



# Confluence

**City of Santa Cruz Habitat Conservation Plan  
Lagoon Fish Population Sampling 2024**

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Water Department**

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**Date: June 25, 2025**

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## Santa Cruz Lagoon Study 2024

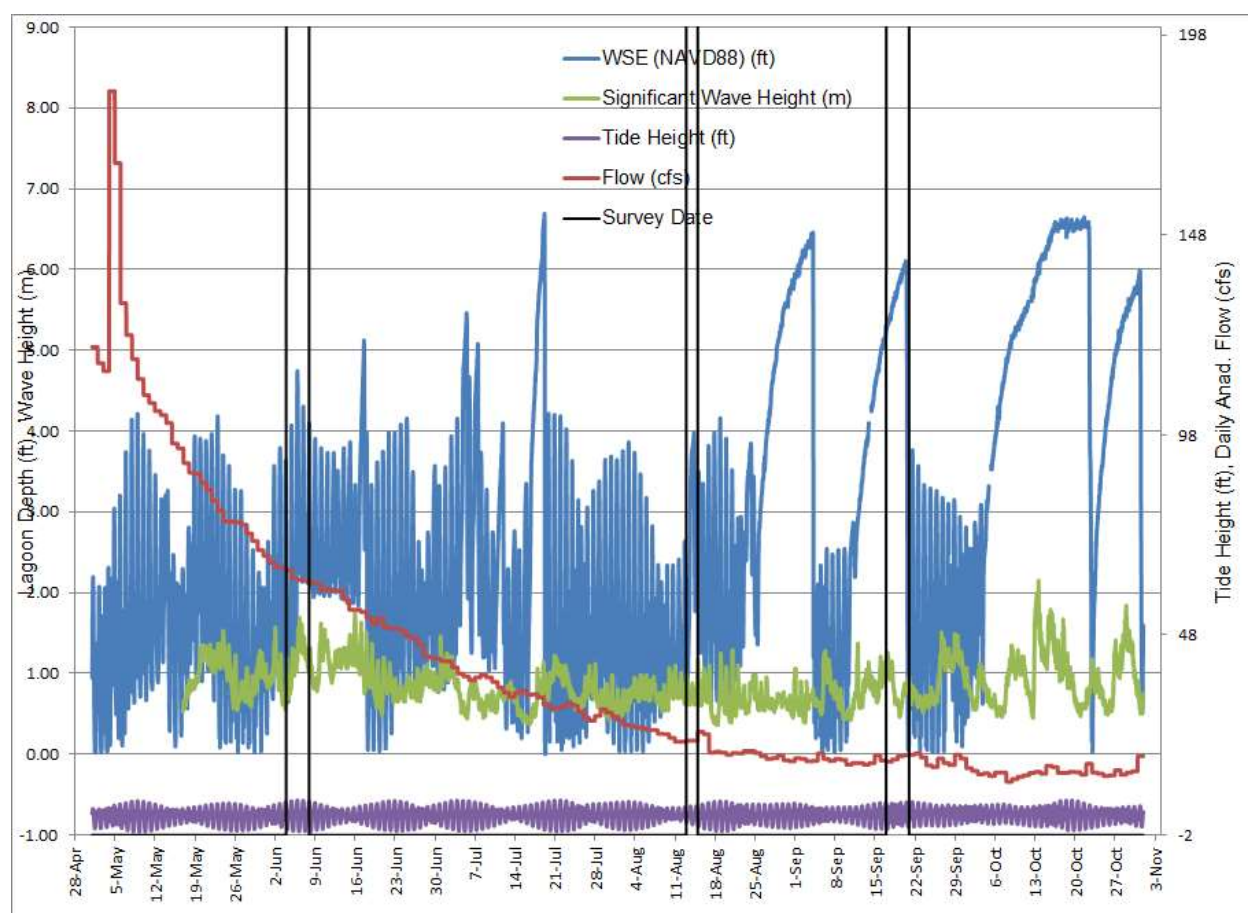
Steelhead (*Oncorhynchus mykiss*) and coho salmon (*O. kisutch*) population abundance and life-history characteristics were assessed in the San Lorenzo River Lagoon and Laguna Creek Lagoon during the summer of 2024 by the City of Santa Cruz Water Department, Confluence Restoration, and Hagar Environmental Science (HES). Mark-recapture abundance surveys were conducted in the early summer (June) and again in the late summer (September) using a large seine to capture fish (46 meter [150 foot] long by 2.4 meter [8 foot] deep), and PIT tag technology to identify recaptures. The net has a mesh size of 3/8 inch. As previously noted in past reports, the net was replaced in July 2021 due to damage and the replacement net of the same dimensions had a somewhat larger mesh (though still sold as 3/8-inch mesh) due to changes in net construction from the supplier. This replacement net may have had a lower capture efficiency for very small young-of-year (YOY) steelhead (less than 80 mm). *O. mykiss* less than 80 mm fork length (FL) young-of-year (YOY) may be under-reported in the catch rates after 2020 compared to sampling in the years prior. This does not affect mark-recapture estimates since fish less than 80 mm are also too small to tag and this size class is excluded from population estimates. Catch per effort estimates may not be comparable if large numbers of YOY are involved (2017 and 2019 in the San Lorenzo River Lagoon and 2011, 2012, 2017 and 2020 in Laguna Creek Lagoon).

In the San Lorenzo River Lagoon, fish were captured and tagged on two consecutive days and recaptured during the subsequent two-day period in June and September. Additional catch-per-effort surveys were conducted in the San Lorenzo River Lagoon during August. July surveys in the San Lorenzo River Lagoon were not completed due to permitting issues. In the smaller Laguna Creek Lagoon, fish were tagged one day and recaptured the next day. These surveys were conducted in June and September.

## San Lorenzo River Lagoon

### Summary

The winter of 2023-2024 had moderately high flows in the San Lorenzo River at Santa Cruz beginning in December and there were three high flow pulses in the February/March timeframe. The lagoon remained open through mid-July, with intermittent, short duration closures occurring prior to that time. There was a brief closure resulting in a breach on July 19. By late August, the lagoon began to close and remained high until a breach on September 4. It began to close again around September 11 and then breached during the last sampling day in September. Through October there were two closure and breach events.



**Figure 1. San Lorenzo River Lagoon stage, streamflow, wave height, and tides 2024 (Source: lagoon stage from City of Santa Cruz Public Works, streamflow from USGS, wave and tide data from NOAA)**

The 2024 season showed a moderate abundance of *O. mykiss* in the lagoon in June, which was within the range of abundances observed from 2016 through 2020 (Table 1, Table 2). Catch rates were the third highest recorded in August but these rates dropped in September. No sampling was conducted in July due to permitting issues. Catch rates were highest in August with higher concentrations of *O. mykiss* around the Trestle bridge (Table 3). One *O. mykiss* captured in June 2024 was originally tagged in September 2023. At the 2023 tagging, it was measured as a 187 mm silvery parr and was subsequently recaptured in June 2024 as a 240 mm resident adult.

Additional information regarding *O. mykiss* movement from the San Lorenzo River Lagoon was provided by the Branciforte Creek Salmonid Tracking Project, funded by the County of Santa Cruz – Fish & Wildlife Advisory Commission and supported by California Trout. Tagged *O. mykiss* passing by the Branciforte Flood Control Channel PIT antenna were recorded by California Trout and checked against this study’s tagging dataset. As of May 2025, 17 *O. mykiss* tagged in the San Lorenzo River Lagoon were detected in Branciforte Creek. In a separate monitoring effort, two *O. mykiss* from the San Lorenzo were detected in Pescadero Creek. (Table A-1).



**Table 1. *O. mykiss* catch per unit effort for the San Lorenzo River Lagoon by month and year (data from HES 2009, HES 2010, HES 2011, HES 2012, HES 2013, HES 2014, HES 2015, HES 2016, HES 2017, HES 2018, HES 2019, HES 2020, HES 2021, HES 2022, HES 2023, and HES 2024)**

	<b><i>O. mykiss</i> Catch per Unit Effort - San Lorenzo River Lagoon</b>				
<b>Year</b>	<b>June</b>	<b>July</b>	<b>August</b>	<b>September</b>	<b>October</b>
2008	2.6	NS	NS	NS	0.1
2009	0.3	NS	NS	1.0	0.5
2010	8.3	21.5	NS	NS	28.3
2011	13.0	NS	NS	NS	2.5
2012	1.7	NS	NS	14.4	NS
2013	2.0	8.4	NS	4.7	NS
2014	1.2	1.1	NS	0.0	NS
2015	2.6	0.0	0.0	NS	0.0
2016	39.7	1.0	2.0	7.8	NS
2017	134.4	452.0	272.0	328.5	NS
2018	23.3	2.5	6.4	6.3	NS
2019	92.2	53.4	277.7	228.2	NS
2020	146.1	120.6	NS	31.0	NS
2021	4.3	6.3	NS	NS	0.3
2022	2.4	20.5	2.3	8.8	NS
2023	5.8	30.8	46.0	24.1	NS
2024	33.1	NS	106.8	15.3	NS
Average	30.2	59.8	89.2	55.8	5.3
Median	5.8	14.5	26.2	11.6	0.4

NS=Not Sampled

**Table 2. *O. mykiss* mark-recapture population estimates in San Lorenzo River Lagoon for fish >80 mm FL and <320 mm FL**

	<b><i>O. mykiss</i> Population Estimate</b>	
<b>Year</b>	<b>Spring</b>	<b>Fall</b>
2011	501	138
2012	60	714 <sup>1</sup>
2013	207 <sup>2</sup>	No estimate <sup>3</sup>
2014	No estimate <sup>4</sup>	None captured
2015	559 <sup>3</sup>	None captured
2016	2,697	1,331
2017	3,636	>3,636 <sup>5</sup>
2018	2,378	704
2019	7,637 <sup>6</sup>	14,105
2020	26,815	18,720
2021	No estimate	No estimate
2022	53	721
2023	444	2,046
2024	2,142	832

Source: data from HES 2012, HES 2013, HES 2014a, HES 2015, HES 2016, HES 2017, HES 2018, HES 2019, HES 2020, HES 2021, HES 2022, HES 2023, and HES 2024

<sup>1</sup> May have been fish entering or leaving lagoon

<sup>2</sup> Low number of marks or recaptures, likely biased

<sup>3</sup> Evidence population not closed, violates assumption of the method

<sup>4</sup> No recaptures

<sup>5</sup> Estimate based on CPUE, mark-recapture estimate not possible, recapture period precluded due to incidental take limitations

<sup>6</sup> Based on proportion of fish in the catch greater and less than 80 mm FL there would have been an estimated 4,504 *O. mykiss* less than 80 mm FL for a total population of 12,141

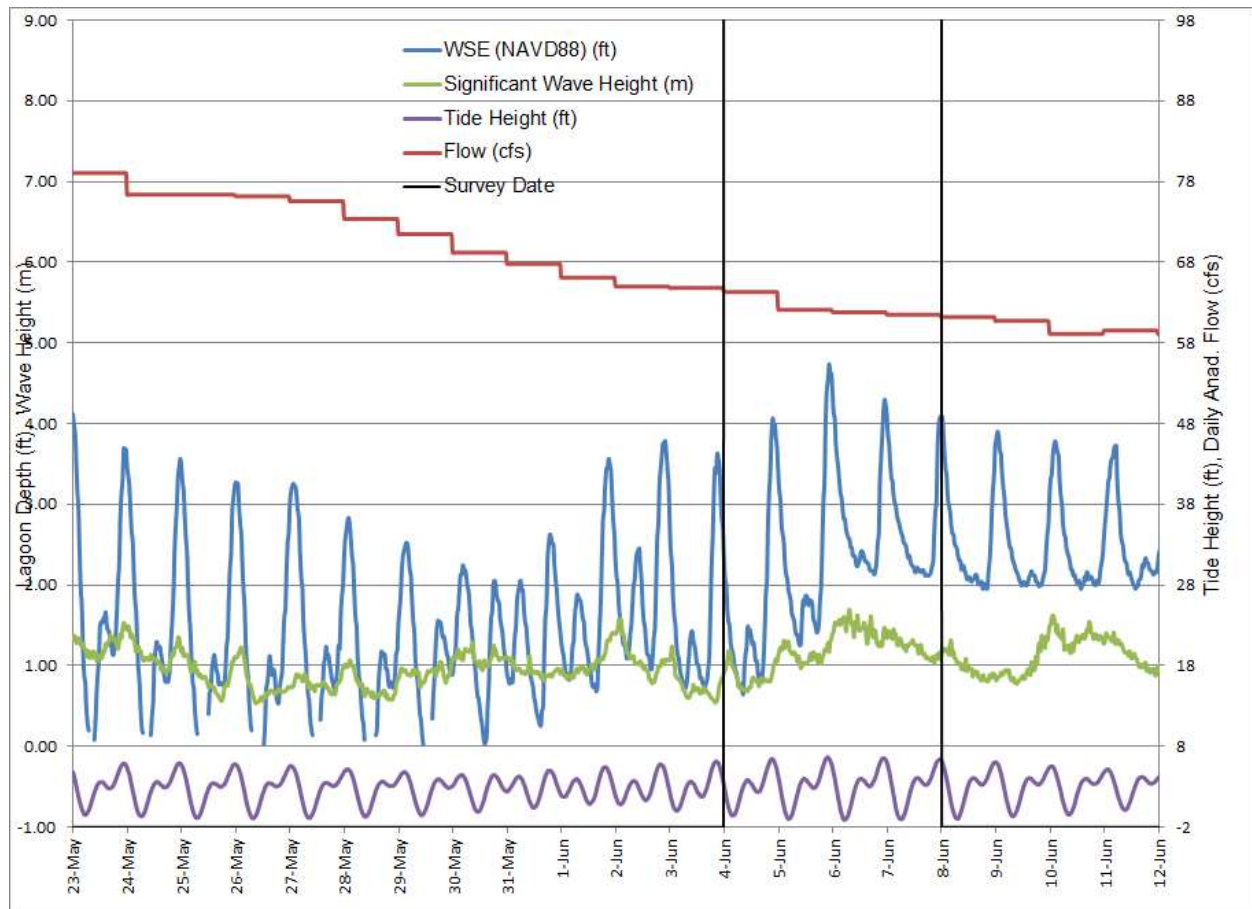
**Table 3. *O. mykiss* catch per haul for the San Lorenzo River Lagoon during 2024**

<b><i>O. mykiss</i> catch per haul for the San Lorenzo River Lagoon during 2024</b>					
<b>Station</b>	<b>Location</b>	<b>June 4-7</b>	<b>Aug 13-14</b>	<b>Sep 19-20</b>	<b>Overall</b>
SL-1	South of Trestle	16.6	8.0	3.5	9.1
SL-2	RR Trestle	91.8	471.0	19.9	104.9
SL-3	Near YSI Station	NS	NS	NS	NS
SL-5	Riverside Drive	40.8	59.7	25.8	36.5
SL-6	U/S Bank Restoration	14.1	11.0	14.6	13.9
	<b>Overall</b>	<b>33.1</b>	<b>106.8</b>	<b>15.3</b>	<b>37.1</b>

**June 2024 Survey (June 4-7)**

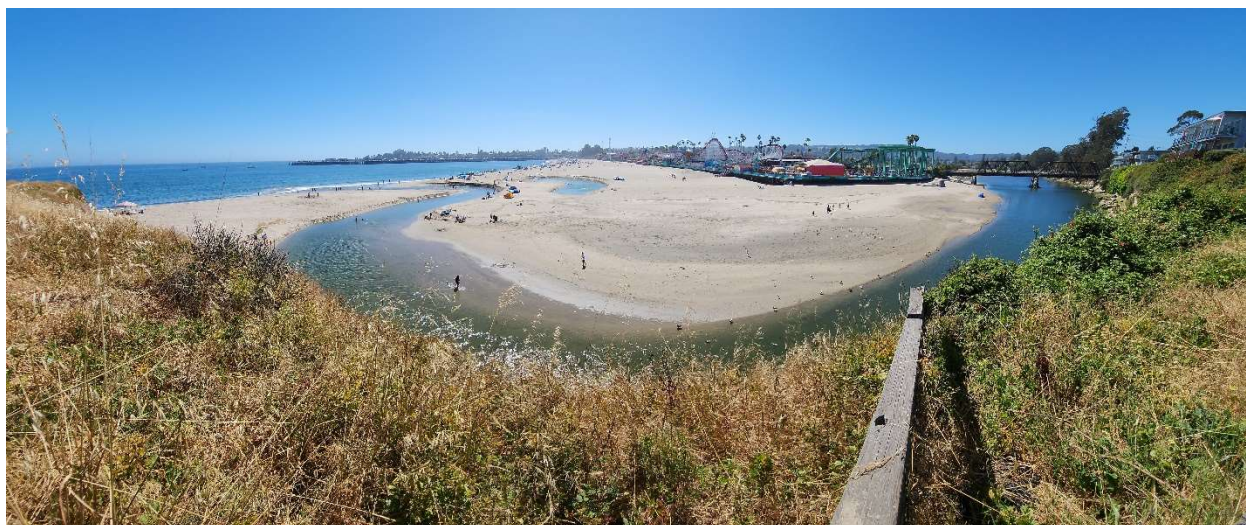
**June (Spring/Early Summer) Site Conditions**

- The lagoon was open and tidal during the June survey (Figure 2, Figure 3, and Figure 4). The stage oscillated with the tides between 0.65 feet and 4.74 feet. The higher lagoon elevations tended to occur during the night hours and did not affect catch efforts but may have influenced catch rates.
- Flow in the San Lorenzo River at Santa Cruz (USGS gage) ranged from 66 cfs on June 4 to 62 cfs at the end of the sampling period on June 7 (Figure 2). Mean flow for June during the period of record (1953-2022) is 34 cfs (historical discharge, USGS site 11161000 San Lorenzo River at Santa Cruz California).
- The open lagoon provided easier access to the sampling sites during the mark period. The hauls were pulled through the deep water along the bluff and finished at the edge of the shelf at the canoe or as a beach finish as the conditions allowed. The lagoon was open during the mark period of sampling upstream of the Riverside Bridge and there were wide sand beaches extending from the bank. These sand beaches continued into the lagoon shoreline creating a shallow shelf into the main channel. Sampling at these sites required a purse seine finish into the canoe at the edge of the shelf. However, during the recapture sampling at the Riverside Bridge sites, the lagoon was beginning to fill resulting in rising lagoon levels. The haul finishes at these sites were therefore completed at the canoe as a purse seine in deeper water due to the beach shelves being inundated. In contrast to previous years, algal growth was minimal and did not hamper sampling efforts.

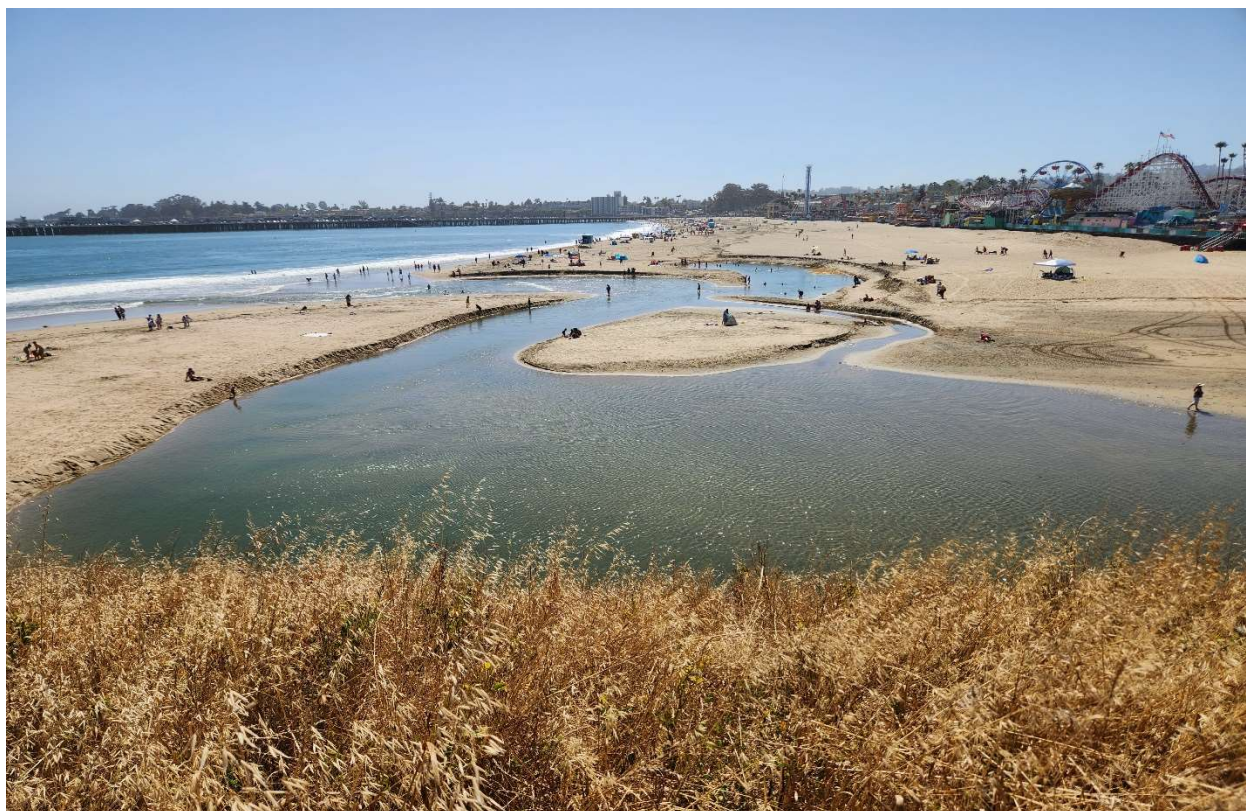


**Figure 2. San Lorenzo River Lagoon stage, streamflow, wave height, and tides around June 2024 sample period (Source: lagoon stage from City of Santa Cruz Public Works, streamflow from USGS, wave and tide data from NOAA)**





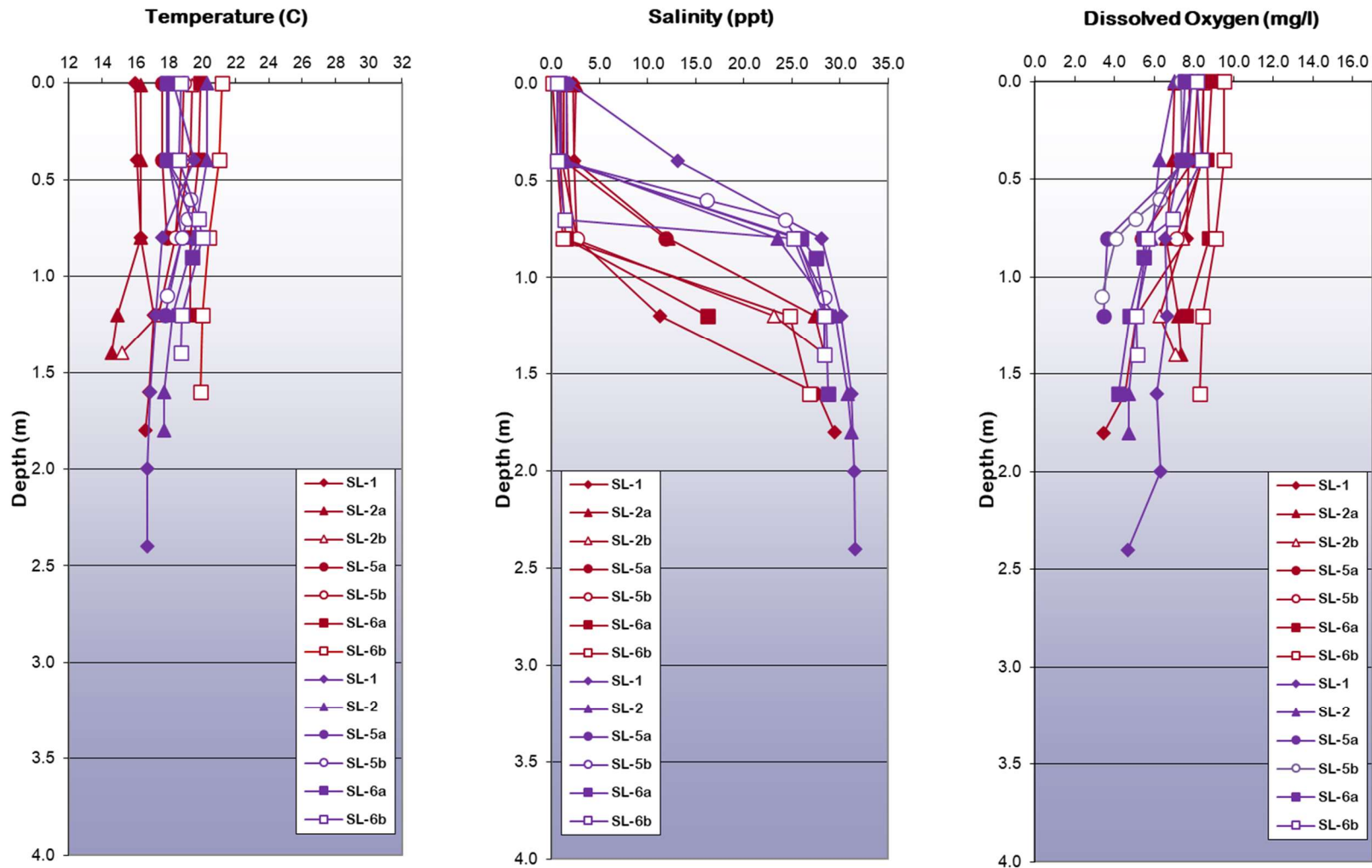
**Figure 3. San Lorenzo River Lagoon mouth June 4, 2024**



**Figure 4. San Lorenzo River Lagoon mouth June 6, 2024. Note the change in configuration in two days as the lagoon was beginning to fill**

- The lagoon showed strong stratification with a freshwater surface layer and notable halocline that began between 0.4 meters (1.3 feet) and 0.8 meters (2.6 feet) deep depending on the sampling stations. Salinity varied from almost fresh at 0.1 ppt to 2.6 ppt in the surface waters and from 16 ppt to 31.6 ppt in the saline layers (Figure 5, center panel).
- The water temperatures were isothermal and ranged from 14.6°C to 21.2°C (Figure 5, left panel). The elevated temperatures were encountered upstream of Riverside Bridge and water quality buoy during the mark phase of the tagging sessions. The air temperature was 32°C, which may have been a contributing factor. Steelhead captured at these stations near the Riverside Bridge were checked for tags but not processed with new tags and were immediately released.
- Dissolved oxygen levels were moderate in the surface layer (0.0 meters to 0.4 meters (1.3 feet) depth), ranging from 6.3 mg/l to 9.5 mg/l (Figure 5, right panel). However, there was a general decrease in dissolved oxygen levels with depth, tracking the increase in salinity (Figure 5, right panel. From 0.8 meters (2.6 feet) to 2.4 meters (7.9 feet), dissolved oxygen levels dropped from a maximum of 8.8 mg/l to a low of 3.4 mg/l just upstream of SL-5 by the Riverside Bridge.
- The secchi depth readings were generally to the substrate, with the deepest at 1.9 meters (6.2 feet). Of the thirteen separate water quality measurements taken, three secchi readings were shallower than the substrate: 1.2 meters (3.9 feet) at 1.8 meters (5.9 feet) depth at SL-1 near the mouth, 1.7 meters (5.6 feet) at 2.4 meters (7.9 feet) depth also near SL-1, and 1.4 meters (4.6 feet) at 1.7 meters (5.6 feet) depth at SL-6 upstream of Riverside Bridge.





**Figure 5. Depth profiles of water quality parameters in the San Lorenzo River Lagoon during June 2024. Profiles plotted in red are June 4-5; profiles in blue are June 6-7**

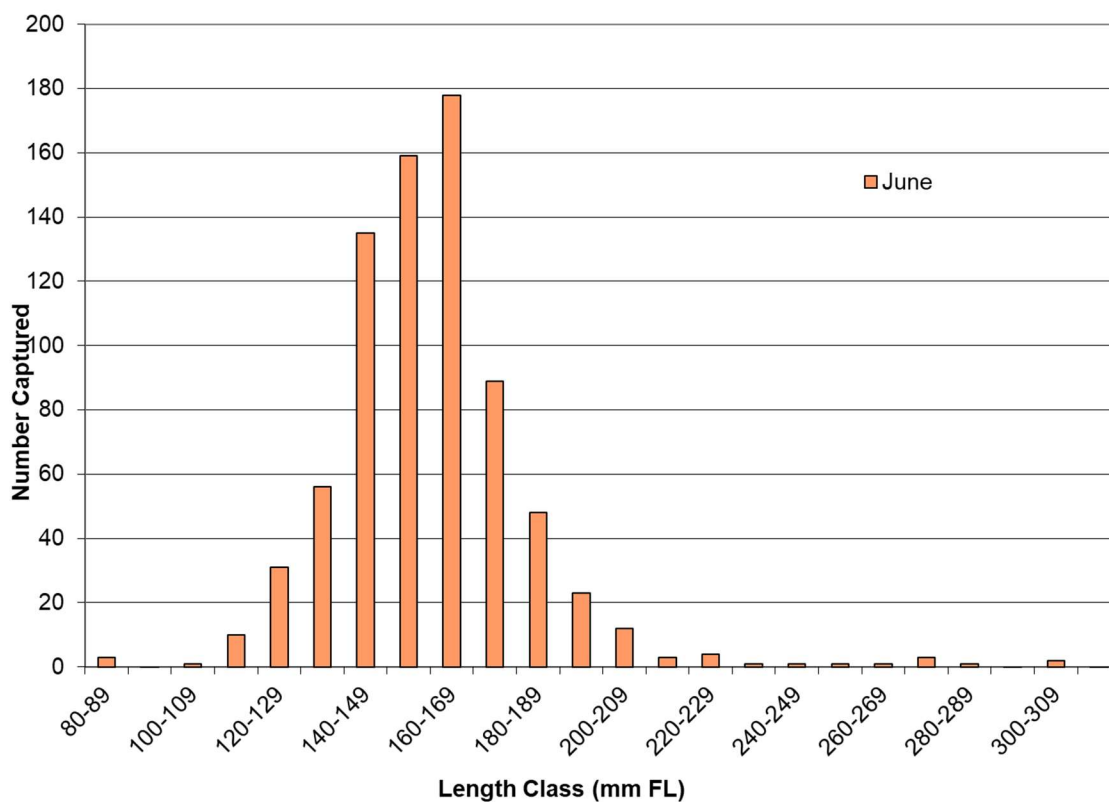
## June Survey Results

- The lagoon was sampled between the beach and the bend upstream of Riverside Bridge on June 4 and June 5 and again on June 6 and June 7. All *O. mykiss* tagged were greater than 90 mm in length
- Twenty-three seine hauls were completed at regularly sampled stations. The lagoon was open and very low throughout this sampling session. The catch was dominated by topsmelt, followed by *O. mykiss*, and shiner surfperch (Table 4). One deceased salmonid was found on the beach towards the lagoon mouth. It measured 80-85 mm, spots on the dorsal side, and large teeth. There were faint parr marks and no adipose was present. The California Trout representative stated that the Monterey Bay Salmon & Trout project was releasing chinook salmon at that time and it was determined that this was likely a chinook from that project.
- *O. mykiss* abundance (CPUE) was 33.1 per haul, which is near the median (30.2) and well above the average (5.8) (Table 1) for all previous June surveys to date. CPUE was highest near the trestle bridge (SL-2) and immediately upstream of Riverside Bridge (SL-5).

**Table 4. Fish catch in the San Lorenzo River Lagoon, June 2024**

	SL-1	SL-2	SL-5	SL-6	Grand Total
<b># Hauls</b>	8	4	4	7	<b>23</b>
<b>Species</b>	<b>Number caught</b>				
<i>O. mykiss</i>	133	367	163	99	<b>762</b>
Pacific herring	1				<b>1</b>
Sacramento sucker			1	1	<b>2</b>
Pacific sardine		3			<b>3</b>
Topsmelt	1,847	1,478	1,099	521	<b>4,945</b>
Threespine stickleback			4	7	<b>11</b>
Bay pipefish		1			<b>1</b>
Staghorn sculpin			3		<b>3</b>
Shiner surfperch		31	71	24	<b>126</b>
Starry flounder		8	1	3	<b>12</b>
Crab	1				<b>1</b>
Crayfish			1		<b>1</b>
Seastar	1				<b>1</b>
<b><i>O. mykiss</i> CPUE</b>	16.6	91.8	40.8	14.1	<b>33.1</b>

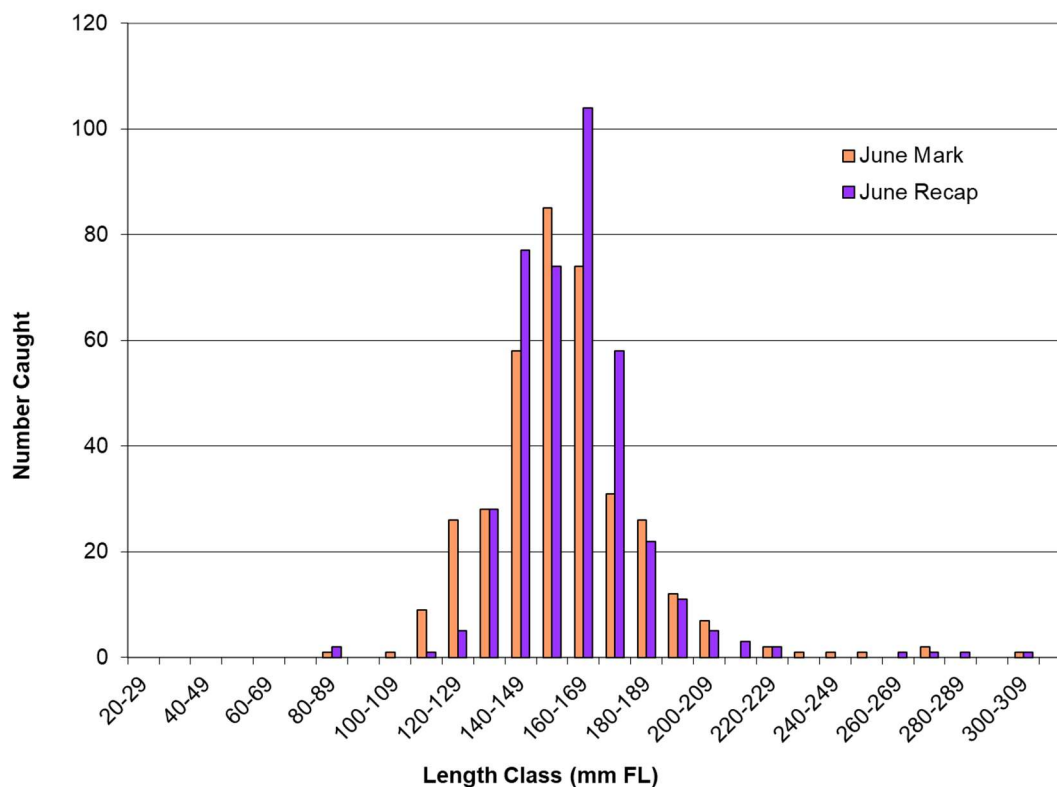
- Most of the *O. mykiss* captured in June were in the 120 mm FL to 180 mm FL size classes (Figure 6). These fish were likely age 1+ and older, consistent with observations in previous years. Four fish in the 80 mm to 109 mm range were likely larger young-of-year (YOY) from early spawning.
- The majority of the catch were advanced parr/advance silvery parr (52%), 39% were classified as parr or advanced parr, and the remaining 3% were smolt or adults.
- All *O. mykiss* captured and evaluated had an adipose fin present, indicating that they were not of hatchery origin.
- Eleven percent of the *O. mykiss* examined had black-spot disease (BSD) lesions, with most very lightly affected. Incidence of BSD has ranged between 11% and 68% in previous spring surveys since 2010.



**Figure 6. *O. mykiss* length classes in the San Lorenzo River Lagoon, June 2024**

## June 2024 *O. mykiss* Population Estimate

- Three hundred sixty-six *O. mykiss* were captured during the marking period (June 4-5). One capture was under the minimum limit for tagging (90 mm). Forty-three were recaptures of fish already tagged during the marking period, six were not tagged due to high temperatures, and three adults were not tagged. Also, one *O. mykiss* recapture was from 2023. Three hundred twelve newly tagged *O. mykiss* were released in the lagoon following the marking period.
- Three hundred ninety-six *O. mykiss* were captured during the recapture period. One was less than the 90 mm tagging limit. Fifty-seven of these fish had tags from the marking period.
- The Peterson population estimate (Ricker 1975) is 2,142 *O. mykiss* in the lagoon in June. The 95% confidence limits for this estimate are 1,660 and 2,762. Size distribution was comparable for the mark and recovery periods (Figure 7). CPUE was somewhat lower in the recapture period than during the marking period (36.6 vs. 30.5). During these surveys, the lagoon was open, which suggests that fish could move in and out of the system and violates the assumption of a closed population. The estimates should be reviewed with caution.
- Changes in CPUE and size distribution between the mark period and recapture period can indicate movement of fish in and out of the lagoon and violation of the assumption of a closed population.



**Figure 7. *O. mykiss* length classes in the San Lorenzo River Lagoon, June 2024 during mark and recapture periods**

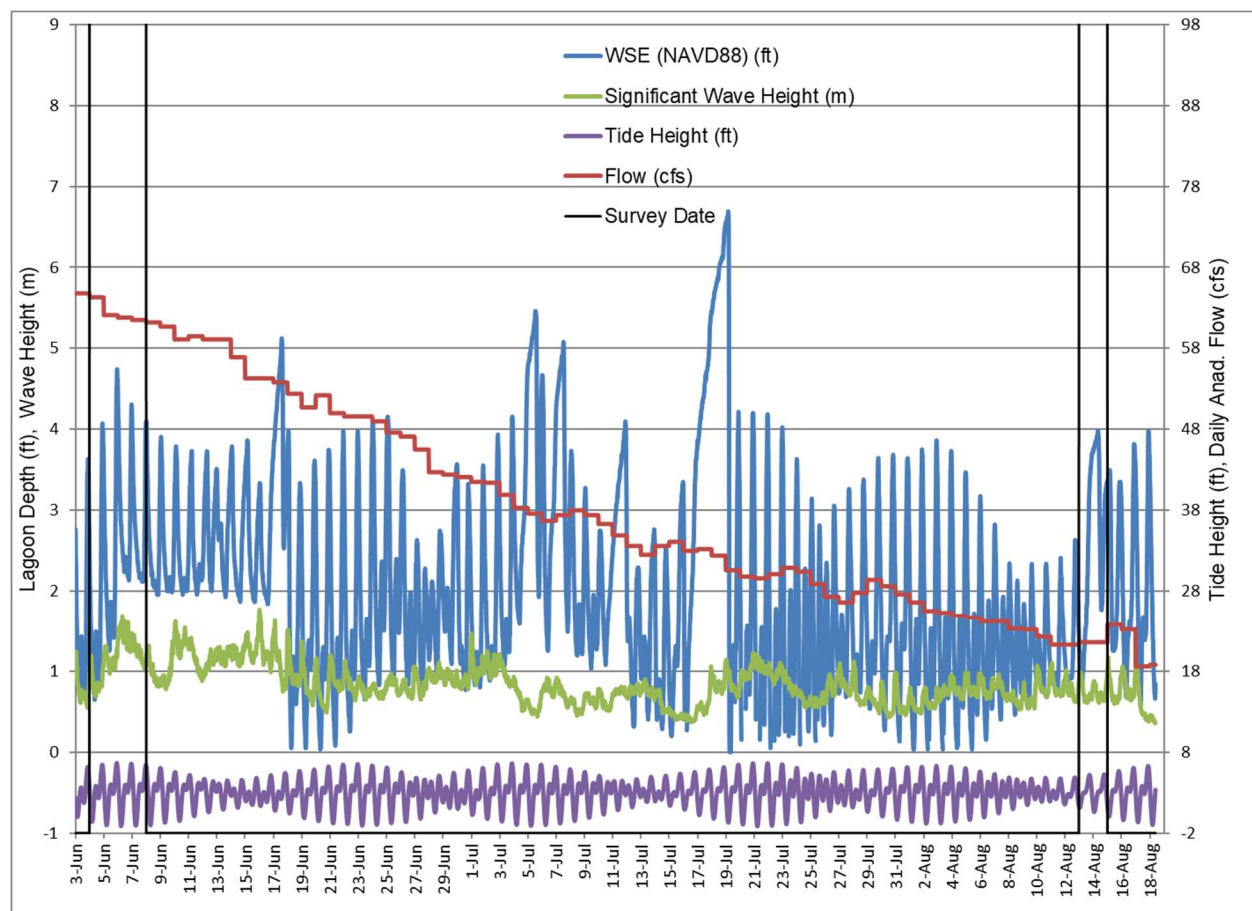
### **August 2024 Survey (August 13-14)**

The August survey was a two-day relative abundance survey without mark-recapture population estimates. Sampling was conducted at standard sampling Stations SL-1 and SL-2, downstream and around the trestle; and Stations SL-5 and SL-6 upstream of the Riverside Bridge. There were no construction or repair activities on the culvert project at the lagoon mouth. Station SL-3 was not sampled due to the high number of fish captured and extended processing time at the hauls complete at Station SL-2. Water temperatures were near the limit at SL-2 and SL-5 and there were large hauls of *O. mykiss* at both these stations. In order to preserve fish health in these large hauls, a subset of the catch was set aside for measurement and tagging. The remainder of these hauls were processed in the net, i.e., scanned for tags and lengths estimated, and released directly back to the lagoon.

### **August Site Conditions**

- The lagoon was open at the start of sampling on August 13 and measured 1.2 feet (Figure 8). It remained open for the duration of sampling on the 13<sup>th</sup> but was closed when sampling began in the morning of August 14. Figure 9 shows the open lagoon mouth on the 13<sup>th</sup> and Figure 10 shows the higher lagoon levels with the closed lagoon the morning of August 14. The high tide was 5.1 feet at 5:30 pm on the 13<sup>th</sup> with the low tide down to 0.7 feet around 1:30 am on the 14<sup>th</sup>. Records indicate that the maximum stage was 4.0 feet around 7:30 am on the 14<sup>th</sup>. Two hours into the sampling upstream of Riverside Bridge on the 14<sup>th</sup>, it was evident that the lagoon had re-opened.
- Inflow from the San Lorenzo River remained at 22 cfs during the August survey (historical discharge, USGS site 11161000 San Lorenzo River at Santa Cruz California) (Figure 8).
- Lagoon salinity ranged from 0.6 ppt to 15.5 ppt in the surface waters (0 meters to 0.4 meters (1.3 feet)) with the highest salinity reading closest to the lagoon mouth (Figure 11, middle panel). There was a strong salinity gradient between 0.4 meters (1.3 feet) and 0.8 meters (2.6 feet) depth and the salinities increased noticeably up to 31.8 ppt (close to full seawater) at depth.
- Water temperatures were adequate for sampling down to 0.4 meters (1.3 feet) depth but rose to peak levels at the top of the halocline before declining somewhat with increased depth (Figure 11, left panel). Surface temperatures (down to 0.4 meters (1.3 feet)) ranged from 16.9°C to 21.1°C. Surface temperatures at the upstream stations (SL-5 and SL-6) ranged from 18.3°C to 20.3°C, and temperatures were warmer below the halocline (20.4°C to 21.5°C).
- Dissolved oxygen was well saturated at the lagoon stations with at least 7 mg/l down to 1.2 meters (3.9 feet). Depressed oxygen levels (below 6 mg/l) were observed at depths below 1.5 meters (4.9 feet) at the lagoon mouth (SL-1) and at the furthest upstream station (SL-6). (Figure 11, right panel).

- Water clarity was down to the substrate at all stations except SL-2 near the trestle bridge where secchi disk visibility was 1.75 meters (5.7 feet) in 1.8 meters of depth. Algae was not significant and did not affect sampling.



**Figure 8. San Lorenzo River Lagoon stage, streamflow, wave height, and tides around August 2024 sample period (Source: lagoon stage from City of Santa Cruz Public Works, streamflow from USGS, wave and tide data from NOAA)**

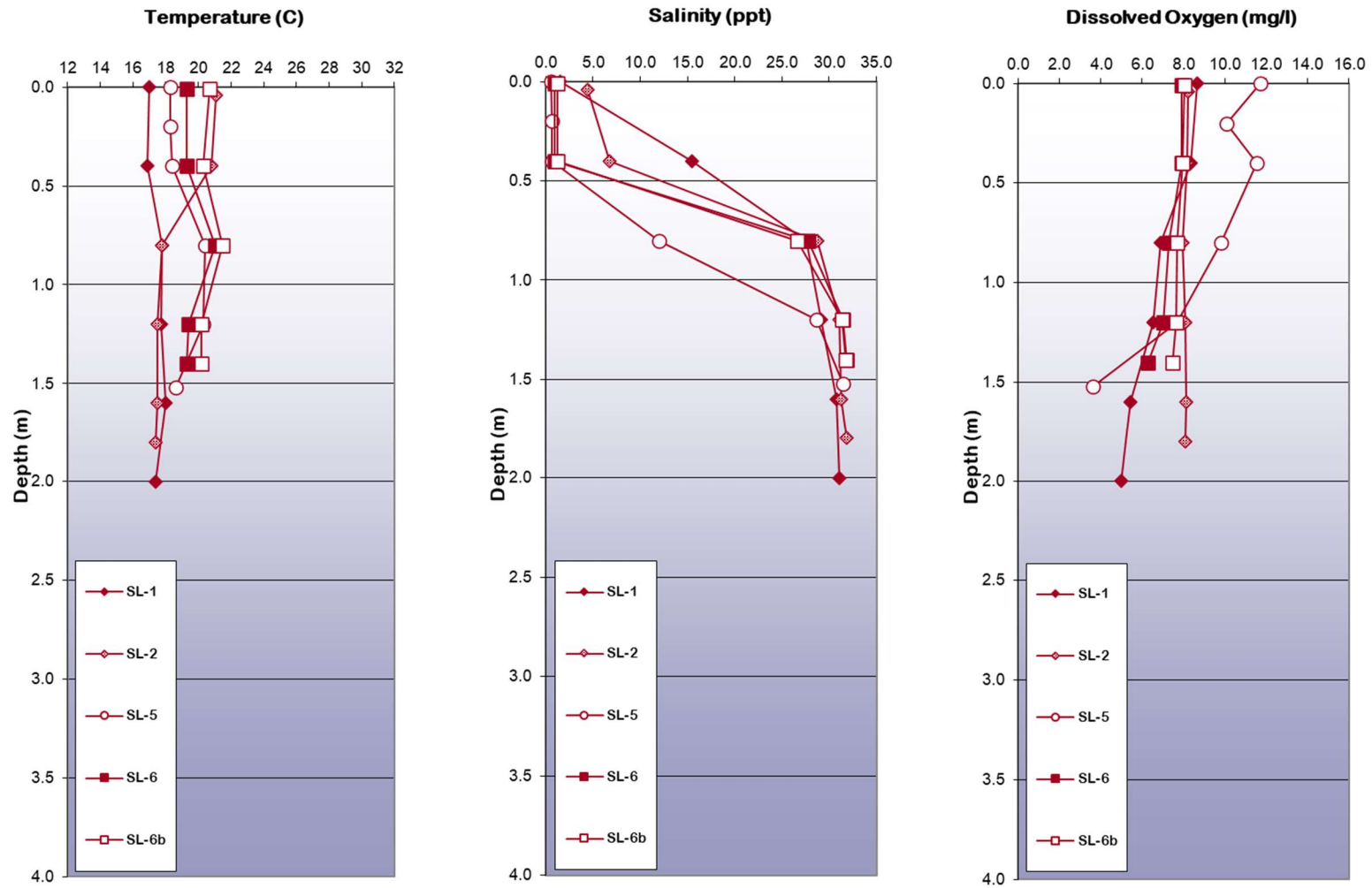




**Figure 9. San Lorenzo River Lagoon mouth August 13, 2024**



**Figure 10. San Lorenzo River Lagoon upstream of Riverside Bridge August 14, 2024**



**Figure 11. Depth profiles of water quality parameters in the San Lorenzo River Lagoon during August 13 and 14, 2024**

## August Survey Results

- Eleven seine hauls were completed between the lagoon mouth beach and upstream of the trestle and upstream of the Riverside bridge (Table 5). The major portion of *O. mykiss* were captured in two hauls: one just downstream of the trestle and one underneath the trestle.

**Table 5. Fish catch in the San Lorenzo River Lagoon, August 2024**

	SL-1	SL-2	SL-5	SL-6	Grand Total
<b># Hauls</b>	4	2	3	2	<b>11</b>
<b><i>Species</i></b>	<b><i>Number caught</i></b>				
<i>O. mykiss</i>	32	942	179	22	<b>1,175</b>
Pacific herring	1				<b>1</b>
Topsmelt	1,327	1,878	308	504	<b>4,017</b>
Shiner surfperch	1		9	14	<b>24</b>
Starry flounder	2				<b>2</b>
Spotfin surfperch			1		<b>1</b>
Shrimp	2				<b>2</b>
Nudibranch	1				<b>1</b>
<b><i>O. mykiss</i> CPUE</b>	<b>8</b>	<b>471</b>	<b>60</b>	<b>11</b>	<b>107</b>

- Due to high density of *O. mykiss* within each of the large hauls by the trestle, subsets were kept for processing and the remainder were scanned for tags while in the net and released due to concerns with water quality and fish health. Recaps were scanned measured and released from the net.
- CPUE was the third highest of the seven surveys conducted in August. CPUE was over three times greater than the June level.
- Topsmelt numbers were high in all the hauls. Shiner surfperch was the second most abundant species, although quite a bit lower than topsmelt.
- Seventy *O. mykiss* captured in August were tagged in June (Table 6). Growth rates averaged 0.38 mm/day and ranged from 0.13 mm/day to 0.63 mm/day. This is lower than the 2023 average of 0.88 mm/day for the same sample time period but within the range of growth rates observed in the San Lorenzo Lagoon (Table 7).
- One recapture was originally tagged September 19, 2023 as a smolt and measured 257 mm at that time. It was recaptured on August 13, 2024 in the same area and had grown to 328 mm and was identified as an ocean adult.

**Table 6. *O. mykiss* tagged in June and recaptured in August 2024**

Previous Capture Date	Recapture Date	Initial Capture Location	Recapture Location	Initial Length (mm)	Length at Recapture (mm)	Growth Rate (mm/day)
6/07/2024	8/13/2024	SL-6	SL-2	127	169	0.63
6/07/2024	8/13/2024	SL-6	SL-2	128	166	0.57
6/05/2024	8/14/2024	SL-6	SL-5	130	158	0.40
6/07/2024	8/13/2024	SL-6	SL-2	130	167	0.55
6/07/2024	8/13/2024	SL-5	SL-2	134	171	0.55
6/04/2024	8/13/2024	SL-2	SL-2	134	176	0.60
6/04/2024	8/13/2024	SL-2	SL-2	137	164	0.39
6/04/2024	8/13/2024	SL-1	SL-2	138	184	0.66
6/06/2024	8/13/2024	SL-2	SL-2	140	165	0.37
6/05/2024	8/14/2024	SL-5	SL-5	142	171	0.41
6/04/2024	8/13/2024	SL-1	SL-2	142	190	0.69
6/06/2024	8/13/2024	SL-2	SL-2	142	178	0.53
6/05/2024	8/13/2024	SL-5	SL-2	143	180	0.54
6/04/2024	8/13/2024	SL-1	SL-2	144	173	0.41
6/06/2024	8/13/2024	SL-2	SL-2	144	179	0.51
6/07/2024	8/13/2024	SL-6	SL-2	145	175	0.45
6/04/2024	8/13/2024	SL-1	SL-2	147	188	0.59
6/05/2024	8/13/2024	SL-5	SL-2	148	183	0.51
6/05/2024	8/13/2024	SL-5	SL-2	149	183	0.49
6/06/2024	8/13/2024	SL-2	SL-2	150	184	0.50
6/04/2024	8/13/2024	SL-1	SL-2	151	186	0.50
6/04/2024	8/13/2024	SL-1	SL-2	151	179	0.40
6/04/2024	8/13/2024	SL-1	SL-2	151	175	0.34
6/04/2024	8/13/2024	SL-2	SL-2	151	182	0.44
6/07/2024	8/13/2024	SL-6	SL-2	153	175	0.33
6/04/2024	8/13/2024	SL-1	SL-2	153	182	0.41
6/05/2024	8/13/2024	SL-5	SL-2	154	183	0.42
6/05/2024	8/13/2024	SL-5	SL-1	154	197	0.62
6/04/2024	8/13/2024	SL-1	SL-2	155	185	0.43
6/04/2024	8/13/2024	SL-1	SL-2	156	186	0.43
6/05/2024	8/13/2024	SL-5	SL-2	158	170	0.17
6/05/2024	8/13/2024	SL-5	SL-2	158	186	0.41
6/04/2024	8/13/2024	SL-1	SL-2	158	183	0.36

**Table 6. *O. mykiss* tagged in June and recaptured in August 2024 (cont.)**

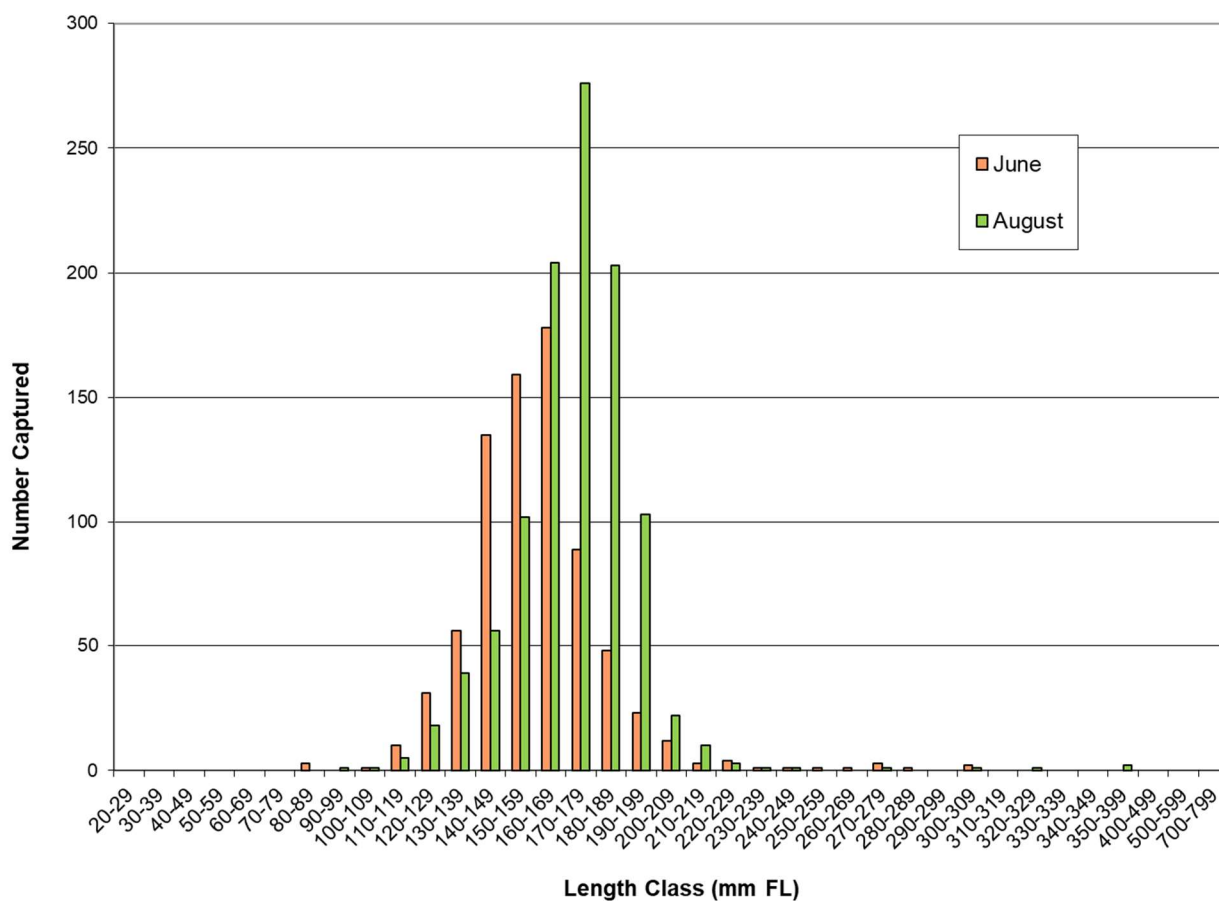
6/07/2024	8/13/2024	SL-6	SL-2	160	179	0.28
6/04/2024	8/13/2024	SL-1	SL-2	160	191	0.44
6/07/2024	8/13/2024	SL-6	SL-2	160	174	0.21
6/04/2024	8/13/2024	SL-1	SL-2	161	188	0.39
6/06/2024	8/13/2024	SL-2	SL-2	163	183	0.29
6/05/2024	8/14/2024	SL-5	SL-5	164	201	0.53
6/05/2024	8/13/2024	SL-5	SL-2	164	200	0.52
6/04/2024	8/13/2024	SL-1	SL-2	165	184	0.27
6/06/2024	8/13/2024	SL-2	SL-2	165	193	0.41
6/05/2024	8/13/2024	SL-6	SL-2	165	188	0.33
6/05/2024	8/13/2024	SL-6	SL-2	165	177	0.17
6/07/2024	8/13/2024	SL-6	SL-2	165	187	0.33
6/06/2024	8/13/2024	SL-2	SL-2	166	184	0.26
6/05/2024	8/13/2024	SL-5	SL-2	166	185	0.28
6/06/2024	8/13/2024	SL-2	SL-2	168	188	0.29
6/04/2024	8/13/2024	SL-2	SL-2	168	182	0.20
6/04/2024	8/13/2024	SL-1	SL-2	169	184	0.21
6/06/2024	8/13/2024	SL-2	SL-2	172	205	0.49
6/06/2024	8/13/2024	SL-2	SL-2	172	188	0.24
6/05/2024	8/13/2024	SL-5	SL-2	173	201	0.41
6/05/2024	8/13/2024	SL-5	SL-2	173	193	0.29
6/04/2024	8/13/2024	SL-2	SL-2	175	193	0.26
6/04/2024	8/13/2024	SL-1	SL-2	175	194	0.27
6/06/2024	8/13/2024	SL-2	SL-2	176	200	0.35
6/04/2024	8/13/2024	SL-1	SL-2	178	199	0.30
6/04/2024	8/13/2024	SL-1	SL-2	178	199	0.30
6/04/2024	8/13/2024	SL-1	SL-2	180	197	0.24
6/05/2024	8/13/2024	SL-5	SL-2	181	195	0.20
6/04/2024	8/13/2024	SL-1	SL-2	182	196	0.20
6/04/2024	8/13/2024	SL-1	SL-2	182	196	0.20
6/04/2024	8/13/2024	SL-1	SL-2	183	203	0.29
6/04/2024	8/13/2024	SL-1	SL-2	188	207	0.27
6/07/2024	8/13/2024	SL-6	SL-2	188	211	0.34
6/04/2024	8/13/2024	SL-1	SL-2	190	211	0.30
6/04/2024	8/13/2024	SL-1	SL-2	195	214	0.27
6/06/2024	8/13/2024	SL-2	SL-2	210	209	0.00
6/06/2024	8/13/2024	SL-2	SL-2	226	235	0.13
<b>Average</b>						<b>0.38</b>

**Table 7. *O. mykiss* Growth Rates for Years Available**

Year	Period	N	Average Growth (mm/day)	Range (mm/day)
2012	June-Sept	4	0.72	0.58-0.84
2013	June-Sept	2	0.34	0.27-0.41
2014		None captured		
2015		None captured		
2016	June-Sept	21	0.90	0.45-1.14
2017	June-July	35	0.78	0.42-1.16
	July-Aug	18	0.62	0.34-1.00
	Aug-Sept	15	0.40	0.05-0.73
	June-Sept	40	0.46	0.02-0.86
2018	June-July	2	0.98	0.88-1.08
	June-Aug	6	0.55	0.38-0.69
	June-Sept	10	0.39	0.26-0.49
2019	June-July	33	0.56	0.14-1.06
	July-Aug	57	0.45	0.04-0.89
	Aug-Sept	85	0.36	0.00-0.75
	June-Sept	88	0.38	0.03-0.85
2020	June-July	5	0.51	0.27-0.69
	July-Sept	3	0.45	0.25-0.58
	June-Sept	5	0.41	0.22-0.62
2021	June-July	1	0.26	
2022	June-July	2	0.30	0.21-0.38
	July-Aug	1	0.20	
	Jun-Aug	1	0.18	
2023	Jun-Jul	2	1.18	1.00-1.37
	Jun-Aug	4	0.88	0.69-1.04
	Jun-Sept	6	0.68	0.46-0.85
	Jul-Sept	7	0.24	0.06-0.48
	Aug-Sept	7	0.21	0.03-0.43
2024	Jun-Aug	70	0.38	0.13-0.63
	Jun-Sept	14	0.37	0.16-0.64
	Aug-Sept	18	0.28	0.03-0.46



- Lengths were measured and/or estimated for 89% of the *O. mykiss* catch. Assuming that the length distribution of the measured steelhead was representative of the entire catch, the shift in size distribution was consistent with measured growth rates.
- The majority of the catch were advanced parr/advance silvery parr (59%), 37% were classified as parr or advanced parr, and the remaining 4% were smolt or adults.
- All *O. mykiss* examined had an adipose fin, indicating they were not of hatchery origin.
- Eleven percent of the individuals examined had black spot disease (BSD) lesions of varying severity. Incidence of BSD in the San Lorenzo River Lagoon has ranged between 8% and 72% in annual surveys since 2009.
- The parasitic copepod, *Lernaea*, was present on one *O. mykiss*.



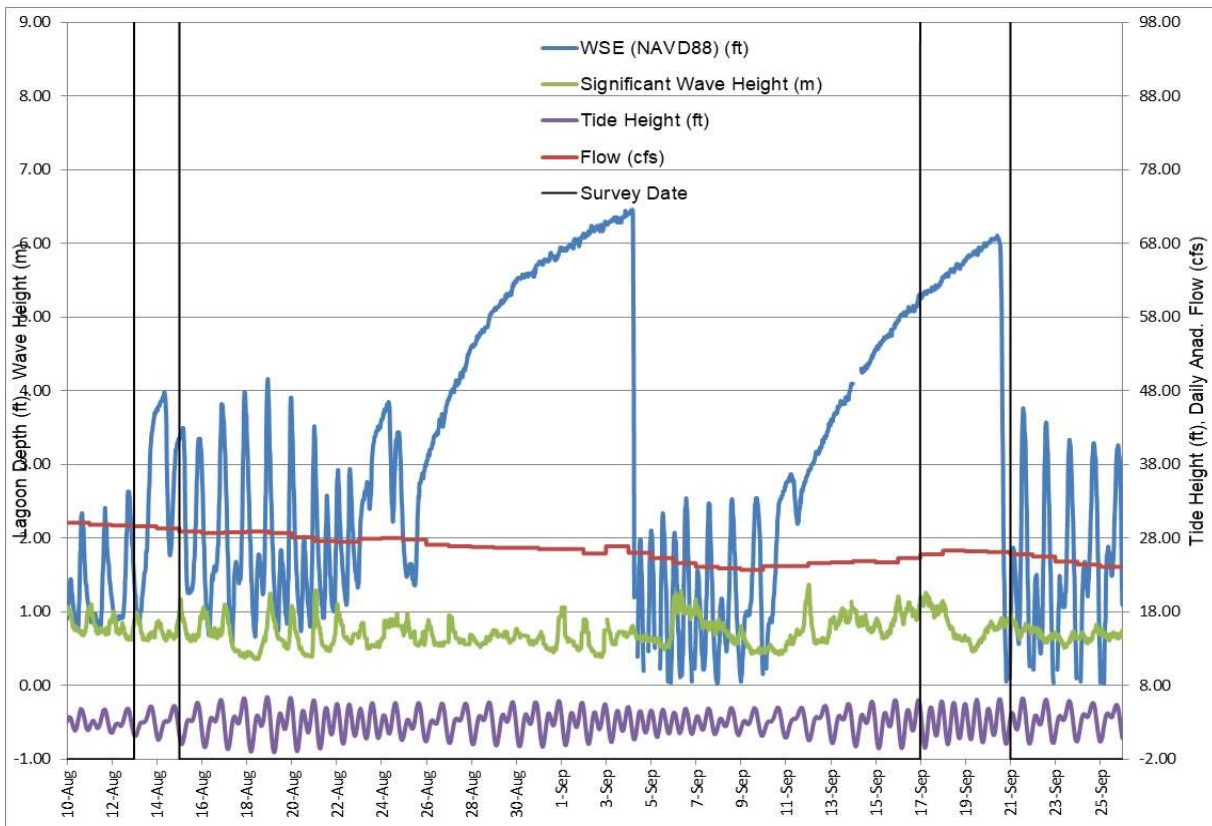
**Figure 12. *O. mykiss* length classes in the San Lorenzo River Lagoon, June and August 2024**

## September 2024 Survey (September 17-20)

### September Site Conditions

The September sampling was a complete survey with mark-recapture population estimates. Sampling was conducted twice at standard sampling Stations SL-1 and SL-2, downstream and around the trestle; and Stations SL-5 and SL-6 upstream of the Riverside Bridge. *O. mykiss* were captured and tagged on September 17 and 18 and the sites then resampled on September 19 and 20 for recaptures.

There was a major lagoon closure after the August survey that lasted approximately 11 days. After that closure and subsequent breach, there were open and tidal conditions until the lagoon began to close around September 11. The lagoon was closed when sampling began on September 17 (Figure 13, 14, 15). The lagoon opened during the last day of sampling on September 20 (Figure 15). Flow in the San Lorenzo River varied from 22 cfs at the end of the August survey to 16 cfs at the beginning of the September survey on September 17 (historical discharge, USGS site 11161000 San Lorenzo River at Santa Cruz California).



**Figure 13. San Lorenzo River Lagoon stage, streamflow, wave height, and tides around September 2024 sample period (Source: lagoon stage from City of Santa Cruz Public Works, streamflow from USGS, wave and tide data from NOAA)**



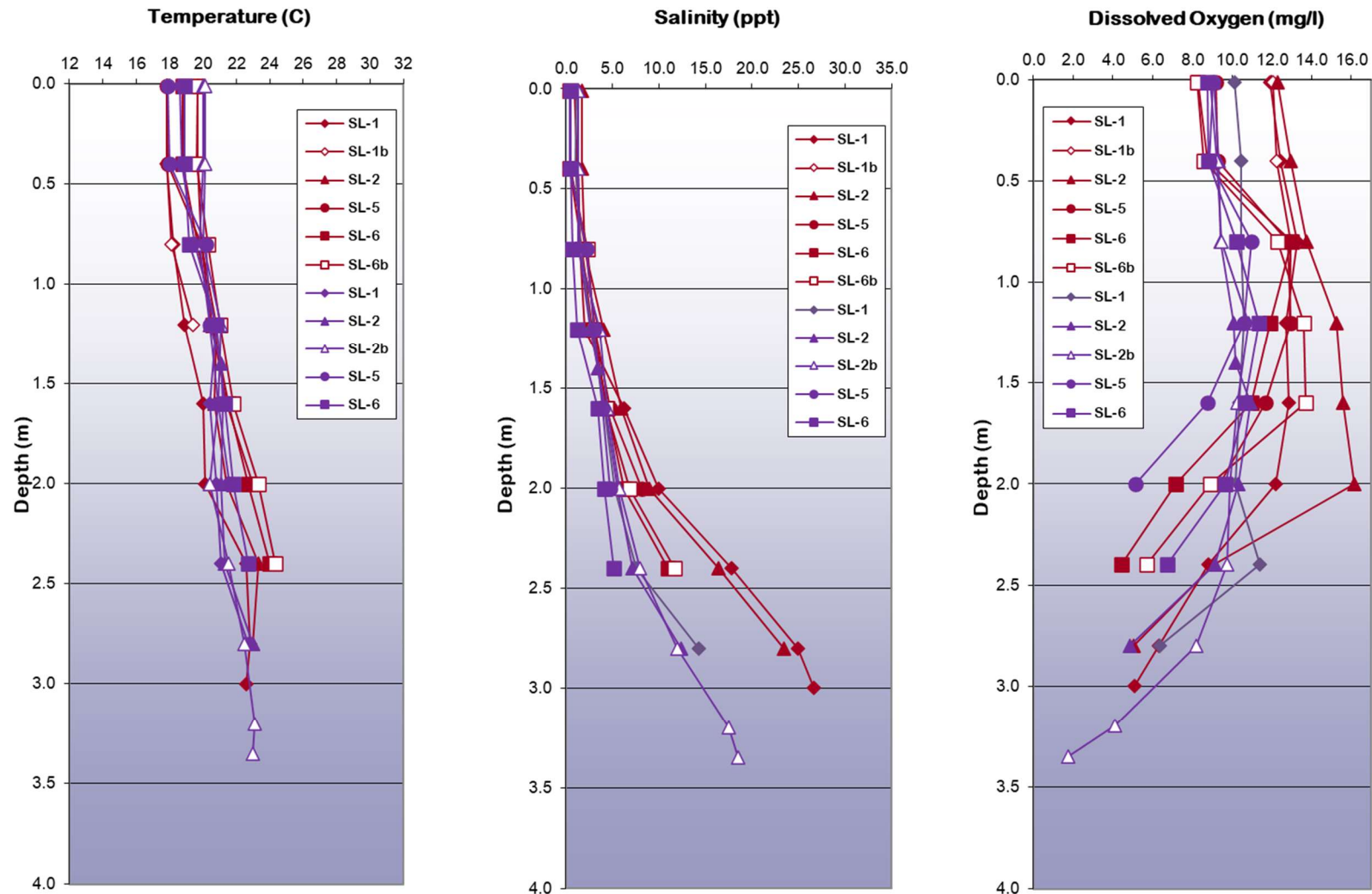
**Figure 14. San Lorenzo River Lagoon mouth September 17, 2024**



**Figure 15. San Lorenzo River Lagoon mouth September 20, 2024 at 3:00pm after sampling had concluded**

## September (Late Summer) Site Conditions

- The lagoon remained closed through the September sampling survey and water levels rose through the survey period. On the last day, September 20, the lagoon reached a maximum of 6.1 feet at 5:30 am and remained at that level for at least six hours. It began to gradually open during the last haul upstream of the Riverside Bridge (SL-6) was being completed on September 20. During the survey period, the daily average flow was 16 cfs to 18 cfs (historical discharge, USGS site 11161000 San Lorenzo River at Santa Cruz California).
- Salinity was low and relatively un-stratified through the lagoon during the sampling events, with increased salinity observed at depth. Salinities ranged from 0.4 ppt to 2.2 ppt in the shallower waters upstream of the Riverside Bridge, whereas salinities at these same depths varied from 1.1 ppt to 1.6 ppt closer to the lagoon mouth. At these lower lagoon stations (SL-1 and SL-2) maximum salinities of 12.4 ppt to 18.3 ppt were observed. These measurements were more reflective of a riverine influence than the influx of marine waters (Figure 14, center panel).
- Water temperatures were adequate and in a suitable range for *O. mykiss* in the lagoons and generally well-mixed. There was a slight increase in temperature at depth with a maximum of 24.3°C at 2.4 meters (7.9 feet) depth at Station SL-6, furthest upstream from the Riverside Bridge (Figure 14, left panel).
- Dissolved oxygen was somewhat stratified, with increases at 0.8 meters (2.6 feet) especially during the mark period and then decreasing at depths below 1.6 meters (5.2 feet). Surface dissolved oxygen levels ranged from 8.25 mg/l to 12.3 mg/l and mid-water column (1.2 meters (3.9 feet) to 2.4 meters (7.9 feet)) dissolved oxygen varied from 10.1 mg/l to 9.1 mg/l. The lowest readings were observed at depth near the substrate, with the lowest reading 1.74 mg/l in 3.4 meters (11.2 feet) of water by the trestle (SL-2) in the lower lagoon (Figure 14, right panel).
- Water clarity was to the bottom during only two of the eleven measurement periods (2.4 meters (7.9 feet) at SL-6 during the tagging period and 2.1 meters (6.9 feet) at SL-5 during the recapture period). Secchi depths ranged from 0.9 meters (2.9 feet) to 2.0 meters (6.6 feet) in water depths of 1.2 meters (3.9 feet) to 3.35 meters (11 feet). Generally, the shallower secchi readings were observed at the deeper waters closer to the lagoon mouth.



**Figure 14. Depth profiles of water quality parameters in the San Lorenzo River Lagoon during September 2024. Profiles plotted in red are September 17-18; profiles in blue are September 19-20**



## September (Late Summer) Survey Results

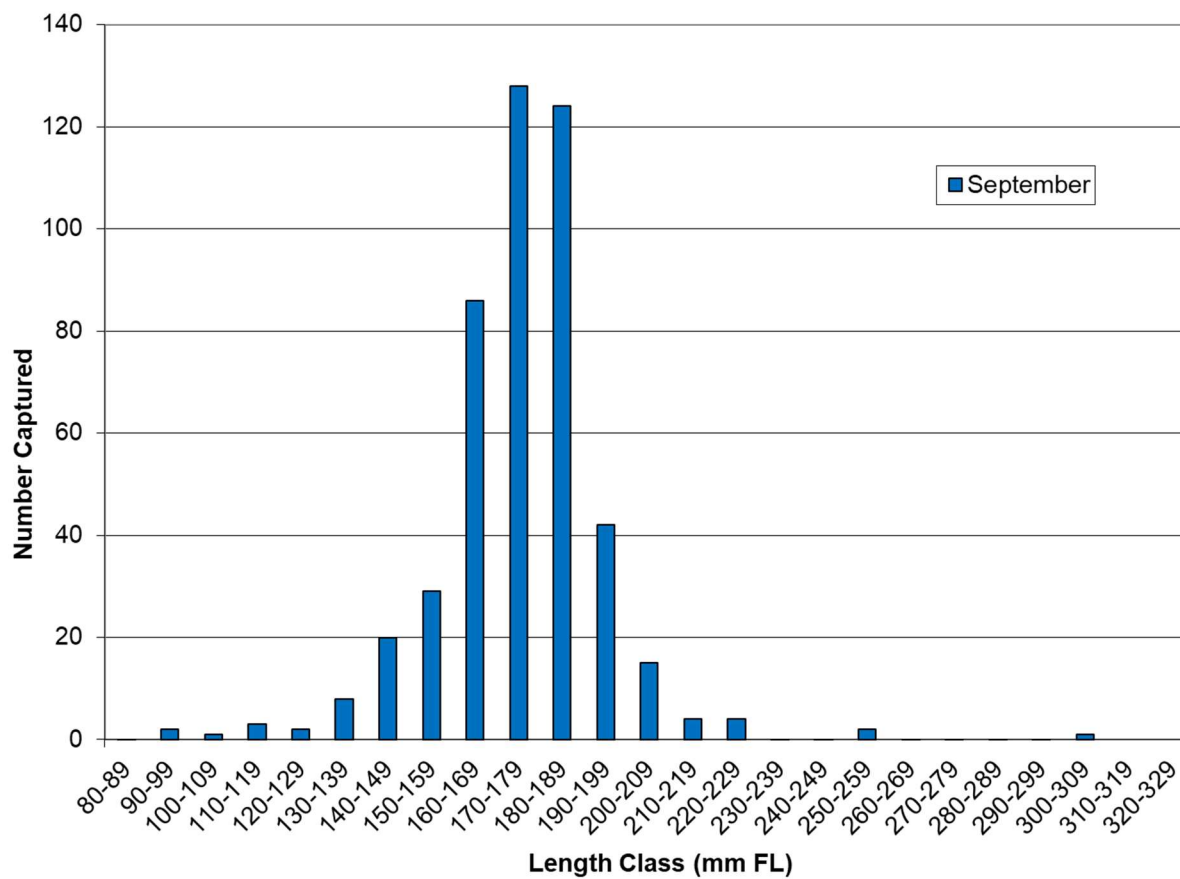
- Thirty-one seine hauls were completed at the regularly sampled stations (SL-1, SL-2, SL-5, and SL-6) from September 17 to September 20. The catch was dominated by topsmelt and *O. mykiss* (Table 8). Topsmelt captured were almost double the number in June and August.

**Table 8. Fish catch in the San Lorenzo River Lagoon, September 2024**

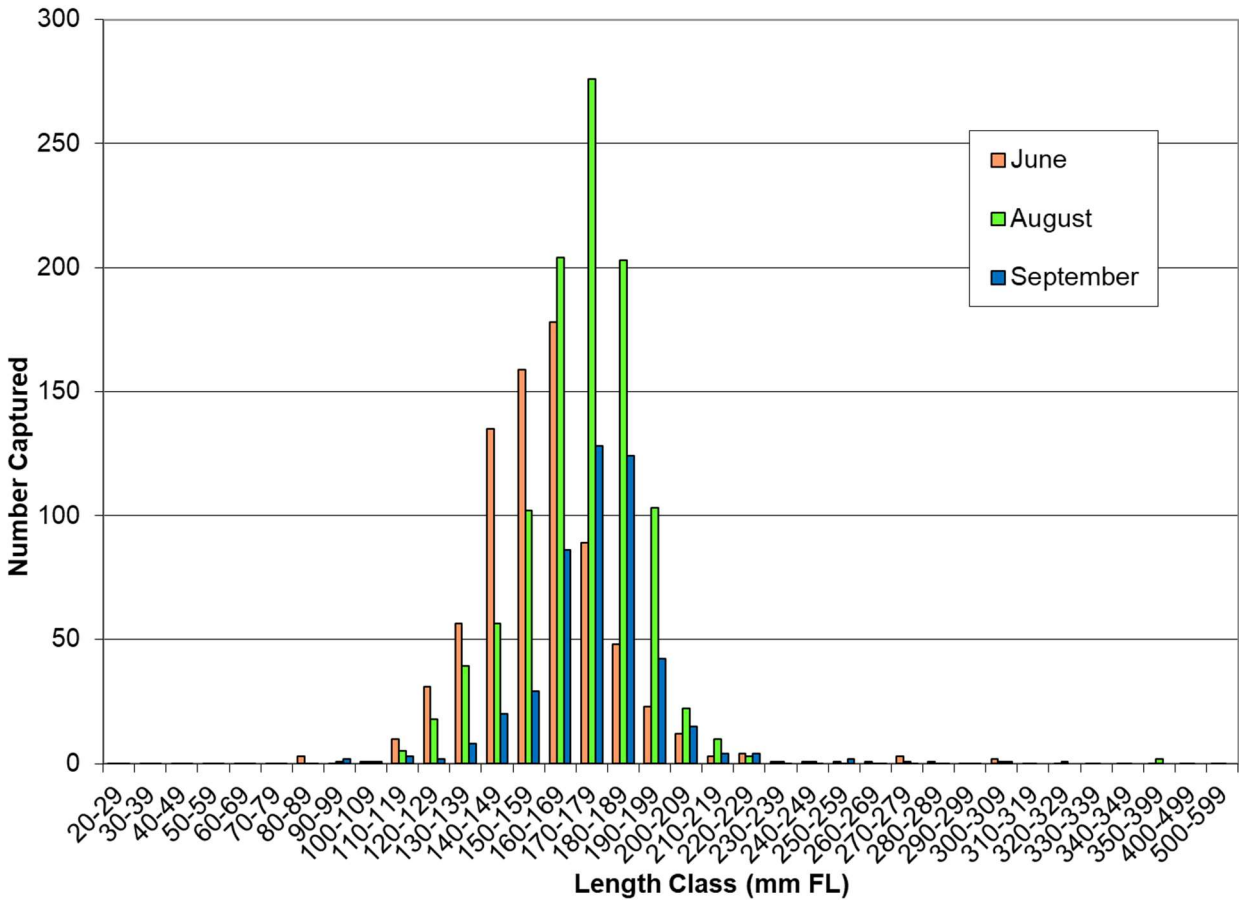
	SL-1	SL-2	SL-5	SL-6	Grand Total
<b># Hauls</b>	10	8	8	5	<b>31</b>
<b><i>Species</i></b>	<b><i>Number caught</i></b>				
<i>O. mykiss</i>	35	159	206	73	<b>473</b>
Sacramento sucker	1		1	1	<b>3</b>
Topsmelt	1,230	3571	2,549	550	<b>7,900</b>
Staghorn sculpin	2		1		<b>3</b>
Shiner surfperch	19	9			<b>28</b>
Starry flounder	3	1	2	5	<b>11</b>
Crab		1		1	<b>2</b>
<b><i>O. mykiss</i> CPUE</b>	3.5	19.9	25.8	14.6	<b>15.3</b>

- *O. mykiss* CPUE was moderate for September surveys with four years having higher CPUE and seven years having lower (Table 1). The September CPUE was the lowest of the three 2024 sampling sessions (Table 3).
- The size distribution in September was nearly uni-modal with a possible break around 180-189 mm (Figure 15). Smaller fish generally have faster growth rates than larger fish so this could have caused the young-of-year fish to cluster toward older fish in the length distribution. Based on observed growth rates, young-of-year could have grown as much as 70 mm between the June and September sampling dates (Figure 16).





**Figure 15. *O. mykiss* length classes in the San Lorenzo River Lagoon, September 2024**



**Figure 16. *O. mykiss* length classes in the San Lorenzo River Lagoon, June, August, and September 2024**

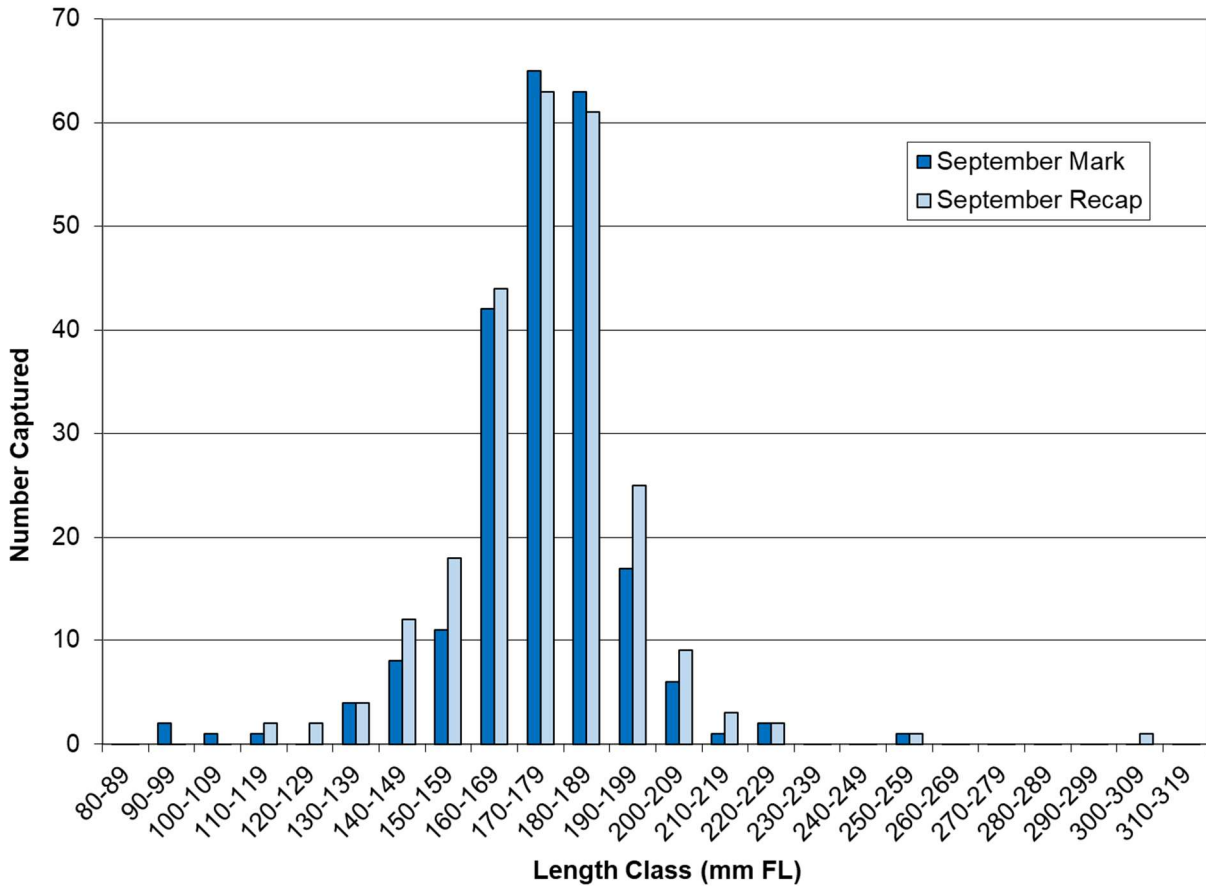
- Thirty-six *O. mykiss* captured in September had been tagged earlier in the summer. Thirty-one of these had length information that allowed growth calculations (Table 9). This indicates that *O. mykiss* may have remained in the lagoon all summer even through the breaches or may have returned to the lagoon by September. Growth rates of *O. mykiss* captured in June appeared to be higher than growth between August and September (Table 9). This observation is consistent with previous years (Table 7).
- Five percent of *O. mykiss* examined were classified as parr or advanced parr, 93% were classified as silvery parr or advance silvery parr, and 2% (6 fish) were classified as adults.
- All *O. mykiss* captured had an adipose fin present, indicated that they were not of hatchery origin.
- Nine percent of *O. mykiss* examined had black-spot disease (BSD) lesions, most were only lightly affected. Incidence of BSD has ranged between 4% and 100% and averaged 36% in previous fall surveys since 2009

**Table 9. *O. mykiss* tagged in June and August and recaptured in the San Lorenzo River Lagoon  
September 2024**

Previous Capture Date	Recapture Date	Initial Capture Location	Recapture Location	Initial length (mm)	Length at Recapture (mm)	Growth Rate (mm/day)
6/04/2024	9/18/2024	SL-2	SL-5	122	187	0.61
6/05/2024	9/20/2024	SL-5	SL-5	123	191	0.64
6/05/2024	9/20/2024	SL-5	SL-5	130	180	0.47
6/07/2024	9/18/2024	SL-5	SL-6	134	180	0.45
6/06/2024	9/20/2024	SL-2	SL-5	143	190	0.44
6/07/2024	9/19/2024	SL-5	SL-2	145	168	0.22
6/04/2024	9/18/2024	SL-1	SL-6	147	194	0.44
6/05/2024	9/19/2024	SL-5	SL-2	152	216	0.60
6/06/2024	9/17/2024	SL-2	SL-1	163	185	0.21
6/07/2024	9/17/2024	SL-6	SL-2	165	196	0.30
6/04/2024	9/18/2024	SL-1	SL-5	169	186	0.16
6/04/2024	9/19/2024	SL-2	SL-1	173	199	0.24
6/06/2024	9/18/2024	SL-2	SL-5	173	193	0.19
6/04/2024	9/20/2024	SL-1	SL-5	175	197	0.20
<b>Average</b>						<b>0.37</b>
8/14/2024	9/20/2024	SL-5	SL-5	133	145	0.32
8/14/2024	9/20/2024	SL-5	SL-5	133	144	0.30
8/14/2024	9/18/2024	SL-5	SL-5	133	147	0.40
8/14/2024	9/20/2024	SL-6	SL-5	142	157	0.41
8/14/2024	9/20/2024	SL-5	SL-5	153	162	0.24
8/14/2024	9/18/2024	SL-5	SL-5	153	160	0.20
8/14/2024	9/20/2024	SL-5	SL-5	160	175	0.41
8/14/2024	9/18/2024	SL-6	SL-6	161	164	0.09
8/13/2024	9/18/2024	SL-2	SL-5	167	175	0.22
8/14/2024	9/20/2024	SL-5	SL-5	173	183	0.27
8/13/2024	9/20/2024	SL-1	SL-5	176	191	0.39
8/13/2024	9/18/2024	SL-1	SL-6	176	188	0.33
8/14/2024	9/18/2024	SL-5	SL-5	176	182	0.17
8/14/2024	9/20/2024	SL-5	SL-5	183	194	0.30
8/13/2024	9/18/2024	SL-1	SL-5	186	187	0.03
8/13/2024	9/19/2024	SL-2	SL-1	188	193	0.14
8/13/2024	9/17/2024	SL-2	SL-2	212	228	0.46
<b>Average</b>						<b>0.27</b>

### September 2024 *O. mykiss* Population Estimate

- A total of 224 *O. mykiss* were captured during the marking period of September 17 and September 18. Twelve were recaps of fish tagged previously during the marking period. A total of 212 *O. mykiss* were tagged (including 7 recaps from June and 11 from August). All fish captured were scanned, measured, tagged (if appropriate), and released. There were no mortalities during tagging.
- A total of 249 *O. mykiss* were captured during the recapture period, with 63 of those were tagged during the marking period
- The Peterson population estimate (Ricker 1975) is 832 *O. mykiss* in the lagoon in September. The 95% confidence limits for this estimate are 653 and 1,060. This abundance estimate is within the mid-range of the twelve years where fall sampling surveys have been completed on the San Lorenzo Lagoon (Table 2). During these surveys, the lagoon was open, which suggests that fish could move in and out of the system and violates the assumption of a closed population. The estimates should be reviewed with caution.
- The size distribution was similar during the mark and recapture periods (Figure 17)
- Changes in CPUE and size distribution between the mark and recapture periods can be indicative of movement of fish in and out of the lagoon. The CPUE during the recapture period was less than half measured during the marking period (15.3 vs. 33.1), which would indicate fewer fish in the lagoon.
- Increasing lagoon stage between the mark and recapture periods could have accounted for the decline in CPUE. Also, since the lagoon breached at least three times and was also tidal between June and September, this was not a closed population.

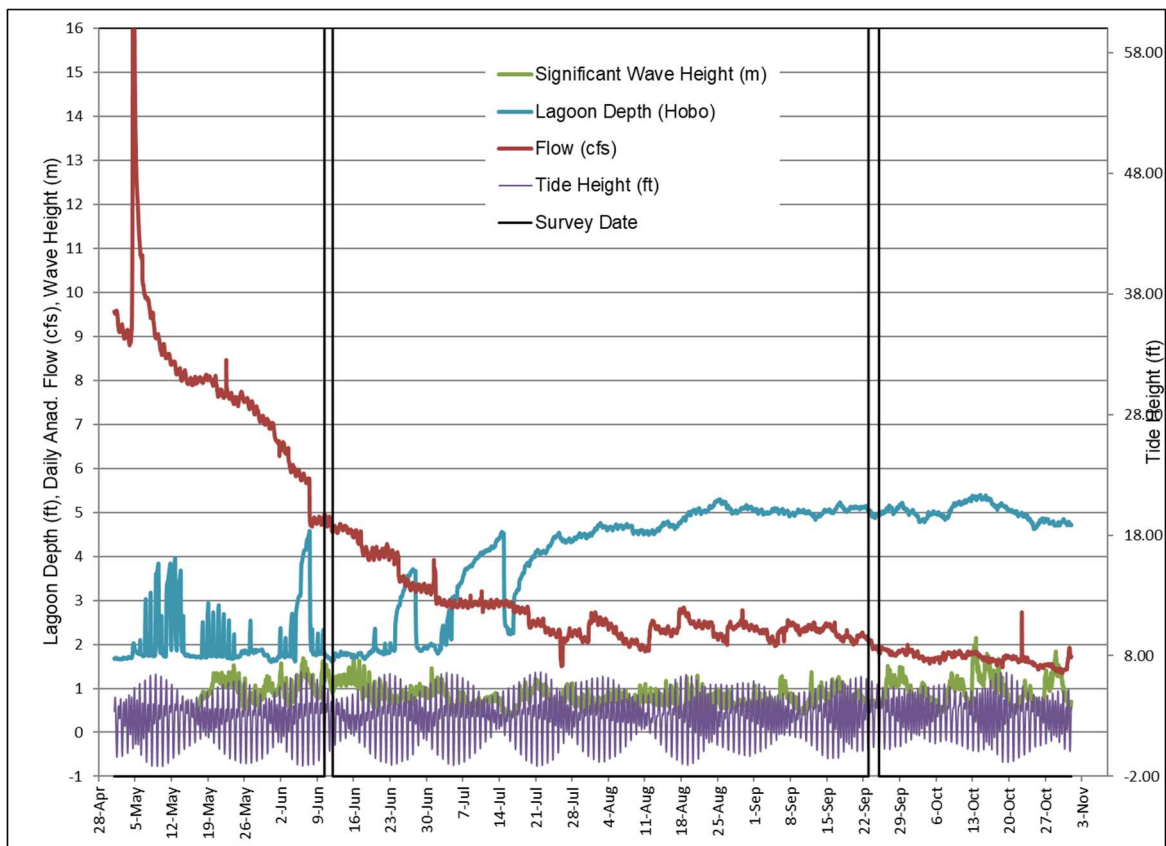


**Figure 17. *O. mykiss* length classes in the San Lorenzo River Lagoon, September 2024 mark and recapture periods**

## Laguna Creek Lagoon

### Summary

The winter of 2023-2024 resulted in spring high flows in Laguna Creek with mean daily flow exceeding 4 cfs through mid-June (Figure 18) (City of Santa Cruz stream monitoring data, Laguna Creek anadromous gage). The lagoon breached on December 28, 2023 and was open through May 4, 2024 when there were a series of short, daily closures – likely tidal - through June 4, 2024 (City of Santa Cruz lagoon depth record). Based on lagoon elevation records, there appeared to be a brief closure of about 3 to 4 days from June 4 to June 7, just before the June survey. The lagoon reopened about 2 1/2 days prior to the June survey and lagoon levels appeared to fluctuate tidally until the beginning of sampling on June 10. The lagoon was open at the time of June sampling and had a long finger extending parallel to the beach to the northwest, eventually intersecting the ocean just below the access road. The lagoon breached twice between the June and September surveys, with the significant closure beginning on July 16. The closed lagoon levels in September 2024 were comparable to conditions encountered in September 2023.



**Figure 18. Laguna Creek Lagoon stage, streamflow, wave height, and tides 2024 (Source: lagoon stage from City of Santa Cruz, streamflow from City of Santa Cruz, wave and tide data from NOAA)**



*O. mykiss* abundance (CPUE) was the highest of all of the annual spring survey dates and second highest for the fall surveys (Table 8). Population estimates were the highest for the spring surveys (710) and very close to the third highest for the fall surveys (Table 9). The lagoon had breached twice between the June and September sampling, suggesting that there may have been movement of *O. mykiss* out of the system. Catch rates were higher in the spring with greater concentrations of *O. mykiss* mid-lagoon in the deeper waters (Table 10). Higher capture probability in spring due to confined lagoon and easier capture due to a shallower, less extensive lagoon. Four *O. mykiss* captured in June 2024 were originally tagged in 2023 (Table 12). Three were originally tagged in June 2023 and one was tagged in September 2023. No *O. kisutch* were captured in 2024.

Additional information regarding *O. mykiss* movement from Laguna Creek Lagoon was provided by California Trout and NOAA. As of May 2025, four *O. mykiss* tagged in Laguna Creek Lagoon were detected in other watersheds: one was detected in Branciforte Creek, one was detected in Pescadero Creek, and two were detected by NOAA in Scott Creek. (Table A-1).

**Table 8. *O. mykiss* and coho salmon (*O. kisutch*) catch per unit effort for the Laguna Creek Lagoon by month and year (data from HES 2009, HES 2010, HES 2011, HES 2012, HES 2013, HES 2014, HES 2015, HES 2016, HES 2017, HES 2018, HES 2019, HES 2020, HES 2021, HES 2022, HES 2023, and HES 2024)**

	<b><i>O. mykiss</i> Catch per Unit Effort - Laguna Creek Lagoon</b>				<b>Coho (<i>O. kisutch</i>) Catch per Unit Effort - Laguna Creek Lagoon</b>			
<b>Year</b>	<b>June</b>	<b>July</b>	<b>September</b>	<b>October</b>	<b>June</b>	<b>July</b>	<b>September</b>	<b>October</b>
2004	NS	NS	NS	NS	NS	NS	0	NS
2008	11.0	NS	6.0	NS	0	NS	0	NS
2009	7.0	NS	19.0	NS	0	NS	0	NS
2010	13.0	NS	NS	1.7	0	NS	NS	0
2011	19.8	NS	NS	0.1	0	NS	NS	0
2012	11.3	NS	10.3	NS	0	NS	0	NS
2013	28.0	NS	8.6	NS	0	NS	0	NS
2014	20.0	NS	33.0	NS	0	NS	0	NS
2015	0.1	NS	NS	11.4	0	NS	NS	0
2016	1.1	NS	5.2	NS	0	NS	0	NS
2017	42.8	NS	14.5	NS	0	NS	0	NS
2018	14.3	NS	6.5	NS	0	NS	0	NS
2019	17.0	NS	2.5	NS	0	NS	0	NS
2020	56.8	NS	11.4	NS	1.4	NS	0	NS
2021	8.4	NS	5.4	NS	1.7	NS	1.1	NS
2022	4.4	NS	14.9	NS	0	NS	0	NS
2023	36.4	NS	19.1	NS	0.2	NS	0	NS
2024	50.9	NS	16.7	NS	0	NS	0	NS

NS – Not Sampled

**Table 9. *O. mykiss* mark-recapture population estimates in Laguna Creek Lagoon for fish >80 mm FL and <320 mm FL (Source: HES annual survey reports 2012-2023)**

	<b><i>O. mykiss</i> mark-recapture population abundance estimates in Laguna Creek Lagoon for fish &gt;80 mm FL and &lt;320 mm FL</b>	
<b>Year</b>	<b>Spring</b>	<b>Fall</b>
2011	300	Early breach, insufficient catch
2012	Open lagoon, insufficient catch	370
2013	499	259
2014	256	828
2015	0	267
2016	45	136
2017	641	548
2018	193	242
2019	Breaching lagoon, insufficient recaps	Open lagoon, insufficient catch
2020	Insufficient recaps, open population(?)	668
2021	Insufficient recaps, open population(?)	245
2022	168	373
2023	563	973
2024	710	665

**Table 10. *O. mykiss* catch per haul for the Laguna Creek Lagoon during 2024**

	<b><i>O. mykiss</i> catch per haul for Laguna Creek Lagoon</b>			
<b>Station</b>	<b>Location</b>	<b>Jun 10-11</b>	<b>Sep 23-24</b>	<b>Overall</b>
LA-1	Lower lagoon	1.2	8.4	5.4
LA-1.5	Mid-lagoon	99.6	35.3	75.5
LA-2	Lagoon channel	53.5	17.2	27.6
LA-3	near YSI station	NS	NS	NS
	<b>Overall</b>	<b>50.9</b>	<b>16.7</b>	<b>31.9</b>

NS = Not Sampled

### **June 2024 Survey (June 10-11)**

#### **June (Spring/Early Summer) Site Conditions**

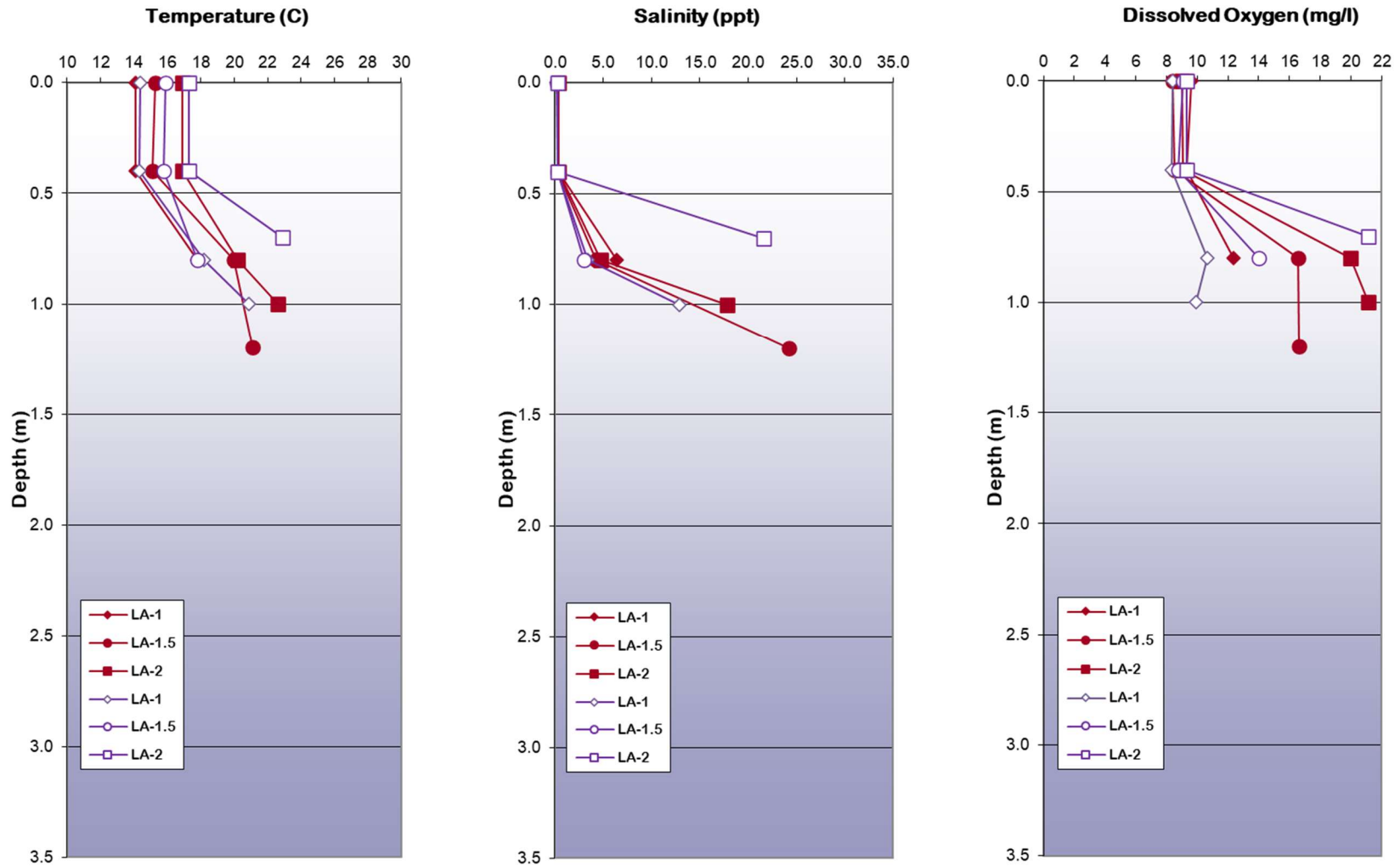
- The mouth was open and the stage was low. Similar to 2023, the outlet channel extended north along the beach before discharging into the ocean (Figure 19, Figure 20). Stage ranged from 1.61 to 1.80 during the June survey (Figure 18).
- The water depth was shallow with greatest depths up to 1.2 meters (3.9 feet) along the rock bluff and the edge of the marsh upstream towards the water quality buoy/recorder.
- Algal growth was minimal in the lower lagoon and was moderate to dense in the upstream sampling locations. The algal densities encountered in the upstream channel station (LA-1.5) required up to 20 minutes of net clearing before all of the fish could be sorted and removed.
- Inflow from Laguna Creek ranged from 4.57 cfs to 4.93 cfs during the June survey (Figure 18).
- In June, while the lagoon was open, the surface waters were oligohaline to 0.8 meters (2.6 feet). Maximum salinities ranged from 12.9 ppt to 24.2 ppt at depth (Figure 21, center panel)
- Temperatures were coolest at the surface (14.1°C to 17.3°C) with the warmer temperatures encountered in the upper lagoon during the afternoons. Temperatures in the more saline waters at depth varied from 17.8°C to 22.9°C (Figure 21, left panel).
- Dissolved oxygen was 8.3 mg/l to 9.6 mg/l at the surface and then rose rapidly from 0.4 meters (1.3 feet) to 0.8 meters (2.6 feet). Dissolved oxygen levels were 9.9 mg/l to 21.1 mg/l in the more saline layers at 0.8 meters (2.6 feet) and deeper (Figure 21, right panel).
- The water column was clear with the bottom visible at the greatest depth surveyed (1.2 meters (3.9 feet)). except at LA-2, the first station fully in the upper lagoon channel. There the bottom was measured at 1.0 meters (3.3 feet) but the secchi depth was 0.8 meters (2.6 feet). This is likely due to the significant algal growth encountered in this area.



**Figure 19. Laguna Creek Lagoon, June 10, 2024**



**Figure 20. Laguna Creek Lagoon mouth, June 10, 2024**



**Figure 21. Depth profiles of water quality parameters in Laguna Creek Lagoon during June 2024. Profiles plotted in red are June 10; profiles in blue are June 11**



## June Survey Results

- *O. mykiss* were captured and marked on June 10. On June 11, the lagoon was re-sampled and the proportion of re-captured fish was recorded. Six seine hauls were completed on each day from the beach (LA-1) upstream to just downstream of the water quality buoy (LA-3).
- *O. mykiss* abundance (CPUE) was the second highest of all spring survey dates (Table 8).
- *O. mykiss* were by far the most common species captured in Laguna Creek Lagoon (Table 11). The three other species captured included threespine stickleback, prickly sculpin, and tidewater goby. The prickly sculpin was captured in the furthest upstream sampling location downstream of the water quality buoy. The smaller threespine stickleback and tidewater goby are likely under-represented as the 3/8-inch mesh used for steelhead does not effectively capture these species.

**Table 11. Fish catch in Laguna Creek Lagoon during June 2024**

	LA-1	LA-1.5	LA-2	Grand Total
<b># Hauls</b>	5	5	2	<b>12</b>
<b>Species</b>	<b>Number caught</b>			
Steelhead	6	498	107	<b>611</b>
Threespine stickleback	2	15	3	<b>20</b>
Prickly sculpin	0	0	1	<b>1</b>
Tidewater goby	0	3	4	<b>7</b>
<b><i>O. mykiss</i> CPUE</b>	<b>1.2</b>	<b>99.6</b>	<b>53.5</b>	<b>50.9</b>

- Two hauls mid-lagoon (LA-1.5) resulted in high numbers of *O. mykiss*. In order to maintain the health and safety of the steelhead, a subset was collected for measurement and tagging. The remaining fish (over 40% of the total steelhead catch) were scanned for tags, estimated for lengths, and immediately released. No life stage characterizations were made.
- Of the *O. mykiss* that were retained for full assessment, three percent were characterized as resident or ocean adults. Representative individuals are shown in Figure 22 and Figure 23. The majority captured were parr (42%) and silvery parr (12%). Less than 1% of the steelhead captured and evaluated were characterized as YOY, smolts, or ocean adults.
- Three hundred forty-two *O. mykiss* were examined for external indications of disease and parasites. No black spot disease, external parasites, or abnormalities were noted.
- All *O. mykiss* examined had an adipose fin present.

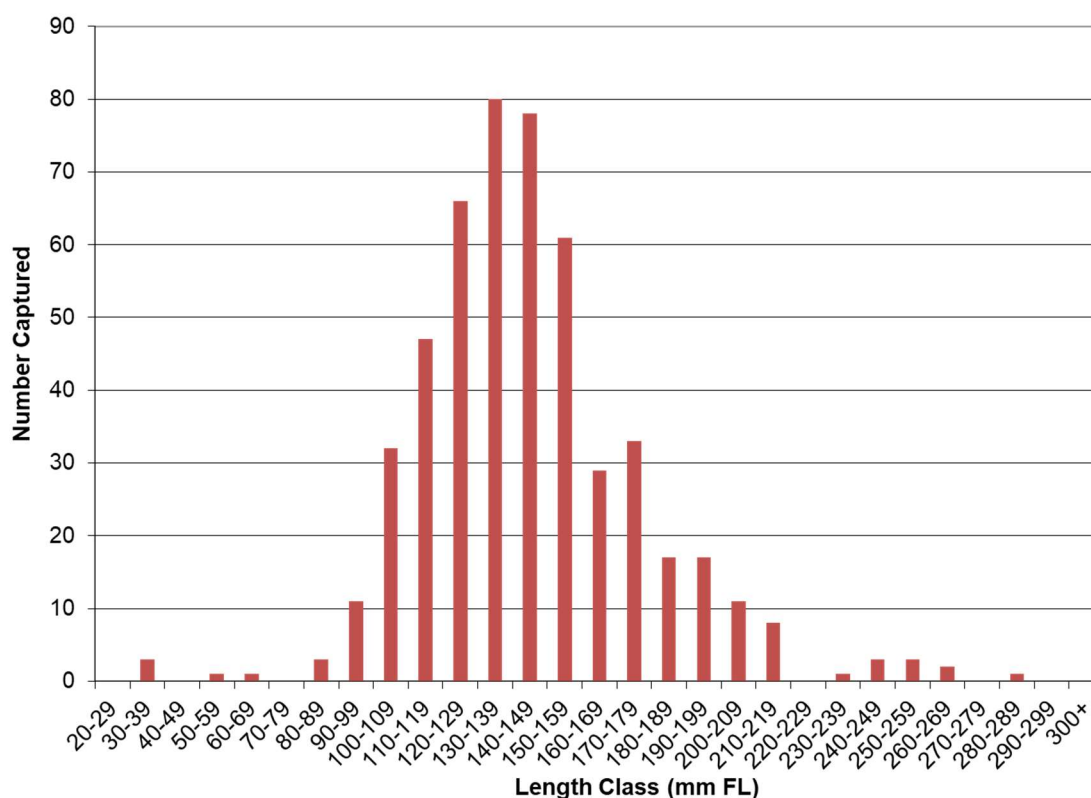


Figure 23. Resident adult *O. mykiss* (288 mm) in Laguna Creek Lagoon, June 10, 2024



Figure 24. Ocean adult *O. mykiss* (262 mm) in Laguna Creek Lagoon, June 11, 2024

- Four *O. mykiss* captured in June 2024 were initially tagged in 2023 (Table 12). Three were originally tagged in June 2023 and fourth one was tagged in September 2023. Growth rates from June to September were ranged from 0.55 mm/day to 0.62 mm/day between June and September and 0.17 mm/day to 0.27 mm/day from September to June. The fish were identified as parr when initially tagged in 2023 and were characterized as adults a year later.
- The length-frequency for steelhead captured in June showed a diverse range of size classes, i.e., ages, of individuals in the lagoon (Figure 25). Fish 60 mm to 69 mm and smaller are likely YOY. These smaller size classes are likely to be under-represented as the net mesh size (3/8") targets larger fish and allows escape of the smaller individuals. Fish in the  $\leq 30$  mm size classes may have emerged fairly close to the spring sampling, which may be indicative of late spawning. Similar to the 2023 spring season, there was a large group of steelhead in the 110-180 mm FL size classes that could be silvery parr to advanced parr. *O. mykiss* in these size classes could have been older parr that were rearing upstream or younger parr with high growth rates rearing in the lagoon



**Figure 25. *O. mykiss* length class in Laguna Creek Lagoon, June 2024**

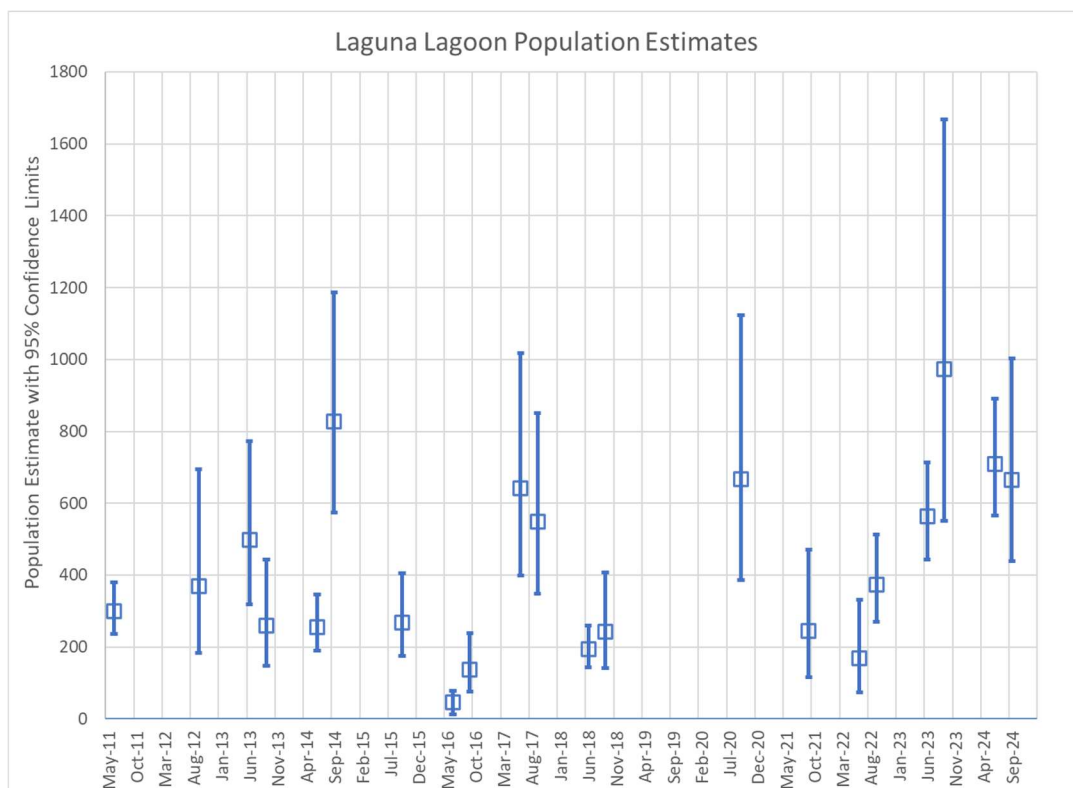
**Table 12. *O. mykiss* tagged in 2023 and recaptured in 2024 in Laguna Creek Lagoon**

Tag Number	Initial Capture Date	First Recapture Date	Second Recapture Date	Length when marked (mm)	Recap Length in Sept 2023 (mm)	Recap Length in June 2024 (mm)	Growth Rate Jun to Sept 2023 (mm/day)	Growth Rate Sept 2023 to June 2024 (mm/day)	Life Stage
989001040545656	6/13/2023	9/26/2023	6/10/2024	133	198	246	0.62	0.19	parr to partial smolt to resident adult
989001040545574	6/12/2023	9/25/2023	6/10/2024	160	218	288	0.55	0.27	parr becoming silvery to partial smolt to resident adult
989001040545555	6/12/2023	9/26/2023	6/10/2024	146	205	258	0.55	0.21	parr becoming silvery to partial smolt to resident adult
989001045161530	9/25/2023	6/10/2024	NA	206	NA	250	NA	0.17	partial smolt to ocean adult

NA = Not Applicable

## June 2024 *O. mykiss* Population Estimate

- Two hundred thirty-one *O. mykiss* were captured during the marking period on June 10. Three were less than 90 mm and not tagged. The majority of the *O. mykiss* were from one haul, which made for very dense holding conditions after capture. In order to maintain the health and safety of the fish, a subset was retained for tagging. The remaining 86 fish were scanned for tags and counted within the net before immediate release into the lagoon. A total of 131 individuals were tagged and four tagged *O. mykiss* were from 2023; therefore, there were a total of 135 tagged and returned to the lagoon.
- Three hundred eighty *O. mykiss* were captured during the recapture period on July 11. Seventy-two were tagged during the marking period.
- Based on the Peterson method (Ricker 1975) which assumes a closed system, the population estimate is 710 *O. mykiss* in the lagoon in mid-June. The 95% confidence limits for this estimate are 565 and 891. This is the highest abundance estimate for spring surveys to date in this lagoon. The second highest estimate was in 2017 (641) and the third highest estimate was in 2023 (563) (Figure 26). During these surveys, the lagoon was open, which suggests that fish could move in and out of the system and violates the assumption of a closed population. The estimates should be reviewed with caution.
- *O. mykiss* with tags captured during the recapture period were tagged in order to collect information on individuals that remained in the lagoon over the summer.



**Figure 26. *O. mykiss* population estimates in Laguna Creek Lagoon over time**

### **September 2024 Survey (September 22-23)**

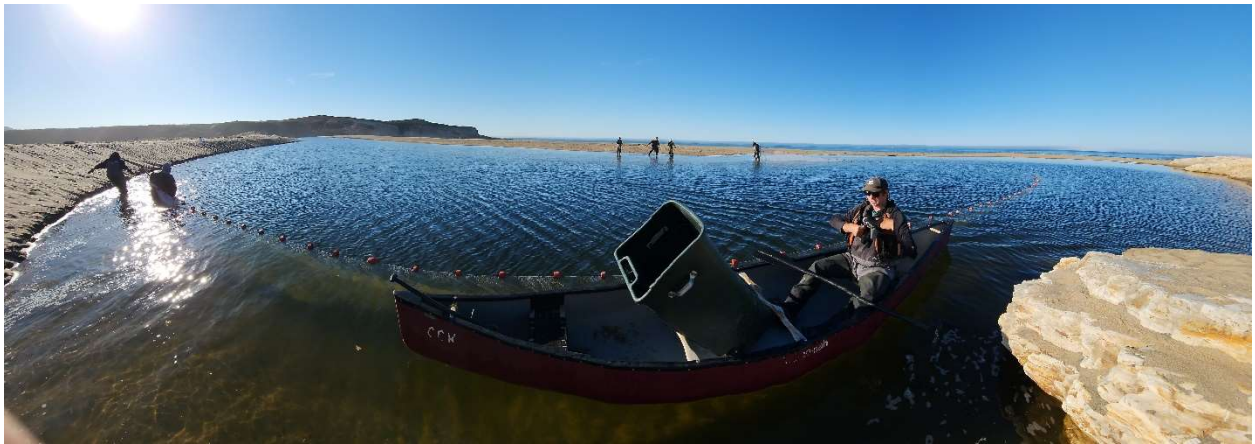
#### **September (Late Summer) Site Conditions**

- The lagoon was closed at the time of the September survey and had been closed since July 16 (City of Santa Cruz data) (Figure 18, Figure 27, Figure 28). The lagoon stage was high, ranging from 4.9 feet to 5.1 feet during sampling and was significantly higher and more extensive than in June. Much of the bordering beach/sandbar was flooded making for long, challenging hauls. A narrow finger of lagoon extended to the northwest just inside the surf zone and a haul covering approximately 450 feet in length was pulled through this area. Four steelhead were captured and tagged in this area.
- Inflow from Laguna Creek during the fall survey ranged from 1.8 cfs to 2.1 cfs (Figure 18).
- Maximum depth measured was 2.1 meters (6.9 feet). The deepest water measured was along the interior marsh edge.
- The lagoon temperatures were suitable for rearing steelhead, ranging from 15.1°C to 18.8°C in most of the water column with some daily variation (Figure 29, left panel).
- The lagoon was fresh on the 23<sup>th</sup> and 24<sup>th</sup> with essentially zero salinity down to the bottom. (Figure 29, center panel).
- Dissolved oxygen ranged between 6.9 mg/l and 10.3 mg/l in the upper 2 meters (6.6 feet) of the water column with no significant stratification and with little variation between the two sample dates (Figure 29, right panel).
- The water column was clear with secchi visibility to the bottom at depths up to 2.1 meters (6.9 feet).

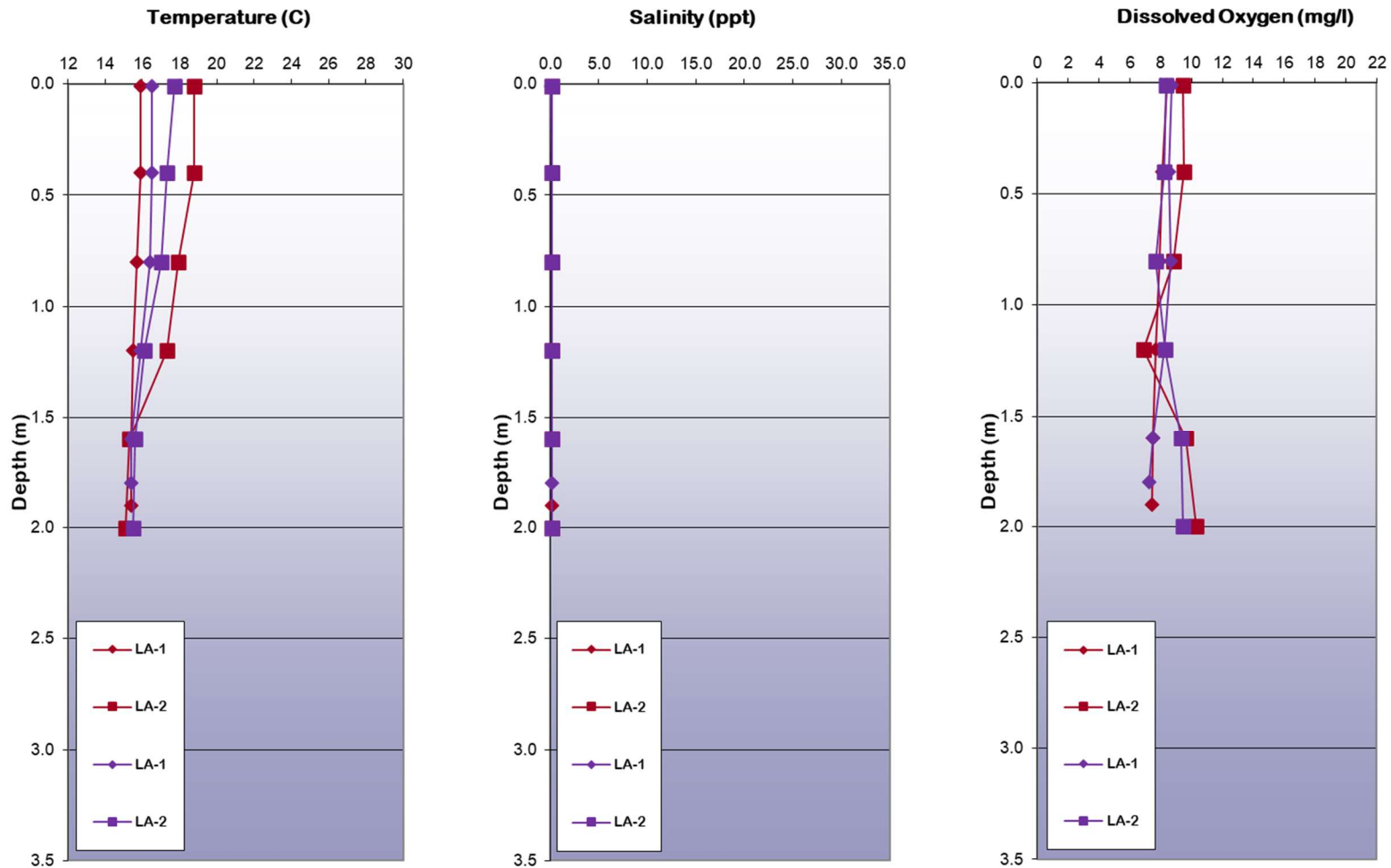




**Figure 27. Laguna Creek Lagoon, September 23, 2024**



**Figure 21. Laguna Creek Lagoon near mouth, September 23, 2024**



**Figure 29. Depth profiles of water quality parameters in Laguna Creek Lagoon during September. Profiles plotted in red are September 23; profiles in blue are September 24**

## September Survey Results

- *O. mykiss* were captured and marked on September 23. On September 24 the lagoon was re-sampled and the proportion of re-captured fish was recorded.
- Eight seine hauls were completed on September 23. However, one haul in the long northern channel had a zero catch and therefore was not included in the analyses of effort. Eight seine hauls were completed on September 24. On both days the lagoon was sampled from the beach (LA-1) and proceeded upstream to near the YSI water quality buoy
- Similar to 2023, seining was difficult due to high water levels in the closed lagoon and the logistics of seining the northern lagoon arm.
- Similar to the June surveys, threespine stickleback and tidewater goby were captured. Staghorn sculpin were observed in September in contrast to the prickly sculpin seen in June.

**Table 13. Fish catch in Laguna Creek Lagoon, September 2024**

	LA-1	LA-1.5	LA-2	Grand Total
<b># Hauls</b>	7	3	5	15
<b>Species</b>	<b>Number caught</b>			
Steelhead	59	106	86	251
Threespine stickleback	9	0	3	12
Staghorn sculpin	3	0	0	3
Tidewater goby	4	0	73	77
<b><i>O. mykiss</i> CPUE</b>	<b>8.4</b>	<b>35.3</b>	<b>17.2</b>	<b>16.7</b>

Note: See figures at end of document for sample station locations.

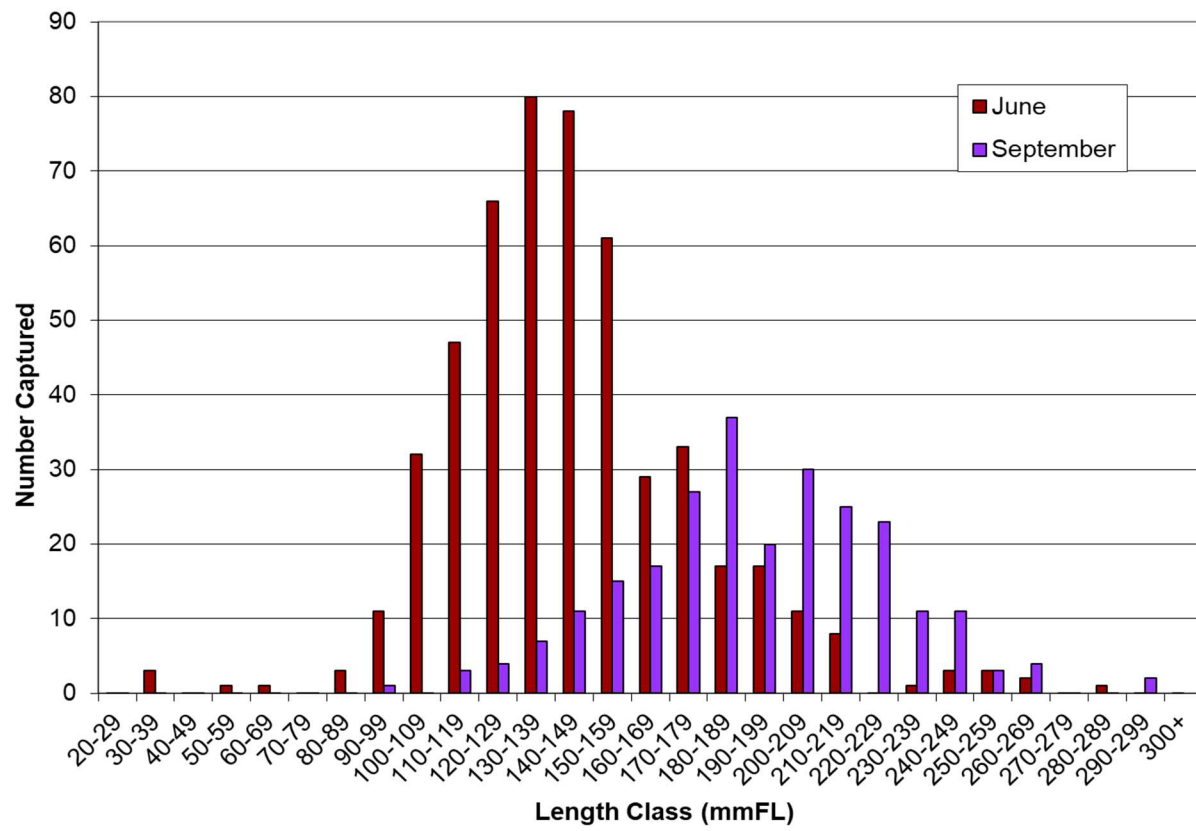
- The overall September abundance of *O. mykiss* based on catch per unit effort (CPUE) was in the top 25% for the fall surveys to date (Table 8).
- In these September hauls, there were no captures of *O. mykiss* tagged in previous years.
- Fifty-seven *O. mykiss* that were tagged in June were recaptured in September. Growth rates ranged from 0.45 mm to 1.24 mm/day, averaging 0.84 mm/day. This growth rate was in the upper 25% of the rates observed in previous years (Table 14).

**Table 14. Laguna Creek Lagoon *O. mykiss* tagged in June and recaptured in September, annual averages**

	Number Recaptured	Average Growth Rate (mm/day)	Range of Growth Rates (mm/day)	Fall CPUE	June CPUE
2012	1	0.86	NA	10.3	11.3
2013	10	0.48	0.22-0.78	8.6	28
2014	72	0.43	0.12-0.80	33	20
2015	1	0.99	NA	11.4	0.1
2016	0	NA	NA	5.2	1.1
2017	13	0.66	0.17-0.89	14.5	42.8
2018	23	0.99	0.87-1.34	6.5	14.3
2019	0	NA	NA	2.5	17.0
2020	4	0.46	0.27-0.62	11.4	56.8
2021	12	0.45	0.12-0.88	5.4	8.4
2022	6	0.69	0.57-0.88	14.9	4.4
2023	65	0.58	0.30-1.04	19.1	36.4
2024	57	0.83	0.45-1.24	16.4	50.9

NA: not applicable

- *O. mykiss* captured in September ranged from 91 mm to 292 mm FL (Figure 30). The large mode of fish from 160 mm to 220 mm may have been composed of fish that were 70 mm to 130 mm in June based on the average growth rates of 0.83 mm/day calculated from the mark-recapture. The observed growth rates of the younger (smaller fish up to approximately 140 mm at initial tagging) were over twice that of larger (greater than 200 mm) fish (Table 15). The lagoon opened twice between the June and September surveys which may have allowed movement in or out of the ocean and affected the number and size distribution.
- Five percent of the *O. mykiss* catch was characterized as parr or advance parr and 57% were characterized as silvery parr or advanced silvery parr. In contrast to 2023 where no adults were observed, 38% of the September catch was characterized as adults
- No coho salmon were captured in September.
- None of the *O. mykiss* examined had any external evidence of disease, parasites, or abnormalities.
- All *O. mykiss* examined had an adipose fin present.



**Figure 30. *O. mykiss* length classes in Laguna Creek Lagoon, late summer 2024 compared to spring 2024**

**Table 15. *O. mykiss* tagged in June and recaptured in Laguna Creek Lagoon September 2024**

Initial Capture Date	Recapture Date	Initial Capture Location	Recapture Location	Length when marked (mm)	Length in September (mm)	Growth Rate (mm/day)
06/10/24	09/24/24	LA-1.5	LA-2	97	193	0.91
06/11/24	09/24/24	LA-2	LA-2	99	203	0.99
06/10/24	09/23/24	LA-1.5	LA-2	100	197	0.92
06/11/24	09/24/24	LA-2	LA-2	100	188	0.84
06/10/24	09/24/24	LA-1.5	LA-1	103	204	0.95
06/10/24	09/24/24	LA-1.5	LA-2	103	206	0.97
06/11/24	09/23/24	LA-1.5	LA-1.5	104	201	0.93
06/11/24	09/23/24	LA-2	LA-1.5	104	194	0.87
06/11/24	09/23/24	LA-1.5	LA-1.5	105	215	1.06
06/11/24	09/23/24	LA-1.5	LA-1	106	209	0.99
06/10/24	09/24/24	LA-1.5	LA-1	107	217	1.04
06/11/24	09/24/24	LA-1.5	LA-1.5	111	220	1.04
06/10/24	09/23/24	LA-1.5	LA-2	111	190	0.75
06/10/24	09/23/24	LA-2	LA-2	113	208	0.90
06/11/24	09/23/24	LA-2	LA-2	116	212	0.92
06/10/24	09/23/24	LA-1.5	LA-1.5	117	215	0.93
06/10/24	09/23/24	LA-1.5	LA-2	118	205	0.83
06/11/24	09/24/24	LA-2	LA-2	118	203	0.81
06/11/24	09/23/24	LA-1.5	LA-2	119	220	0.97
06/10/24	09/24/24	LA-2	LA-1	123	240	1.10
06/11/24	09/23/24	LA-1.5	LA-1.5	125	223	0.94
06/11/24	09/23/24	LA-1.5	LA-2	125	210	0.82
06/11/24	09/24/24	LA-1.5	LA-1.5	126	222	0.91
06/11/24	09/24/24	LA-2	LA-2	126	214	0.84
06/10/24	09/24/24	LA-1.5	LA-2	129	206	0.73
06/11/24	09/23/24	LA-1.5	LA-2	130	215	0.82
06/11/24	09/23/24	LA-1.5	LA-1.5	134	236	0.98
06/11/24	09/24/24	LA-2	LA-2	135	265	1.24
06/11/24	09/23/24	LA-1.5	LA-2	137	224	0.84
06/10/24	09/23/24	LA-1.5	LA-1	140	242	0.97
06/11/24	09/24/24	LA-1.5	LA-2	141	230	0.85
06/11/24	09/24/24	LA-2	LA-2	141	227	0.82
06/11/24	09/24/24	LA-1.5	LA-1.5	143	225	0.78
06/10/24	09/24/24	LA-1.5	LA-2	144	218	0.70



**Table 15. *O. mykiss* tagged in June and recaptured in Laguna Creek Lagoon September 2024  
(cont.)**

06/11/24	09/24/24	LA-2	LA-2	144	225	0.77
06/10/24	09/24/24	LA-1.5	LA-2	146	224	0.74
06/10/24	09/23/24	LA-1.5	LA-2	146	226	0.76
06/11/24	09/23/24	LA-2	LA-1.5	146	229	0.80
06/10/24	09/24/24	LA-1.5	LA-1	147	234	0.82
06/11/24	09/24/24	LA-1.5	LA-2	149	224	0.71
06/11/24	09/23/24	LA-2	LA-1.5	149	231	0.79
06/11/24	09/23/24	LA-2	LA-1.5	150	239	0.86
06/11/24	09/23/24	LA-1.5	LA-1.5	153	226	0.70
06/11/24	09/23/24	LA-1.5	LA-2	156	244	0.85
06/10/24	09/24/24	LA-1.5	LA-1	157	245	0.83
06/11/24	09/24/24	LA-2	LA-1.5	157	241	0.80
06/10/24	09/23/24	LA-1.5	LA-2	158	240	0.78
06/10/24	09/24/24	LA-1.5	LA-2	162	257	0.90
06/10/24	09/23/24	LA-1.5	LA-2	163	230	0.64
06/10/24	09/23/24	LA-2	LA-2	170	263	0.89
06/11/24	09/23/24	LA-1.5	LA-1.5	172	250	0.75
06/10/24	09/23/24	LA-1.5	LA-1.5	180	251	0.68
06/11/24	09/23/24	LA-2	LA-1.5	180	245	0.63
06/10/24	09/24/24	LA-1.5	LA-2	182	244	0.58
06/10/24	09/24/24	LA-1.5	LA-1.5	186	245	0.56
06/10/24	09/24/24	LA-1.5	LA-2	216	263	0.44
06/10/24	09/23/24	LA-1.5	LA-1.5	245	292	0.45
<b>Average</b>						<b>0.84</b>

### September *O. mykiss* Population Estimate

- One hundred fifty-seven *O. mykiss* were captured during the marking period on September 23. Eleven were recaptures already tagged during the marking period. There were 146 marked (tagged) *O. mykiss* released in the lagoon on September 23, including 116 new tags and 30 tags from June. On September 24, 94 *O. mykiss* were captured, 20 of which were recaptures from the marking period.
- There were no mortalities during either the mark or recapture surveys.
- Based on the Peterson method (Ricker 1974), the population estimate of *O. mykiss* in the lagoon in mid-September is 665. The 95% confidence limits for this estimate are 438 and 1,002. This estimate is mid-range for all the surveys conducted in Laguna Creek Lagoon (Table 9).

- The fall recapture rate for tagged fish (number of tagged fish captured during the recapture period divided by the number of fish marked during the mark period) was 13.7% compared to 53.3% in June. This difference in recapture rate may be explained by the differences in lagoon depth between June and September and is similar to what was recorded in 2023 in terms of changes in lagoon depth and observed recapture rates. Although sampling procedures and techniques were very similar for both survey periods, the fish were concentrated in a more confined habitat due to a shallower and less extensive lagoon in June. The maximum depth measured during water quality in June was 1.2 meters (3.9 feet) and the lagoon was a narrow channel in the downstream stations. In contrast, the September maximum depth was 2.1 meters (6.9 feet) and the shallow sand banks were inundated, resulting in a far greater surface area.
- CPUE for the recapture period (11.8) was almost half that of the mark period (22.4). This suggests that the lagoon population was somewhat fluid between the two periods and individuals were moving between the lagoon and upstream habitats.

## Appendix A

**Table A-1. *O. mykiss* detected 2024-2025 (to date) in water courses outside of the standard San Lorenzo River Lagoon and Laguna Creek Lagoon monitoring stations**

Species	Tag Number	Tag Date	Tag Site	Length at Tagging	Stage at Tagging	Date Detected	Location Detected	Reporting Agency
<i>O. mykiss</i>	989001045161239	8/16/2023	SL-5	147	1+	3/16/2024	Pescadero Creek	California Trout
<i>O. mykiss</i>	989001045161437	9/21/0023	SL-2	267	2+	3/20/2024	Pescadero Creek	California Trout
<i>O. mykiss</i>	989001045567232	6/5/2024	SL-5	119	1	12/12/2024	Branciforte Creek	California Trout
<i>O. mykiss</i>	989001045567208	6/4/2024	SL-1	159	1+	12/15/2024	Branciforte Creek	California Trout
<i>O. mykiss</i>	989002026967049	6/11/2024	LA-2	133	1+	12/15/2024	Branciforte Creek	California Trout
<i>O. mykiss</i>	989002026968007	6/10/2024	LA-1.5	130	1+	11/26/2024	Scott Creek	NOAA
<i>O. mykiss</i>	989001045567101	9/18/2024	SL-6	184	2	1/2/2025	Branciforte Creek	California Trout
<i>O. mykiss</i>	989001045567021	9/18/2024	SL-5	156	2	1/2/2025	Branciforte Creek	California Trout
<i>O. mykiss</i>	989001045566930	9/17/2024	SL-2	184	2	1/3/2025	Branciforte Creek	California Trout
<i>O. mykiss</i>	989001045161391	6/4/2024	SL-2	168	2	1/3/2025	Branciforte Creek	California Trout
<i>O. mykiss</i>	989001045567037	9/18/2024	SL-5	175	2+	1/3/2025	Branciforte Creek	California Trout
<i>O. mykiss</i>	989002026967166	6/7/2024	SL-6	166	1+	1/3/2025	Branciforte Creek	California Trout
<i>O. mykiss</i>	989002026967093	8/13/2024	SL-1	201	2	1/3/2025	Branciforte Creek	California Trout
<i>O. mykiss</i>	989001045161082	6/6/2024	SL-2	118	1	1/3/2025	Branciforte Creek	California Trout
<i>O. mykiss</i>	989001045567026	9/18/2024	SL-5	209	2	1/3/2025	Branciforte Creek	California Trout
<i>O. mykiss</i>	989001045161119	6/6/2024	SL-2	181	2+	1/3/2025	Branciforte Creek	California Trout
<i>O. mykiss</i>	989001045567148	6/4/2024	SL-1	230	3	1/3/2025	Branciforte Creek	California Trout
<i>O. mykiss</i>	989001045161372	6/4/2024	SL-1	155	1+	2/11/2025	Branciforte Creek	California Trout
<i>O. mykiss</i>	989001045567286	6/5/2024	SL-5	194	2+	2/11/2025	Branciforte Creek	California Trout
<i>O. mykiss</i>	989002026967210	6/7/2024	SL-6	145	1+	3/13/2025	Branciforte Creek	California Trout
<i>O. mykiss</i>	989001040545714	6/13/2023	LA-1.5	211	2	4/2/2025	Pescadero Creek	California Trout
<i>O. mykiss</i>	989001045161580	9/25/2023	LA-2	195	2	5/14/2025	Scott Creek	NOAA

Notes:

- All tagging done as part of the City of Santa Cruz steelhead monitoring
- SL = San Lorenzo River Lagoon
- LA = Laguna Creek Lagoon

**Table A-2. *O. mykiss* catch per haul for the San Lorenzo River Lagoon during sampling events (data from H.T. Harvey & Associates 2003, 2NDNATURE 2006, Ellen Freund (NOAA Fisheries), HES 2005, HES 2009, HES 2010, HES 2011, HES 2012, HES 2013, HES 2014, HES 2015, HES 2016, HES 2017, HES 2018a, HES 2019, HES 2020, HES 2021, HES 2022, HES 2023, and HES 2024)**

Station	Location	<i>O. mykiss</i> Catch per Haul					
<b>2002</b>						Oct 1	Nov 20
SL-2	RR Trestle						0.0
SL-3	Near YSI Station					5.5	
SL-4	Below Riverside						
SL-5	Riverside Drive						9.0
SL-7	Laurel St.						1.0
SL-8	Soquel Ave.					20.0	0.3
<b>2004</b>			July 6		Sep 21	Sep 29	
SL-1	Near Mouth				0.0	0.0	
SL-2	RR Trestle		24.5			0.5	
SL-3	Near YSI Station		20.0				
SL-4	Below Riverside		0.0				
SL-5	Riverside Drive		62.0		0.0	0.0	
SL-6	U/S Bank Restoration		3.0			0.0	
SL-7	Laurel St.		3.0				
SL-8	Soquel Ave.				0.0	0.0	
<b>2005</b>		Jun 14	Jul 14	Aug 16		Oct 5	
SL-1	Near Mouth	0.0	0.0	1.7		0.0	
SL-2	RR Trestle	28.0	5.3	179.5		0.0	
SL-5	Riverside Drive	0.0	12.3	10.7		62.7	
SL-8	Soquel Ave.	7.7	1.0	0.0		0.0	
<b>2008</b>		Jun 8, 19				Oct 7-8	
SL-1	Near Mouth	0				0	
SL-2	RR Trestle	9				0.25	
SL-3	Near YSI Station	0				0	
SL-5	Riverside Drive	0				0	
SL-6	U/S Bank Restoration	0				0	
SL-8	Soquel Ave.	0				0	
	<b>Overall</b>	<b>2.6</b>				<b>0.1</b>	
<b>2009</b>		Jun 10-11			Sep 16	Oct 21	
SL-2	RR Trestle	0.75			1.0	0.25	
SL-3	Near YSI Station	0.25					
SL-5	Riverside Drive	0				0	
SL-6	U/S Bank Restoration	0				1.5	
	<b>Overall</b>	<b>0.3</b>			<b>1.0</b>	<b>0.5</b>	
<b>2010</b>		Jun 22-23	Jul 17			Oct 6-7	
SL-1	Near Mouth	0.0				0	
SL-2	RR Trestle	11.7	0.5			31.3	
SL-3	Near YSI Station		42.5			0	
SL-5	Riverside Drive	0.0				9.0	
SL-6	U/S Bank Restoration	6.0				80.0	
	<b>Overall</b>	<b>7.7</b>	<b>21.5</b>			<b>28.25</b>	
<b>2011</b>		Jun 9-14				Oct 13-18	
SL-2	RR Trestle	11.7				1.7	
SL-3	Near YSI Station	7.8				5.7	
SL-4	Near Marsh Outlet	16.0				1.0	
SL-5	Riverside Drive	48.5				2.2	
SL-6	U/S Bank Restoration	0.5				0.3	
	<b>Overall</b>	<b>13</b>				<b>2.5</b>	

**Table A-2 (continued)**

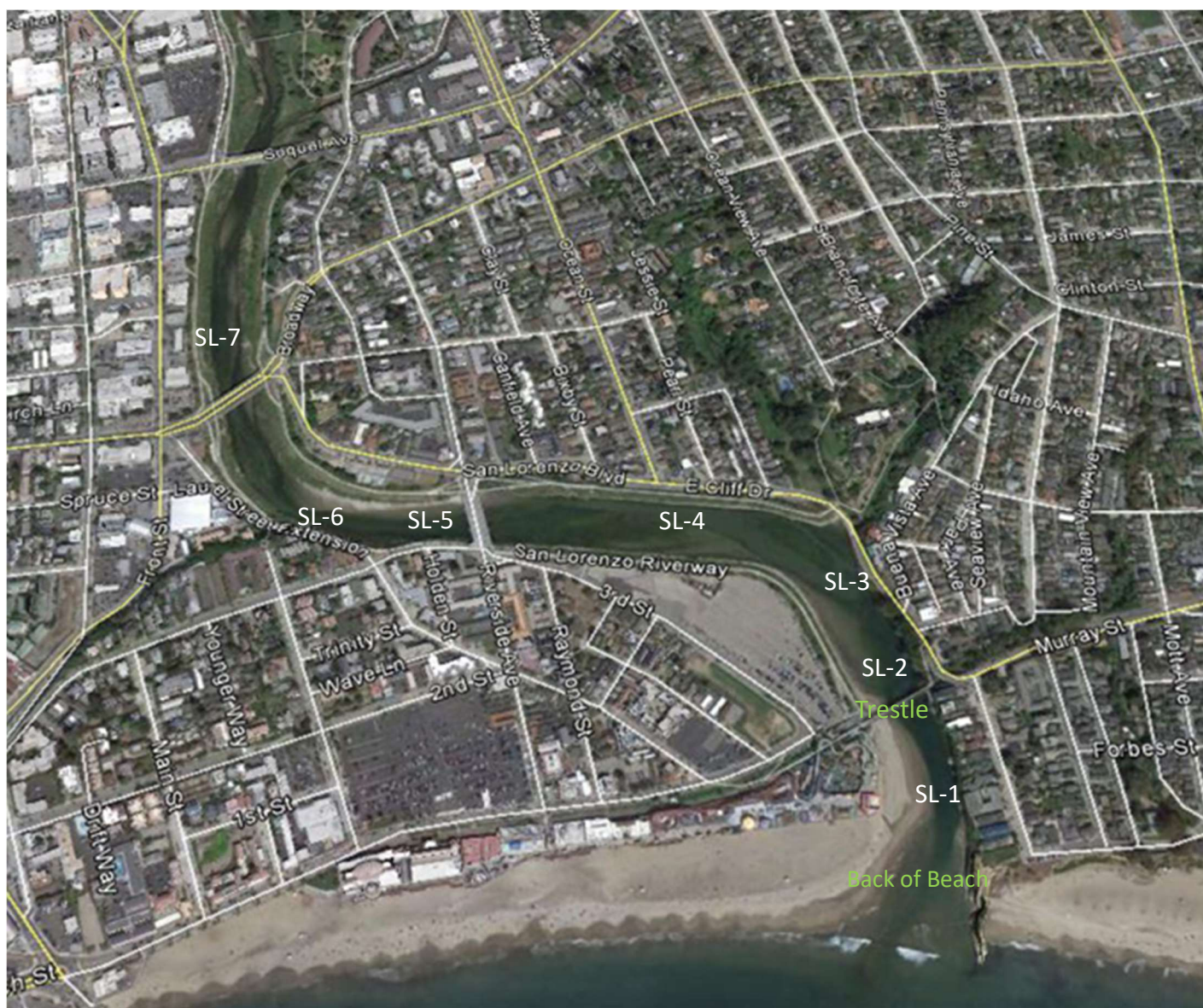
Station	Location	<i>O. mykiss</i> Catch per Haul					
<b>2012</b>		Jun 7-12			Sep 13-18		
SL-2	RR Trestle	5.2			21.3		
SL-3	Near YSI Station	0.8			17.5		
SL-4	Near Marsh Outlet	0					
SL-5	Riverside Drive	0			3.5		
SL-6	U/S Bank Restoration	0.1			5.0		
	<b>Overall</b>	<b>1.7</b>			<b>14.4</b>		
<b>2013</b>		Jun 6-11	July 17		Sep 12-17		
SL-1	South of Trestle	0.6			13		
SL-2	RR Trestle	0.8	2.2		1.6		
SL-3	Near YSI Station	6	24		1		
SL-4	Near Marsh Outlet	3			2		
SL-5	Riverside Drive	3			5.8		
SL-6	U/S Bank Restoration	0.3			6		
	<b>Overall</b>	<b>2</b>	<b>8.4</b>		<b>4.7</b>		
<b>2014</b>		Jun 5-10	July 17		Sep 11-15		
SL-1	South of Trestle	3.2	0		0		
SL-2	RR Trestle	0.9	3.5		0		
SL-3	Near YSI Station	1.0	0.5		0		
SL-5	Riverside Drive	0.5	0		0		
SL-6	U/S Bank Restoration	0.8	1		0		
SL-8	Water Street				1.1		
	<b>Overall<sup>1</sup></b>	<b>1.2</b>	<b>1.1</b>		<b>0.0</b>		
<b>2015</b>		Jun 4-9	July 28-29	Aug 18-19		Oct 8-9	
SL-1	South of Trestle	0.8	0	0		0	
SL-2	RR Trestle	1.4	0	0		0	
SL-3	Near YSI Station	0.4	0	0		0	
SL-5	Riverside Drive	8.8	0	0		0	
SL-6	U/S Bank Restoration	2	0	0		0	
SL-10	Water Street	0					
	<b>Overall<sup>1</sup></b>	<b>2.6</b>	<b>0</b>	<b>0</b>		<b>0</b>	
<b>2016</b>		Jun 9-14	July 13-14	Aug 16-17	Sept 22-27		
SL-1	South of Trestle	38.0	2.8	1.8	13.1		
SL-2	RR Trestle	138.5	0.5	2.8	4.4		
SL-3	Near YSI Station	2.0	1.0	0.3	17.0		
SL-4	Near Marsh Outlet		0.0				
SL-5	Riverside Drive	0.7	0.0	2.5	3.3		
SL-6	U/S Bank Restoration	22.0	0.0	2.4	8.0		
	<b>Overall</b>	<b>39.7</b>	<b>1.0</b>	<b>2.0</b>	<b>7.8</b>		
<b>2017</b>		Jun 15-20	July 11	Aug 15	Sept 21		
SL-1	South of Trestle	5.5	466.0	265.0	643.0		
SL-2	RR Trestle	100.9	424.0	279.0			
SL-5	Riverside Drive	566.7			13.0		
SL-6	U/S Bank Restoration	76.6			15.0		
	<b>Overall</b>	<b>134.4</b>	<b>452.0</b>	<b>272.0</b>	<b>328.5</b>		

<sup>1</sup> Standard sites only (SL1-SL6) used in Overall calculation



**Table A-2 (continued)**

Station	Location	<i>O. mykiss</i> Catch per Haul					
<b>2018</b>		Jun 7-12	Jul 16-17	Aug 14-15	Sep 20-25		
SL-1	South of Trestle	12.8	5.3	8.5	8.8		
SL-2	RR Trestle	20.5	0.0	1.5	6.0		
SL-3	Near YSI Station	11.0	0.5	0.0	3.0		
SL-5	Riverside Drive	59.8	2.5	14.5	3.0		
SL-6	U/S Bank Restoration	14.8	2.8	5.3	7.3		
	<b>Overall</b>	<b>23.3</b>	<b>2.5</b>	<b>6.4</b>	<b>6.3</b>		
<b>2019</b>		Jun 13-18	Jul 16-17	Aug 13-14	Sep 19-24		
SL-1	South of Trestle	1.0	10.0	49.7	7.2		
SL-2	RR Trestle	55.8	95.7	440.0	509.0		
SL-3	Near YSI Station				35.0		
SL-5	Riverside Drive	274.4	59.0	457.5	462.3		
SL-6	U/S Bank Restoration	40.5	22.0		66.6		
	<b>Overall</b>	<b>92.2</b>	<b>53.4</b>	<b>277.7</b>	<b>228.2</b>		
<b>2020</b>		11-16 Jun	Jul 7-8	Aug 19-20*	Sep 17-22		
SL-1	South of Trestle	70.5	29.5	NS	0.1		
SL-2	RR Trestle	75.0	369.0	NS	30.1		
SL-3	Near YSI Station	155.0	NS	NS	NS		
SL-5	Riverside Drive	257.0	70.5	NS	19.0		
SL-6	U/S Bank Restoration	207.3	13.5	NS	83.8		
	<b>Overall</b>	<b>146.1</b>	<b>120.6</b>	<b>NS</b>	<b>30.7</b>		
<b>2021</b>		Jun 8-11	Jul 13-14	Aug*	Sep	Oct 12-13	
SL-1	South of Trestle	3.9	1.0	NS	NS	0.0	
SL-2	RR Trestle	4.2	9.7	NS	NS	0.2	
SL-3	Near YSI Station	0.0	NS	NS	NS	0.5	
SL-5	Riverside Drive	7.0	9.5	NS	NS	0.5	
SL-6	U/S Bank Restoration	4.0	6.0	NS	NS	0.3	
	<b>Overall</b>	<b>4.3</b>	<b>6.3</b>	<b>NS</b>	<b>NS</b>	<b>0.3</b>	
<b>2022</b>		Jun 7-10	Jul 13-14	Aug 16-17	Sep 20-23		
SL-1	South of Trestle	4.0	0.7	3.0	25.0		
SL-2	RR Trestle	2.7	73.0	1.6	8.7		
SL-3	Near YSI Station	NS	NS	NS	NS		
SL-5	Riverside Drive	0.5	10.0	4.0	13.8		
SL-6	U/S Bank Restoration	0.8	5.0	0.0	1.4		
	<b>Overall</b>	<b>2.4</b>	<b>20.5</b>	<b>2.3</b>	<b>8.8</b>		
<b>2023</b>		Jun 6-9	Jul 18-19	Aug 15-16	Sep 19-22		
SL-1	South of Trestle	0.2	24.3	1.3	1.8		
SL-2	RR Trestle	7.4	44.7	146.0	46.4		
SL-3	Near YSI Station	NS	NS	NS	NS		
SL-5	Riverside Drive	13.5	23.3	30.5	18.3		
SL-6	U/S Bank Restoration	1.8		1.0	17.1		
	<b>Overall</b>	<b>5.8</b>	<b>30.8</b>	<b>46.0</b>	<b>24.1</b>		
<b>2024</b>		June 4-7		Aug 13-14	Sep 17-20		
SL-1	South of Trestle	16.6		8.0	3.5		
SL-2	RR Trestle	91.8		471.0	19.9		
SL-3	Near YSI Station	NS		NS	NS		
SL-5	Riverside Drive	40.8		59.7	25.8		
SL-6	U/S Bank Restoration	14.1		11.0	14.6		
	<b>Overall</b>	<b>33.1</b>		<b>106.8</b>	<b>15.3</b>		







**Figure A-2. Laguna Creek Lagoon sampling stations**



**Figure A-3. San Lorenzo River Lagoon – lower lagoon June 4, 2024**





**Figure A-4. San Lorenzo River Lagoon – lower lagoon pre-sampling June 4, 2024**



**Figure A-5. San Lorenzo River Lagoon – Riverside beach seine June 5, 2024**





**Figure A-6. San Lorenzo River Lagoon downstream of the trestle bridge, June 6, 2024**  
**Note the lagoon had begun to close and the stage was rising**



**Figure A-7. San Lorenzo River Lagoon upstream of Riverside Bridge, June 7, 2024**  
***O. mykiss* smolt/adult 332 mm**





**Figure A-8. Lower Laguna Creek Lagoon June 10, 2024**



**Figure A-9. Laguna Creek Lagoon towards the marsh, June 11, 2024**





**Figure A-10. San Lorenzo River Lagoon by the trestle bridge, August 13, 2024**  
***O. mykiss* ocean adult 375 mm**





**Figure A-11. Lower San Lorenzo Lagoon August 13, 2024**



**Figure A-12. Lower San Lorenzo Lagoon September 17, 2024**  
**Note: higher water levels at same station as Figure A-13**





**Figure A-13. Laguna Creek Lagoon, September 23, 2024**  
***O. mykiss* adult recapture 292 mm**



**Figure A-14. Laguna Creek Lagoon, September 23, 2024**  
***O. mykiss* partial smolt 144 mm**

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