 102 mm	0.9/ 96 mm	@ Very Poor	3.4/ 116 mm	Site -
Branciforte 21b	11.1/ 100 mm	6.4/ 106 mm	@@@@ Fair	12/ 100 mm	Reach - Compared to 2023
Soquel #1	3.7/ 106 mm	2.1/ 103 mm	@@ Poor	3.9/ 130 mm	Reach -
Soquel #4	6.3/ 105 mm	1.0/ 77 mm	@ Very Poor	0.6/ 117 mm	Reach -
Soquel #6	4.7/ 102 mm	2.5/ 80 mm	@@ Poor	2.5/ 103 mm	Site -
Soquel #10	8.8/ 93 mm	3.6/ 81 mm	@@ Poor	5.2/ 117 mm	Reach - Compared to 2023
Soquel #12	8.0/ 93 mm	2.15/ 85 mm	@@ Poor	18.4/ 98 mm	Site -
East Branch Soquel #13a	8.7/ 97 mm	5.3/ 102 mm	@@@ Below Average	8.6/ 86 mm	Reach - Since 2024
East Branch Soquel #16	9.3/ 99 mm	7.0/ 88 mm	@@@ Below Average	17.6/ 93 mm	Site -
West Branch Soquel #19	5.9/ 99 mm	2.35/ 81 mm	@@ Poor	6.9/ 98 mm	Reach - Since 2024
West Branch Soquel #21	9.1/ 97 mm	7.5/ 91 mm	@@@ Below Average	8.3/ 97 mm	Site -
Aptos #3	7.3/ 110 mm	5.6/ 115 mm	@@@@ Fair	3.8/ 127 mm	Reach - Since 2024
Aptos #4	8.3/ 106 mm	6.7/ 99 mm	@@@ Below Average	8.2/ 99 mm	Reach + Compared to 2022
Valencia #2	6.7/ 98 mm	1.8/ 85 mm	@@ Poor	5.4/ 107 mm	Site -
Valencia #3	9.9/ 103 mm	12.0/ 95 mm	@@@@ Fair	8.6/ 100 mm	Site -

\*Rating Assumes that habitat was saturated, which was doubtful.

### Ratings of Steelhead Rearing Habitat For Small, Central Coast Streams. (Assumes saturated habitat; From Smith 1982.)

1. Very Poor- less than 2 smolt-sized (<=75 mm SL) fish per 100 feet 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 " " " "

Average Length less than 89 mm SL- reduces rating one category;

Average Length greater than 102 mm SL- increases rating one category

**Table 3. Habitat Change in the SAN LORENZO MAINSTEM AND TRIBUTARIES from most recent years' reach averages compared to 2024 reach averages, or site comparisons when reach averages were unavailable.**

**(Green highlight indicates Reach Comparisons. Yellow highlight indicates Site Comparisons.)**

Reach or (Site Only) Comparison To Previous Years	2025 Baseflow Comparison (Most Important Factor May- September)	Pool Depth / Fastwater Habitat Depth	Fine Sediment Pool/ Fastwater Habitat	Embeddedness Pool/ Fastwater Habitat	Pool Escape Cover/ Fastwater Habitat Cover	Overall Habitat Change & (Improvement/ Deterioration )
(Mainstem Site 0a) (Since higher baseflow in 2024)	-	- / -	+ pool / Sim	+ pool / Sim riffle + run	+ / -	- (less food, shallower, less pool sediment, less embedded in pool and run, more pool cover)
(Mainstem Site 1) (Since higher baseflow in 2024)	-	/ -	/ Same	- / -	/ +	- (less food, shallower, more embedded, more fastwater cover)
<b>Mainstem Rch 2</b> (Since higher baseflow in 2024)	-	- / -	Sim / + riffle Sim run	Sim / Sim riffle Same run	Sim / + riffle - run	- (less food, shallower, riffles less embedded and more cover, runs less cover)
(Mainstem Site 4) (Since higher baseflow in 2024)	-	/ Sim riffle - run	/ Sim	/ Sim	/ -	- (less food, shallower run, less fastwater cover)
(Mainstem Site 6) (Since higher baseflow in 2024)	-	/ Sim	/ Same	/ Very +	/ -	- (less food, less embedded fastwater habitat, less fastwater cover)
(Mainstem Site 8) (Since higher baseflow in 2024)	-	/ - riffle Sim run	/ Sim	/ Sim	/ +	- (less food, shallower riffle, more fastwater cover)
(Mainstem Site 9) (Since higher baseflow in 2024)	-	/ -	/ Same	/ Sim	/ Sim	- (less food, shallower)
(Mainstem Site 10) (Since higher baseflow in 2024)	-	- / + riffle Sim run	Same / Sim riffle + run	Very + / Sim	Very - / -	- (less food, shallower pool, less embedded pool, much less pool cover)
(Mainstem Site 11) (Since higher baseflow in 2024)	-	- / Sim riffle + run	Sim / Sim	- / Sim	Very + / +	- (less food, shallower and more embedded pool, but more pool cover)
(Mainstem Site 12b) (Since higher baseflow in 2024)	-	+ / + riffle - run	Sim / Sim riffle + run	Sim / Sim	Very + / Sim	- (less food, deeper pools with much more cover)

Reach or (Site Only) Comparison To Previous Years	2025 Baseflow Comparison (Most Important Factor May-September)	Pool Depth / Fastwater Habitat Depth	Fine Sediment Pool/ Fastwater Habitat	Embeddness Pool/ Fastwater Habitat	Pool Escape Cover/ Fastwater Habitat Cover	Overall Habitat Change & (Any Improvement)
(Zayante Site 13a) (Since higher baseflow in 2024)	-	- / -	+ / - riffle Same run	+ / Sim	Very - /	- (less food, shallower, pool less embedded and less sediment, less cover in pool)
(Zayante Site 13c) (Since higher baseflow in 2024)	-	Sim / Sim	Sim / Sim	Very - / Very - riffle	Same /	- (less food, more embedded, similar otherwise)
Zayante Reach 13d (Since higher baseflow in 2024)	-	- / -	Sim / Sim	Sim / Sim	+ / Sim	- (less food, shallower, more pool escape cover)
(Zayante Site 13i) (Since higher baseflow in 2024)	-	+ / - riffle + run	Same / Sim	+ / - riffle + run	- /	- (less food, pools less embedded, less cover in alternative pool (original pool unsampleable - large logjam))
(Bean Site 14a) (Since higher baseflow than 2018)	+	- / -	- / -	Sim / Sim riffle Very - run	+ / +	+ (compared to 2018) (more food, shallower, more fine sediment, more escape cover)
(Bean Reach 14b) (Since higher baseflow in 2024)	-	Sim / -	Sim / + riffle Sim run	Sim / +	+ / Very +	- (less food, reduced fastwater embeddedness, more escape cover)
(Bean Site 14c-2) (Since higher baseflow in 2024)	-	Sim / Sim riffle - avg run	Sim / Same riffle - run	Sim / Same riffle	Same /	- (less food, shallower fastwater habitat)
Fall Reach 15a (Since similar baseflow in 2024)	? (measured flow higher in Oct. 2025 than 2024)	- / -	Sim / -	Sim / Same	Same /	- (shallower, more sediment in fastwater habitat)
Fall Reach 15b (Since higher baseflow in 2024)	-	- / -	Sim / Sim	Sim / Same riffle Sim run	Same / -	- (less food, shallower, more riffle sediment, more run embed., less cover)
(Newell Site 16) (Since higher baseflow in 2024)	-	- / Same	Sim / Sim	+ / + riffle Sim run	+ /	- (less food, shallower new and shorter pool, higher pool escape cover index)
(Boulder Site 17a) (Since higher baseflow in 2024)	-	- avg + max/ Sim riffle - run	Sim / -	+ / Same riffle + run	Very + /	- (less food, shallower avg pool depth, shallower runs, more fastwater fines, reduced embeddedness, more pool cover)

Reach or (Site Only) Comparison To Previous Years	2025 Baseflow Comparison (Most Important Factor May-September)	Pool Depth / Fastwater Habitat Depth	Fine Sediment Pool/ Fastwater	Embed-dedness Pool/ Fastwater	Pool Escape Cover/ Fastwater Habitat Cover	Overall Habitat Change & (Any Improvement)
<b>Boulder Reach 17b</b> (Since higher baseflow in 2023)	-	- / -	+ / + riffle Sim run	Sim / Sim	Same / Sim	- (less food, shallower pool depth, shallower runs, reduced pool and fastwater fines, similar embeddedness and escape cover)
<b>Bear Reach 18a</b> (Since higher baseflow in 2023)	-	- / -	Sim / Sim	Sim / - run Sim riffle	- / -	- (less food, shallower, more run embed., less escape cover)
<b>Bear Reach 18b</b> (Since Higher baseflow in 2024)	-	Sim / - run	Sim / +	Sim / Sim riffle - run	- /	- (less food, shallower run, less fastwater sediment, reduced pool escape cover)
<b>(Branciforte Site 21a-2)</b> (Since Higher baseflow in 2024)	-	Sim / -	- / -	- / Same riffle Sim run	+ /	- (less food, shallower fastwater habitat, more fine sediment, increased pool sediment, more pool cover)
<b>Branciforte Reach 21b</b> (Since higher baseflow in 2023)	-	- / Sim riffle + run	- / Sim riffle - run	Same / Sim	- / +	+ (less food, shallower pools with more sediment and less pool cover, more cover in fastwater habitat)

Figure 6a. Trend in Escape Cover Index for Reach 2 Riffles in the Lower Mainstem San Lorenzo River, 1999-2000 and 2007-2025. (Segment partially changed in 2011.)

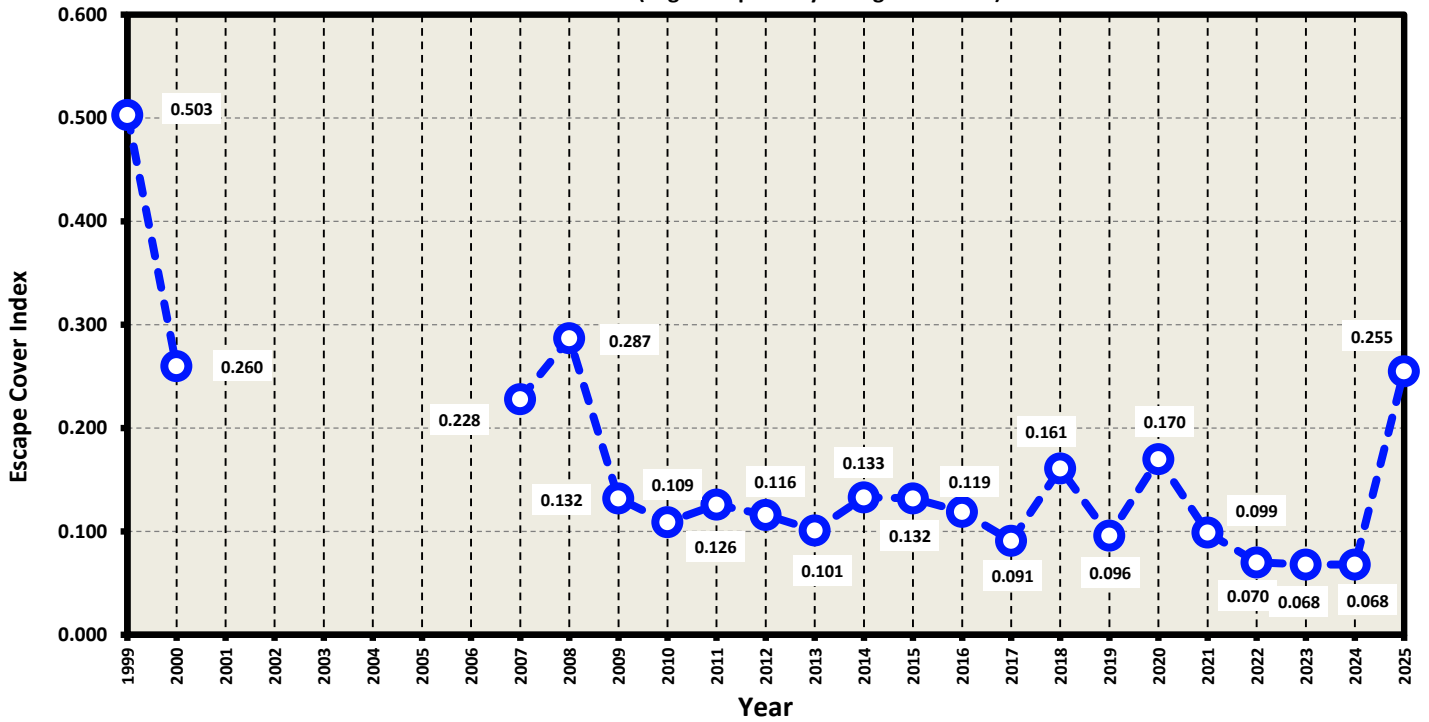


Figure 6a. Trend in the Escape Cover Index for Reach 2 Riffles in the Lower San Lorenzo River.

Figure 6b. Trend in Averaged Maximum and Mean Riffle Depth in Reach 2 of the Lower Mainstem San Lorenzo River, 2000 and 2007-2025. (Segment partially changed in 2011.)

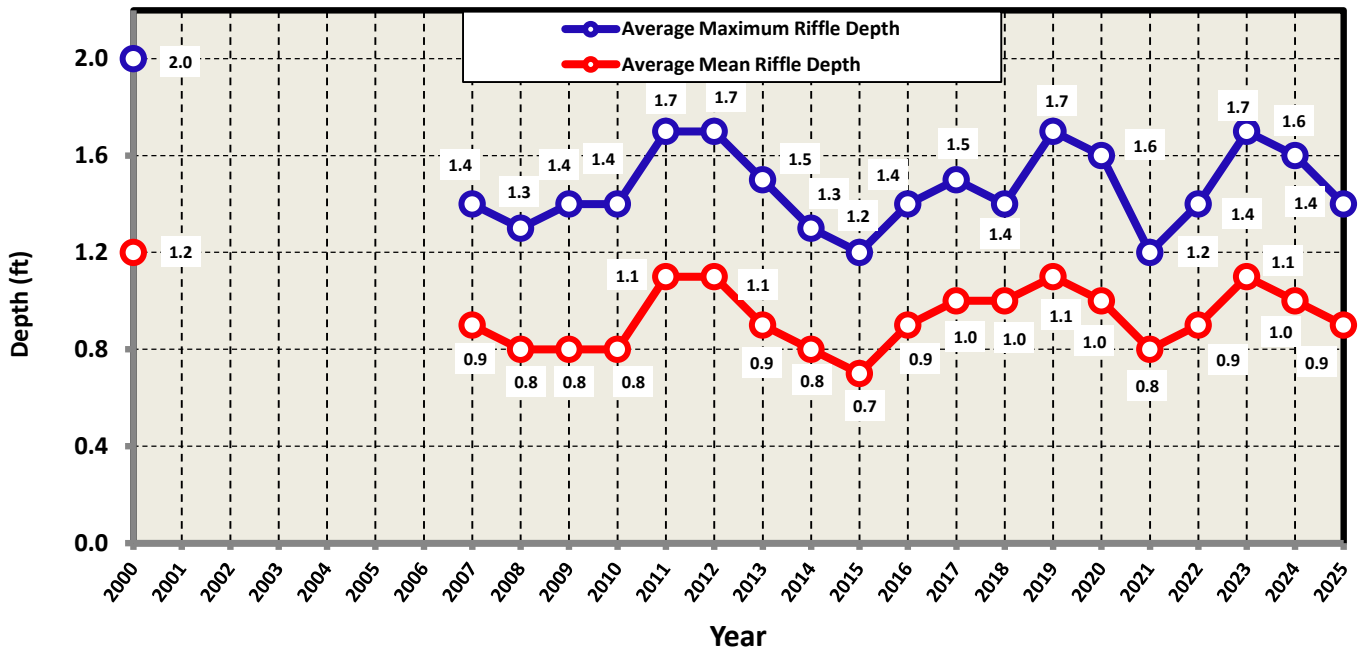


Figure 6b. Trend in Riffle Depth for Reach 2 in the Lower San Lorenzo River.

Figure 7a. Trend in Pool Escape Cover Index for Zayante Creek Reach 13d.

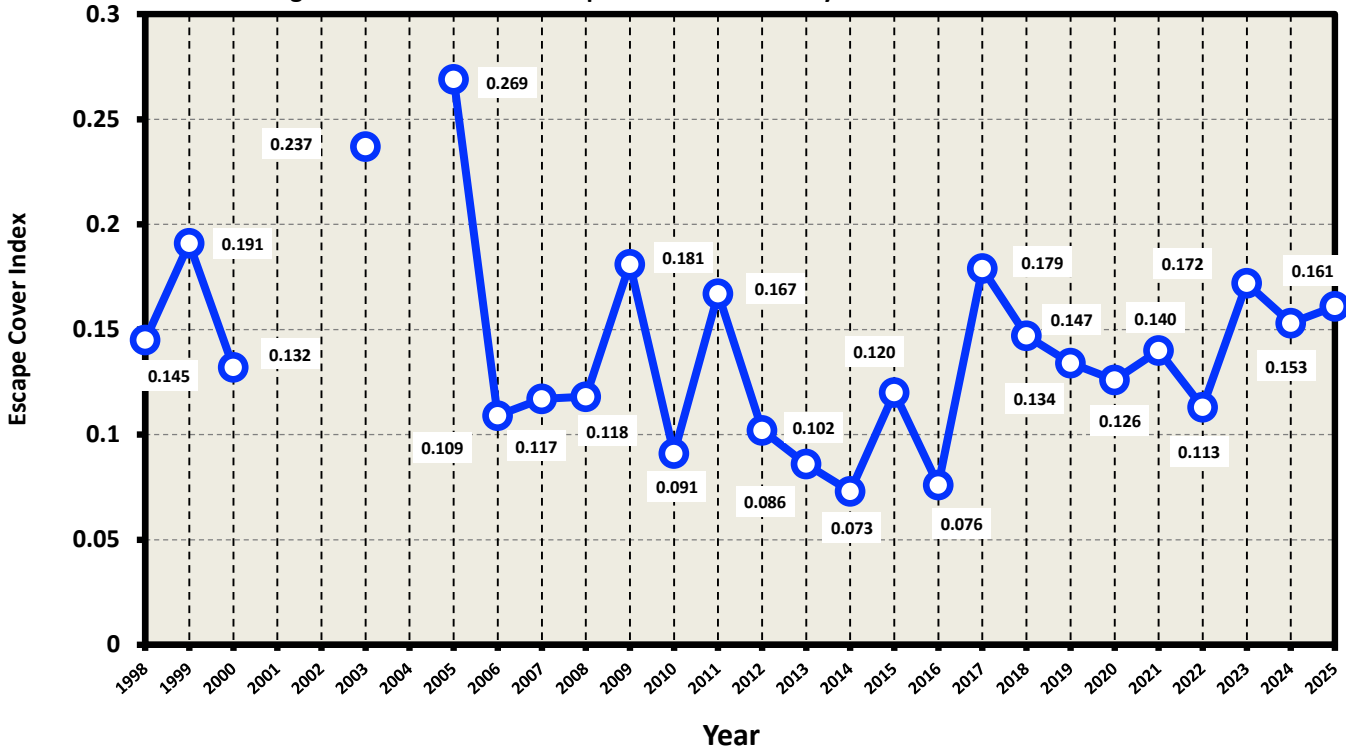


Figure 7a. Trend in Pool Escape Cover Index for Zayante Creek, Reach Segment 13d.

Figure 7b. Trend in Averaged Maximum and Mean Pool Depth in Reach 13d of Zayante Creek.

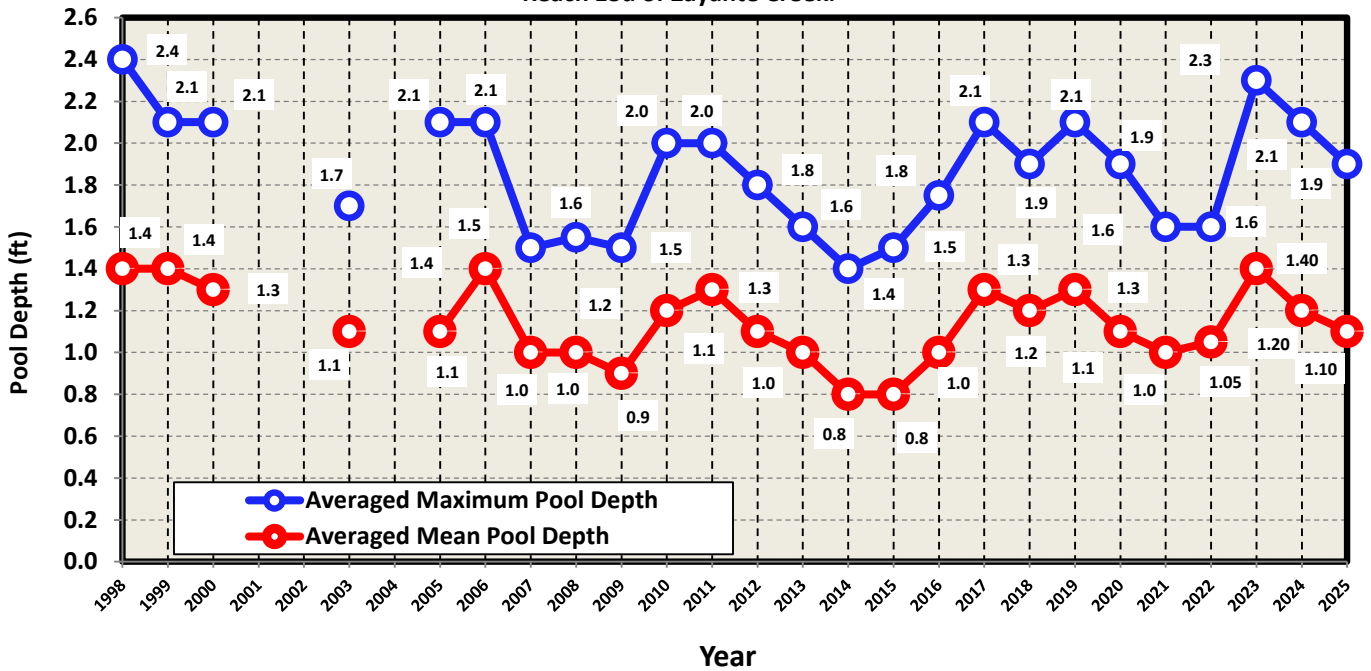
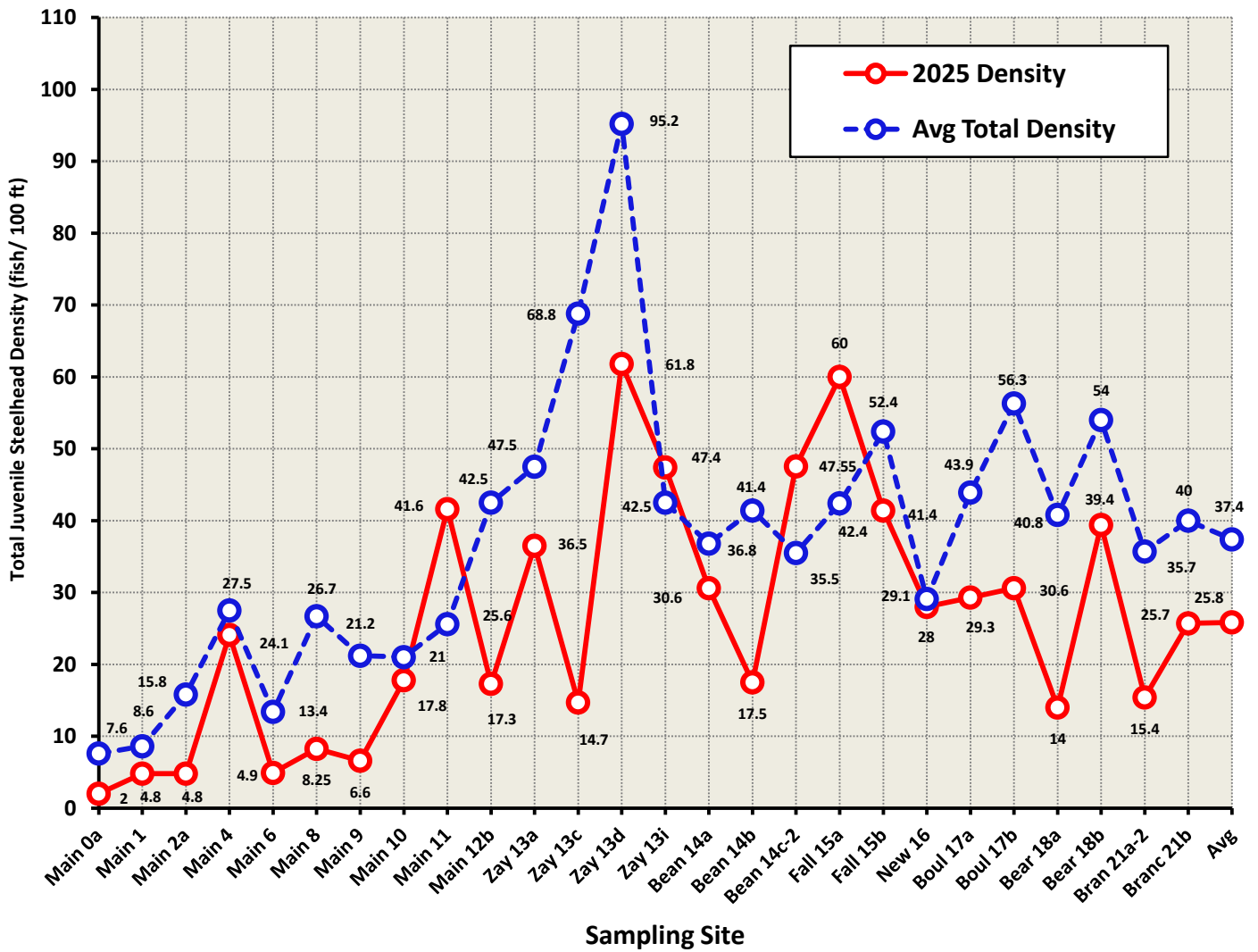


Figure 7b. Trend in Averaged Maximum and Mean Pool Depth in Reach 13d , Zayante Creek.

**Figure 8. TOTAL JUVENILE STEELHEAD SITE DENSITIES IN THE SAN LORENZO RIVER WATERSHED in 2025 Compared to the Average Density. (Averages based on up to 29 years of data since 1997; lines connecting site densities for visual effect only).**



**Figure 8. Total Juvenile Steelhead Site Densities in the San Lorenzo River in 2025 Compared to Average Density.**

Figure 9. YOUNG-OF-THE-YEAR STEELHEAD SITE DENSITIES in the San Lorenzo River in 2025. (Averages based on up to 29 years of data; lines connecting site densities are for visual effect only.)

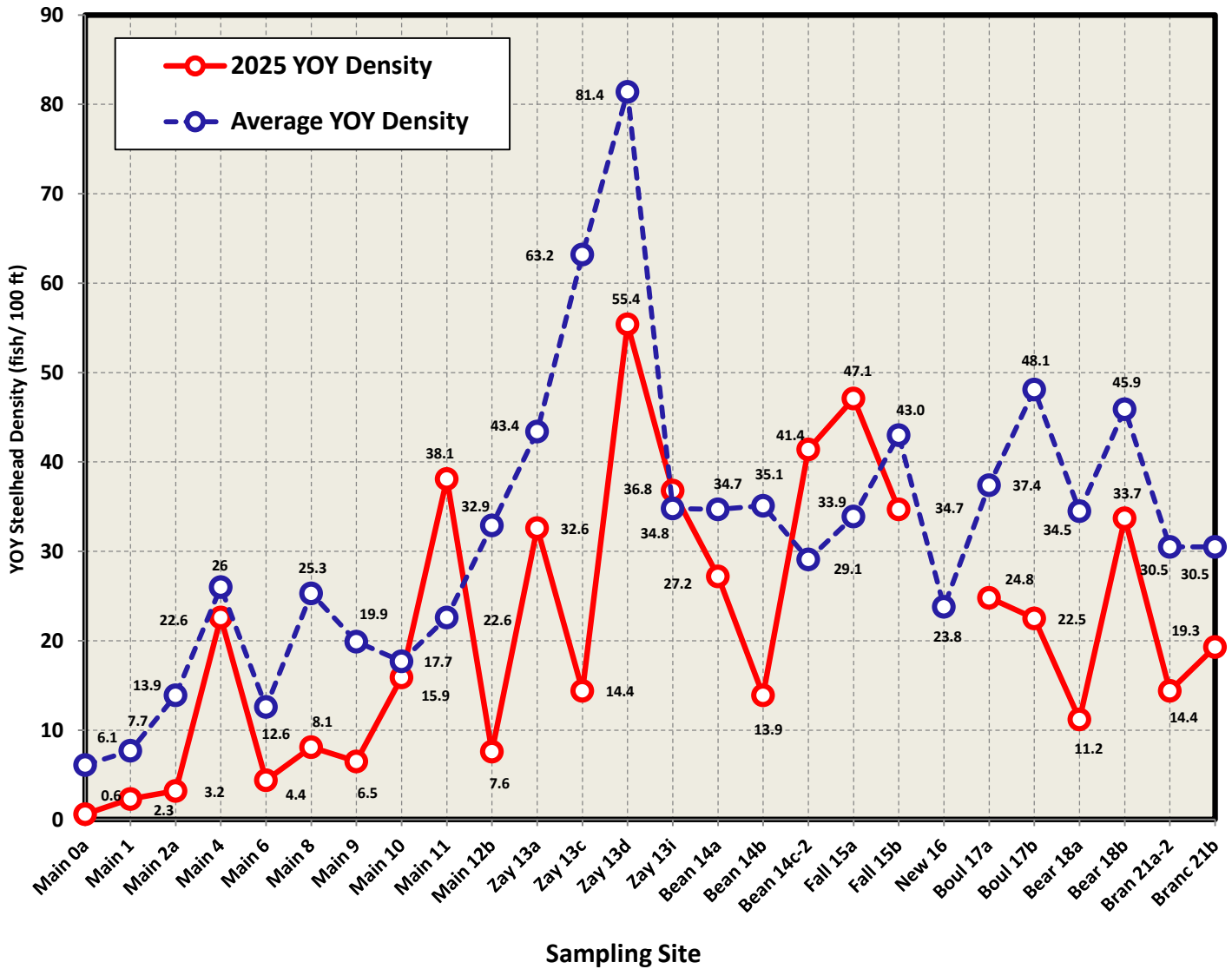


Figure 9. Young-of-the-Year Steelhead Site Densities in the San Lorenzo River in 2025 Compared to Average Density.

Figure 10. Young-of-the-Year Steelhead Site Densities in the San Lorenzo River in 2025 Compared to 2024. (Lines connecting site densities are for visual effect only.)

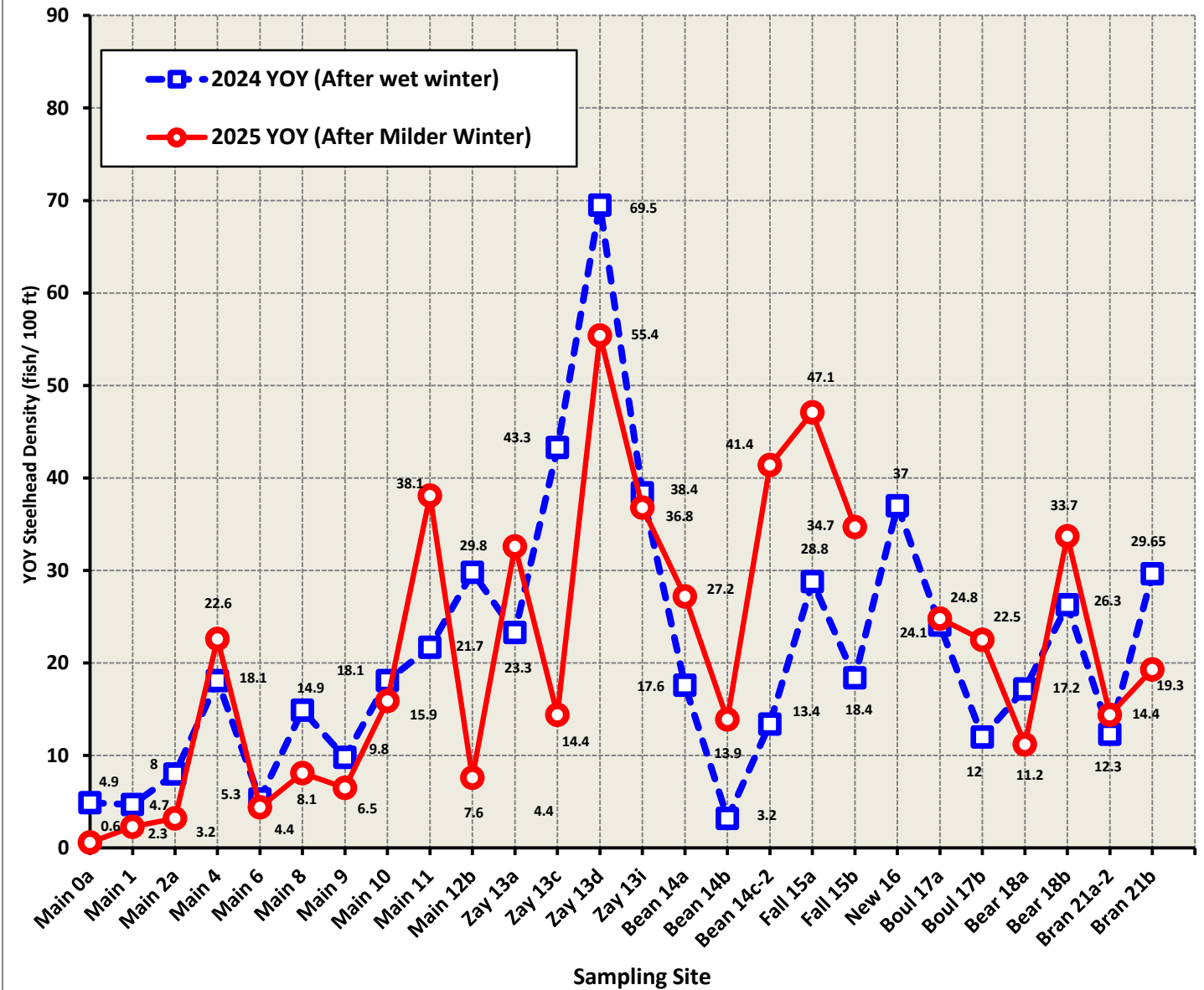


Figure 10. Young-of-the-Year Site Densities in the San Lorenzo Watershed Comparing 2025 to 2024.

Figure 11. Estimated Adult Steelhead Returns to Scott Creek and San Clemente Dam on the Carmel River.

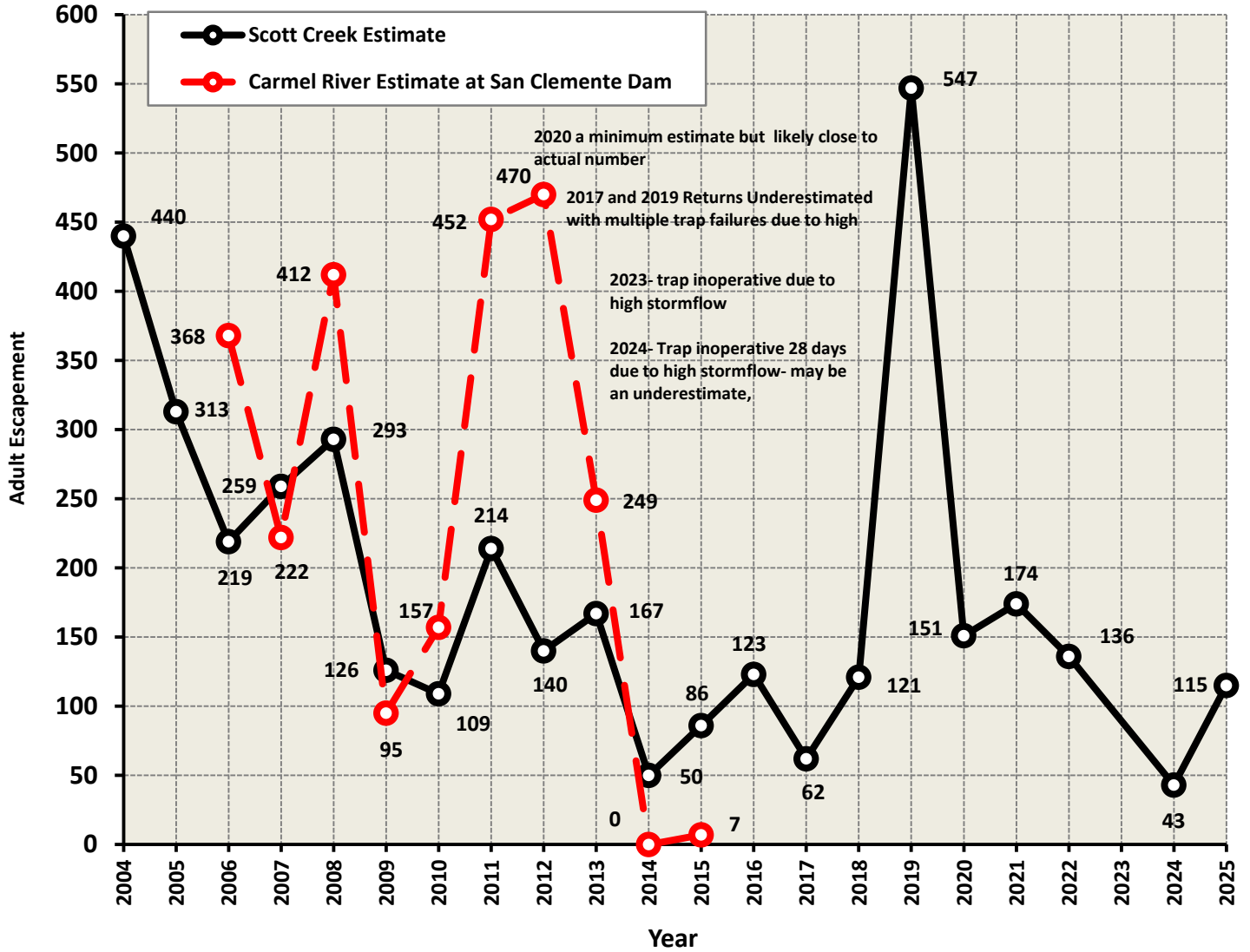


Figure 11. Estimated Adult Steelhead Returns to Scott Creek and San Clemente Dam (Carmel River).

Figure 12. Yearling and Older Steelhead Site Densities in the San Lorenzo River in 2025 Compared to Average Density. (Averages based on up to 29 years of data; lines connecting site densities are for visual effect only.)

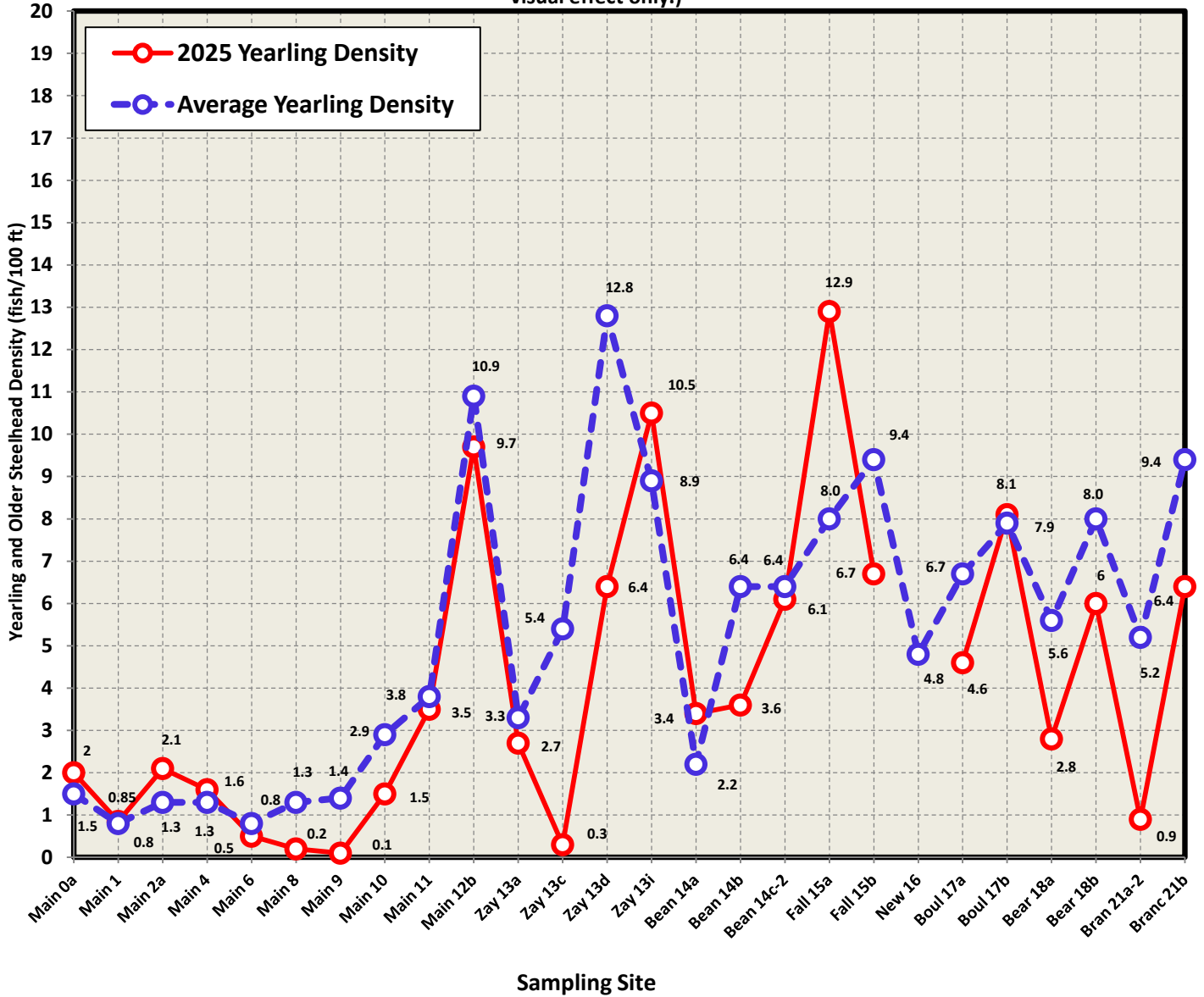


Figure 12. Yearling Steelhead Site Densities in the San Lorenzo River in 2025 Compared to Average Density.

Figure 13. SIZE CLASS II AND III STEELHEAD SITE DENSITIES in the San Lorenzo River in 2025 Compared to Average Density. (Based on up to 29 years of data; lines connecting site densities are for visual effect.)

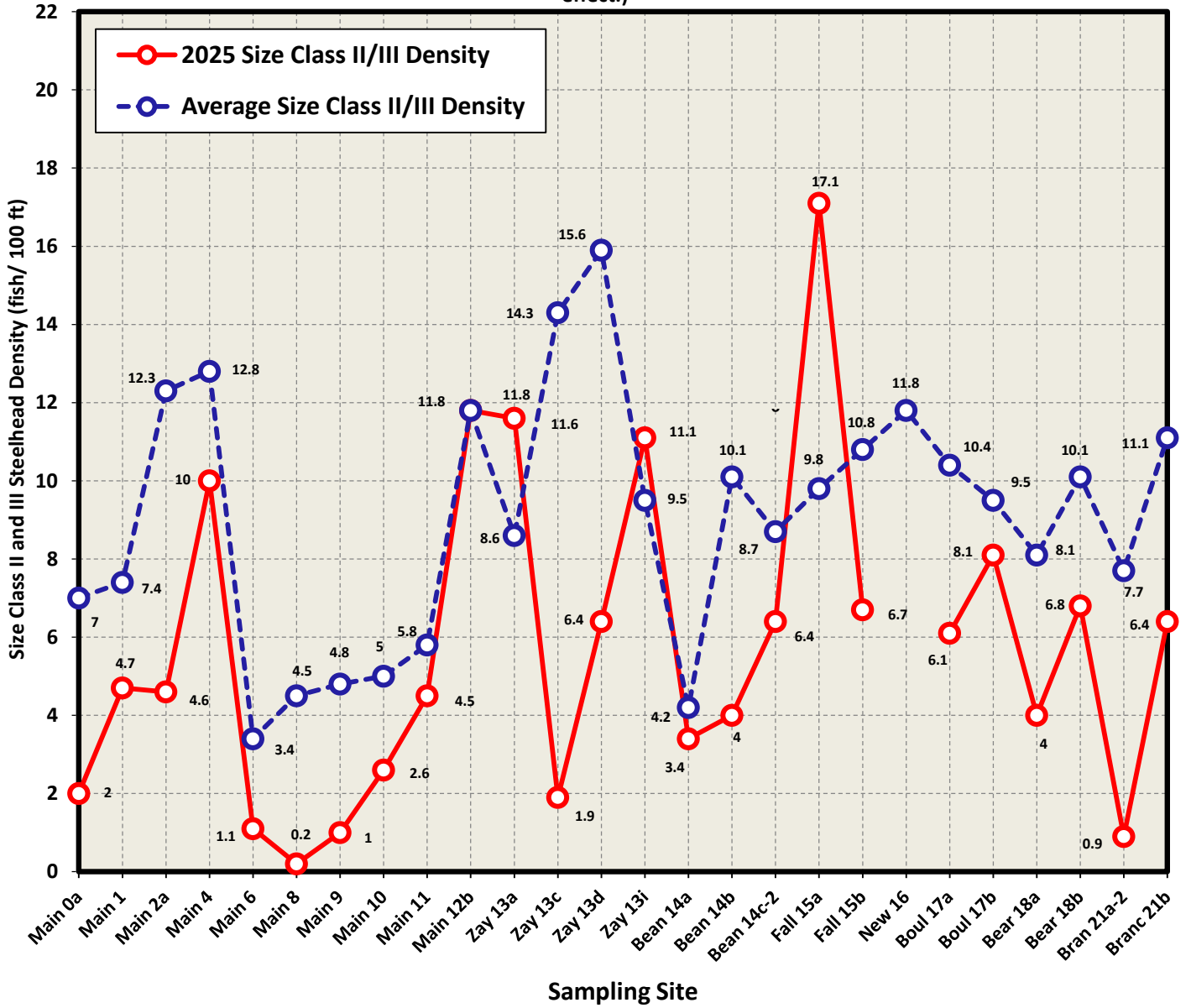


Figure 13. Size Class II/III Steelhead Site Densities in the San Lorenzo River in 2025 Compared to Average Density.

Figure 14. SIZE CLASS II AND III STEELHEAD SITE DENSITIES in the San Lorenzo River in 2025 Compared to 2024.  
(Lines connecting site densities are for visual effect.)

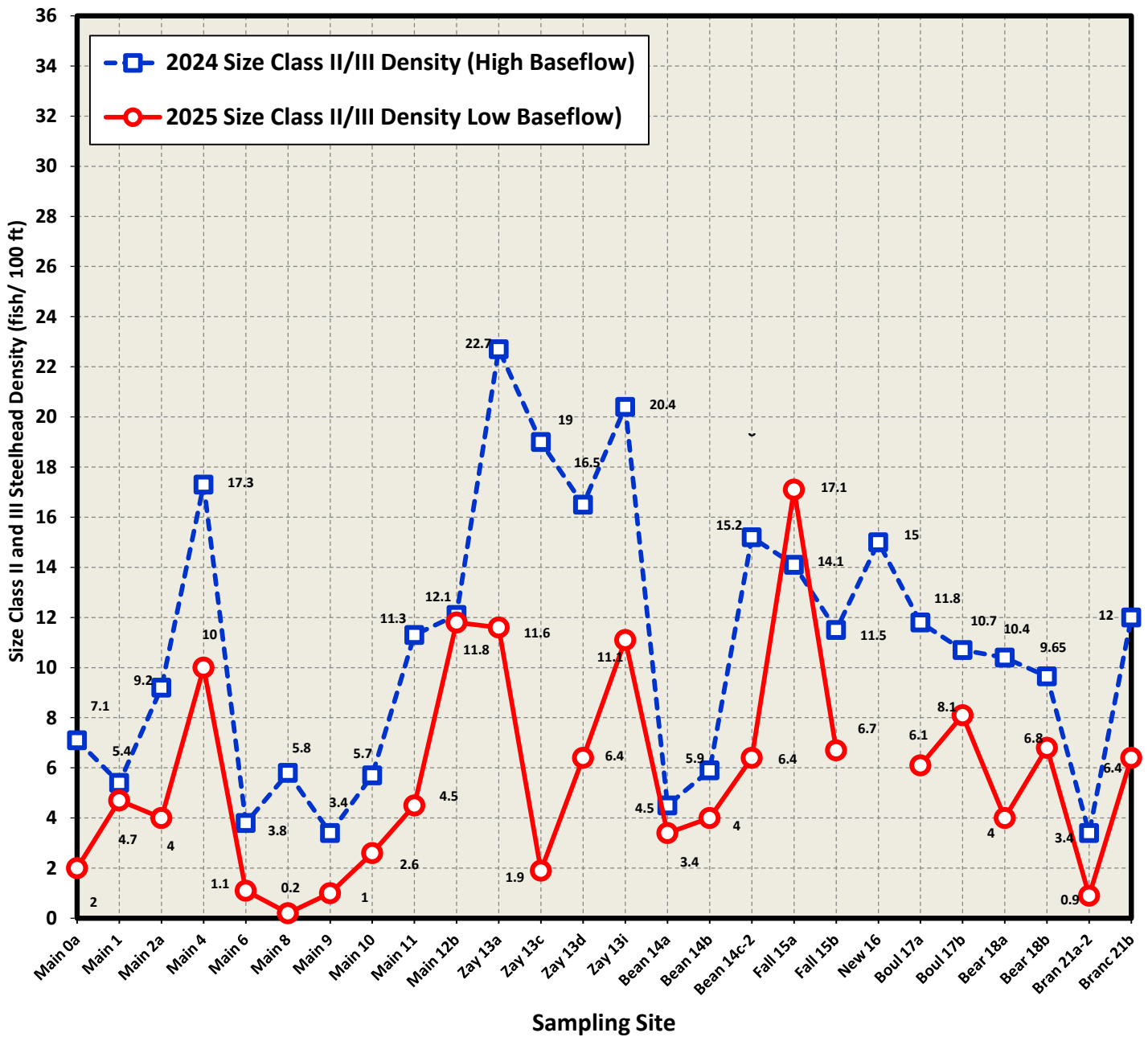


Figure 14. Size Class II/III Steelhead Site Densities in the San Lorenzo Watershed Comparing 2025 to 2024.

Figure 15. Trend in Total Juvenile Steelhead Density at San Lorenzo Mainstem Sites, 1997-2025.

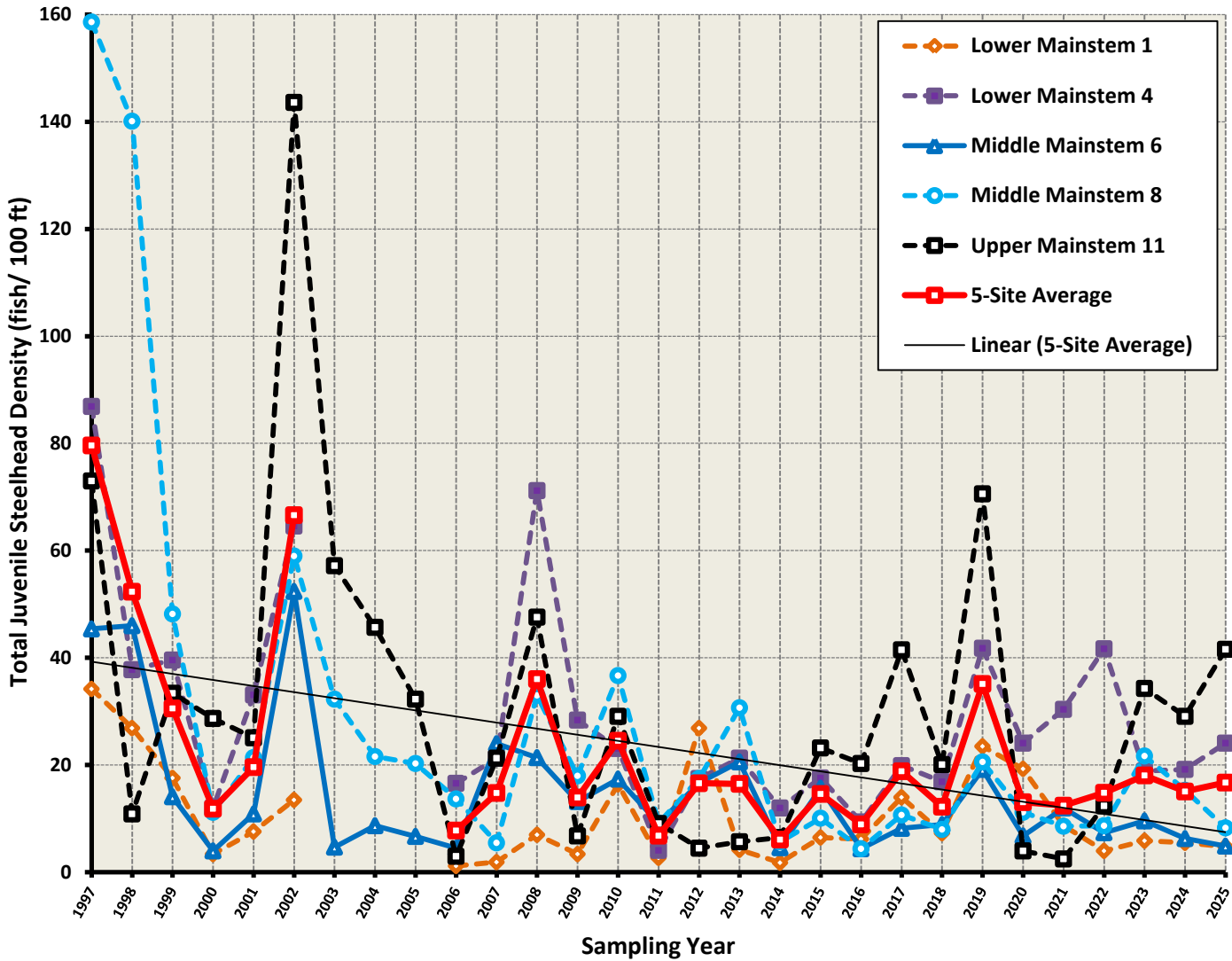


Figure 15. Trend in Total Juvenile Steelhead Density at San Lorenzo Mainstem Sites, 1997-2025.

Figure 16. Trend in Total Juvenile Steelhead Density at 7 San Lorenzo Tributary Sites, 1997-2025. (Bean Creek Segment 14c was moved upstream in 2016 because it then became frequently dewatered.)

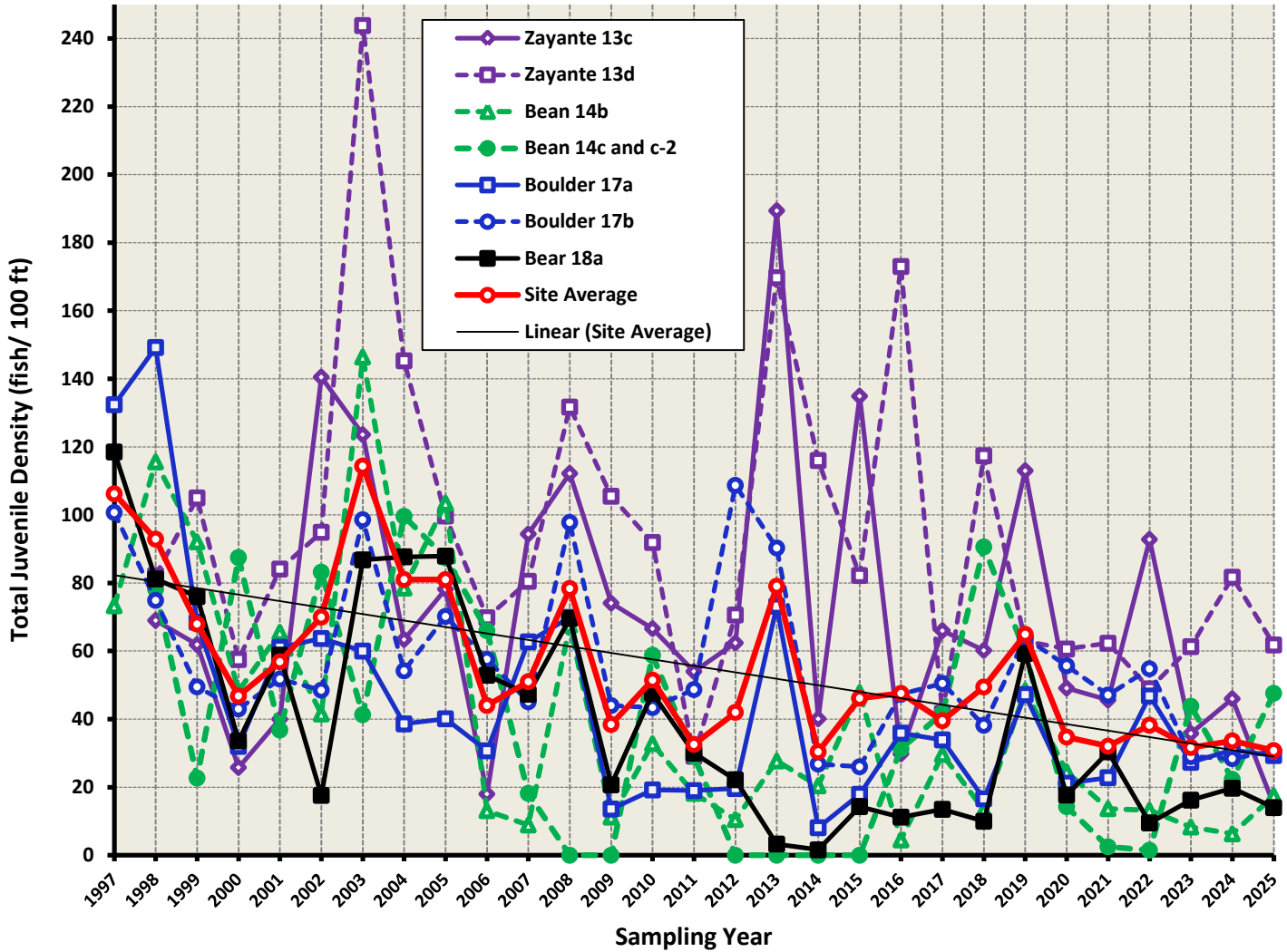


Figure 16. Trend in Total Juvenile Steelhead Density at San Lorenzo Tributary Sites, 1997-2025.

Figure 17. Trend in Size Class II/III ( $\Rightarrow$ 75 mm SL) Juvenile Steelhead Density at San Lorenzo Mainstem Sites, 1997-2025.

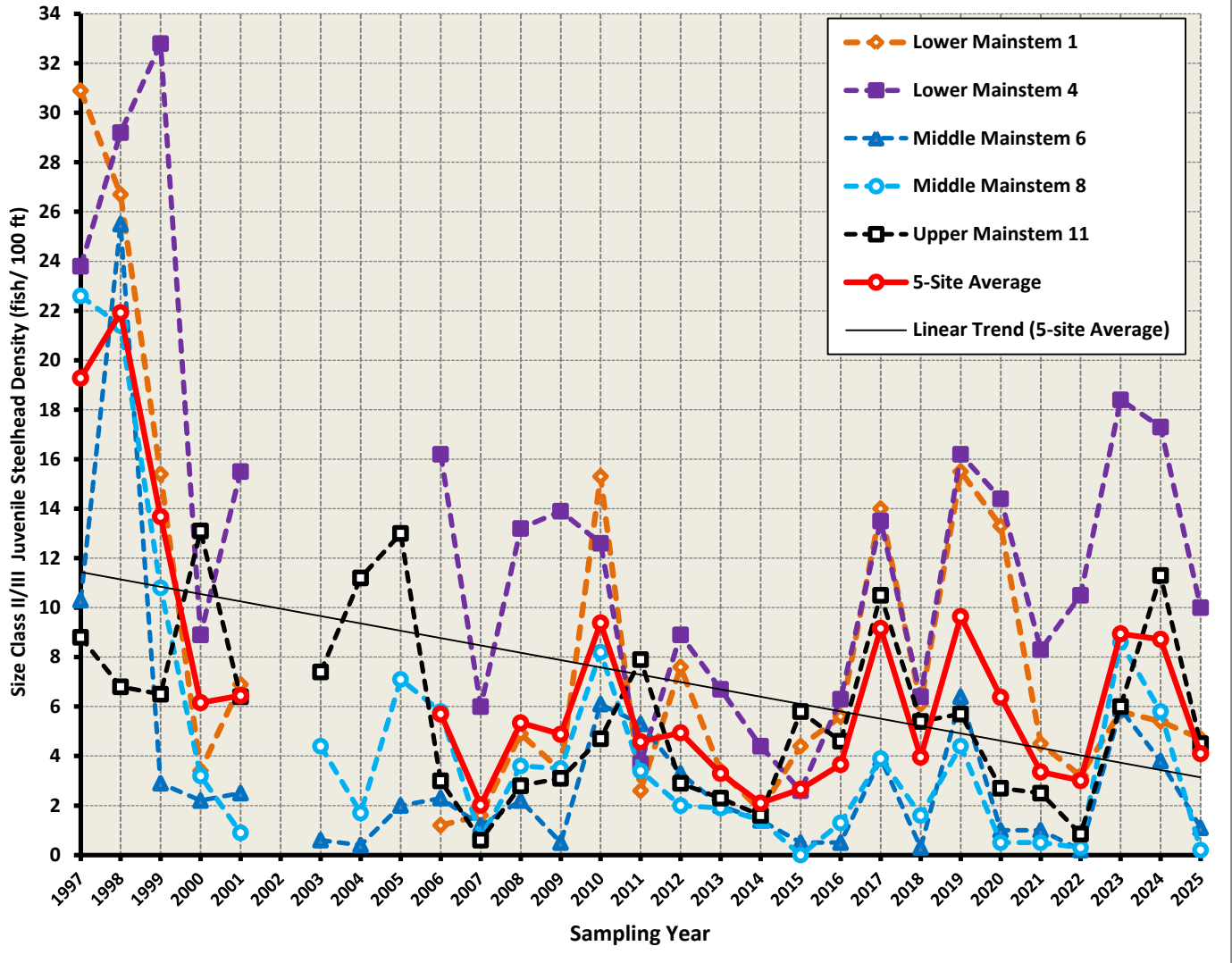


Figure 17. Trend in Size Class II/III Juvenile Steelhead Density at San Lorenzo Mainstem Sites, 1997-2025.

Figure 18a. Trend in Size Class II/III ( $\Rightarrow$ 75 mm SL) Juvenile Steelhead Density at 7 San Lorenzo Tributary Sites, 1997-2025. (Bean Creek Segment 14c was moved upstream to 14c-2 in 2016 because 14c was dewatered.)

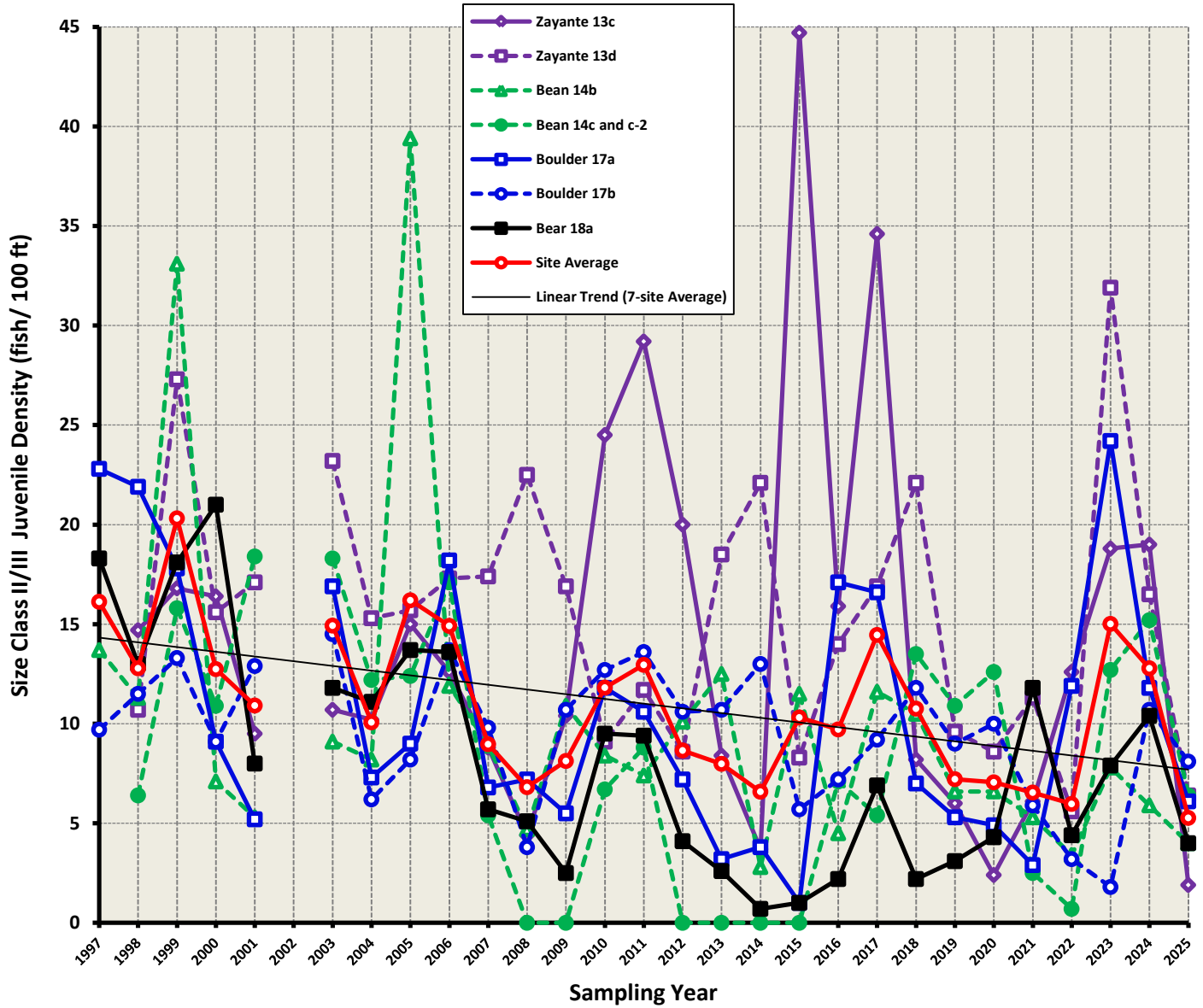


Figure 18a. Trend in Size Class II/III Juvenile Steelhead Density at San Lorenzo Tributary Sites, 1997-2025.

Figure 18b. Trends in Size Class II/III ( $\geq 75$  mm SL) Juvenile Steelhead Density in the San Lorenzo, Soquel and Aptos/Valencia Watersheds, 1997–2025.

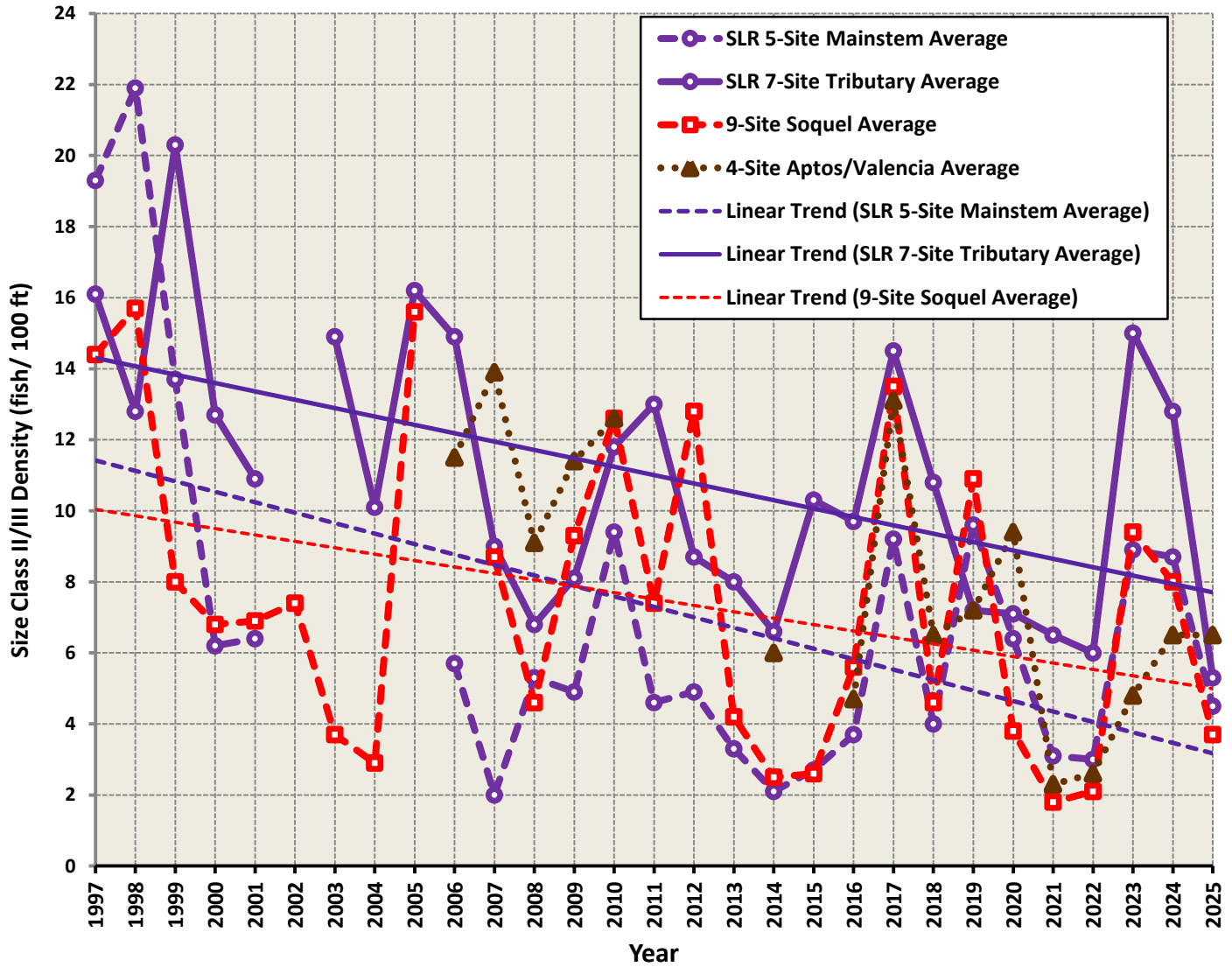


Figure 18b. Trend in Size Class II/III Juvenile Steelhead Density in San Lorenzo, Soquel and Aptos/Valencia Sites, 1997-2025.

Figure 19a. Trend in Size Class II/III ( $\Rightarrow$ 75 mm SL) Juvenile Steelhead Density at San Lorenzo Mainstem and Tributary Sites with 5-Month Baseflow Average, 1997-2025.

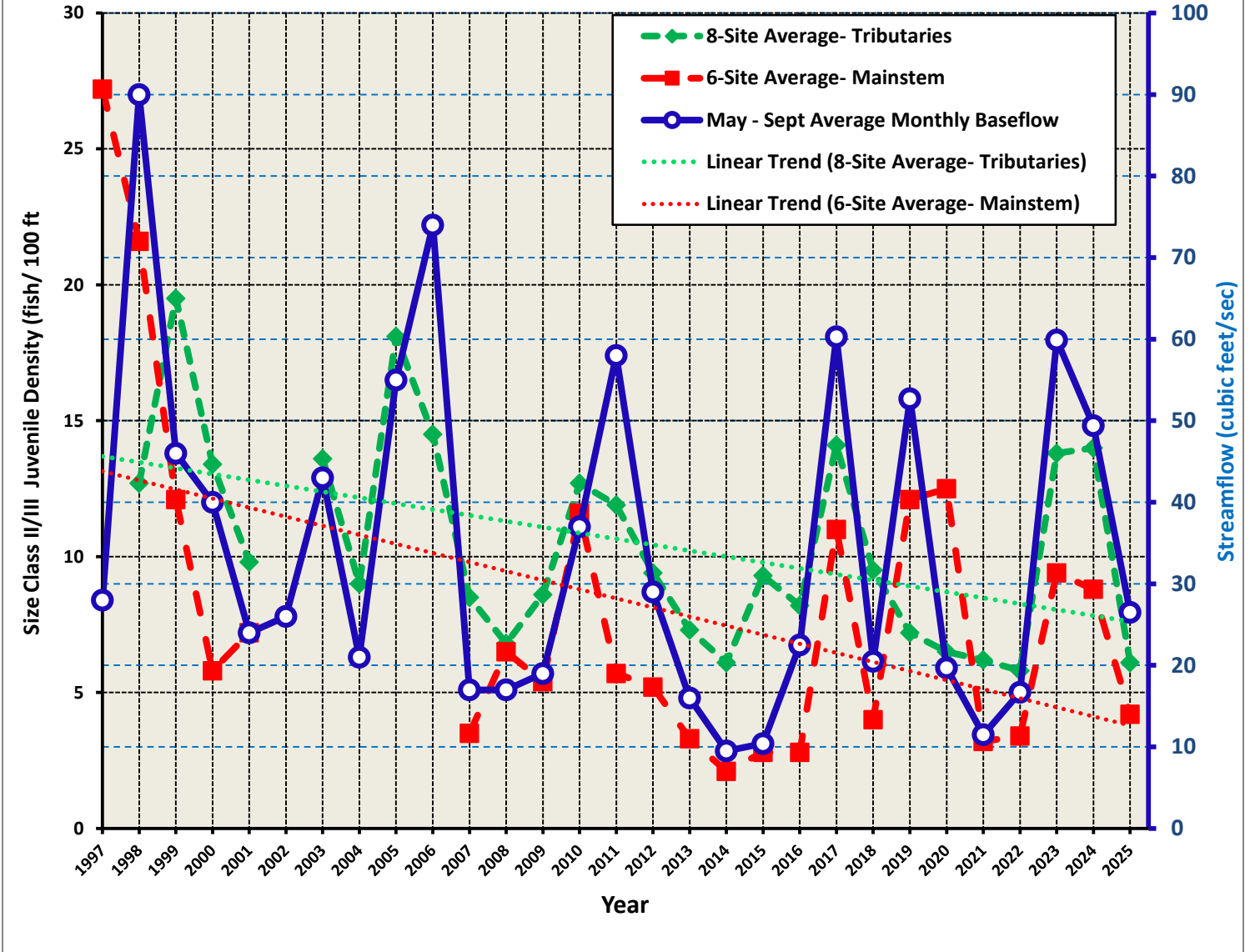


Figure 19a. Trend in Size Class II/III ( $\Rightarrow$ 75 mm SL) Juvenile Steelhead Density at San Lorenzo Mainstem and Tributary Sites with 5-Month Baseflow Average, 1997-2025.

Figure 19b. Trend in Size Class II/III ( $\Rightarrow$ 75 mm SL) Steelhead Density at Middle Mainstem San Lorenzo Sites with 5-Month Baseflow Average, 1997-2025.

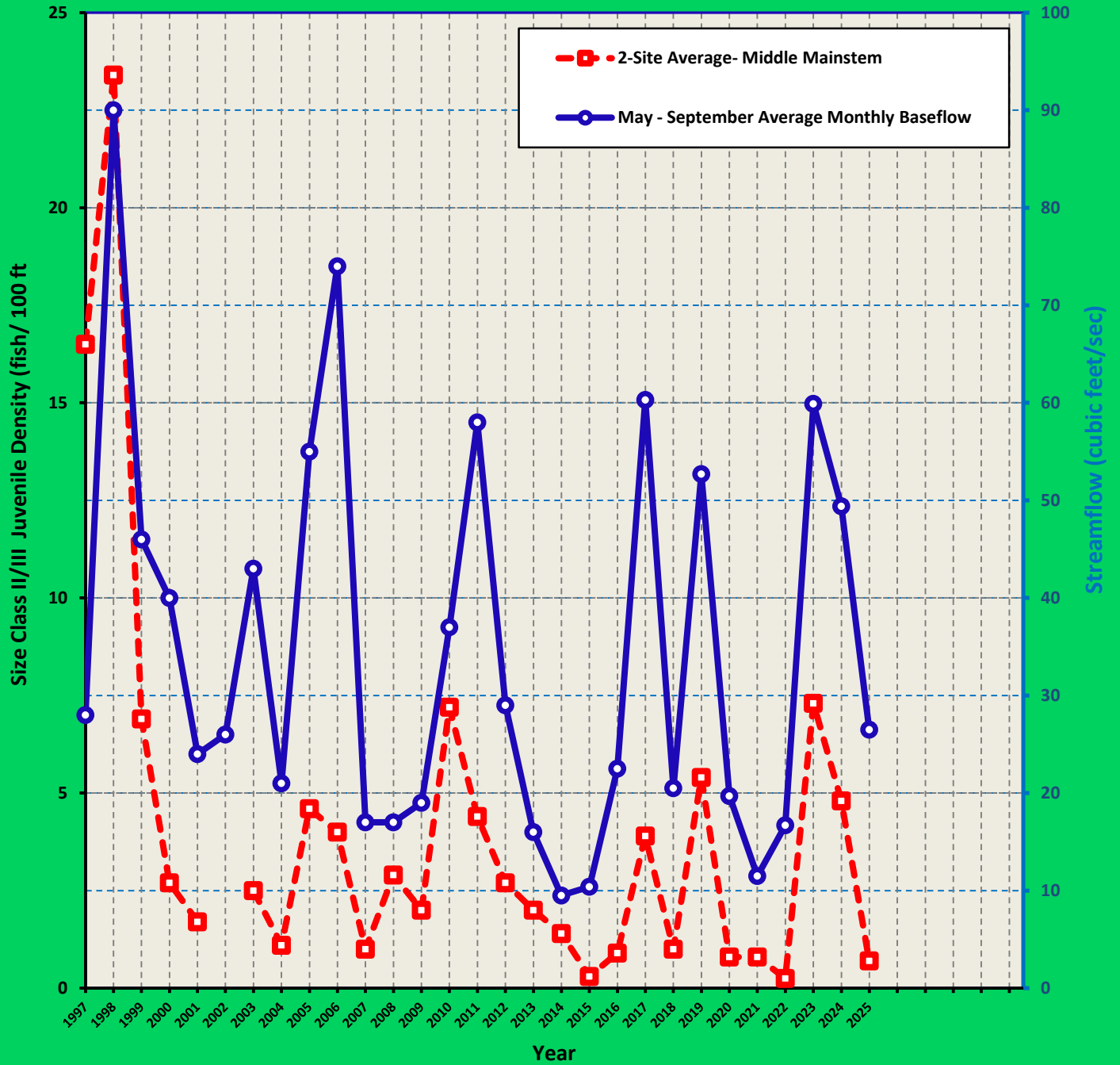


Figure 19b. Trend in Average Size Class II/III ( $\Rightarrow$ 75 mm SL) Juvenile Steelhead Density at San Lorenzo Middle Mainstem Sites with 5-Month Baseflow Average, 1997-2025.

Figure 20a. Trend in Index of Size Class II/III ( $\Rightarrow$ 75 mm SL) Juvenile Production in 6 Mainstem and 11 Tributary San Lorenzo River Reaches with 5-Month Baseflow Average, 2010-2025.

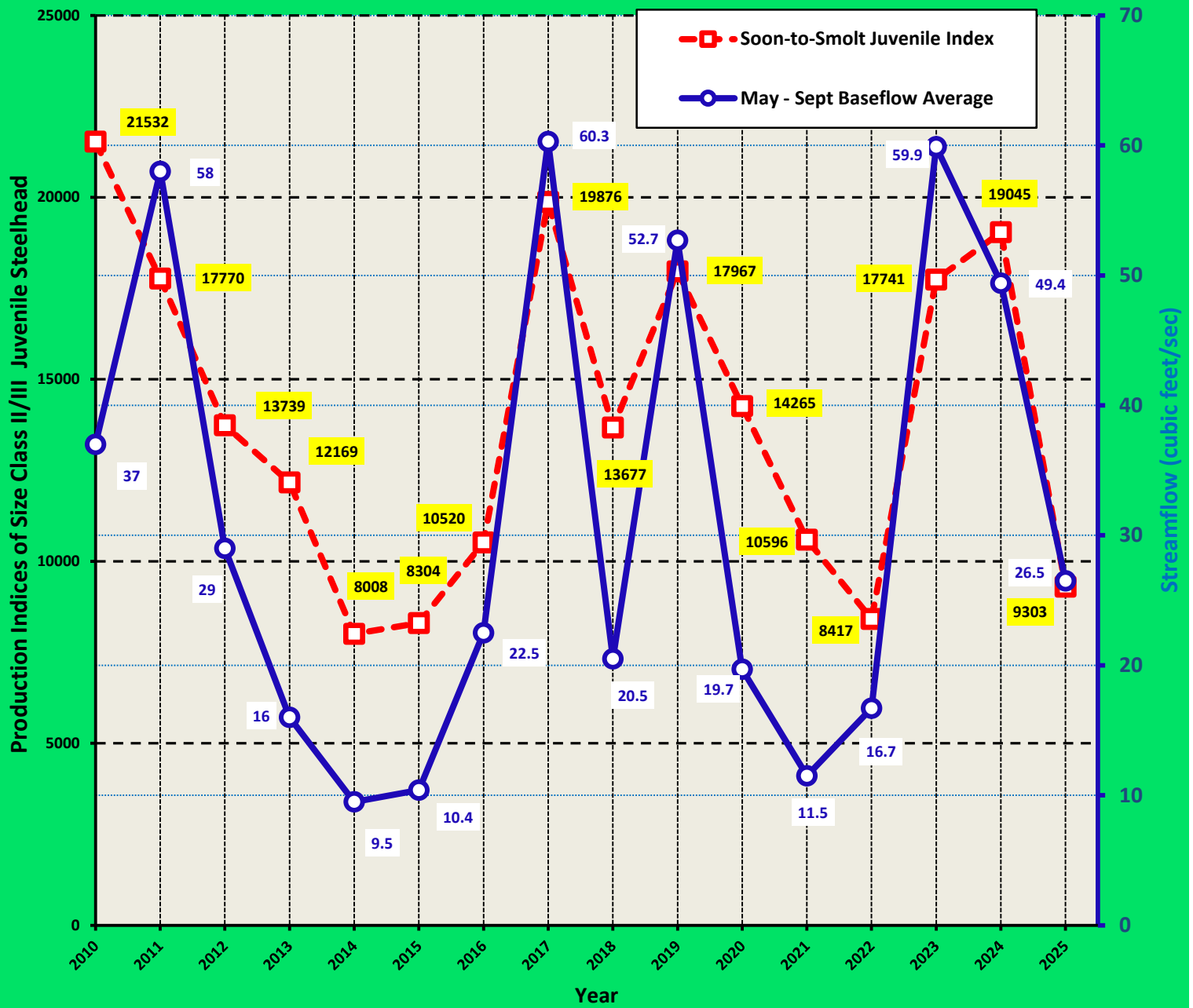


Figure 20a. Trend in Index of Size Class II/III ( $\Rightarrow$ 75 mm SL) Juvenile Steelhead Production in 6 Mainstem and 11 Tributary San Lorenzo River Reaches with 5-Month Baseflow Average, 2010-2025.

Figure 20b. Soon-to-Smolt Juvenile Steelhead Indices of Production for 6 Mainstem San Lorenzo River Reaches (1, 2, 4, 6, 8 and 11) with 5-Month Baseflow Average since 1997.

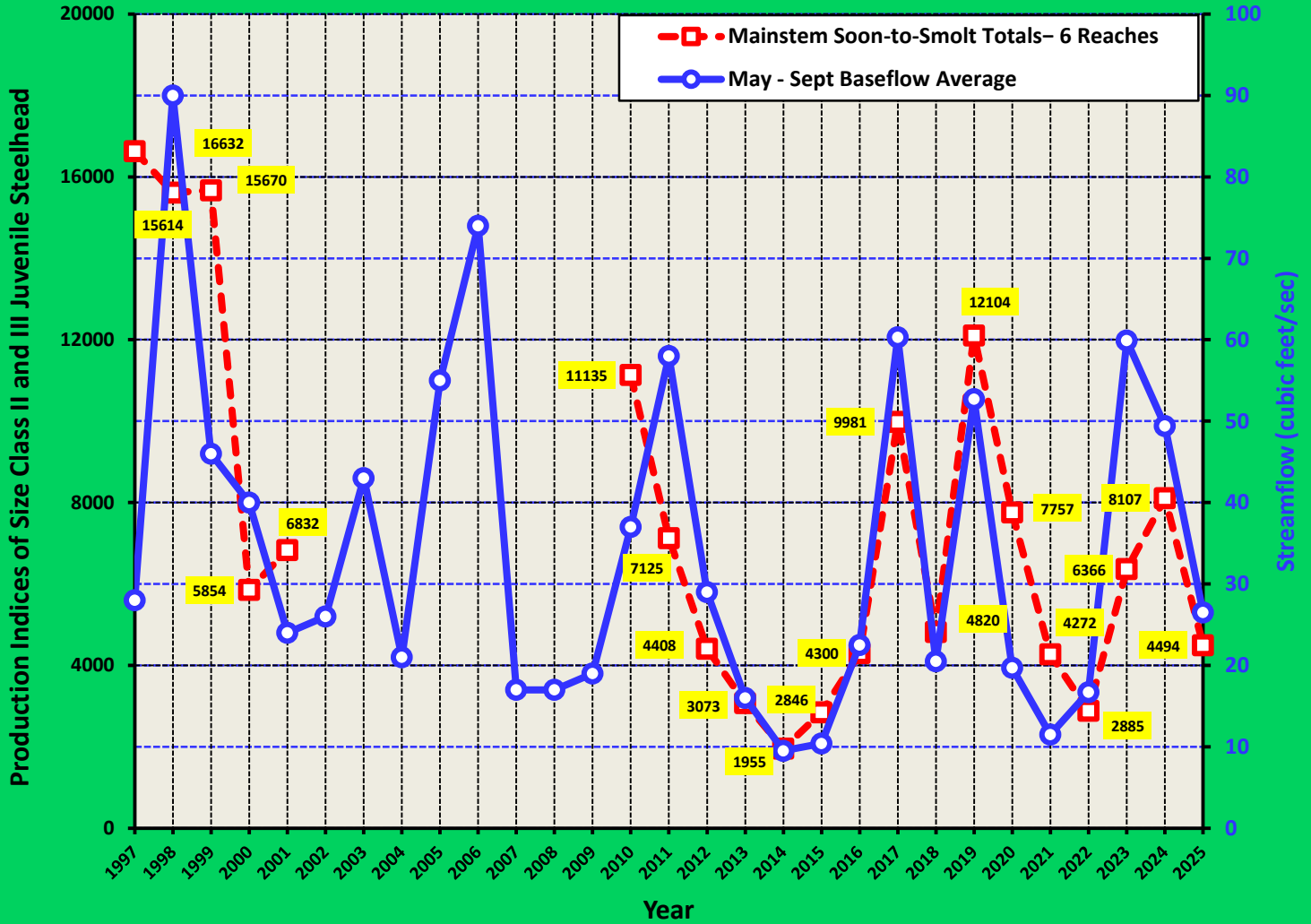
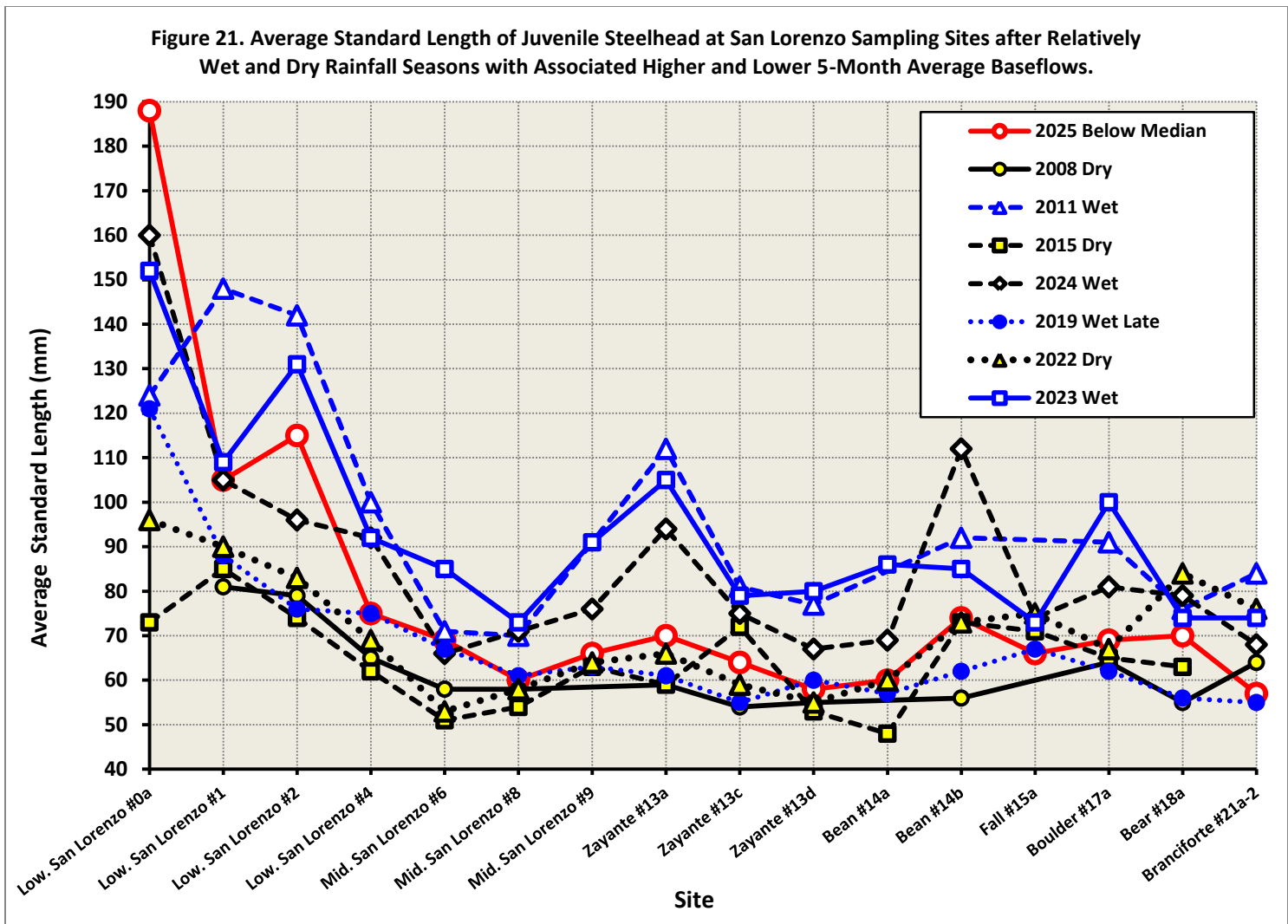


Figure 20b. Trend in Index of Size Class II/III Juvenile Steelhead Production in 6 Mainstem San Lorenzo River Reaches with 5-Month Baseflow Average Since 1997.



**Figure 21. Average Standard Length of Juvenile Steelhead at San Lorenzo Sampling Sites after Relatively Wet and Dry Rainfall Seasons, with Associated High and Low Annual Baseflows.**

**ii. Steelhead Abundance and Habitat in the Soquel Creek Watershed**

1. Soquel Creek had a WY2025 hydrograph similar to the San Lorenzo drainage, with stormflows at the same frequency and with similar intensity. The one February stormflow exceeding bankfull in Soquel Creek (3,400 cfs; bankfull- 2,000 cfs), a second February stormflow of 1,300 cfs and the 400 cfs stormflow in mid-March were sufficient to provide adult spawning access to upper sampling sites but were likely sufficient to scour redds or smother them to reduce egg survival, especially in this sand-laden watershed, particularly in the Mainstem downstream of Moores Gulch. All Soquel Creek reaches/ sites had habitat decline from reduced baseflow and less food available compared to 2024.
2. Overall 2025 habitat quality declined in all site/reaches when compared to 2023 and 2024 conditions (Table 5; Map in Figure 2). Where only site data were collected in 2025, site conditions were compared to 2024 site conditions. Habitat declined at all sites and reaches due to decreased baseflow, decreased insect drift rate and decreased fastwater area (less food), with baseflow below the median until late July after which it fluctuated above and below the median until stormflow in mid-October (Figures 22a-22b). October streamflow comparisons between years in Table 4 are inconclusive due

to elevated streamflow after an early storm in 2025). In 2025 when 5 habitat-typed reach segments were compared to the closest previous years (2023 or 2024), all showed reduced habitat depth along with all sampling sites except increased maximum pool depth at East Branch Site 16 in the SDSF. In 2025, lower West Branch Reach 13a had the same amount of pool cover but increased riffle embeddedness. The lower East Branch Reach 9a had increased fine sediment in pools and less pool escape cover. In the Mainstem, Reaches 3a and 7 had similar habitat conditions to previous years, other than shallower habitat, with increased pool escape cover. Lowermost Mainstem Reach 1 had similar habitat conditions to 2024 except shallower depth. The two lowermost Mainstem reaches had similar pool escape cover. Pool escape cover declined at Mainstem Sites 6 and 12 and upper Branch Sites 16 (East Branch) and 21 (West Branch). A plant nursery and former surface water diverter from mainstem Soquel Creek closed downstream of Moores Gulch in 2023. This continued to enhance summer baseflow in Soquel Creek .

3. **Total and YOY juvenile steelhead densities** in 2025 were well below average at all sampling sites except approaching average at the upper West Branch 21 (**Figures 23 and 24**). In 2025 the 9 sites averaged 14 total juveniles/100 ft compared to the long term average of 32.5 juveniles and 12 YOY/100 ft compared to the long term average of 30 YOY. The highest YOY densities were at the uppermost West Branch 21 and at the uppermost East Branch Site 16 in the SDSF, indicating spawning access. The decreased total and YOY juvenile densities from 2024 to 2025 were not statistically significant (**Table 9 (page 72; Figure 25)**). In 2025, Smith (**pers. comm.**) found in Gazos Creek that channel habitat was similar to 2024 and remained highly sedimented from impacts of the 2020 CZU fire. In 2025, mean steelhead YOY density in Gazos Creek remained high (38.5 / 100 ft) (33.2 /100 ft in 2024, which was nearly tripled compared to 2023 and had been the second highest since 2009). In 2025, he found in Waddell Creek that average YOY steelhead density was slightly improved to 7.7/100 ft and not much different from the dismal results in 2024 (4.8/100 ft) and 2023 (3.2/100 ft). The three downstream sites in Waddell Creek had improved in 2024 since the CZU fire, but no further improvements were evident in 2025. He did not sample Scott Creek in 2025.
4. **Yearling densities** were slightly above average at 3 of 9 sites in 2025, with the reduced 2025 site densities from 2024 being statistically significant (**Table 9; Figure 26**). In 2025 the 9 sites averaged 2 yearlings/100 ft compared to the long term average of 2.4/100 ft. Smith (**pers. comm.**) also found average yearling density in Gazos Creek to decrease in 2025 (3.8/100 ft) compared to 2024 (7/100 ft) and 2023 (7.5/100 ft). He found that average yearling density remained very low in Waddell Creek in 2025 (0.6/100 ft) compared to 2024 (1.1/100 ft) and 2023 (1.4/100 ft).
5. **Size Class II and III densities** were below average at all 9 sites in 2025 (**Figure 27**). With the shortage of YOY and yearlings at lower Mainstem sites, Size Class II and III densities were low in 4 of 5 Mainstem sites. The differences between 2025 (drier year) and 2024 (wetter year) densities were not statistically significant at replicated sites, despite much higher 2024 densities at upper Mainstem Site 12 and upper East Branch Site 16 in the SDSF (**Table 9; Figure 28**). In 2025 the 9-site average Size Class II/III density was much less (3.7/100 ft) than in 2024 (8/100 ft). The 28-year average was 7.2/100 fish. A portion of the YOY's grow into Size Class II their first growing season where food is more abundant. Therefore, the Size Class II/III group includes YOY and yearlings at some sites (primarily Mainstem sites when fewer YOY grow into Size Class II in a lower baseflow year such as 2025 than in higher baseflow years like 2023 and 2024 when a substantial portion of YOY also reach Size Class II at lower East and West Branch sites. The density of these larger fish that will soon smolt is more important than the total or YOY densities of juvenile steelhead. Relevant here is that Smith (**2015**) found from scale analysis of down-migrant smolts in the SLR that 98% of YOY that could not reach at least 60 mm SL their first year did not survive to smolt. Therefore, high densities of small YOY at upper tributary sites may contribute little to the returning adult population.
6. In 2025, the 6-site long-term trend in total juvenile density (consisting of mostly YOY) remained low and declined to 9.2/100 ft from 13.9/100 ft in 2024, with a long term average of 33/100 ft (**Figure**

29). In 2025, the 6-site long-term **trend in Size Class II/ III densities** declined more than half to 3.5/100 ft (9.1/100 ft in 2024) with a long term average of 6.8/100 ft (**Figure 30**). The downward trend in total and YOY juvenile steelhead densities in Soquel Creek over the years, excepting 2019, was likely due to a steady decline in returning adults that made spawning patchy and egg survival low during a preponderance of dry winters.

7. **This annual trends in density and production indices of Size Class II/III numbers positively tracked with averaged 5-month baseflow from May through September (Figure 31a-b)**. The production index from 8 Soquel Creek reaches decreased from 3,856 in 2024 to 1,843 in 2025, which was a decline of more than 50% but higher than during drought years. The decreased production index of these larger juveniles in lower baseflow years comes from slower growth in YOY's and fewer reaching Size Class II. Trends in these larger juveniles in Soquel Creek follow similar fluctuations through the wet and dry years as noted in the SLR watershed (**Figures 20a-b**), and to a degree in the Aptos/Valencia watershed (**Figure 38b**).
8. The juvenile steelhead population estimate in Soquel Lagoon in 2025 was much above average at 2,309 (average= 1,534) in a deeper lagoon than 2024 (**Alley 2026**). A healthy pondweed forest existed in the lagoon to provide substrate for aquatic invertebrates (fish food) and escape cover for steelhead. YOY densities were very low at stream sites in the lower and middle Mainstem, indicating low spawning effort and/or scour of redds constructed there. YOY's may have drifted into the lagoon from considerable distance. In drier years when production of Size Class II/III is relatively low, the size of the lagoon steelhead population is more important. Fortunately, the 2025 lagoon estimate was much above average, with all but 1 of over 300 captured juveniles in the Size Class II/III size category.
9. Habitat conditions based on soon-to-smolt densities ( $\geq 75$  mm SL) ranged from "very poor" to "below average" in 2025, which were diminished from 2024 ratings in all 5 Mainstem sites and all 4 Branch sites (**Table 2; page 21**). These ratings incorporated fish density and fish length. The decline in ratings was due to smaller average fish length and/or fewer fish in Size Class II in 2025 compared to 2024, when fish growth rate was higher. In 2025, 4 of 5 mainstem sites were rated "poor" with Site 4 adjacent the flower fields rated "very poor." Three of 4 Branch sites were rated "below average" with the lower West Branch Site 19 rated "poor." The largest declines were at upper Mainstem Site 12 ("good" in 2024 to "poor" in 2025) at upper Mainstem Site 7 ("fair" in 2024 to "poor" in 2025).
10. As stated for the San Lorenzo River YOY population in 2025, two factors may explain the relatively low YOY densities at most sites in Soquel Creek. One factor may have been low adult returns as indicated from adult returns estimated for Scott Creek mentioned earlier (**Figure 11**). A second factor may have been poor egg survival during a winter in which 2 larger February stormflows occurred that could either scour out redds or smother them with fine sediment that was abundant throughout Soquel Creek, especially in the lower Mainstem. Even the 400 cfs stormflow registered at the Soquel Village gage in March may have been sufficient to smother some redds. Tables of fish densities in Soquel Creek are in the detailed analysis report which is available upon request.

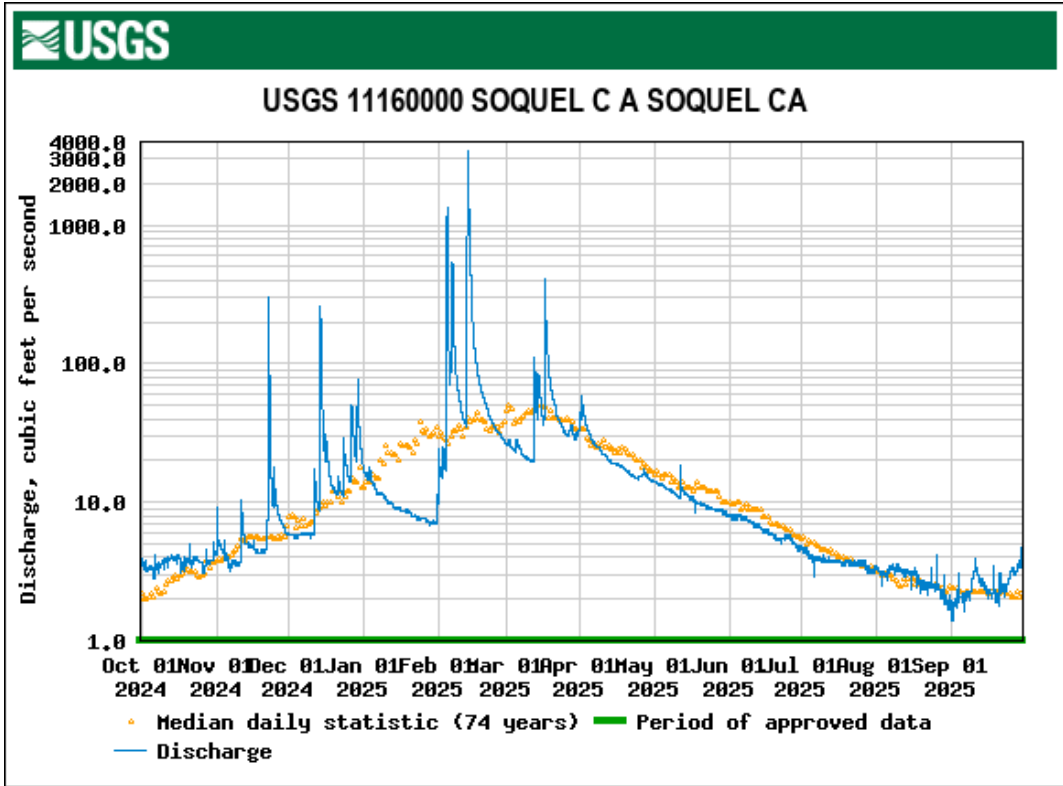


Figure 22a. The WY2025 Discharge at the USGS Gage on Soquel Creek at Soquel Village.

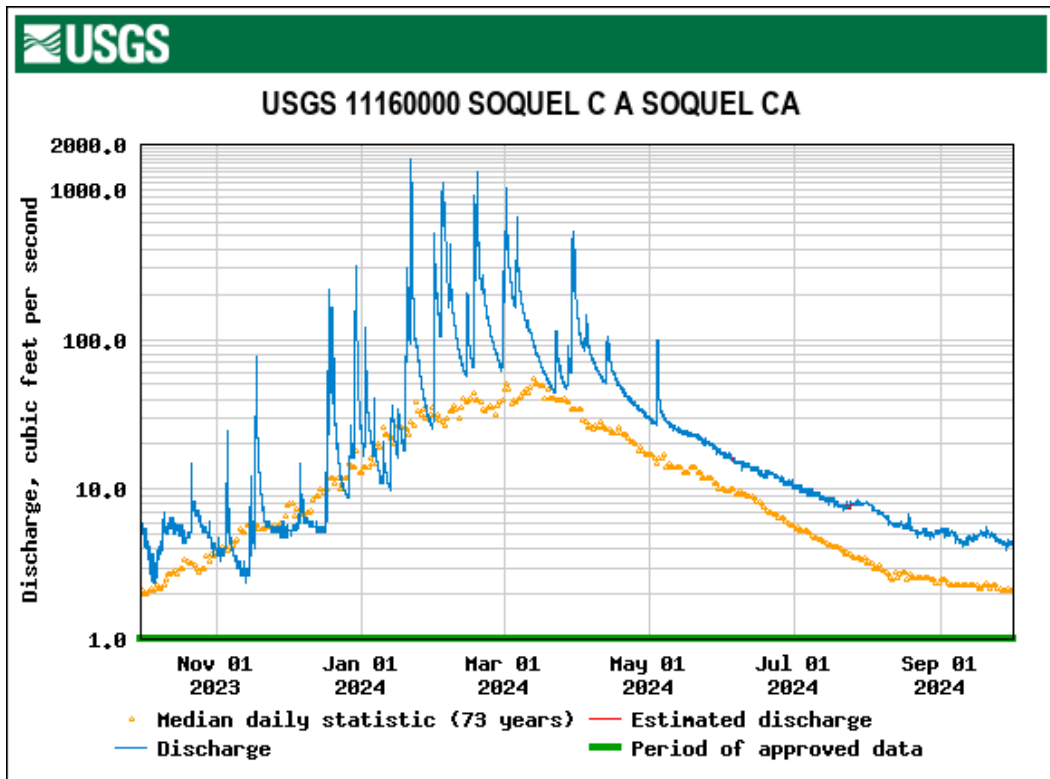


Figure 22b. The WY2024 Discharge at the USGS Gage on Soquel Creek at Soquel Village.

**Table 4. Fall/Late Summer STREAMFLOW (cubic feet/ sec) Measured by Santa Cruz County Staff in 2007–2017 (where dates are specified), from the USGS Stream Gage and by D.W. ALLEY & Associates; 2010 (September), 2011–2015, 2018– 2025 (October) at fall baseflow conditions.**

Location	2007/ 2008	2009	2010	2011	2012	2013	2014	2015	2017	2018	2019	2020	2021	2022*	2023	2024	2025 **
Branciforte @ Isabel Lane	/ 0.3	0.25	0.42 (8/26)		0.57 (8/22)	0.59 (6/20)	0.31 (8/7)										
Soquel Creek above Lagoon in Reach 1			2.3 (DWA)	4.9 (DWA)	1.8 (DWA)	0.33 (DWA)	0.19 (DWA) (Walnut St.)	0.18 (DWA) (Walnut St.)	3.98 (DWA) (Walnut St)	1.59 (DWA) (Walnut St)	2.84 (DWA) (Walnut St)	1.50 (DWA) (Walnut St)	0.29 (DWA) (Walnut St)	1.40 (DWA) (Walnut St)	4.33 (DWA) (Walnut St)	4.13 (DWA) (Walnut St)	2.89 (DWA) (Walnut St)
Soquel Cr @ USGS Gage in Reach 2	1.4/ 0.65	1.2	3.4	5.8	1.8	0.36	0.35	0.36 0.10 (9/9)	5.0 (12 Oct)	2.18 (12 Oct)	2.93 (12 Oct)	1.79 (12 Oct)	0.25 (15 Oct)	1.76 (18 Oct)	5.06- 5.96 (12 Oct) ???	3.96- 4.19 (16 Oct)	4.85 (22 Oct)
Soquel Cr @ Bates Cr	-/ 1.08		4.2 (9/1)	7.3 (8/31)	2.0 (9/19)	0.95 (9/11)	0.22 (9/17)	0.35 (9/9)									
Soquel Cr above Moores Gulch in Reach 7			2.16 (DWA)	4.3 (DWA)	2.0 (DWA)	1.26 (DWA)	0.72 (7/16) 0.80 (DWA)	0.54 (7/28) 0.56 (DWA)	4.46 (DWA)	1.51 (DWA)	3.30 (DWA)	1.57 (DWA)	0.72 (DWA)	1.35 (DWA)	3.50 (DWA)	3.15 (DWA)	3.11 (DWA)
W. Branch Soquel Cr below Old S.J. Road Olive Springs Bridge	1.75 After rain	-	1.2 @ Mouth (DWA)	2.2 @ Mouth (DWA); 3.0 (8/31)	1.1 @ Mouth (DWA); 1.21 (9/05)	0.91 @ Mouth (DWA); 1.73 (5/14)	0.80 (9/16) 0.74 @ Mouth (DWA)	0.58 (9/14) 0.59 @ Mouth (DWA)	1.85 @ Mouth (DWA)	1.16 @ Mouth (DWA)	1.59 @ Mouth (DWA)	0.93 @ Mouth (DWA)	0.79 @ Mouth (DWA)	0.96 @ Mouth (DWA)	2.16 Mouth (DWA)	1.76 Mouth (DWA)	1.58 Mouth (DWA)
E. Branch Soquel Cr @ 152 Olive Springs Rd.	1.0 After rain	-	0.77 @ Mouth (DWA)	2.1 @ Mouth (DWA); 2.7 (8/31)	0.54 @ Mouth (DWA); 0.43 (9/05)	0.16 @ Mouth (DWA); 2.0 (5/14)	0.0 (7/16) Trickle @ Mouth; Dry above (DWA)	Dry (DWA)	1.44 @ Mouth (DWA)	0.45 @ Mouth (DWA)	1.06 @ Mouth (DWA)	0.44 @ Mouth (DWA)	Trickle Immeasurable (DWA)	0.24 @ Mouth (DWA)	1.85 Mouth (DWA)	1.31 Mouth (DWA)	1.50 Mouth (DWA)
E. Branch Soquel Cr above Amaya Creek in Reach 12a		Trickle (DWA)	0.44 (DWA)			0.03 (DWA)	Dry (DWA)	Dry (DWA)	0.71 (DWA)	0.15 (DWA)	0.46 (DWA)	0.10 (DWA)	Dry (DWA)	0.12 (DWA)	0.66 (DWA)	0.23 (DWA)	0.48 (DWA)
Aptos Cr below Valencia Creek confluence	1.2 After Rain/ 0.77	0.53	0.85 (9/1)		0.87 (DWA); 1.10 (9/05)	0.75 (DWA) 0.84 (9/11) (Valencia Cr. dry)	0.47 (9/16)		2.52 (DWA)	1.08 (DWA)	1.65 (DWA)	1.12 (DWA)	0.72 (DWA)	0.96 (DWA)	2.34 (DWA)	2.05 (DWA)	1.18 (DWA)
Aptos Cr above Valencia Creek			0.97 (DWA)	1.6 (DWA)			0.63 (DWA)	0.44 (DWA)									
Valencia Cr @ Aptos Cr	-/ 0.007	0.34 (May)	0.09 Adj. School (DWA)	0.8 Adj. School (7/27)	0.20 (9/05)	0.105 (9/11)											
Valencia Creek below Valencia Rd			0.22 (DWA)														

\*Streamflow measured in 2022 a month after mid-September stormflow that likely elevated baseflow.

\*\*Streamflow measured in 2025 was 9 days after early October stormflow that likely elevated baseflow.

**Table 5. Habitat change in SOQUEL CREEK WATERSHED Reaches and Sites from the Most Recent, Previous Year Having Data.**

**(Green highlight indicates Reach Comparisons. Yellow highlight indicates Site Comparisons.)**

Reach or (Site Only) Comparison To Previous Years	2025 Baseflow Comparison (Most Important Habitat Factor May-September)	Depth - Pool / Fast-water Habitat	Fine Sediment- Pool / Fastwater Habitat	Embeddedness - Pool / Fastwater Habitat	Pool Escape Cover	Overall Habitat Change and (Any Improvement)
Site 1 <b>Reach 1</b> (Since higher baseflow in 2024)	-	- max / - max riff - run	Sim / Sim riffle - run	Sim / Sim	Sim	- (less food, shallower)
Site 4 <b>Reach 3a</b> (Since higher baseflow in 2024)	-	Sim / -	Sim / Sim riffle - run	Sim / Sim	+	- (less food, shallower fastwater habitat, increased pool cover)
<b>(Site 6)</b> Reach 4 (Since higher baseflow in 2024)	-	- / Same riffle - run	+ / Sim riffle + run	Same / Sim riffle - run	-	- (less food, shallower depth in pool and run, less pool and run sediment, more run embed., less pool cover)
Site 10 <b>Reach 7</b> (Since higher Baseflow in 2023)	-	- / -	Sim/ Sim	Sim / Sim	+	- (less food, shallower, more pool cover)
<b>(Site 12)</b> Reach 8 (Since higher baseflow in 2024)	-	- / -	+ / - riffle	Sim / - riffle	-	- (less food, shallower, less pool sediment, more riffle sediment and embed., less pool escape cover)
East Branch (Site 13a) <b>Reach 9a</b> (Since higher baseflow in 2024)	-	- / -	- / Sim riffle + run	Same / Sim	-	- (less food, more pool fine sediment, less pool cover)
East Branch <b>(Site 16)</b> Reach 12a (Since higher baseflow in 2023)	-	+ max / - riffle + run	Sim / + riffle Sim run	- / + riffle - run	-	- (less food, deeper max. pools, shallower riffles with less sediment and embed., deeper run with more embed., less pool cover )
West Branch Site 19 <b>Reach 13</b> (Since higher baseflow in 2024)	-	- / - riffle Sim run	Sim / Sim	Sim / - riffle Sim run	Same	- (less food, shallower, more riffle embeddedness)
West Branch <b>(Site 21)</b> Reach 14b (Since higher baseflow in 2024)	-	- max / - max riffle - avg run	+ / - riffle Sim run	Sim / + riff Same run	-	- (less food, shallower max pool and riffle and avg run, less % pool sediment, more riffle sediment but reduced embed., less pool escape cover)

Figure 23. TOTAL JUVENILE STEELHEAD DENSITIES IN SOQUEL CREEK in 2025 Compared to up to the 29-Year Average. (Lines between site densities are for visual effect only).

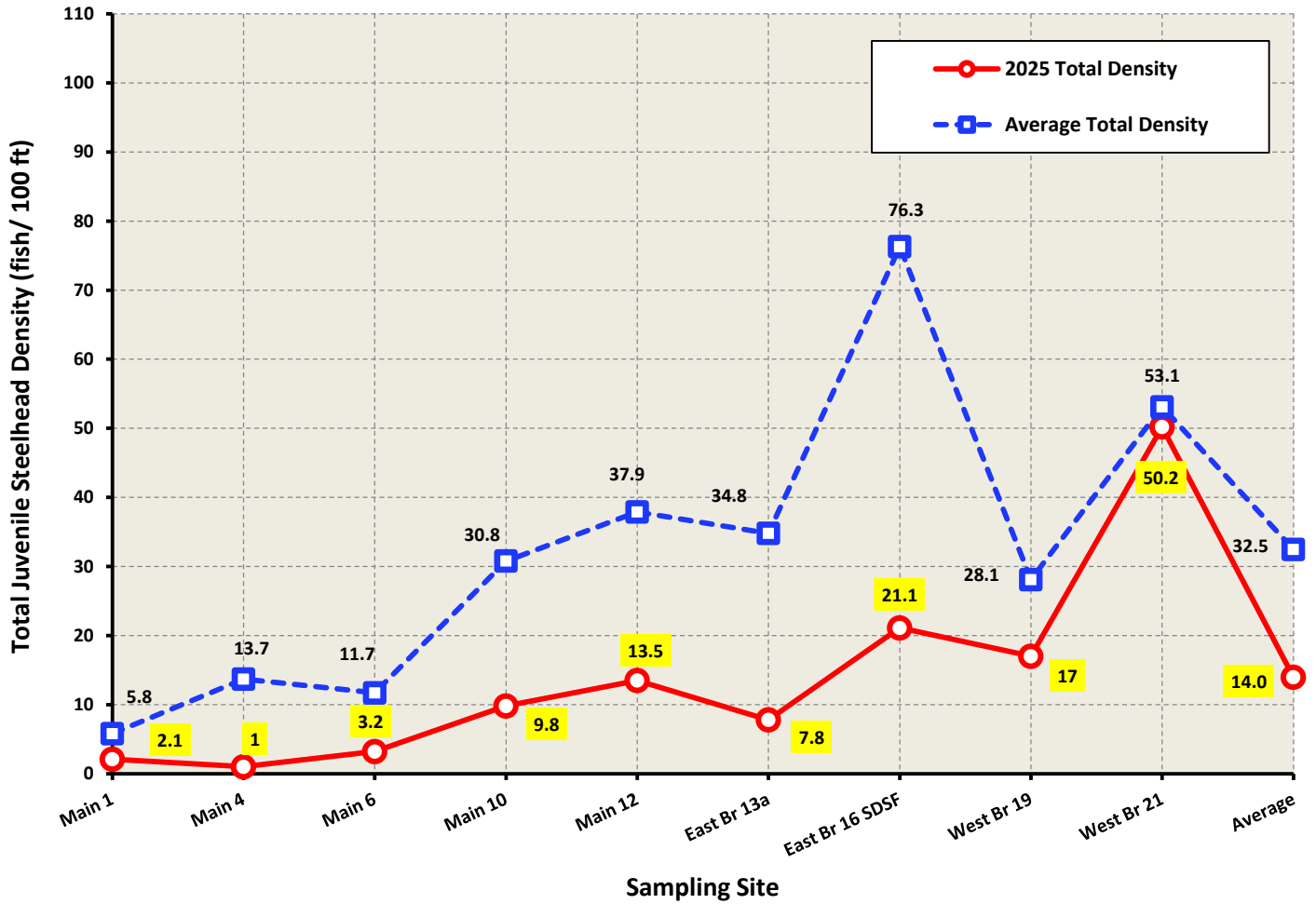


Figure 23. Total Juvenile Steelhead Site Densities in Soquel Creek in 2025 Compared to up to the 29-Year Average (15-year average for Mainstem Site #6.)

Figure 24. YOUNG-OF-THE-YEAR JUVENILE STEELHEAD SITE DENSITIES IN SOQUEL CREEK 2025 Compared to up to 29-Year Average  
(Lines between site densities are for visual effect only.)

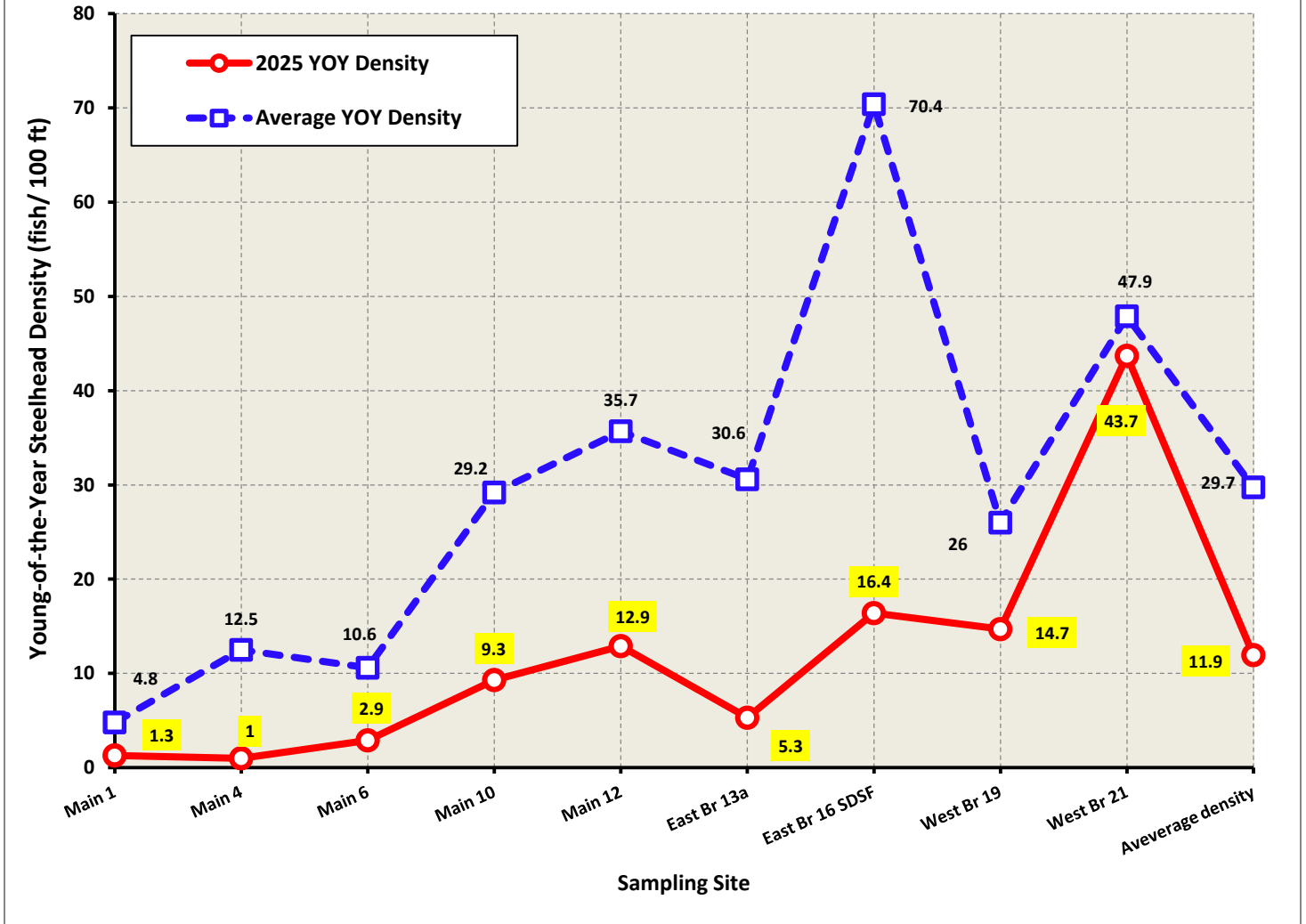


Figure 24. Young-of-the-Year Steelhead Site Densities in Soquel Creek in 2025 Compared to up to the 29-Year Average (14-year average for Mainstem Site #6.)

Figure 25. YOUNG-OF-THE-YEAR JUVENILE STEELHEAD SITE DENSITIES IN SOQUEL CREEK IN 2025 COMPARED TO 2024. (Lines connecting site densities are for visual effect only.)

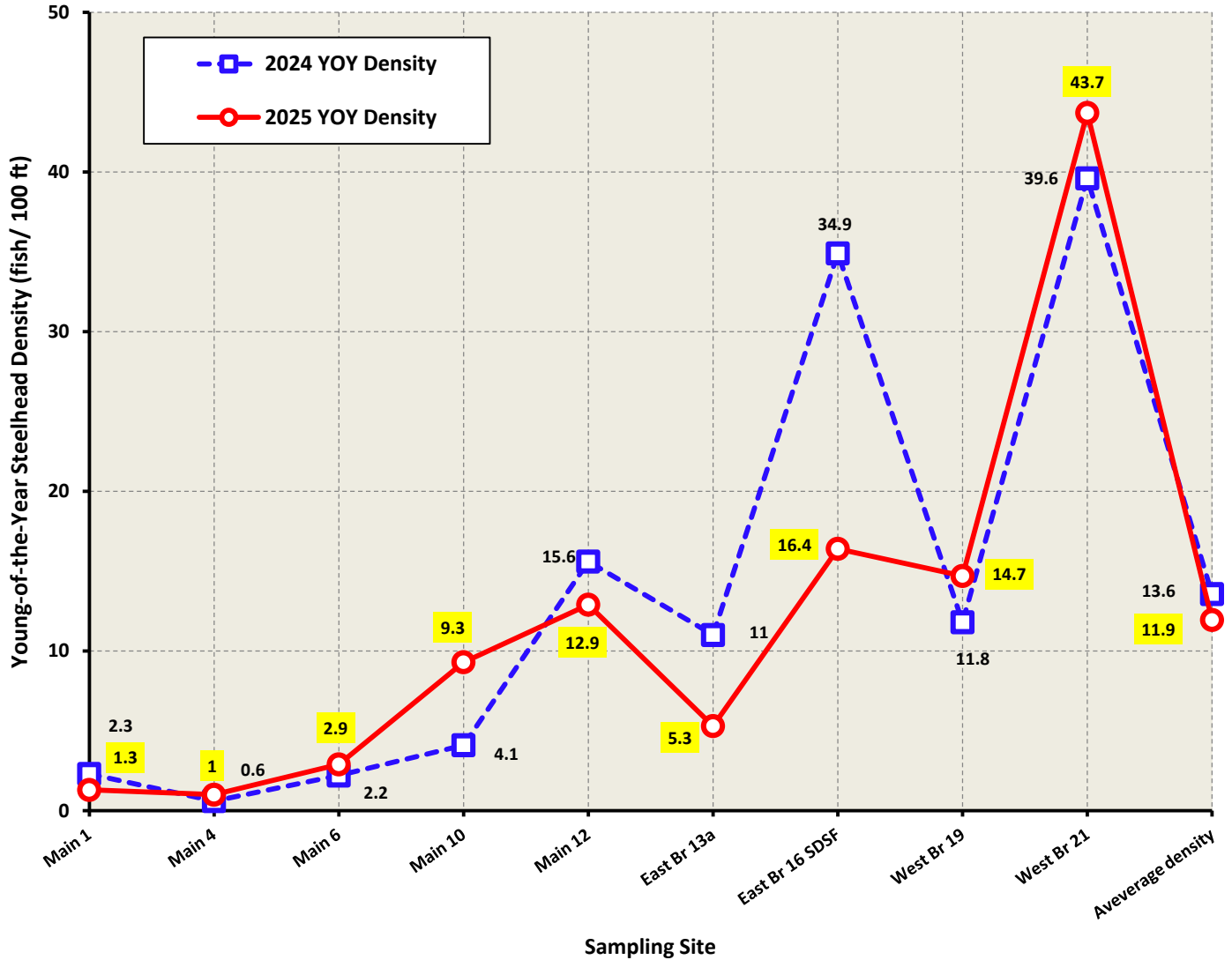


Figure 25. Young-of-the-Year Site Densities in Soquel Creek, Comparing 2025 to 2024.

Figure 26. YEARLING STEELHEAD SITE DENSITIES IN SOQUEL CREEK in 2025 Compared to up to the 29-Year Average. (Lines connecting site densities are for visual effect only.)

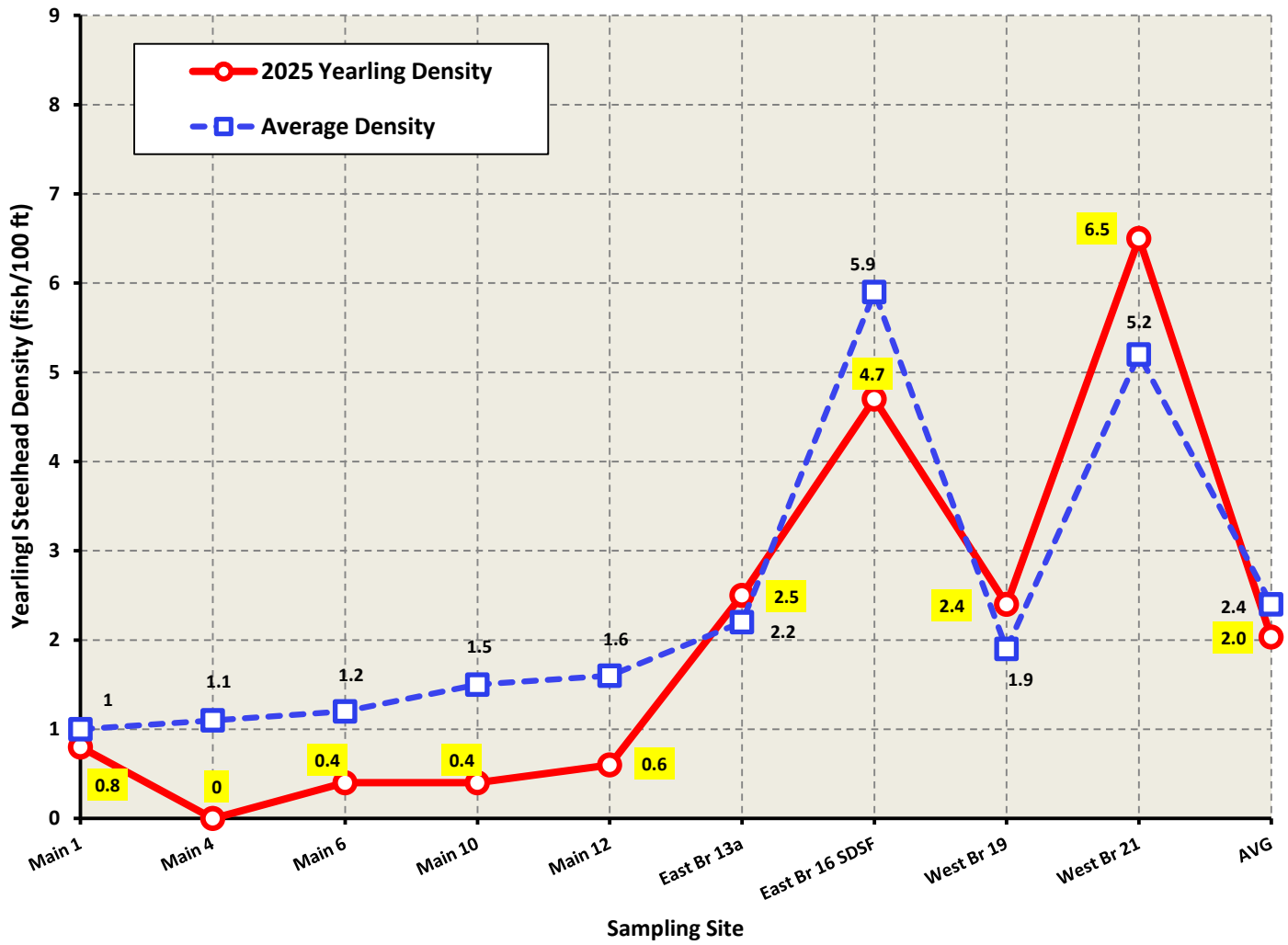


Figure 26. Yearling Steelhead Site Densities in Soquel Creek in 2025.

Figure 27. SIZE CLASS II AND III STEELHEAD SITE DENSITIES IN SOQUEL CREEK in 2025 Compared to up to the 29-Year Average. (Lines between site densities are for visual effect only.)

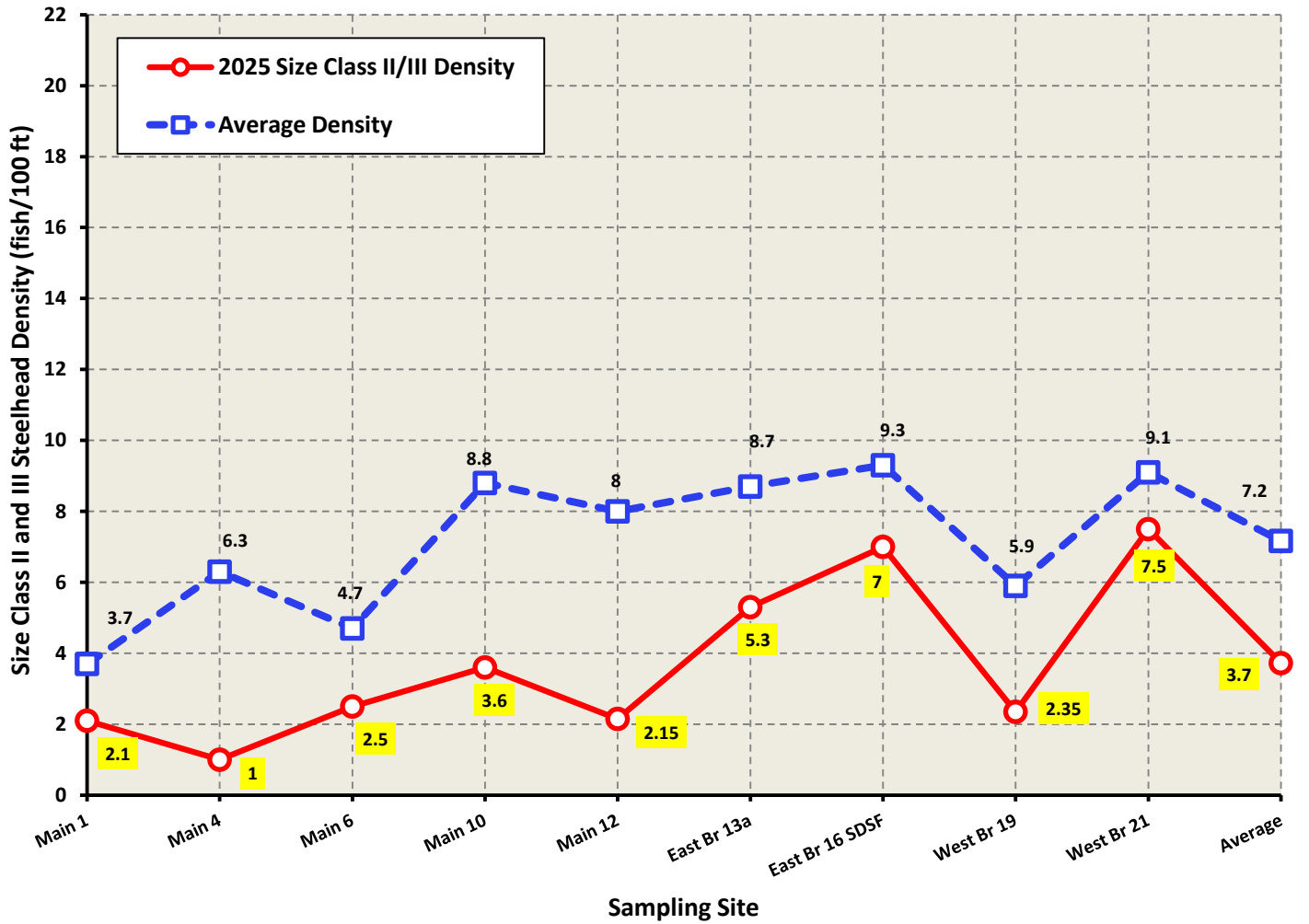
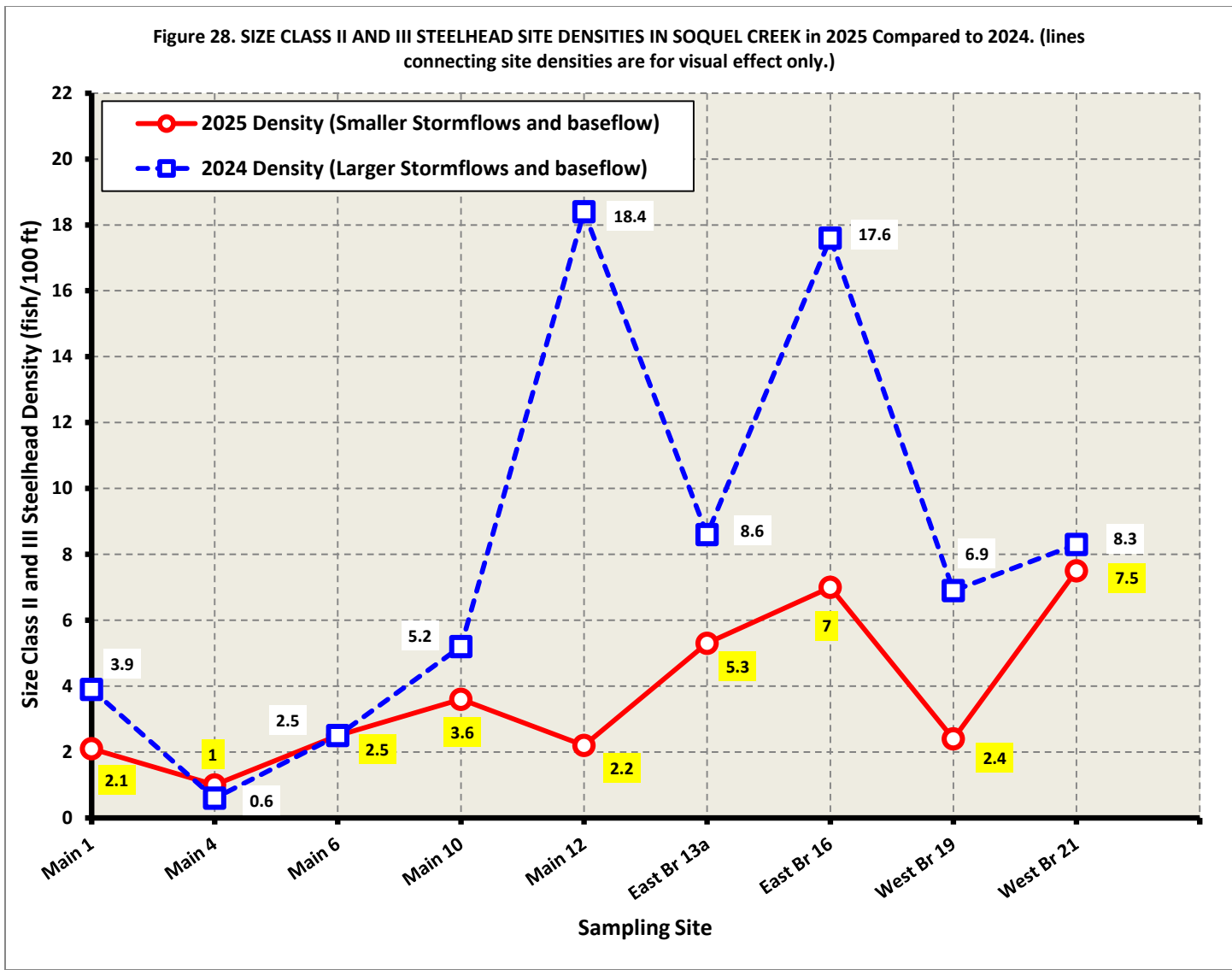


Figure 27. Size Class II and III Steelhead Site Densities in Soquel Creek in 2025.



**Figure 28. Size Class II/III Steelhead Site Densities in Soquel Creek Comparing 2025 to 2024.**

Figure 29. Trend in Total Juvenile Steelhead Density (Mostly YOY) at Soquel Creek Sites, 1997-2025.  
 (East Branch 16 in the SDSF was dry in 2014, 2015 and 2021.)

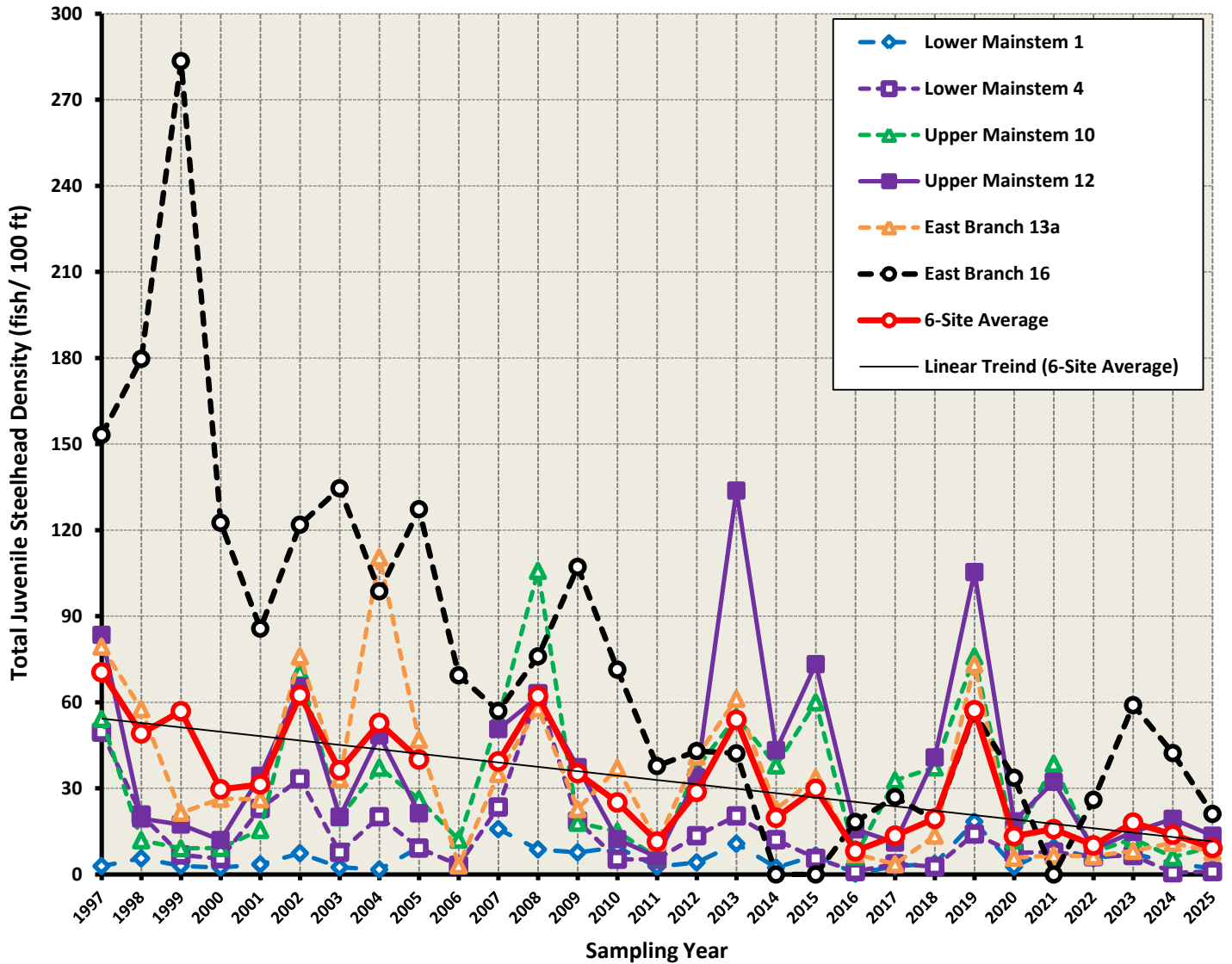


Figure 29. Trend in Total Juvenile Steelhead Density (Mostly YOY) at Soquel Creek Sites, 1997-2025.

Figure 30. Trend in Size Class II/III ( $\Rightarrow$ 75 mm SL) Juvenile Steelhead Density at Soquel Creek Sites, 1997-2025 (Site #16 in the SDSF was dry in 2014, 2015 and 2021).

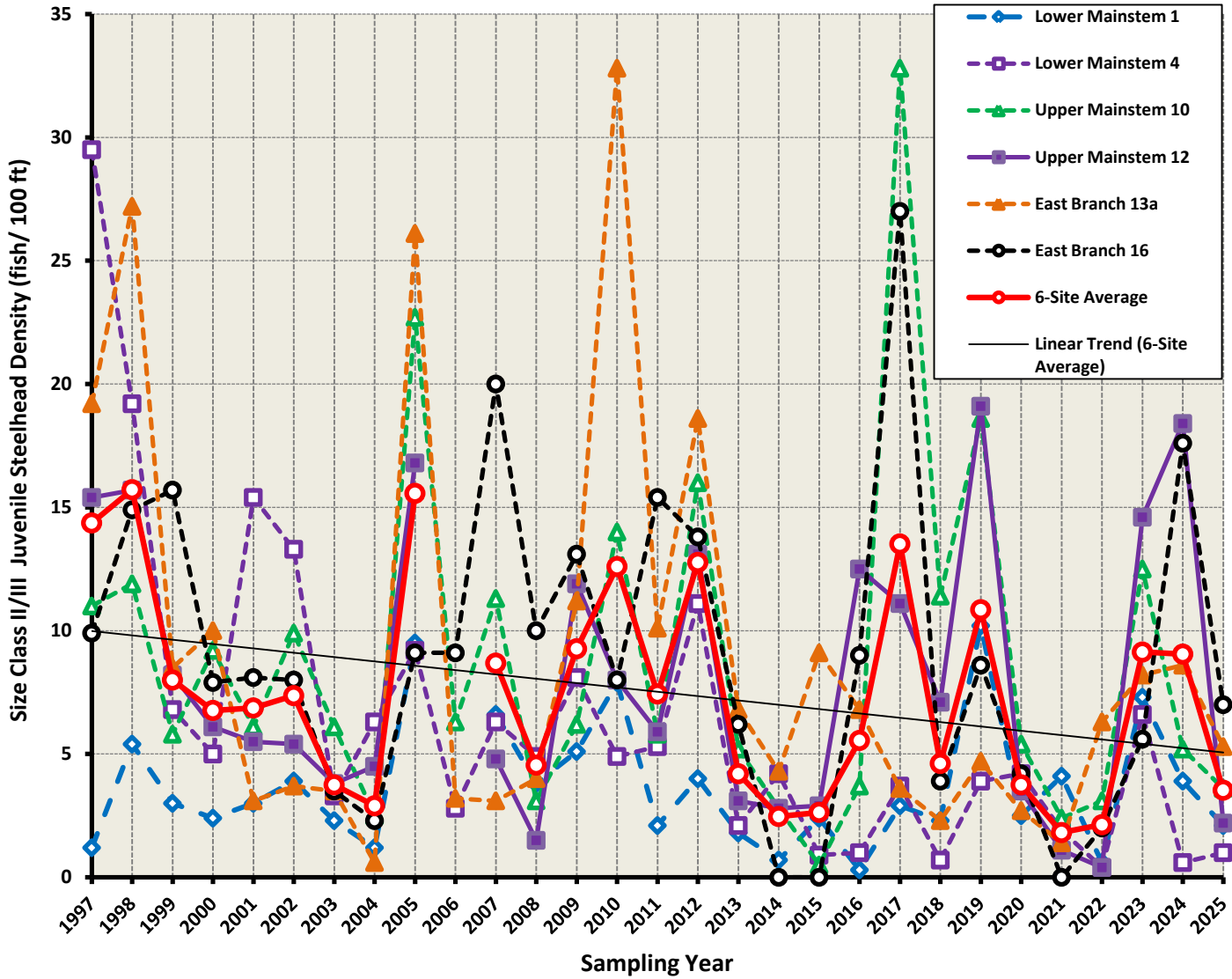


Figure 30. Trend in Size Class II/III Juvenile Steelhead Density at Soquel Creek Sites, 1997-2025.

Figure 31a. Trend in Size Class II/III ( $\Rightarrow$ 75 mm SL) Juvenile Steelhead Density at Soquel Creek Sites with 5-Month Baseflow Average, 1997-2025.

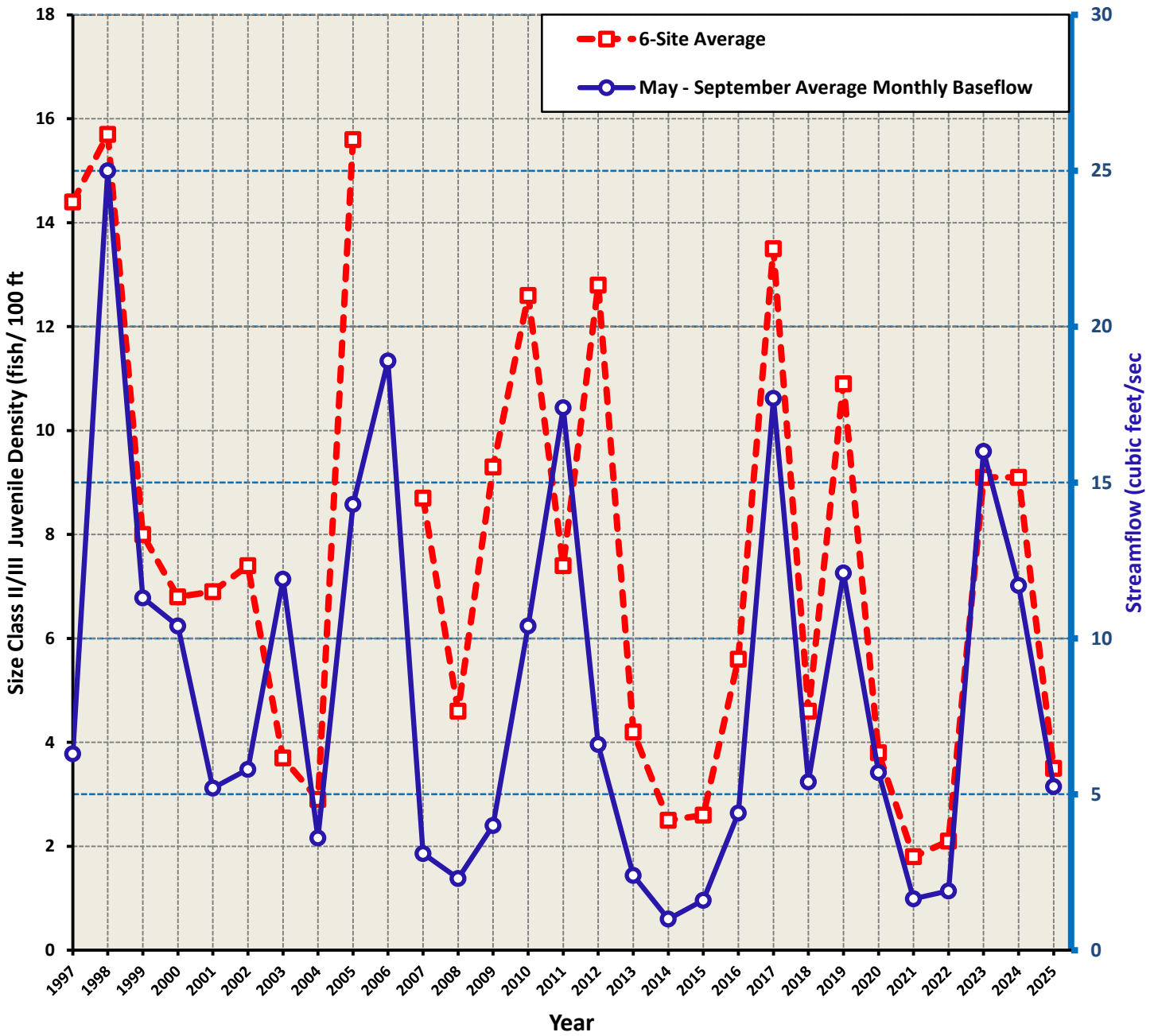


Figure 31a. Trend in Size Class II/III ( $\Rightarrow$ 75 mm SL) Juvenile Steelhead Density at Soquel Creek Sites with 5-Month Baseflow Average, 1997-2025.

Figure 31b. Trend in Index of Size Class II/III ( $\geq 75$  mm SL) Juvenile Steelhead Production in 8 Soquel Creek Reaches with 5-Month Baseflow Average, 2010-2025.

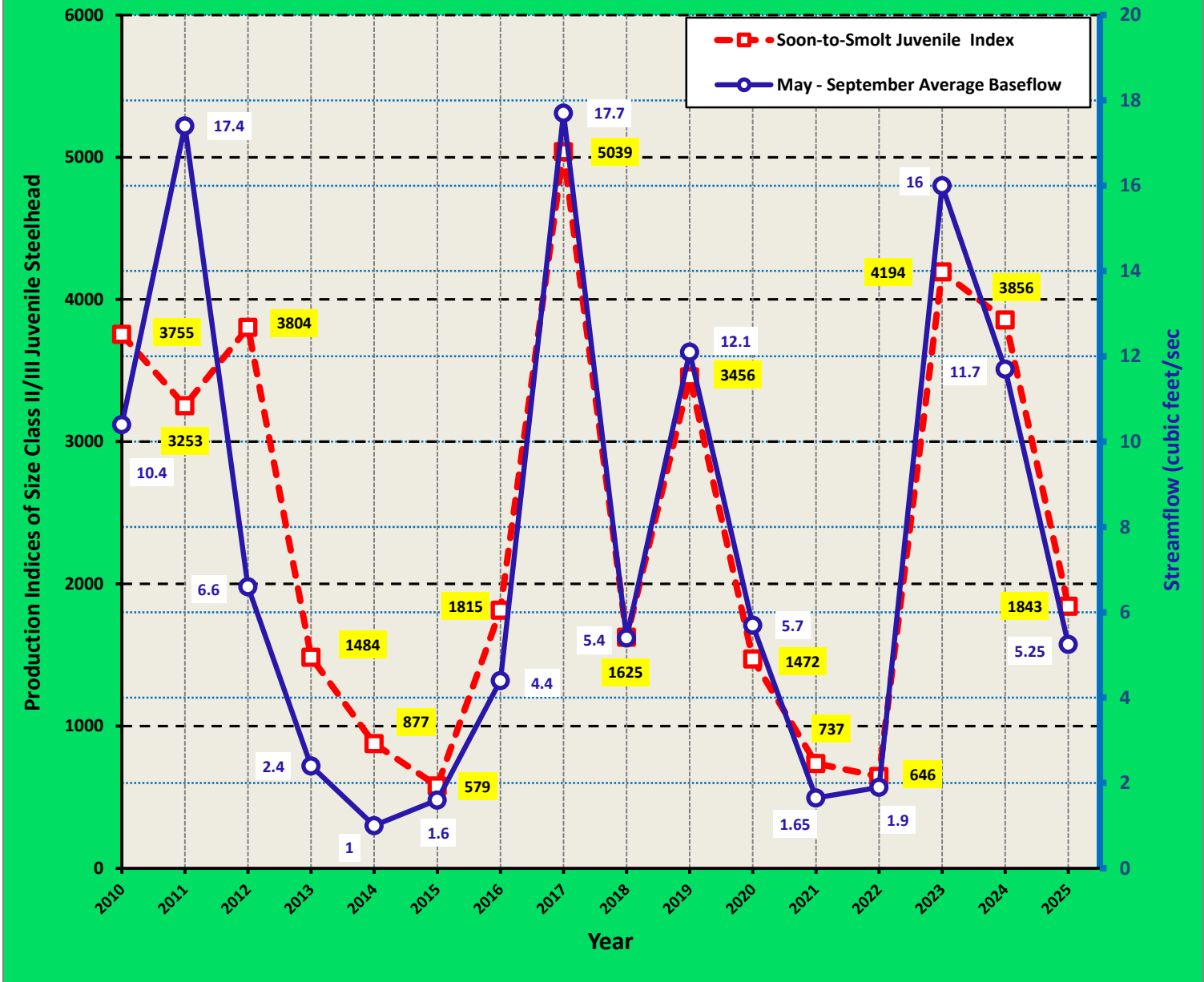


Figure 31b. Trend in Index of Size Class II/III ( $\geq 75$  mm SL) Juvenile Steelhead Numbers in 8 Soquel Creek Reaches with 5-Month Baseflow Average, 2010 – 2025.

### **iii. Steelhead Abundance and Habitat in the Aptos Creek Watershed**

1. Aptos Creek likely had a WY2025 hydrograph similar to that in the Soquel drainage, with stormflows at the same frequency (**Figure 22**). These stormflows likely provided adequate adult steelhead spawning access, with YOY steelhead present at upper sampling sites. Egg survival may have been reduced after the one February stormflow likely exceeded bankfull due to redd scour and/or smothering with sand, especially in lower Aptos and all of sandy Valencia Creek.
2. Overall habitat conditions in 2025 compared to 2024 declined in the Aptos Creek and Valencia Creek arms primarily due to reduced baseflow (less food) (**Table 6**). But other habitat conditions improved in pools of lower Aptos Reach 3 (increased maximum depth, less fine sediment, and more escape cover). Compared to 2022, conditions also improved in pools of upper Aptos Reach 4 (increased depth and more escape cover), but it had more fine sediment. Tables of habitat measurements are available in the detailed analysis report upon request.
3. In the Valencia Creek arm, pool habitat at lower Site 2 worsened with reduced baseflow and other pool parameters (much shallower, continued high percent fines/ embeddedness and reduced escape cover) (**Table 6**). In 2025 at Site 2, juvenile steelhead densities declined and were below average. Habitat conditions declined at upper Site 3 with reduced baseflow and pool escape cover. Site 3 improvements included greater pool maximum depth and reduced pool embeddedness, although percent fines remained high.
4. **Total and YOY steelhead densities were again much below average at lower Aptos and lower Valencia sites but above average at upper Aptos and Valencia sites** (4-site average of 21 total juveniles /100 ft in 2025 (16.8/100 ft in 2024; 7.9 in 2023; 7.8 in 2022; 4.4 in 2021) and 15 YOY/100 ft in 2025 (12/100 ft in 2024; 5.8 in 2023, 5.2 in 2022; 2.0 in 2021)) (**Figures 32 and 33**). YOY densities increased at both Aptos sites in 2025, but declined at both Valencia sites compared to 2024 (**Figure 34**). The trend in 4-site total steelhead site density increased in 2025 to nearly the multi-year average (**Figure 38**). With only two degrees of freedom, the differences in 2025 and 2024 total and YOY densities were not statistically significant (**Table 10**). The multiple bankfull events the previous rainy season apparently afforded adult fish passage above the wood cluster examined in Aptos Creek in 2022 between Sites 3 and 4. YOY densities in 2023 – 2025 at Aptos Site 4 were greater than in 2022. YOY were not detected there in 2021.
5. **Yearling and older densities were above average at 3 of 4 sites in 2025 (Figure 35)**. Densities increased at 3 of 4 sites, excepting lower Valencia Site 2, and the 4-site average was 6.3 fish/100 ft (4.4/100 ft in 2024; 2.1 in 2023; 2.6 in 2022); longterm, multi-year average of 5.8 fish/100 ft with 2025 included.
6. **Size Class II/III densities were below average in 2025 at 3 of 4 sites and increased at 2 sites in 2025 (Figures 36 and 37)**. The 2025 4-site average was again 6.5/100 ft (6.5/100 ft in 2024; 4.8 in 2023; 2.6 in 2022; 2.3 in 2021). With only 2 degrees of freedom, the increase at 2 of 4 sites was not statistically significant (**Table 10; page 73**). With the reduced spring/summer baseflow only a few YOY reached Size Class II at lower Aptos Site 3, where food is most abundant. Therefore, at that site in Aptos Creek, the Size Class II/III group included YOY and yearlings. In Valencia Creek, growthrate is slower, especially at the lower site, and past scale analysis indicated that some soon-to-smolt size fish are two-year olds in fall. The trend in average 4-site density of Size Class II/III juveniles stayed constant in 2025 from 2024 and was below the multi-year average of 8.1/100 ft beginning in 2006 (**Figure 39a**).
7. Trends in the SLR and Soquel watersheds of densities and index production numbers of larger

juveniles ( $\geq 75$  mm SL) track positively with 5-month (May through September) average baseflow through wet and dry years, and to a degree in the Aptos/Valencia watershed (**Figures 19a-b, 20a-b, 31a-b and 39b**). They increase during higher baseflow years and decrease during lower baseflow years. The production indices for Aptos/Valencia Creek sites in 2019, 2024 and 2025 were exceptions to positive tracking. The 2019 production index decreased with increased baseflow. The 2024 and 2025 indices increased despite decreased baseflow the previous year. The production index in 2025 increased to 698 from 582 in 2024. Positive tracking may not occur in every year in the Aptos watershed because the annual adult steelhead return has likely declined to produce so few juvenile offspring in some years to reduce density dependent competition that would typically reduce YOY densities and growthrate in drier years with lower baseflows. This is likely the case because juvenile densities do not come close to saturating the rearing habitat in the Aptos Creek branch even in dry years, based on much higher juvenile densities found in SLR tributaries and upper Soquel branches over the years (**Figures 8 and 23**). The positive tracking might also improve in Aptos Creek if the number of sampling sites was increased to track the production index more precisely. In the SLR and Soquel watersheds, larger juveniles increase in higher baseflow years partially because many more YOY grow into Size Class II. But in Aptos Creek, chronically low total juvenile density may allow faster YOY growthrate into Size Class II even in low baseflow years, especially at the lower Aptos Site 3. Because many YOY may reach Size Class II at Aptos Site 3, egg survival greatly influences Size Class II densities. Egg survival may be much less in lower Aptos Creek in some wetter years due to increased sedimentation and smothering of redds. This will reduce the positive tracking between baseflow and Size Class II/III production. The poor 2019 tracking occurred because despite higher baseflow, YOY growthrate into Size Class II was minimal and yearling densities were low. This was a year when density dependent competition likely occurred with abundant YOY and slow YOY growthrate. High stormflows that would provide adult spawning habitat came late in 2019. YOY produced from late spawning were relatively abundant but had a reduced growing season with a shorter period of high baseflow conditions in spring. With few YOY reaching Size Class II in 2019 and few yearlings recruited in 2019 from the previous year's small YOY population, production of Size Class II/III juveniles did not increase in 2019 as it had in the SLR and Soquel watersheds.

8. *The Aptos Lagoon steelhead population estimate of 85 in 2025 was below the 11-year average of 235 (median=184) (Figure 40).* A total of 32 juveniles were captured and marked the first day, with 40 captured the second day. There were 15 recaptures. All captured juveniles were in Size Class II/III (mostly Size Class III ( $\geq 150$  mm SL)) and had a median length of 170-174 mm SL the first day and 185-179 mm 7 days later (**Figure 41**). The drop in steelhead numbers at 180-184 mm SL, with greater numbers of juveniles smaller than that on the size histogram may indicate that juveniles larger than that were dominated by yearlings. The two outliers longer than 234 mm SL may have been 2-year olds. The 2024 population estimate of 312 was 3.5 times the 2025 estimate, and median length of steelhead in 2025 was greater (perhaps due to less competition than in 2024). In 2024, the Aptos estuary was shallower than the 2025 lagoon. By comparison, the juvenile steelhead population estimate in Soquel Lagoon in 2025 was much above average at 2,309 (average= 1,534) in a deeper lagoon than 2024 (**Alley 2026**).
9. In 2025, Aptos Lagoon had converted to freshwater. The morning water quality at the Rio Del Mar walk bridge was relatively warm the first day (29 September; 18.7°C) and cooler a week later on the second day (6 October; 17.5°C) with much cooler air temperature the second day. Freshwater filled the entire water column that was 1.25 m deep both days in the thalweg under the walk bridge. Water temperature was constant from surface to bottom (**Table 7**). With freshwater conversion, no stratification of saltwater, water temperature or oxygen occurred, with very good oxygen concentration ( $> 7$  mg/L) to the bottom on both sampling days. A sand berm had developed at the end of the rock jetty to prevent saltwater from entering the lagoon even at high tide. See the photos

that follow. Just east beyond the jetty was the separate, saline outlet channel with tidal fluctuation. The lagoon to the west of the jetty sandberm remained fresh water.

10. **Tidewater gobies (*Eucyclogobius newberryi*) were captured in Aptos Lagoon along the jetty with the 30-foot goby seine (1/8-inch mesh) on both days, 29 September (8 tidewater gobies in 2 seine hauls and 6 October (6 tidewater gobies in 2 seine hauls). Lagoon conditions were freshwater (0.4-0.5 ppt) and conducive to tidewater goby nesting and reproduction. Besides steelhead, other species captured on both days, combined, were 5 starry flounder (*Platichthys stellatus*), 36 staghorn sculpin (*Leptocottus armatus*), one prickly sculpin (*Cottus asper*) and hundreds threespine stickleback (*Gasterosteus aculeatus*). In 2025, only one tidewater goby each was captured at Soquel Lagoon and Pajaro Estuary with the fine-meshed seine.**



Looking north and upstream from the walk bridge at the leveed Aptos Lagoon. 9-29-2025



Looking southeast and downstream with the main Aptos Lagoon on the right and a sand berm at the end of the rock jetty, sealing off the freshwater lagoon from the outlet channel to the left of the jetty. 9-29-2025



Looking south at the end of the rock jetty with the freshwater lagoon to the right of the rock jetty and the sealed off, saline outlet channel to the left of the jetty. 9-29-2025



Looking south at the shallow exit to the Monterey Bay of the Aptos outlet channel separated from the freshwater lagoon. 9-29-2025

Table 6. Habitat Change in Reaches and Sites in the APTOS WATERSHED from most recent previous years.

(Green highlight indicates reach comparisons. Yellow highlight indicates site comparisons.)

Reach or (Site Only) Comparison To Previous Years	2025 Baseflow Comparison (Most Important Factor May-September)	Pool Depth	Pool Fine Sediment	Pool Embeddedness	Pool Escape Cover	Overall Pool Habitat Change (Any Improvement)
<b>(Aptos Reach 3)</b> Aptos Reach 3 (Since higher baseflow in 2024)	-	+ max.	+	Similar	+	- (less food, deeper max., less sediment, more pool cover)
<b>(Aptos Reach 4)</b> Aptos Site 4 (Since lower baseflow in 2022)	+	+	-	Similar	+	+ (more food, deeper pool, more sediment, more escape cover)
Valencia Reach 2 <b>Valencia Site 2</b> (Since higher baseflow in 2024)	-	Very -	Similarly High	Similarly High	-	- (less food, much shallower, less pool escape cover)
Valencia Reach 3 <b>Valencia Site 3</b> (Since higher baseflow in 2024)	-	+ max	Similarly High	+	-	- (less food, deeper max. depth, less pool escape cover)

Figure 32. TOTAL JUVENILE STEELHEAD SITE DENSITIES IN APTOS CREEK WATERSHED in 2025.  
 (Valencia Creek with resident fish), with up to a 21-Year Average in Aptos Creek and up to a 17-Year Average in Valencia  
 Creek (1981; 2006-2025; lines connecting site de

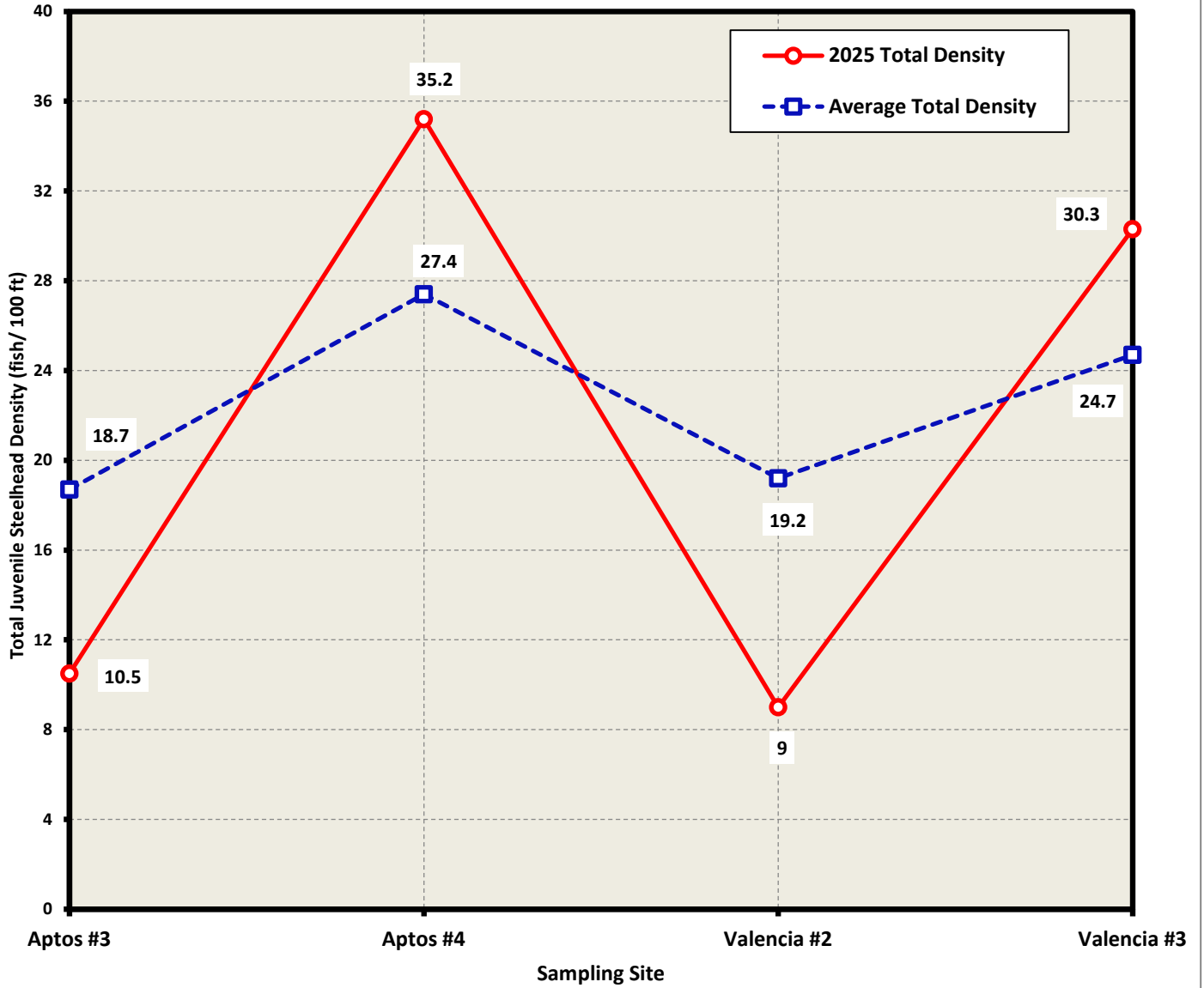


Figure 32. Total Juvenile Steelhead Site Densities in Aptos Watershed in 2025.

Figure 33. YOUNG-OF-THE-YEAR JUVENILE STEELHEAD SITE DENSITIES IN THE APTOS CREEK WATERSHED in 2025 (Valencia Creek with Resident fish), with a 21-Year Average in Aptos Creek and 17-Year Average in Valencia Creek (1981; 2006-2025; lines connecting site d

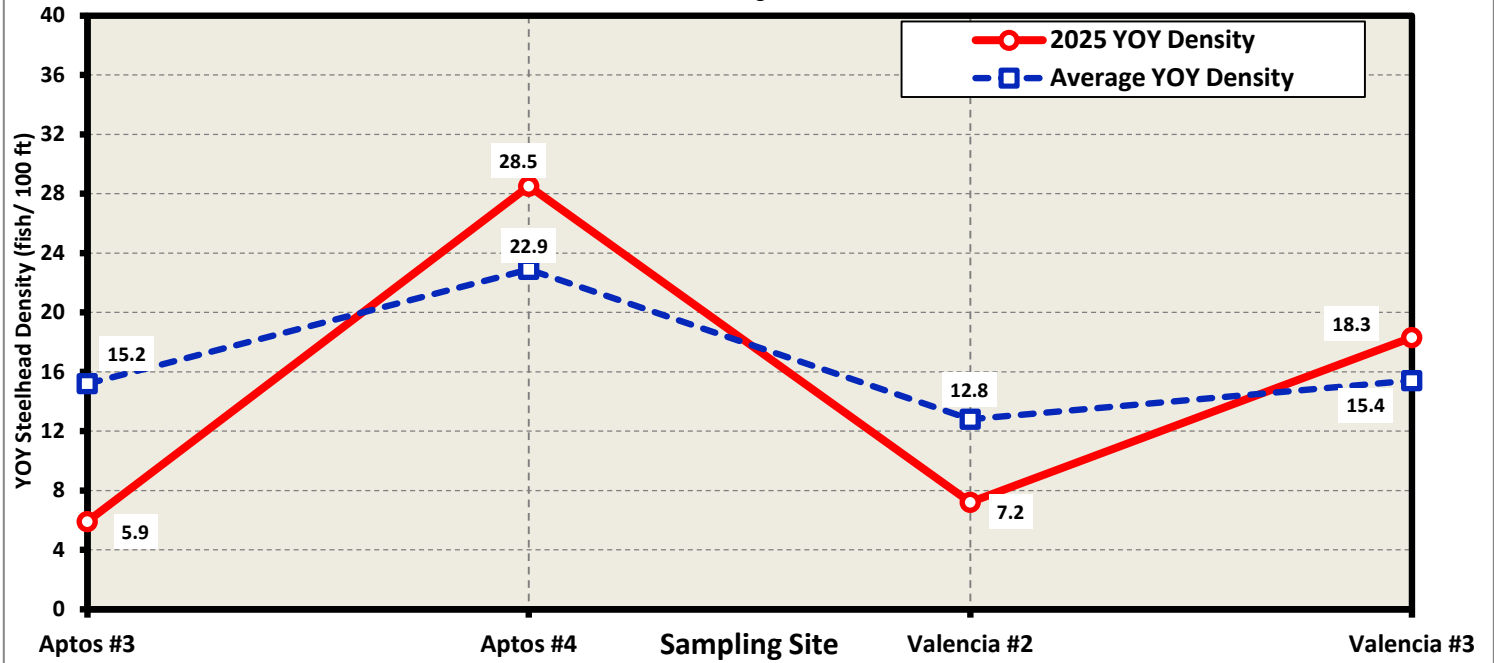


Figure 33. Young-of-the-Year Site Densities in the Aptos Watershed in 2025.

Figure 34. Young-of-the-Year Steelhead Site Densities in Aptos Watershed in 2025 Compared to 2024. (Lines connecting site densities are for visual effect only.)

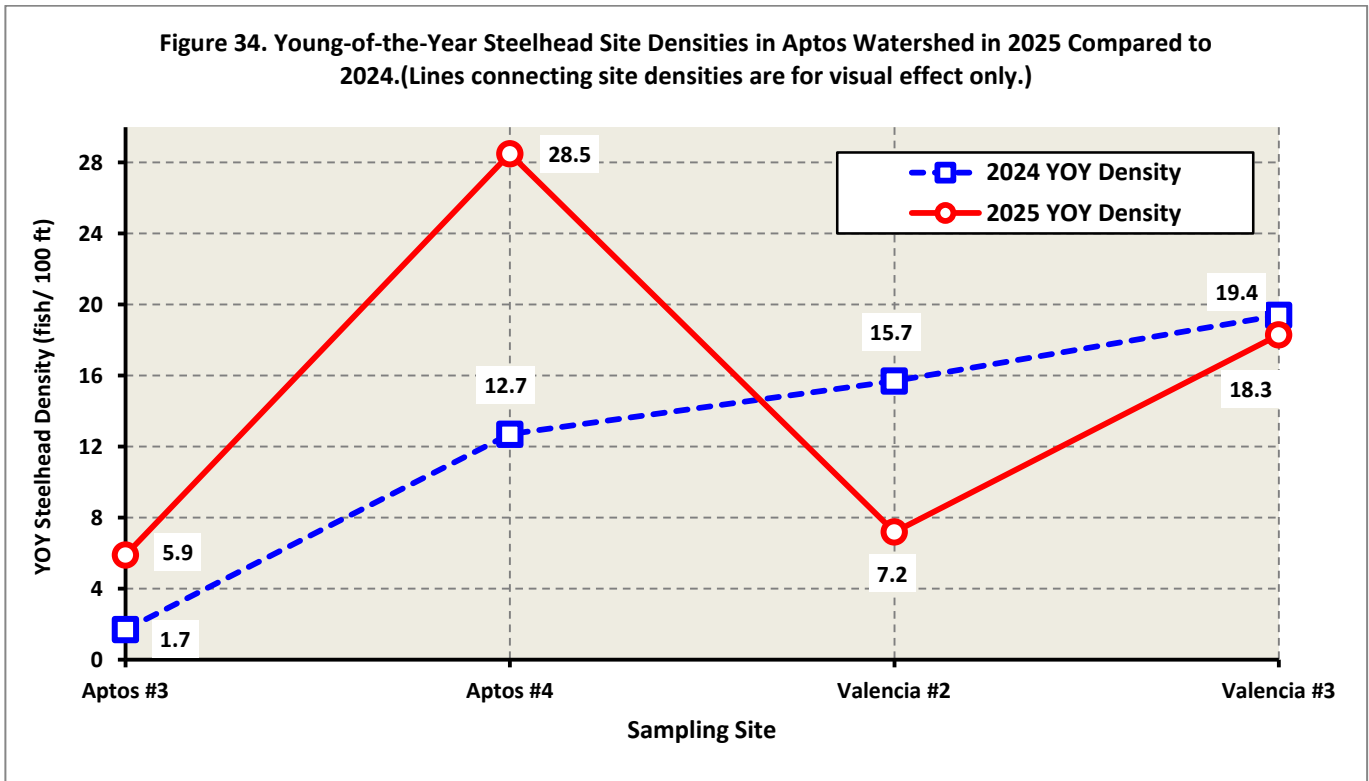


Figure 34. Young-of-the-Year Site Densities in Aptos Creek, Comparing 2025 to 2024.

Figure 35. YEARLING AND OLDER SITE DENSITIES IN THE APTOS CREEK WATERSHED in 2025, with up to a 21-Year Average in Aptos Creek and 17-Year Average in Valencia Creek. (1981; 2006-2025; lines between site densities are for visual effect only).

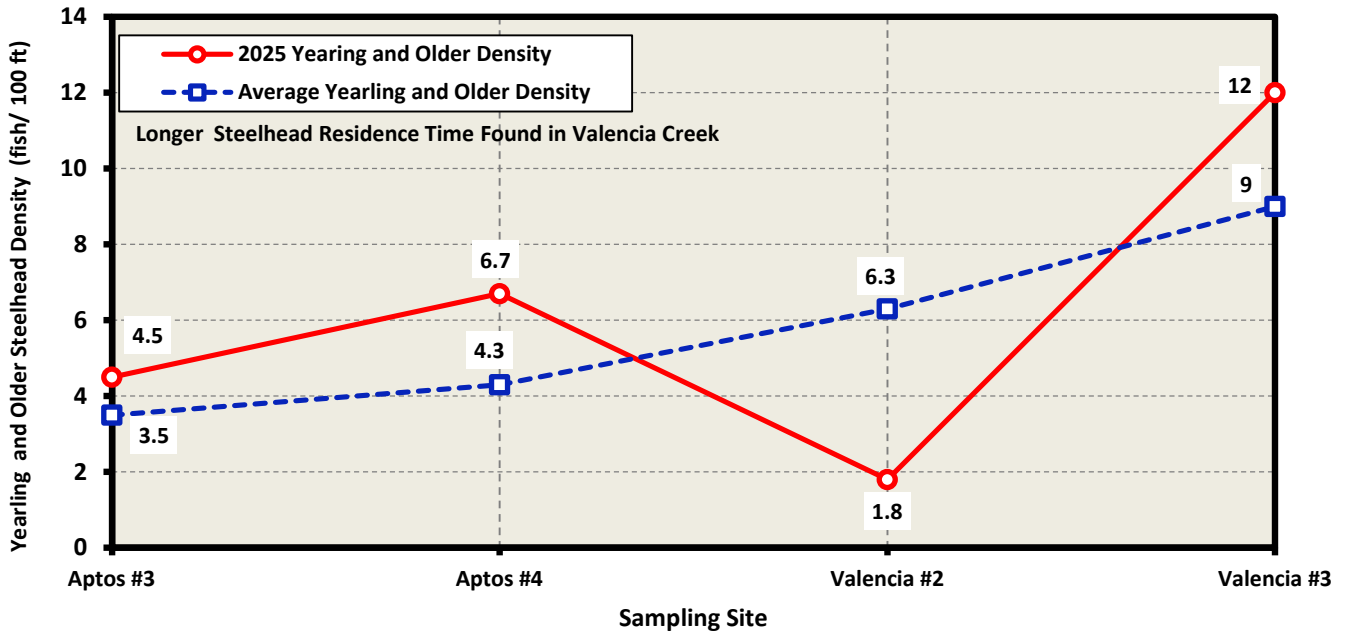


Figure 35. Yearling and Older Steelhead Site Densities in Aptos Watershed in 2025.

Figure 36. SIZE CLASS II AND III STEELHEAD SITE DENSITIES IN THE APTOS CREEK WATERSHED in 2025, with up to a 21-Year Average in Aptos Creek and 17-Year Average in Valencia Creek. (1981; 2006-2025; lines between site densities are for visual effect only).

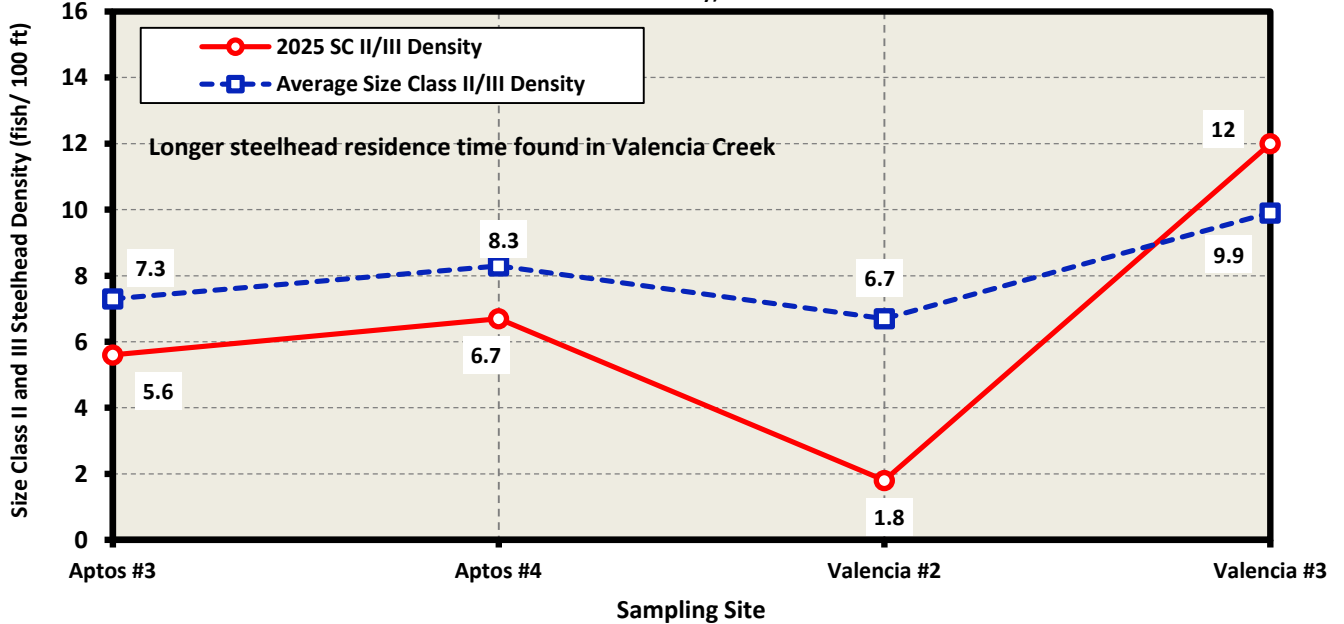
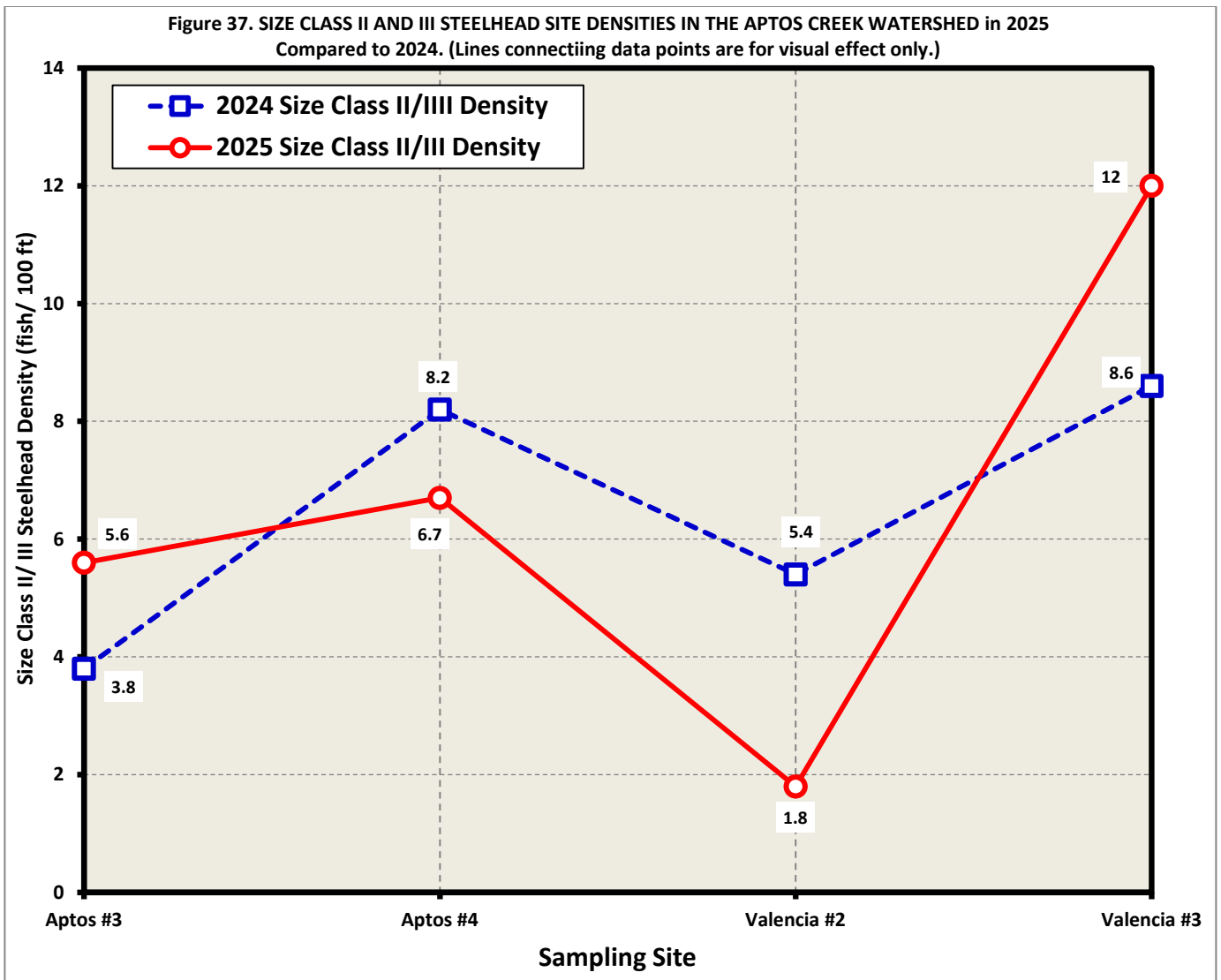


Figure 36. Size Class II and III Steelhead Site Densities in Aptos Watershed in 2025.



**Figure 37. Size Class II/III Steelhead Site Densities in Aptos Creek Comparing 2025 to 2024.**

Figure 38. Trend in Total Juvenile Steelhead Density at Aptos and Valencia Creek Sites.  
 (Steelhead at Valencia Creek Sites found to include 2 and 3-year old fish., which may increase density.)

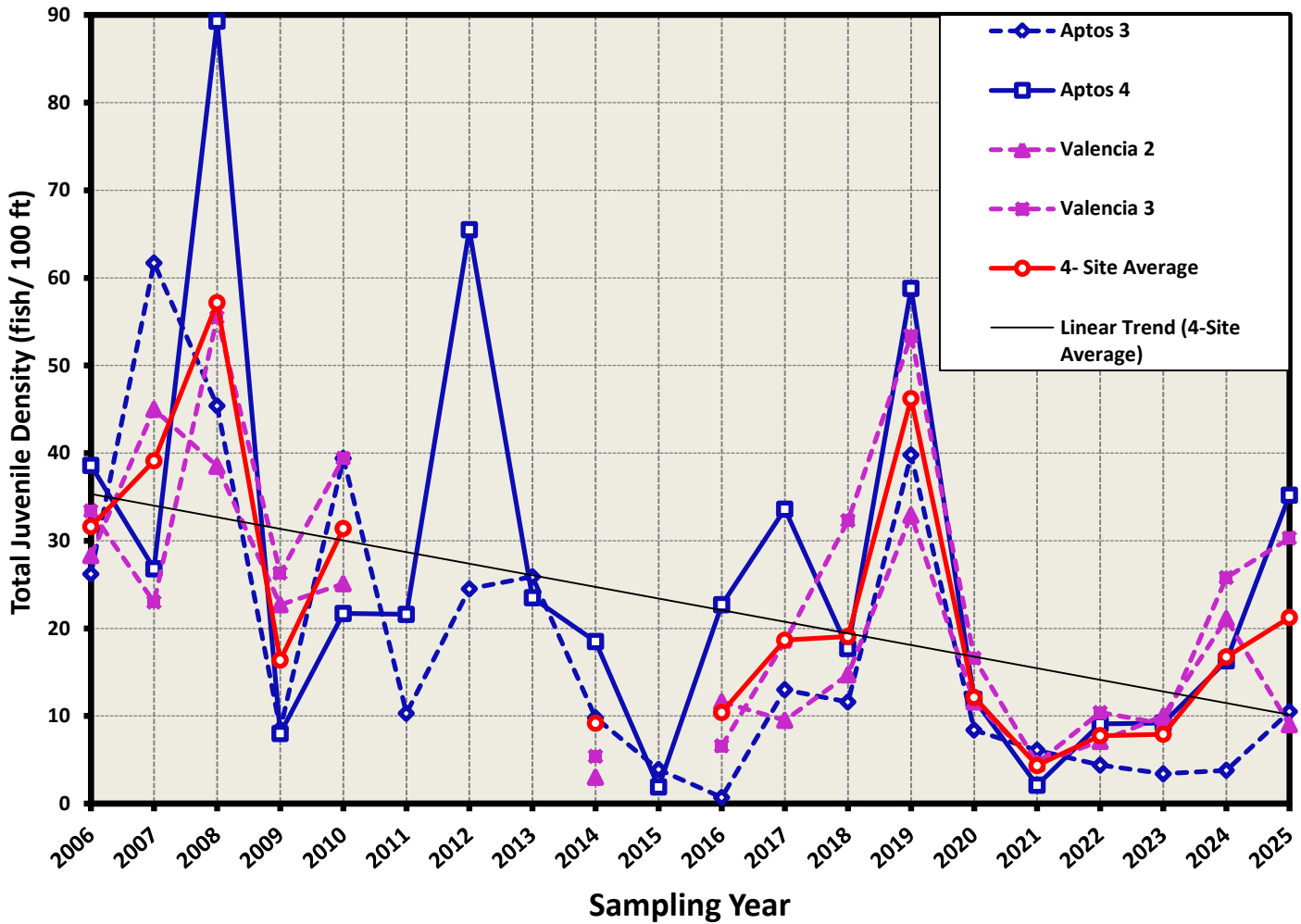


Figure 38. Trend in Total Juvenile Steelhead Site Densities in Aptos Watershed for 2006 – 2025.

Figure 39a. Trend in Size Class II/III Juvenile Steelhead Density at Aptos and Valencia Creek Sites. (Steelhead in Valencia Branch include 2 and 3-year olds, which may increase density.)

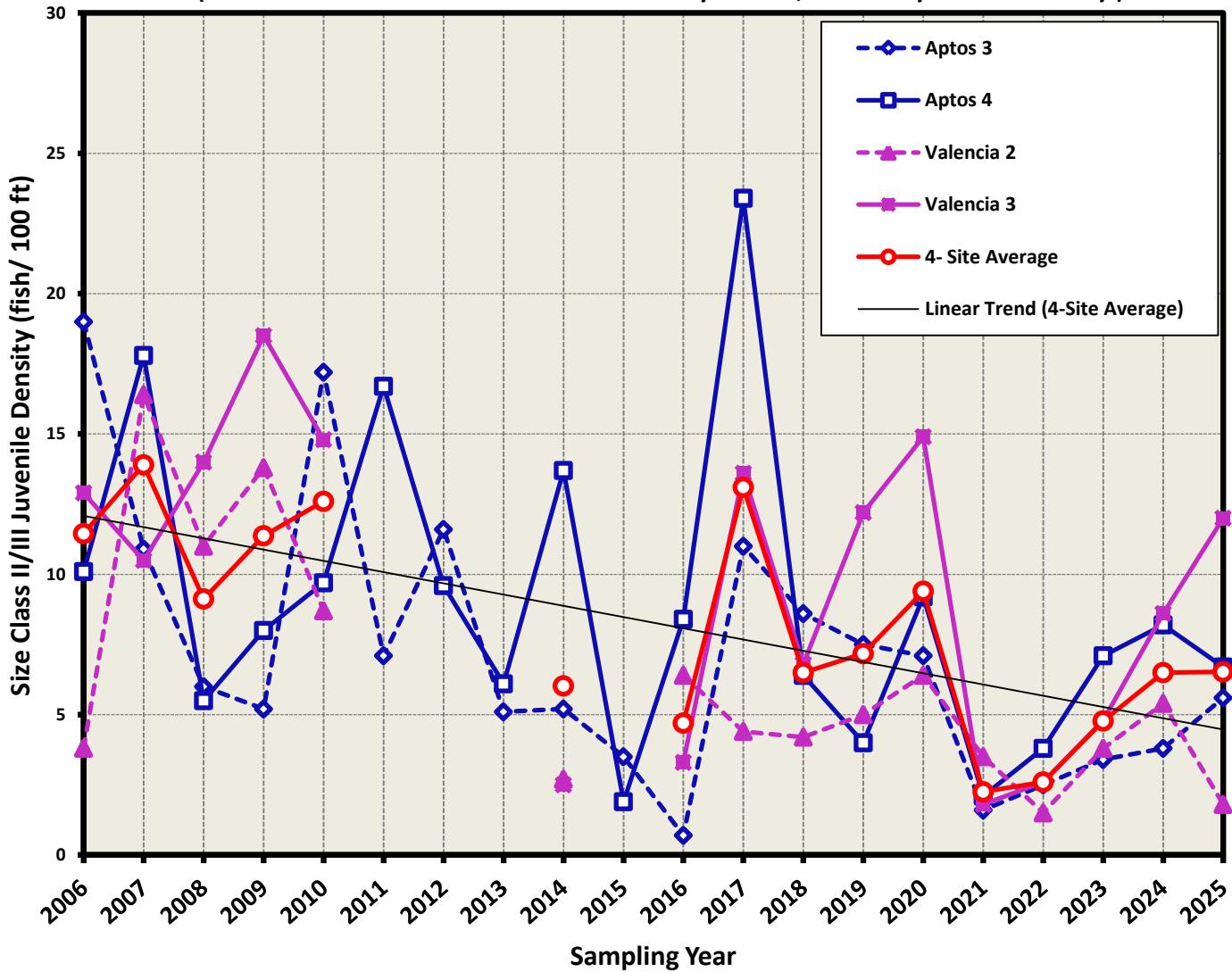


Figure 39a. Trend in Size Class II/III Steelhead Site Densities in Aptos Watershed for 2006 – 2025.

Figure 39b. Trend in Index of Size Class II/III ( $\Rightarrow$ 75 mm SL) Juvenile Steelhead Production in 4 Aptos/Valencia Creek 1/2-mile Segments with 5-Month Baseflow Average on Soquel Creek at the Soquel Village USGS Gage, 2010-2025.

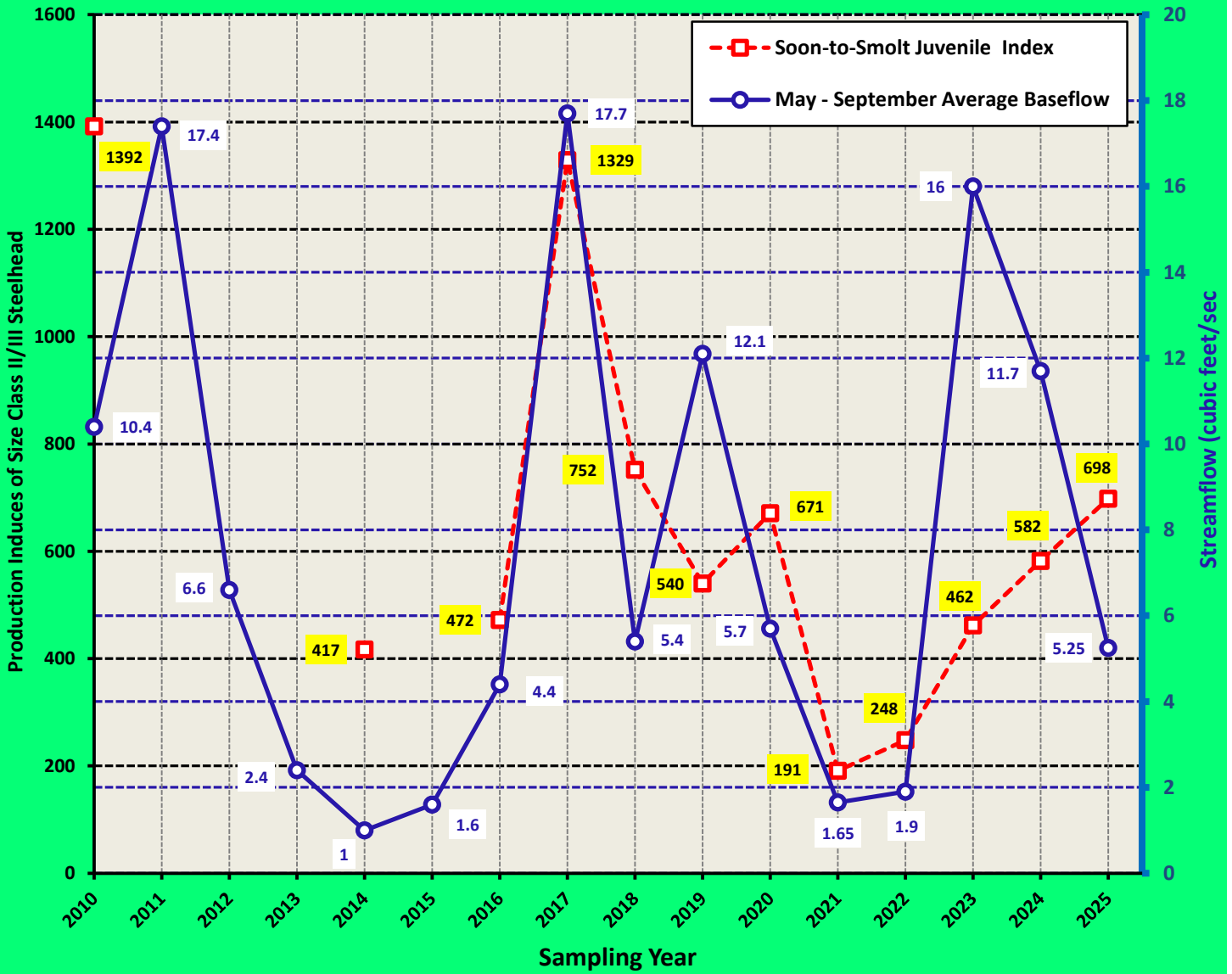
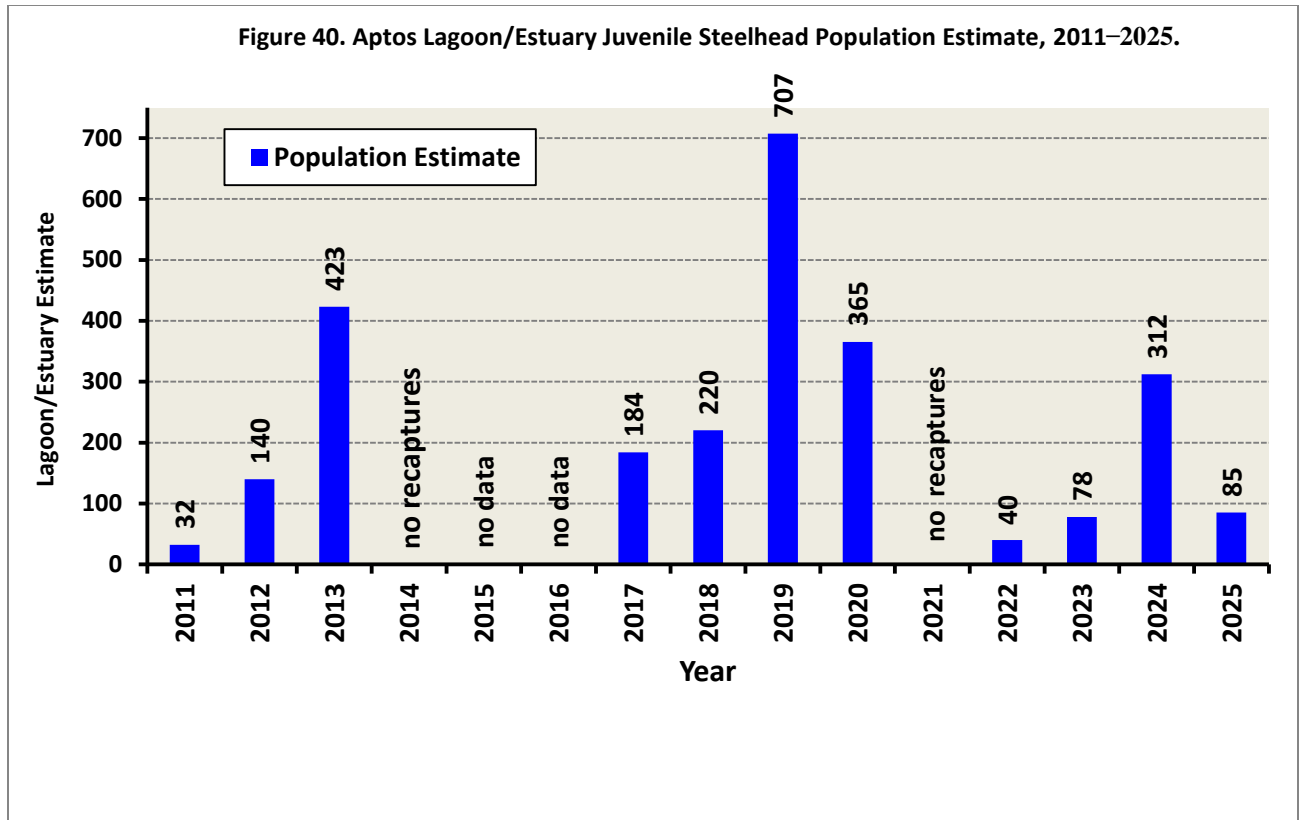
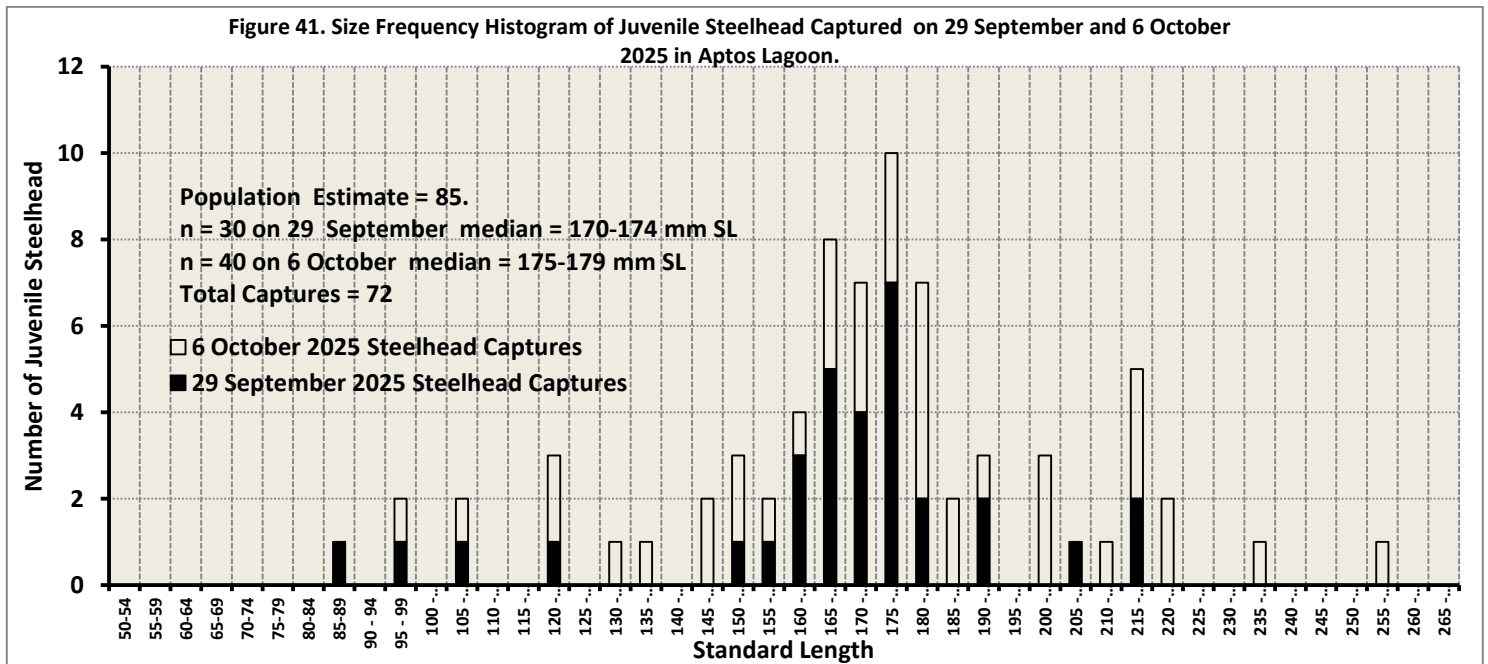


Figure 39b. Trend in Index of Size Class II/III ( $\Rightarrow$ 75 mm SL) Juvenile Steelhead Numbers in 4 Aptos/Valencia Creek Segments Graphed with 5-Month Baseflow Average in Soquel Creek, 2010 – 2025.



**Figure 40. Aptos Lagoon/Estuary Juvenile Steelhead Population Estimate, 2011–2025.**



**Figure 41. Size Frequency Histogram of Steelhead Captured in Aptos Lagoon, October 2025.**

**Table 7. Water quality measurements in Aptos Lagoon (sand berm at end of jetty) during steelhead sampling, 29 September and 6 October 2025.**

29 September 2025					6-Oct-2025			
Walk-bridge (thalweg) Air temp. 17.7°C Gage Height =					Walk-bridge (thalweg) Air temp. 13.9°C; Gage Height =			
0832 hr					0836 hr			
Depth	Temp	Salin	Oxygen	Cond	Temp	Salin	Oxygen	Cond
(m)	( C)	(ppt)	(mg/l)	micro-mhos	( C)	(ppt)	(mg/l)	micro-mhos
0 (surface)	18.7	0.5	7.78	747	17.5	0.5	9.22	714
0.25	18.7	0.5	7.61	746	17.5	0.4	8.73	617
0.5	18.7	0.5	7.68	746	17.5	0.4	8.69	617
0.75	18.7	0.5	7.82	747	17.5	0.4	8.72	617
1.00	18.7	0.5	8.23	748	17.5	0.4	8.64	617
1.25b	18.7	0.5	8.04	749	17.5	0.4	8.57	617

\* “b” indicates the lagoon/estuary bottom where measurements were taken through the water column.

***iv. Statistical Analysis of Annual Difference in Juvenile Steelhead Densities***

**Table 8. Paired T-test for the Trend in Steelhead Site Densities by Size Class and Age Class at All Replicated Sampling Sites in the SAN LORENZO Watershed (2025 to 2024; n=22 for Total Density and n=21 for the other size/age classes).**

Statistic	Size class 2	Age class1- YOY	Age class 2	All Sizes
Mean difference	-5.12	0.78	-1.80	-1.89
Df	20	20	20	21
Std Error	0.97	2.85	0.59	2.77
t Stat	-5.26	0.27	-3.07	-0.68
P-value (2-tail)	0.0000	0.7880	0.0060	0.5019
95% CL (lower)	-7.15	-5.16	-3.03	-7.64
95% CL (upper)	-3.09	6.72	-0.58	3.86

**Table 9. Paired T-test for the Trend in Steelhead Site Densities by Size Class and Age Class at All Replicated Sampling Sites in the SOQUEL Watershed (2025 to 2024; n=7).**

Statistic	Size class 2	Age class1- YOY	Age class 2	All Sizes
Mean difference	-4.80	-1.53	-1.30	-2.90
Df	6	6	6	6
Std Error	2.39	3.05	0.44	3.31
t Stat	-2.01	-0.50	-2.95	-0.87
P-value (2-tail)	0.0913	0.6344	0.0258	0.4153
95% CL (lower)	-10.65	-9.00	-2.37	-11.01
95% CL (upper)	1.05	5.94	-0.22	5.21

**Table 10. Paired T-test for the Trend in Steelhead Site Densities by Size Class and Age Class at All Replicated Sampling Sites in the APTOS Watershed (2025 to 2024; n=3).**

Statistic	Size class 2	Age class1- YOY	Age class 2	All Sizes
Mean difference	0.53	-1.78	1.47	-0.30
Df	2	2	2	2
Std Error	2.12	3.68	2.69	5.93
t Stat	0.25	-0.48	0.55	-0.05
P-value (2-tail)	0.8247	0.6762	0.6399	0.9643
95% CL (lower)	-8.57	-17.64	-10.09	-25.83
95% CL (upper)	9.64	14.07	13.03	25.23

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## D. GLOSSARY

**Bankfull stage/ discharge:** Corresponds to the discharge (streamflow) at which channel maintenance is most effective. It is the discharge at which sediment moves, thus forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphologic characteristics of stream channels. The bankfull discharge or greater discharges are channel-forming streamflows. The bankfull discharge has a recurrence interval of approximately 1.3– 2 years.

**Baseflow:** Streamflow that is derived from natural storage, i.e., groundwater outflow outside the net rainfall that creates surface runoff. It is the discharge (streamflow) sustained in the stream channel, not as a result of direct runoff and without the effects of regulation, diversion or other human activities. Also called groundwater flow.

**Escape cover:** Where a fish hides from predators, including beneath surface turbulence and overhanging riparian vegetation and under unembedded boulders, within undercut banks and under instream wood.

**Fish Density:** Number of fish per 100 feet of stream channel in this report.

**Fish Habitat:** Where a fish lives that provides food and shelter necessary to survive. There are the aquatic environment and the immediate terrestrial environment that combine to provide biological and physical support systems required by fish species during various life stages.

**Fork Length (FL):** Fish length from snout to mid point in the tail's edge.

**Hydraulic control point:** The top of an obstruction in the stream channel in which streamflow must rise before passing over, or a point in the stream where the flow is constricted. The hydraulic control point determines the water surface elevation upstream to the next riffle or run. It is typically at the tail of a pool. Riffles and runs have no hydraulic controls except for very short distances at most.

**Hydrograph:** A graph showing the discharge (streamflow) or stage (water surface elevation) at a specific location with respect for time.

**Instream Wood cluster:** Logjam that extends into the summer low-flow channel.

**Large woody debris:** A large piece of relatively stable instream wood having a diameter greater than 1 foot and length greater than 6 feet that extends into the stream channel, either at baseflow or during winter stormflows. We prefer to call it **large instream wood**.

**Low flow:** The lowest streamflow recorded over a specified period of time. Also called **minimum flow**.

**Mainstem:** The principal or dominating stream channel in a drainage system. Tributaries flow into it.

**Overwintering cover:** Where fish find refuge and resting places from fast water during stormflows. It may be along undercut banks or behind large boulders and/or large instream wood.

**Percent Embeddedness:** The percent buried in fine sediment or sand of large streambed particles (cobbles and boulders large enough for Size Class II salmonids to hide under for escape cover).

**Percent fines:** The percent of the streambed area covered with silt and sand in a habitat type.

**Pool:** A deeper stream habitat with little surface turbulence except at the head and that has places where downstream water velocity is near zero or water is backwatered with upstream eddies. Pools are formed by scour objects, such as large instream wood, large boulders, streambank tree roots or bedrock faces. Pools are the primary habitat for coho salmon and for larger juvenile steelhead in Santa Cruz Mountain tributaries and Mainstem headwater sites.

**Reach segment:** A specified length of stream within a stream reach. In this study, stream segments are ½ mile in length and are considered representative of habitat in the reach. Habitat characteristics and fish are sampled within historically designated reach segments to assess annual trends in habitat conditions and fish densities within reaches.

**Representative reach fish sampling:** For all stream reaches except the Mainstem San Lorenzo River up to the Boulder Creek confluence, fish sampling sites are chosen within representative stream segments of stream reaches based on the pools within the sampling site having near-average pool depth and escape cover for the segment. Representative pools and adjacent fastwater habitats are sampled by electrofishing at the site. For the Mainstem San Lorenzo River, representative fastwater riffles and runs regarding near-average stream depth are electrofished, and nearby historical pools are snorkel censused.

**Riffle:** Relatively shallow, fastwater habitat with surface turbulence and often exposed cobbles and boulders. It is where most aquatic insect larvae are produced and where insect drift rate is the highest.

**Riparian vegetation:** Vegetation growing on or near streambanks or other water bodies on soils that exhibit near or completely water saturated conditions during some portion of the growing season. Common native riparian tree species in the Santa Cruz Mountains include redwood, Douglas fir, California bay, tanoak, willow, alder, bigleaf maple, cottonwood, dogwood, sycamore and box elder. Acacia, a non-native riparian tree species, is becoming more common.

**Run:** Deeper than a riffle, fastwater habitat without surface turbulence, but is moving.

**Scour:** The localized removal of material from the streambed by flowing water. It causes the stream channel to deepen and is the opposite of fill.

**Shade:** The percent canopy closure over the stream as estimated by a spherical densiometer.

**Size Class I steelhead/ coho salmon:** Juvenile steelhead or coho salmon captured in the fall that are less than 75 mm Standard Length.

**Size Class II steelhead/ coho salmon:** Juvenile steelhead or coho salmon captured in the fall that are between 75 and 150 mm Standard Length. Steelhead in this size class include fast-growing young-of-the-year and yearling juveniles.

**Size Class III steelhead:** Juvenile steelhead captured in the fall that are at least 150 mm Standard Length and include yearling and older juveniles.

**Soon-to-smolt-steelhead:** Juvenile steelhead captured in the fall that are 75 mm Standard Length or larger and will likely smolt the following spring. Smith (2015) found from scale analysis of down migrant steelhead smolts trapped in spring of 1987 and 1989 (both dry springs during drought years), that 61% of the smolts had reared the previous year as YOY in high flow areas, like the Mainstem San Lorenzo River, and down-migrated as yearling smolts (“YOY’s” [the previous fall when we do our sampling](#)). Most (97%) of these yearling smolts were 76 mm SL or larger at their first scale annulus (the mark on the scale where growth stopped in winter). Of the 39% of smolts that down-migrated as 2-year olds (“yearlings” [the previous fall when we sample](#)), a third were larger than 80 mm SL at their first annulus, and also may have reared in the faster-growth portions of the watershed.

**Spawning Gravel:** Streambed particle size between one quarter and 3 and a half inches in diameter. Usually found within **spawning glides** at the tails of pools or runs just upstream of steep, focused riffles.

**Standard Length (SL):** Fish length from snout to end of spinal column in caudal peduncle before tail.

**Steelhead/ Coho Salmon adult migration:** Adult steelhead are sexually mature and typically migrate upstream from the ocean through an open sandbar after several prolonged storms; the migration seldom begins earlier than December and may extend into May if late spring storms develop. Many of the earliest migrants tend to be smaller than those entering later in the season. Adult fish may be blocked by barriers such as bedrock falls, wide and shallow riffles and occasionally logjams. Man-made objects, such as culverts, bridge abutments, dams and remnant dam abutments are often significant barriers. Some barriers may completely block upstream migration, but many barriers in coastal streams are passable at higher streamflows. If the barrier is not absolute, some adult steelhead are usually able to pass in most years, since they can time their upstream movements to match optimal stormflow conditions. However, in drought years and years when storms are delayed, some obstructions can be serious barriers to steelhead and especially coho salmon spawning migration. Sexually mature adult coho salmon often have more severe migrational challenges because much of their migration period, November through early February, may be prior to stormflows needed to pass bridge abutments, shallow riffles, boulder falls and partial logjam barriers. Access is also a greater problem for coho salmon because they die at maturity and cannot wait in the ocean an extra year if access is poor due to failure of sandbar breaching during drought or delayed stormflow.

**Steelhead/ Coho Salmon smolt migration:** Fish undergo physiological changes to their gills and kidneys to adapt to saltwater to prevent dehydration. Juveniles passively migrate with the current at night, downstream to the ocean, mostly in February through May. They may spend time in the estuary to grow much larger and become silvery with black-tipped fins before exiting the stream.

**Step-run:** A habitat that is turbulent like a riffle but has many hydraulic controls formed by larger cobbles and boulders to create slower, deeper pocket water as the stream's water surface stair-steps over the multiple hydraulic controls. Step-runs often have considerable escape cover in the form of surface turbulence and spaces under unembedded boulders.

**Streambank:** The portion of the stream channel cross section that restricts lateral movement of water at below bankfull flows. The streambank often has a gradient steeper than 45 degrees and exhibits a distinct break in slope from the stream bottom.

**Stream Gradient:** The slope or rate of change in vertical elevation of the water surface of a flowing stream per unit of horizontal distance.

**Stream Reach:** A relatively homogeneous section of a stream having a repetitious sequence of physical characteristics and habitat types, and it differs from adjacent reaches. Reach boundaries may be determined by changes in stream gradient that determine dominant particle size and habitat length, changes in streamflow and water temperature with the confluence of tributaries, changes in substrate composition associated with stream gradient and tributary sediment input, and changes in tree canopy (shade). As stream gradient lessens, pool length increases and pool to riffle ratios increase.

**Thalweg:** The line connecting the deepest points along a streambed (where water depth is greatest). Water volume with the fastest water velocity flows through the thalweg. Salmonids spawn in the thalweg of spawning glides.

**Tributary:** A smaller stream feeding, joining, confluencing with or flowing into a larger stream.

**Turbidity:** It is related to water clarity. It is a measure of the extent to which light passing through water is reduced due to suspended materials- can be suspended sediment or phytoplankton. Juvenile salmonids are visual feeders and require conditions of low turbidity to see their drifting prey.

**Undercut streambank:** A streambank with its base cut away by water scour action along man-made and natural overhangs in streams, such as those formed by rootmasses of riparian trees.

**Water Depth:** The vertical distance from the water surface to the streambed.

**Yearling steelhead:** Juvenile steelhead captured in the fall and hatched 2 springs previously.

**Young-of-the-year steelhead and coho salmon (YOY):** Juvenile steelhead and coho captured in the fall and hatched earlier in the spring. Most are <75 mm Standard Length but many may be => 75 mm Standard Length and in the Size Class II if food is more abundant where they rear, such as in the lower San Lorenzo River downstream of the Zayante Creek confluence and in lagoons in most years.