



## Initial Summary of Steelhead Sampling Results in Santa Cruz County Streams and the Pajaro Lagoon in 2023

December 2023

This summary is preliminary to analysis of steelhead rearing habitat conditions and calculation of juvenile densities at fish sampling sites. The summary is based on numbers of juvenile steelhead electrofished or observed by snorkeling prior to calculation of actual juvenile densities. A more detailed annual summary report of juvenile steelhead monitoring will follow this initial report. All data will be entered into a County spreadsheet, including presence/absence data on other fish species. Densities of larger juveniles (Size Class II and III) are most important in producing adult spawners, rather than densities of smaller YOY fish. The annual differences in juvenile numbers in **Table 1** reflect mostly differences in YOY numbers between years because they dominate the catch.

### San Lorenzo River Watershed

We were unable to obtain adult return estimates from Scott Creek during the wet winter of 2022/2023 because the NOAA Fisheries trap could not be maintained with the multiple high stormflow events (**Joseph Kiernan pers. comm.**). So, we cannot hypothesize as to the adult return numbers to the San Lorenzo drainage. Winter and spring adult steelhead passage and spawning flows were good during the wet 2022/2023 winter and spring. However, redd scour was probably prevalent from larger stormflows. Over the past winter, the significant stormflows during the steelhead spawning period occurred in December, January and March, with 3 significant stormflows in December producing peak flows at the Big Trees USGS gage of approximately 2,000 cfs, 1,500 cfs and 15,000 cfs (**Figure 1**). In January there were 3 significant stormflows of approximately 3,500, 20,000 and 15,000 cfs. In March there were 3 significant stormflows of approximately 12,000, 8,000 and 4,000 cfs. Bankfull events (1.5 year recurrence interval) are capable of scouring spawning redds or smothering them with sediment. Bankfull at Big Trees was likely in the approximately 3,000 cfs range (2,800 cfs had a 1.3 year recurrence interval in 1999). Streamflow remained above 100 cfs at Big Trees gage until mid-mid-May and remained above 25 cfs throughout the dry season, providing relatively good rearing habitat for juvenile steelhead that survived the winter.

YOY steelhead numbers in the SLR mainstem were similarly low in fastwater habitat in 2023 compared to 2022 except for Site 9 below Boulder Creek where numbers were higher (**Table 1**). Also, juvenile steelhead numbers, both YOY and yearlings, were much higher in 2023 in mainstem pools at all mainstem sites downstream of Boulder Creek and in Waterman Gap (Site 12b). As in 2022, numbers of juvenile steelhead in 2023 were relatively low at lower tributary and mainstem sites but generally increased at upper sampling sites, most notably in the upper mainstem near Teihl Road (11), Waterman Gap (12b), middle and upper Zayante (13c, 13d and 13i), upper Bean 14c-2, upper Bear Site 18b, and upper Branciforte 21b. Lower Fall Site 15a had

much higher numbers than upper Fall Site 15b. The former wood cluster that had been a passage impediment in Fall Reach 15a below the fish ladder had washed away but was replaced by another substantial wood cluster further downstream. Our Fall 15a sampling site straddled this wood cluster above and below. Reach 15a downstream of the fish ladder repair activities was highly sedimented, with sediment increasing from August to September. Lower Zayante Site 13a had very low numbers, with substantial streambank erosion and wood accumulation at a bend in the lower reach next to the San Lorenzo Lumber access road. Other sites with relatively low numbers were lower mainstem Site 1, lower and middle Bean 14a and 14b, Newell 16 (for a wet year) and lower Branciforte 21a-2. With the high baseflow and moderate numbers of YOY at most sites, the percent of YOY reaching soon-to-smolt size (75 mm SL) was relatively high, as is typical for wet years. We suspect that low YOY numbers at the more downstream sites were partially due to scour of spawning redds by high stormflows and possibly low adult returns. At some tributary sites, a few larger YOY were captured that likely came from early winter spawning occurring in late January and February after the December and January stormflows.

### **Soquel Creek Watershed**

We were unable to obtain adult return estimates from Scott Creek during the wet winter of 2022/2023 because the NOAA Fisheries trap could not be maintained with the multiple high stormflow events (**Joseph Kiernan pers. comm.**). So, we cannot hypothesize as to the adult return numbers to the Soquel Creek drainage. In Soquel Creek, winter and spring adult steelhead passage and spawning flows were good and followed the same pattern as in the SLR, with significant stormflows producing a peak flow at the Soquel Village gage of approximately 1,400 cfs in December, peak flows in January of approximately 1,100, 9,800, 8,000 and 6,000 cfs, and peak flows in March of approximately 6,000, 3,000 and 1,500 cfs (bankfull was likely between approximately 1,000 and 1,400 cfs) (**Figure 2**).

2023 YOY juvenile steelhead numbers were relatively low compared to previous years except at upper mainstem Site 12, upper East Branch Site 16 in the SDSF and both West Branch Sites 19 and 21 (**Table 1**). Presence of YOY at our uppermost sampling sites in the East and West branches indicated adult spawning access into the upper watershed in 2023. The low numbers of captured YOY juveniles at the other sites was likely a result of increased spawning effort in the upper watershed and the scouring and smothering of spawning redds in the lower watershed during the multiple, above bankfull stormflows in December, January and March. There may also have been low adult returns. Because of the relatively high baseflow during the dry season, the few YOY that survived the winter grew rapidly, with a high percentage reaching soon-to-smolt size (75 mm SL) in the fall. As in the San Lorenzo, a few larger YOY likely came from early spawning. The Soquel Lagoon juvenile steelhead population estimate of 660 was well below average, as is typical after wet winters when most spawning effort and success is in the upper watershed. Yellow-legged frog reproduction is generally low in wet springs, and few were observed in 2023 except in the lower East Branch Reach 9 below Mill Pond.

### **Aptos Creek Watershed**

We were unable to obtain adult return estimates from Scott Creek during the wet winter of 2022/2023 because the NOAA Fisheries trap could not be maintained with the multiple high stormflow events (**Joseph Kiernan pers. comm.**). So, we cannot hypothesize as to the adult return numbers to the Aptos Creek drainage, but suspect that they were low due to continued

very low YOY densities. As in nearby Soquel Creek (**Figure 2**), adult winter/spring passage flows and spawning conditions were likely good with adult spawning access to all 4 sampling sites. We identified a large accumulation of instream wood in Aptos Creek between our lower and upper sampling sites in 2022 that may have been a significant passage impediment that year. Additional survey of that area is needed to determine if passage impediments still exist. A low number of YOY were captured at all 4 sites in 2023, as has been the case for the last 3 years (**Table 1**). This was likely due to a combination of few spawning adults and scouring and smothering of spawning redds during multiple, above bankfull stormflows over the winter/spring. Total juvenile numbers were highest at lower Valencia Site 2, which also likely had older resident rainbow trout, based on scale analysis in the past. With YOY numbers being low in Aptos Creek and the high baseflow over the summer and fall, the percentage of YOY reaching soon-to-smolt size ( $\leq 75$  mm SL) during the first growing season was relatively high.

78 juvenile steelhead were captured in Aptos estuary on the first day of sampling, which was a good number. But only 2 juvenile steelhead were captured on the second (both recaptures). The juvenile steelhead population estimate in 2023 was 78. The standard error was calculated to be zero because all of the fish captured on the second day were recaptures. On the second day of sampling, poorer water quality in the lower estuary may have caused juveniles to move upstream beyond where we could successfully seine. The low capture rate and assumedly small population size also occurred in dry years- 2014, 2021 and 2022. The 2020 lagoon estimate was 365 and third highest in 11 annual censuses since 2011. The highest estimate was in 2019 with 707. The estuary was likely very important in producing smolt-sized juveniles in such years as 2011, 2017–2020 and 2023, producing a significant proportion of the larger juveniles to return as adults. Tidewater gobies were not captured in the Aptos estuary in 2023, as was the case in Soquel Lagoon.

On the first sampling day, 30 September 2023, the shallow estuary had good water quality in the morning with respect to temperature and oxygen, with some stratification of these parameters below 0.5 m from the surface due to saline stratification. On the second sampling day, 6 October, stratification had increased with warmer water temperature and reduced oxygen at depth compared to a week earlier. On 30 September, oxygen was above 5 mg/L down to 1.25 m from the surface, and on 6 October it dropped to 2 mg/L at 1.0 m and was less below. Water temperature at the bottom on the first sampling day was 19.8 C, but had increased to 21.5 C on the second sampling day. Air temperature was 13.5 C on the first morning of sampling and 15.3 C on the second. The sandbar was open on both days of sampling.

**Pajaro Lagoon**

Pajaro Lagoon was sampled in early October with a closed sandbar and common tidal overwash. No steelhead were captured or observed, as was the case in all previous annual fall sampling, 2012-2022. Tidewater gobies were captured in 2022 but not 2023, though arrow goby was common (239 individuals captured) in 2023. In 2023, the lagoon was dominated again by smelt (495+ captured- mostly YOY), but adults were in fewer numbers than previous years. Four other notable native fish species that were captured included starry flounder (3), California halibut (1), Bay pipefish (2), staghorn sculpin (11), shiner perch (1) and adult prickly sculpin (1). Surprisingly, no threespine sticklebacks were captured. Water temperature and oxygen levels were good in the lower and upper estuary. But the estuary was very saline throughout the water column except at the upper boat ramp site. Yellowshore and Dungeness crabs were present at several sites but were not abundant.

**Table 1. Number of Santa Cruz County Steelhead Either Captured by Electrofishing or Observed by Snorkeling – 2017-2023 and number of Unintentional Mortalities in 2023. (With same or similar average habitats and stream lengths sampled between years at each site but not between sites, preventing comparisons between sites because densities (fish/stream lengths are not included).**

Stream	Site #	Number* of Steelhead 2017 (wet year)/ % YOY in Size Class II/III from E-fishing	Number*of Steelhead 2018 (drought year)/ % YOY in Size Class II/III from E-fishing	Number*of Steelhead 2019 (wet year)/ % YOY in Size Class II/III from E-fishing	Number*of Steelhead 2020 (below average year)/ % YOY in Size Class II/III from E-fishing	Number*of Steelhead 2021 (drought year)/ % YOY in Size Class II/III from E-fishing	Number*of Steelhead 2022 (drought year)/ % YOY in Size Class II/III from E-fishing	Number*of Steelhead 2023 (wet year)/ % YOY in Size Class II/III from E-fishing	Number of Unintentional Steelhead Mortalities in 2023
SLR Mainstem	0a	16/100%	15/100%	16/93%	9/80%	4/100%	9/43%	14/100%	0
SLR Main	1	60(+51 snorkeling)/ 99%	49(+8 snorkeling)/ 76%	87(+71 snorkeling)/ 80%	136(+3 snorkeling)/ 64%	59(+4 snorkeling)/ 53%	31(0 snorkeling)/ 78%	18(+23 snorkeling)/ 100%	0
SLR Main	2	110(+37 snorkeling)/ 87%	30(+11 snorkeling)/ 81%	182(+164 snorkeling)/ 46%	124(+41 snorkeling)/ 62%	46(+11 snorkeling)/ 23%	54(+1 snorkeling)/ 69%	31(+47 snorkeling)/ 100%	0
SLR Main	4	110(+6 snorkeling)/ 61%	105(0 snorkeling)/ 38%	204(+37 snorkeling)/ 41%	133(+4 snorkeling)/ 57%	169(+2 snorkeling)/ 28%	235(+2 snorkeling)/ 25%	99(+10 snorkeling)/ 100%	0
SLR Main	6	25(+22 snorkeling)/ 49%	51(0 snorkeling)/ 2%	52(+65 snorkeling)/ 8%	36(+5 snorkeling)/ 0%	63(+6 snorkeling)/ 0%	36(+6 snorkeling)/ 0%	31(+21 snorkeling)/ 67%	0
SLR Main	8	49(+15 snorkeling)/ 31%	48(0 snorkeling)/ 16%	81(+29 snorkeling)/ 14%	53(+2 snorkeling)/ 0%	53(+0 snorkeling)/ 4%	48(0 snorkeling)/ 0%	36(94 snorkeling)/ 23%	0
SLR Main	9	122(+4 e-fish pools)/ 49%	51(1 snorkeling)/ 10%	151(+29 snorkeling)/ 29%	70(+2 snorkeling)/ 1%	26(+4 snorkeling)/ 9%	37(+10 snorkeling)/ 11%	74(+25 snorkeling)/ 83%	0
SLR Main	10	84/36%	28/8%	76/ 10%	13/38%	5/33%	34/36%	24/100%	1
SLR Main	11	84/19%	44/6%	150/ 4%	9/0%	6/0%	20/0%	77/9%	1
SLR Main	12a	104/0%	No sample	No sample	No sample	No sample	No sample	No sample	

Stream	Site #	Number* of Steelhead 2017 (wet year)/ % YOY in Size Class II/III from E-fishing	Number* of Steelhead 2018 (drought year)/ % YOY in Size Class II/III from E-fishing	Number* of Steelhead 2019 (wet year)/ % YOY in Size Class II/III from E-fishing	Number* of Steelhead 2020 (below average year)/ % YOY in Size Class II/III from E-fishing	Number* of Steelhead 2021 (below average year)/ % YOY in Size Class II/III from E-fishing	Number* of Steelhead 2022 (drought year)/ % YOY in Size Class II/III from E-fishing	Number* of Steelhead 2023 (drought year)/ % YOY in Size Class II/III from E-fishing	Number of Unintentional Steelhead Mortalities in 2023
SLR Main	12b	233/0%	143/0%	185/ 0%	34/53%	10 (no YOY)	28/0%	99/3.5%	0
Zayante	13a	60/48%	60/0%	217/ 6%	143/1%	162/3%	113/4%	21/95%	1
Zayante	13c	176/45 %	176/6%	361/ 2%	158/3%	135/9%	274 /10%	116 /67%	0
Zayante	13d	80/32%	208/0%	111/ 4%	105/0%	126/0%	113/3%	142/56%	2
Zayante	13i	114/0%	62/0%	163/ 0%	43/58%	13/0% (1 YOY)	27/8%	86/5%	0
Lompico	13e	No sample	60/0%	No sample	No sample	No sample	No sample	No sample	
Bean	14a	57/31%	40/0%	114/ 4%	71/0%	104/2%	50/0%	15/100%	0
Bean	14b	66/50%	25/67%	131/ 8%	62/0%	26/16%	27/17%	19/93%	0
Bean	14c-1	Wetted	0 (dry)	Wetted	0 (dry)	0 (dry)	0 (dry)	Wetted	
Bean	14c-2	106/0%	208/1%	177/ 5%	43/67%	7 (no YOY)	10/0% (1 YOY)	145/22%	0
Fall	15a	125/7%	115/0%	133/ 6%	79/17%	106/3%	62/9%	124/17%	0
Fall	15b	97/3%	51/11%	84/ 2%	33/65%	28/0%	76/0%	73/0%	1
Newell	16	63/63%	31/29%	108/ 24%	27/69%	19/6%	32/63%	46/97%	0
Boulder	17a	72/36%	38/12%	113/ 7%	51/0%	55/2%	88/18%	53/86%	0
Boulder	17b	91/9%	76/0%	115/ 8%	113/0%	94/0%	78/0%	56/20%	0
Bear	18a	42/34%	27/0%	165/ 2%	45/0%	85/0%	26/35%	49/48%	0
Bear	18b	47/89%	104/1%	301/ 3%	90/0%	12/0% (1 YOY)	138/8%	163/18%	0
Branciforte	21a-2	99/14%	77/0%	166/ 4%	56/0%	37/0%	52/32%	18/100%	0
Branciforte	21b	No sample	No sample	153/ 1%	39/24%	82/0%	57/3%	81/31%	0
Branciforte	21c	108/1%	No sample	No sample	No sample	No sample	No sample	No sample	
Total- San Lorenzo (E-fishing + snorkeling)		2,535 (3 sites added, 2 removed)	1,942 (2 sites removed)	4,193 (1 site added, 1 removed)	1,775+57= 1,832	1,534+27= 1,561	1,756 +19 =1,775	1,710 +220=1,930	6 (0.3 % mortality rate from e-fishing)
Soquel	1	9	12/38%	60/ 54%	10/88%	30/35%	20/11%	26/100%	0
Soquel	4	9	8/14%	43/ 24%	18/43%	20/17%	16/6%	32/100%	0
Soquel	6				15/45%	33/21%	22/15%	10/100%	0
Soquel	10	57	73/25%	149/ 23%	24/38%	78/6%	15/40%	32/100%	0
Soquel	12	38	132/16%	339/ 17%	60/11%	115/1%	41/5%	67/98%	0
E. Br. Soq	13a	10	35/12%	160/ 6%	13/30%	13/17%	11/100%	14/100%	0
E. Br. Soquel	16 SDSF	155	44/0%	133/ 6%	64/4%	44/0% Below Amaya	39/0%	160/54%	0
E. Br. Soquel	Long-ridge				90/4%	Dry	No sample	No sample	
E. Br. Soquel	Spanish Ranch				147/1%	85/0	No sample	No sample	
E. Br. Soquel	Ashbury				249/0%	No sample	No sample	No sample	
Amaya					28/20%	No sample	No sample	No sample	

Stream	Site #	Number* of Steelhead 2017 (wet year)/ % YOY in Size Class II/III from E-fishing	Number* of Steelhead 2018 (drought year)/ % YOY in Size Class II/III from E-fishing	Number* of Steelhead 2019 (wet year)/ % YOY in Size Class II/III from E-fishing	Number* of Steelhead 2020 (below average year)/ % YOY in Size Class II/III from E-fishing	Number* of Steelhead 2021 (below average year)/ % YOY in Size Class II/III from E-fishing	Number* of Steelhead 2022 (drought year)/ % YOY in Size Class II/III from E-fishing	Number* of Steelhead 2023 (drought year)/ % YOY in Size Class II/III from E-fishing	Number of Unintentional Steelhead Mortalities in 2023
W. Br. Soquel	19	31	44/5%	64/ 8%	28/0%	13/17%	51/6%	119/54%	0
W. Br. Soquel	21	84	127/1%	172/ 9%	55/0%	44/0%	37/0%	138/10%	0
Total-Soquel Watershed		384	475	1,120	800	475	252	598	0 (0% mortality rate from e-fishing)
Soquel Lagoon Estimate***		256	46	3,353	1,283	2,500 (catch/unit effort)	1,632	660	0 (Under separate permit)
Aptos	3	44	39/61%	115/ 15%	34/75%	27/0%	18/27%	10/100%	0
Aptos	4	77	57/8%	178/ 5%	31/53%	6 (no YOY)	24/33%	26/75%	0
Valencia	2	27	49/0%	98/ 0%	38/36%	17/50%	23/0%	38/23%	0
Valencia	3	39	69/0%	118/ 0%	38/75%	10/0%	20/6%	19/47%	0
Aptos Lagoon/ Estuary		164 (114 on 11 Oct; 50 on 18 Oct; 31 recap.)	92 (22 on 9 Oct; 70 on 16 Oct; 7 recap.)	328 (170 on 9 Oct; 158 on 15 Oct; 38 recap.)	276 (129 on 1 Oct; 147 on 8 Oct; 52 recap.)	7 (4 on 1 Oct; 3 on 8 Oct; 0 recap.)	13 (8 on 30 Sep; 5 on 7 Oct; 1 recapture)	80 (78 on 29 Sep; 2 on 6 Oct; 2 marked recapture)	0
Total-Aptos Watershed		351	306	837	417	67	98	173	0 (0% mortality rate)
Aptos Lagoon Estimate**		184	220	707	365	Could not estimate due to no recaptures	40	78	
Pajaro Lagoon		0	0	0	0	0	0	0	0

\* These totals lump small YOY fish with the number of valuable steelhead in the larger size classes II and III that will likely smolt to the ocean the following winter/spring.

\*\* Red print indicates relatively low numbers of YOY for the site.

\*\*\*Soquel Lagoon and Aptos Lagoon/Estuary estimates were based on mark and recapture, using a large bag seine except estimate by catch/unit effort in 2021. Soquel Lagoon steelhead captures were not part of the Santa Cruz County's federal permit. Soquel Lagoon sampling occurred under separate permits and was contracted with the City of Capitola.



Figure 1. Hydrograph of Discharge at the Felton Big Trees Gage on the San Lorenzo River, 1 October 2022 to 30 September 2023.

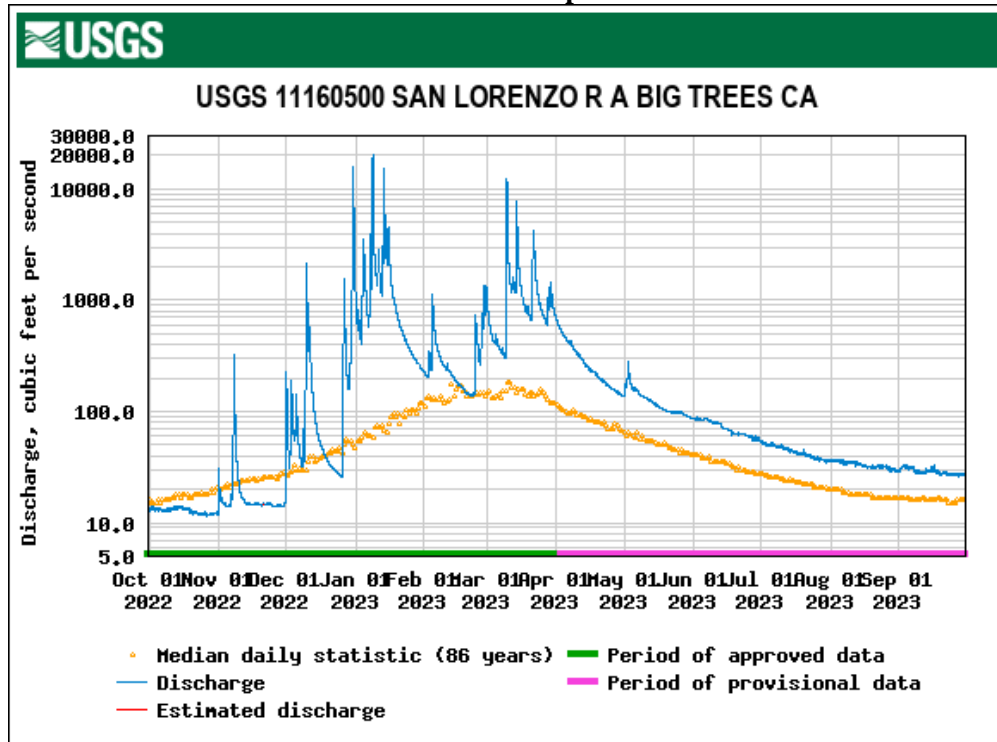
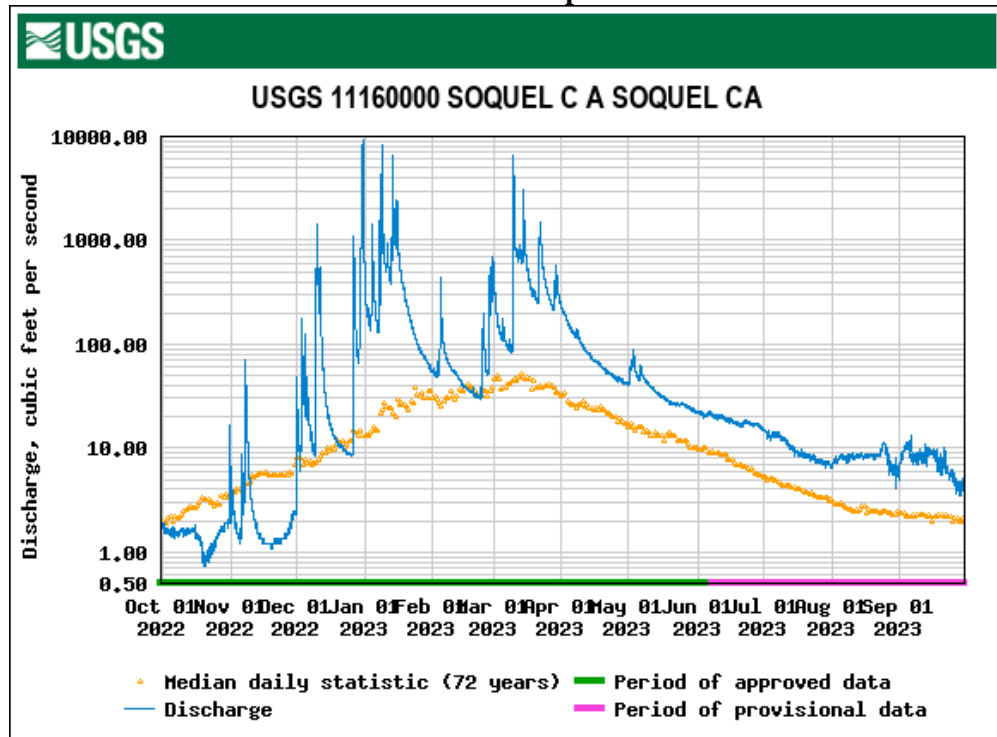


Figure 2. Hydrograph of Discharge at the Soquel Village Gage on Soquel Creek, 1 October 2022 to 30 September 2023.





Aptos Estuary Exiting at the Beach. 6 October 2023



California Halibut with Arrow Gobies, Pajaro Lagoon. 5 October 2023