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Chorro Creek Steelhead Growth and Movement Study

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Cover photos: PIT-tag antenna located at Chorro Flats (top left), habitat conditions in San Luisito Creek (top right), habitat conditions in Chorro Creek (bottom left), *Oncorhynchus mykiss* in excellent condition (bottom right).

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Acronyms and Abbreviations

°C	degrees Celsius
DPS	Distinct Population Segment
FL	fork length
m	meter
mm	millimeter
NMFS	National Marine Fisheries Service
O. mykiss	*Oncorhynchus mykiss*
PIT	Passive Integrated Transponder
SCCC	South-Central California Coast
TL	total length

1 INTRODUCTION

The Chorro Creek watershed is unique among central California coast watersheds in that it is largely undeveloped, has perennial flows, provides near year-round connectivity to a highly productive estuary, Morro Bay, and supports a plethora of native species, including steelhead (*Oncorhynchus mykiss [O. mykiss]).* The National Marine Fisheries Service (NMFS) (2013) describes the steelhead in Chorro Creek as part of the South-Central California Coast (SCCC) Distinct Population Segment (DPS), which encompasses all naturally spawned steelhead that occur in waterways located between the Pajaro and Santa Maria rivers (NMFS 2013).

Individual *O. mykiss* exhibit either a resident or anadromous life history strategy. Resident adults, known as rainbow trout, remain in freshwater rivers and streams throughout their lives. Anadromous individuals, known as steelhead, spend 1–3 years in freshwater or estuary environments before outmigrating to the ocean as smolts[1] (NMFS 2013). After 1–4 years in marine environments, anadromous individuals return to their natal freshwater streams as adults to spawn. This flexibility of life history strategies, paired with diversity in migration timing and habitat selection, has enabled this species to persist in the highly dynamic and varying habitat regimes in the SCCC DPS (NMFS 2013).

Rates of expression of anadromy and residency are variable between populations and are understood to be influenced by both genetic and environmental factors (Hayes et al. 2008, Kobayashi et al. 2024). For example, expression of the anadromous life history type appears to depend on habitat types that produce large smolts, which have increased marine survival and thus a greater probability of returning to their natal stream to spawn as adult steelhead (Bond et al. 2008, Ohms and Boughton 2019). Due to the decline of anadromous steelhead in the SCCC DPS, understanding the timing, migration patterns, and habitat conditions associated with successful smolt production is particularly useful for guiding conservation and restoration efforts aimed at preserving and augmenting the anadromous life history type (NMFS 2013).

Steelhead population monitoring within the SCCC DPS was deemed unsatisfactory in the 5-Year Status Review (2017–2022) of the SCCC Steelhead DPS due to a lack of coordinated monitoring efforts across the region (NMFS 2023). Few data regarding steelhead populations exist for streams south of the Big Sur River and even fewer data exist regarding the movement patterns and key life history timing (i.e., smolt outmigration) of steelhead within the SCCC DPS, especially within the San Luis Obispo Terrace Biogeographic Population Group. Recognizing the data deficiencies within the DPS, NMFS identified additional research and monitoring, especially on life history strategies and nursery habitats, as being essential to the effective recovery and management of the steelhead populations in central and southern California (NMFS 2023).

The ongoing research Stillwater Sciences and the Morro Bay National Estuary Program have been conducting on steelhead in Chorro Creek provides a unique opportunity to closely monitor how steelhead are using the watershed to meet their life history needs. The goal of this study is to measure seasonal growth rates and migration patterns from tributaries and mainstem Chorro Creek to the lower watershed and estuary. These data, coupled with long-term population monitoring being conducted as part of the invasive pikeminnow control program, provides critical information to inform management and restoration planning within the watershed and more broadly throughout the DPS.

[1] Smolts are juvenile steelhead migrating to the ocean (i.e., smolting); they have undergone physiological changes (smoltification) to adapt from the freshwater environment to a saltwater environment.

2 STEELHEAD LIFE HISTORY AND GENERAL HABITAT REQUIREMENTS

As described above, *O. mykiss* can exhibit both anadromous and resident life history strategies within a single watershed (NMFS 2013). Resident and anadromous adults spawn in freshwater and both life history types may produce anadromous offspring (Donohoe et al. 2021). After spawning, anadromous adults return to the ocean as kelts. Anadromous adults can return to freshwater for spawning up to two times during their lifetime (Moyle 2002). A generalized representation of Chorro Creek *O. mykiss* life history is shown in Figure 1.

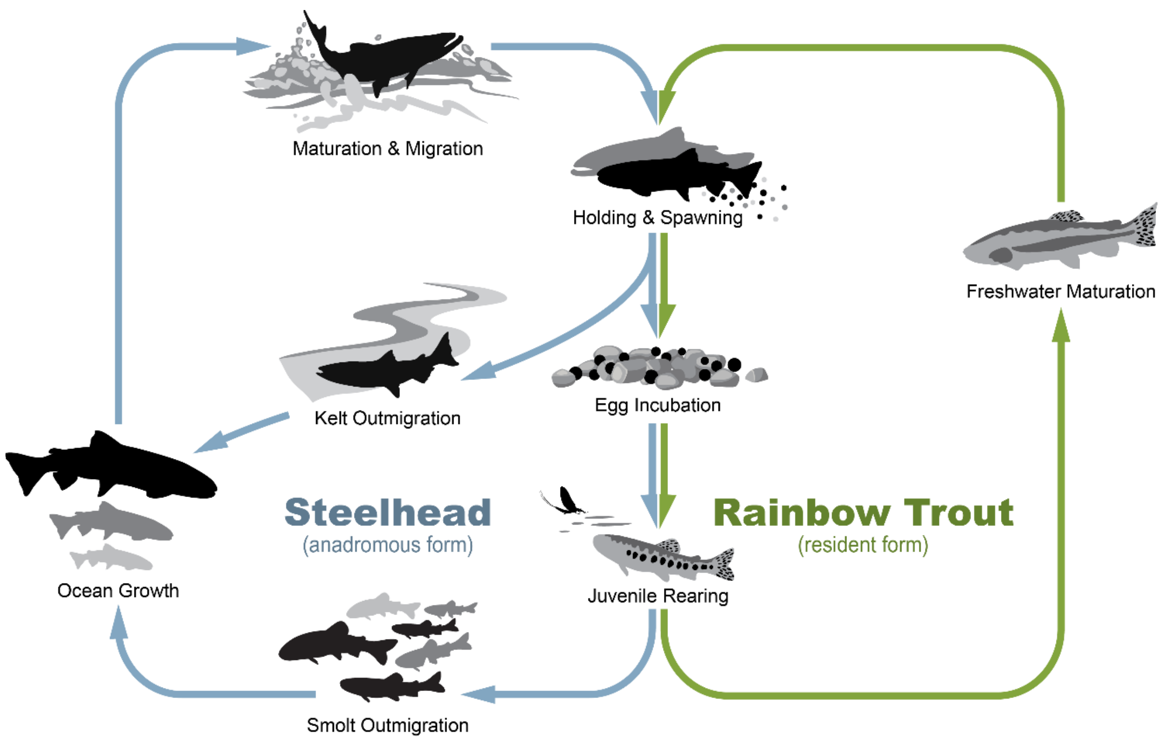


Figure 1. Chorro Creek *Oncorhynchus mykiss* life history.

Steelhead smolts within the Chorro Creek watershed are presumed to out-migrate in the spring, with peak migration through Morro Bay occurring between March and May (Fukushima and Lesh 1998). The duration of time juvenile steelhead spend in freshwater appears to be related to a combination of genetic and environmental factors including growth rates (Hayes et al. 2008, Kobayashi et al. 2024). In general, larger and fast-growing members of a given cohort tend to smolt at younger ages (Peven et al. 1994, Boughton et al. 2020). In areas with warm-water temperatures where feeding and growth are possible throughout the winter, steelhead may require a shorter period in freshwater before smolting, while steelhead in colder tributaries may rear for 3 or 4 years before smolting (Moyle 2002).

Habitat requirements for different age classes of juvenile steelhead are relatively similar, except that they require more space for foraging and cover as they grow. Age 0+ juvenile steelhead use shallow-water and low-velocity habitats, such as stream margins and low-gradient riffles, to meet their energetic demands and escape predators (Hartman 1965, Moyle 2002). Older juvenile steelhead (age 1+/2+) require deeper, more complex pools and large rocky substrate or in-channel wood for cover while feeding (Hartman 1965, Fontaine 1988, Spina et al. 2005).

Water temperature has a strong influence on almost every steelhead life history stage (Berman 1998) due to its influence on metabolism and growth (Sullivan et al. 2000). Warm water temperatures increase metabolic demand, such that age 0+ and age 1+ juvenile steelhead feed aggressively in fast water habitat (e.g., riffles, heads of pools). If sufficient food resources are available, these fish are able to grow quickly by feeding on benthic and terrestrial invertebrates (often from riparian input; Krug et al. 2012) and typically smolt at age 1+ or 2+. Temperature requirements for juvenile steelhead vary between populations, but growth and energetic capacity tend to be optimized at approximately 17–20 degrees Celsius (°C) and temperature tends to become physiologically limiting at approximately 23–25°C (Myrick and Cech 2000, Verhille et al. 2016, Dressler et al. 2023, Dressler et al. 2025).

3 STUDY AREA

The Study Area includes the mainstem Chorro Creek from the tidal extent of Morro Bay upstream to Chorro Reservoir and San Luisito Creek, a tributary to Chorro Creek (Figure 2). The Study Area was divided into two distinct study reaches—Chorro Creek and San Luisito Creek.

Figure 2. Study Area and index sites within Study Reaches of the Chorro Creek watershed.

4 METHODS

The general approach to assess growth and movement of steelhead in the Chorro Creek watershed included mark-recapture methods on juvenile steelhead within the Study Area. Individual steelhead were monitored using unique Passive Integrated Transponder (PIT) tags and fixed PIT-tag antenna arrays to monitor migratory patterns for two migratory seasons. Migration patterns were monitored using a combination of three seasonal mark-recapture efforts paired with stationary PIT-tag antennas. Details of the approach are described below.

4.1 Field Sampling

Fish were sampled from 17 sites along Chorro Creek, starting at Chorro Flats and extending upstream to just below Chorro Reservoir, and from 2 sites in San Lusito Creek (Figure 2). Fish were captured using a combination of multiple-pass and single-pass backpack electrofishing. Within designated index sites, multiple-pass backpack electrofishing was conducted following methods by Pollock and Otto (1983), wherein captured fish are temporarily removed from the sample site during sequential passes and returned to the stream once sampling is completed. Block nets were installed at the upstream and downstream extent of each index site to prevent migration into or out of the site and facilitate an accurate assessment of sample populations. Two biologists with Smith Root LR-24 backpack electrofishers and two or three netters began at the downstream block net and proceeded upstream, working closely together. As fish were captured, they were placed in buckets with aerated stream water until the completion of the pass. A minimum of three passes was conducted within each index site. If there was poor depletion after three passes, a fourth pass was performed.

To increase fish captures for tagging, single-pass electrofishing was conducted adjacent to each index site. For locations sampled using single-pass electrofishing, one to two biologists with Smith Root LR-24 backpack electrofishers and two or three netters moved in the upstream direction until a sufficient number of steelhead was captured. As fish were captured, they were placed in buckets with aerated stream water.

Fish capture and associated PIT tagging occurred in the fall of 2023, the spring of 2024, and the fall of 2024. All captured steelhead were counted and measured in millimeters (mm) for fork length (FL) and total length (TL) and for mass (grams). Steelhead ≥ 65-mm FL were anesthetized with tricaine methanesulfonate (MS-222) buffered with sodium bicarbonate and implanted with a PIT tag (12.5-mm APT FDX tag or 23-mm FDX tag; Biomark). A subset of fish ≥ 120 mm were implanted with 23-mm PIT tags. All PIT-tagged fish that were recaptured during spring and fall of 2024 and spring of 2025 were re-measured for FL, TL, and mass.

The Morro Bay National Estuary Program monitored water temperatures within the Study Area to assess temperatures in Chorro Creek and San Luisito Creek (Figure 1). Each temperature logger continuously recorded water temperature at 30-minute intervals through the duration of the study. Non-linear least squares analysis was used to compare mean daily temperatures at each of these locations during the 2024 water year.

4.2 Growth Analysis and Fish Density

Growth rate was calculated for all PIT-tagged fish that were recaptured between 2023 and 2025. Depending on the timing of tagging and recapture, growth rate calculations reflect changes in individual FL over the following periods:

- October to May (winter growth)
- May to October (summer growth)

Absolute growth rates were calculated by subtracting the initial FL of each fish from its FL at recapture. If fish were recaptured twice (n = 8) during the study period, the FL at last recapture was used as the "initial" FL for the most recent season of growth. It is well known that smaller fish tend to grow at faster rates than larger fish, so Stillwater Sciences accounted for initial FL in its growth rate analysis. Fish that were recaptured multiple times within the same sampling effort (e.g., fish were recaptured the day after they were tagged) were excluded from growth rate analysis. The effects of initial FL, tagging location (mainstem: Chorro Creek, tributary: San Luisito Creek), and growing season (winter, summer) on absolute growth rate were tested using multiple linear regression and Akaike Information Criterion was used for model selection.

Relative growth rates were calculated by dividing the absolute growth rate by the initial FL. A two-way Anova and post-hoc Tukey test were used to test for differences in relative growth rate between tagging locations and age classes using a p-value ≤ 0.05 as a threshold for statistical significance.

O. mykiss density (fish/100 meters [m]) was calculated for multiple-pass index units using the Fisheries Stock Assessment R package (Ogle et al. 2020).

4.3 Movement and Migration of PIT-Tagged Individuals

To monitor the movement behavior of PIT-tagged steelhead during the study period, a series of stationary PIT-tag antennas were installed within lower Chorro Creek at two locations: (1) Chorro Creek Estuarine Ecotone[2] and (2) Chorro Flats (Figure 3). The PIT-tag antenna at Chorro Flats is a standalone antenna installed in a swim-through orientation. The Chorro Creek Estuarine Ecotone station is composed of a paired set of swim-over antennas.

[2] An estuarine ecotone is a brackish transitional zone or boundary area between the freshwater riverine ecosystem and the saline tidal estuary ecosystem.

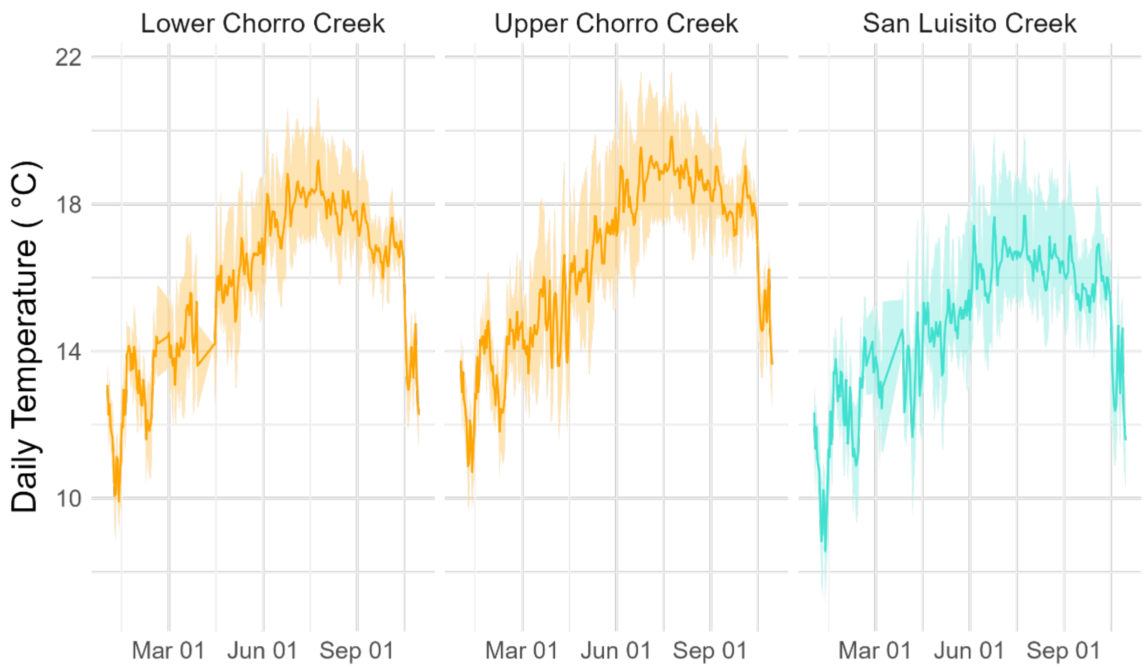
Figure 3. Swim through standalone PIT-tag antenna at (A) Chorro Flats and (B) the paired swim-over PIT-tag antennas at the Chorro Creek Estuarine Ecotone.

PIT tag antenna data were used to elucidate the timing and spatial patterns of downstream movement for the Chorro Creek *O. mykiss* population. Detection dates, times, and locations were compiled for all fish detected on the PIT-tag antennas to create individual fish detection histories. Fish were classified into the following groups based on their detection histories: Chorro Flats residents (fish that were tagged at Chorro Flats and were detected only at the Chorro Flats PIT antenna), one-way migrants (fish that were detected downstream of their tagging location), and two-way migrants (fish that were detected at the Estuarine Ecotone but were later detected back upstream at Chorro Flats). Dates of first detection at the Estuarine Ecotone were noted to approximate the timing window for smoltification within Chorro Creek.

5 RESULTS

5.1 Temperature and Fish Density

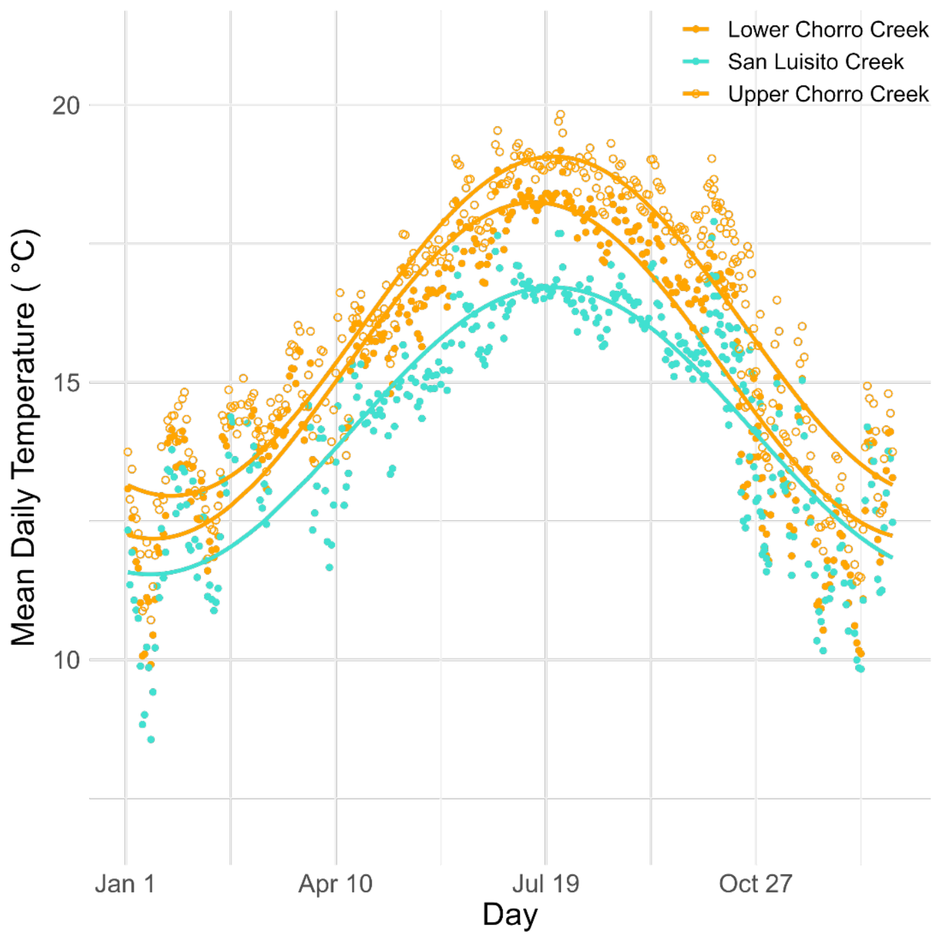
Stream temperatures generally remained within the thermal tolerance bounds (<23°C) for juvenile *O. mykiss* at all three logger locations throughout the 2024 water year (Figure 4). Overall, temperatures ranged from 7.1 to 21.6°C. The Upper Chorro Creek logger measured the warmest temperatures with a mean daily mean temperature of 18.7°C and a mean daily maximum temperature of 20.4°C during the summer. The Lower Chorro Creek logger measured slightly cooler temperatures compared to the Upper Chorro Creek logger, with a mean daily mean temperature of 17.9°C and a mean daily maximum temperature of 19.5°C during the summer. Temperatures were slightly cooler still at the San Luisito Creek logger with a mean daily mean of 16.4°C and a mean daily max of 18.5°C during the summer.



Note: Solid lines display mean daily temperatures, and shading indicates the minimum and maximum daily temperatures.

Figure 4. Temperatures in each of the Study Reaches from January 1 to October 31, 2024.

Mean daily temperature exhibited a sinusoidal relationship with Julian day, where temperatures peaked in mid-July (Figure 5). Analysis of sine curves fit using non-linear least squares confirmed that mean daily temperatures measured in San Luisito Creek were significantly cooler than both mainstem reaches and that mean daily temperatures measured in Lower Chorro Creek were significantly cooler than those measured in Upper Chorro Creek.



Note: Orange points and curves indicate mainstem temperatures, with open circles representing mean daily temperatures in Upper Chorro Creek and closed circles representing mean daily temperatures in Lower Chorro Creek. Blue points and curve indicate temperatures in San Luisito Creek.

Figure 5. Mean daily temperatures measured in each of the Study Reaches during the 2024 water year (October 2023–October 2024) and fitted curves representing the relationship between mean daily temperature and Julian day.

Within index units containing *O. mykiss*, fish densities ranged from 4 to 102 fish per 100 m in the mainstem units and from 44 to 263 fish per 100 m in San Luisito Creek. Fish densities were variable based on sample reach and timepoint. Overall, index units in San Luisito consistently had fish densities at the upper end of the range for each given timepoint, and in October of 2024, densities were extraordinarily high (262 to 263 fish per 100 m in both units). Additional sampling would be required to determine whether high *O. mykiss* densities within tributaries is a consistent pattern within this watershed because multi-pass sampling has been conducted in just two units in San Luisito (compared to 13 units in the mainstem).

5.2 Fish Capture and Detection

A total of 1,225 *O. mykiss* were captured and 870 were PIT-tagged during the three sampling efforts (Table 1). A total of 61 *O. mykiss* were recaptured at least once, and 8 *O. mykiss* were recaptured at least twice.

Table 1. Summary of *Oncorhynchus mykiss* mark and recaptures within the Chorro Creek Watershed.

Sampling effort	Captured *O. mykiss*	PIT-tagged *O. mykiss*	Recaptured *O. mykiss*[a]
October 2023	355	302	NA
May 2024	389	129	22
October 2024	481	439	39
March 2025[b]	--	--	9
Total	**1,225**	**870**	**70**

Notes: NA = not applicable

[a] Although 70 O. mykiss were recaptured, 1 fish > 250 mm was excluded because it was from an older age class.

[b] Fish recaptured in downstream migrant trap in operation for an acoustic telemetry study in Chorro Creek.

5.3 Growth Analysis

A total of 61 PIT-tagged *O. mykiss* were recaptured across sampling events—during the spring of 2024 (n = 22), fall of 2024 (n = 39), and/or in the Chorro Creek downstream migrant trap during spring of 2025 (n = 9). The vast majority of recaptured fish were within the size range for age 0+ to 2+, so fish with an initial FL > 250 mm (n = 1) were excluded because these are from an older, less common age class.

Fork lengths at the time of tagging and at recapture are shown in Figure 6. The slope of each line in Figure 6 is an indication of the absolute growth rate of each fish, such that high absolute growth rates appear as "steep" lines connecting individual measurements of FL over time. Most fish had positive growth over time during both winter and summer growing seasons.

In general, smaller fish grew at faster rates than larger fish. Absolute growth rates for age 0+ individuals averaged 0.29 mm/day in Chorro Creek and 0.14 mm/day in San Luisito Creek. Absolute growth rates for age 1+ individuals averaged 0.11 mm/day in the mainstem and 0.07 mm/day in San Luisito Creek. Regression model testing revealed that the strongest predictor of absolute growth rate was initial FL (Figure 7). Tagging location (tributary versus mainstem) was also a significant predictor of absolute growth rate whereby mainstem fish tended to have higher growth rates than tributary fish (Figure 7). Growth season was not a significant predictor of absolute growth rate—fish grew at the same rate during the winter season as they did during the summer season. Permit conditions precluded sampling during the spring, which may have limited the ability to discern subtle differences in growth rates across seasons. Akaike Information Criterion model testing confirmed that the best fit was a multiple linear regression with initial FL and tagging location as predictors ($R^2 = 0.47$, $p<0.001$; Figure 7). There was no significant interaction between initial FL and tagging location.

Discrepancies in growth rate between *O. mykiss* in Chorro Creek and San Luisito Creek were particularly pronounced in young-of-the-year fish (age 0+; Figure 8). Two-way Anova results revealed that age class (age 0 + versus age 1–2+), tagging location, and the interaction between these two variables all had significant influence on relative growth rate. Post-hoc Tukey test results revealed that relative growth rate was not significantly different between Chorro Creek and San Luisito Creek for fish age 1 to age 2+ ($p = 0.76$), but that age 0+ fish tagged in Chorro Creek had significantly higher relative growth rates compared to age 0+ fish tagged in San Luisito Creek ($p < 0.001$).

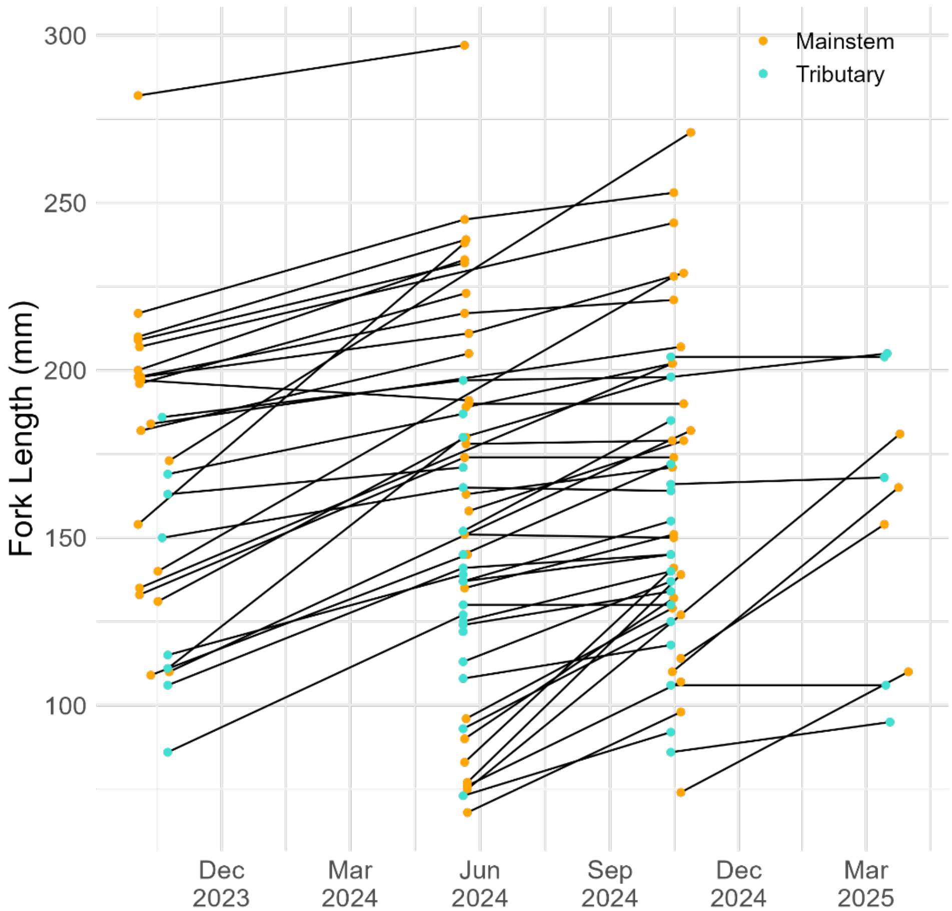


Figure 6. Fork length (millimeter) of recaptured fish over time for fish tagged in Chorro Creek (orange) and in San Luisito Creek (blue).

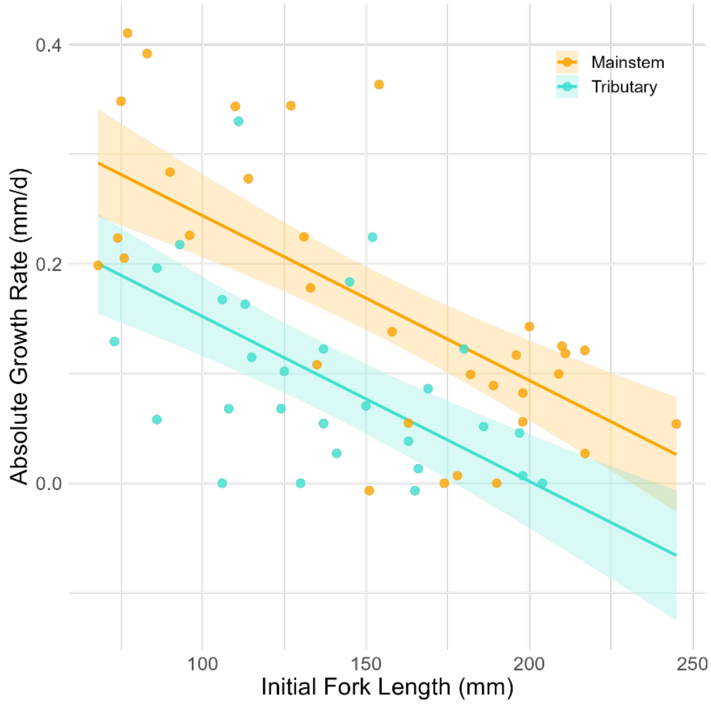
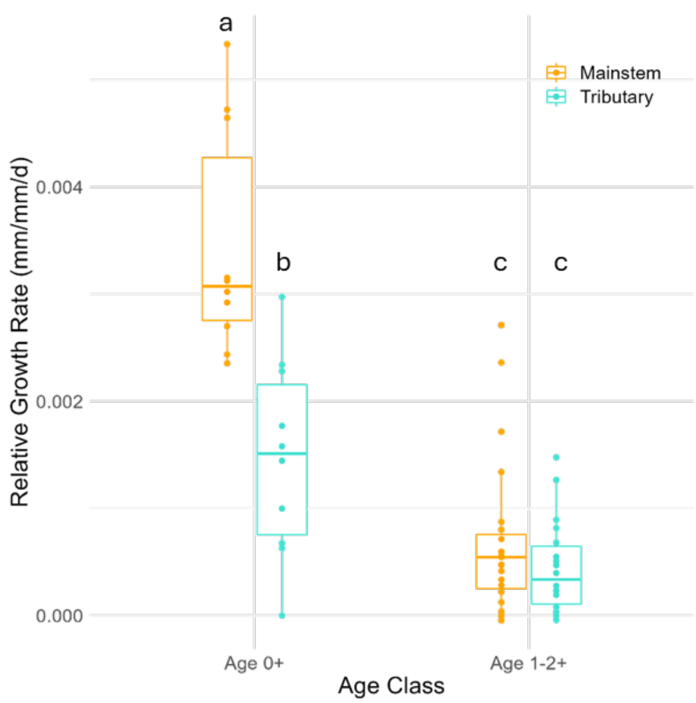


Figure 7. Relationship between absolute growth rate (millimeter/day) and initial fork length (millimeter) for juvenile *Oncorhynchus mykiss* tagged in the Chorro Creek (orange) and in San Luisito Creek (blue).



Note: Matching lowercase letters indicate statistical similarity between groups.

Figure 8. Relationship between relative growth rate (millimeter/millimeter/day), age class, and tagging location.

5.4 Fish Migration

In total, 201 fish were detected at PIT-tag antennas between November 2023 and June 2025. Of these, 127 fish were detected only at the Chorro Flats PIT-tag antenna—114 were considered Chorro Flats residents because they were tagged at Chorro Flats, and 13 were considered one-way migrants because they were tagged at an upstream location. The remaining 74 fish were detected by the Estuarine Ecotone antennae. Of these, 67 were considered one-way migrants (i.e., smolts) because they were last detected at the Estuarine Ecotone, and 7 were considered two-way migrants as they were last detected at Chorro Flats (Table 2). In general, the observed behavior most likely attributed to smolting was age 2+ fish migrating from San Luisito Creek or the upper watershed, passing the Chorro Flats PIT-tag antenna, and subsequently passing the Estuarine Ecotone within a few days (e.g., Figure 9). Occasionally, fish spent more time near the Estuarine Ecotone antenna and were detected many more times over the course of several weeks (e.g., Figure 10). Two-way migrants appeared not to smolt and were detected back at the Chorro Flats antenna several days to weeks after being detected at the Estuarine Ecotone antenna (e.g., Figure 11). These migration patterns are illustrated in Figure 12. Of the 33 smolts detected at the Estuarine Ecotone in 2024, 67% were originally captured and tagged within the San Luisito Creek, and 33% were originally tagged in Chorro Creek (18% in lower mainstem, 15% in the middle/upper mainstem reaches) (Table 2). Of the 30 smolts detected at the Estuarine Ecotone in spring 2025, 36% were originally tagged in San Luisito Creek and 64% were originally tagged in Chorro Creek (33% in the lower mainstem, 31% in the middle/upper mainstem reaches).

Table 2. Tagging location and number of smolts detected at the Estuarine Ecotone antenna.

Year	Number of Smolts Detected		Total
	San Luisito Creek	Chorro Creek	
2024	26	7	33
2025	7	23	30

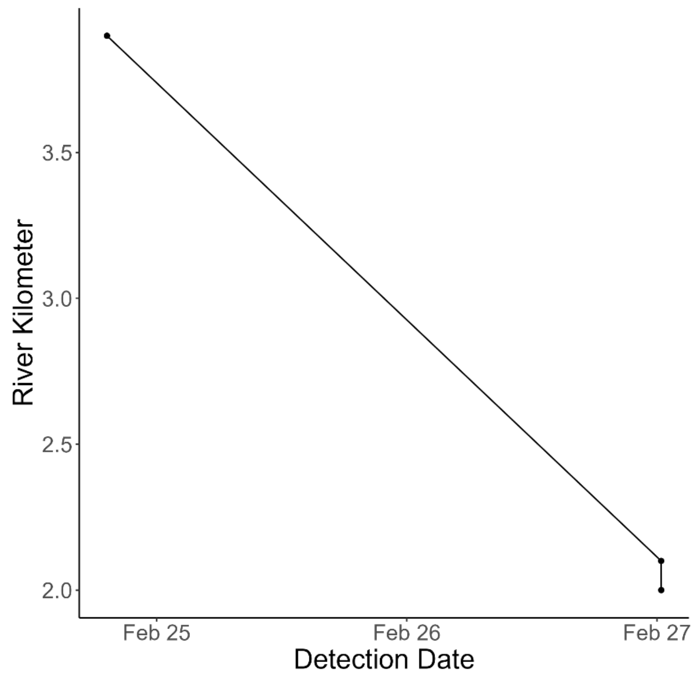


Figure 9. Example PIT-tag antenna detection pattern of a 149-millimeter initial fork length *Oncorhynchus mykiss* originally tagged at San Luisito Creek in May 2024.

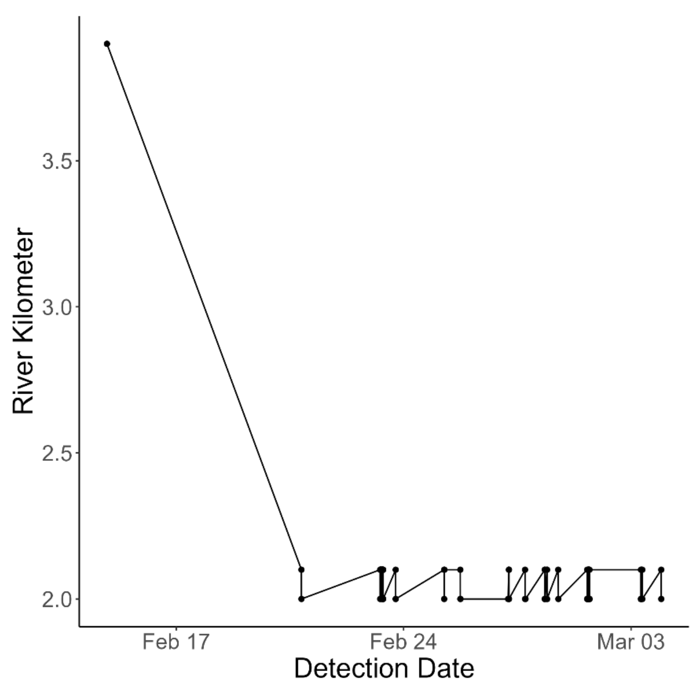
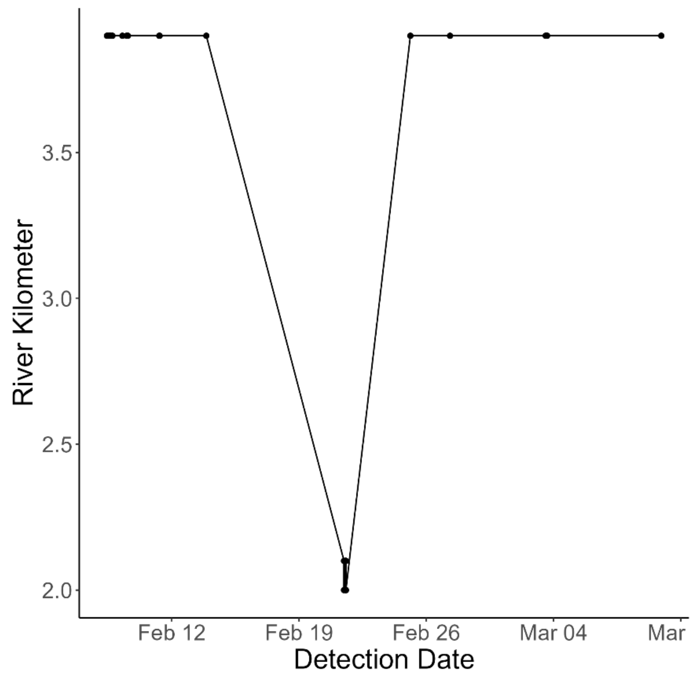


Figure 10. Example PIT-tag antenna detection pattern of an 82-millimeter initial fork length juvenile, originally tagged at Camp San Luis Obispo in October 2024, where the fish was detected many times over multiple weeks at the Estuarine Ecotone PIT-tag antenna in February and early March 2025.



Note: This fish was detected at the Estuarine Ecotone antenna in February 2024 and then back at the Chorro Flats antenna in March 2024.

Figure 11. Example PIT-tag antenna detection pattern of a 127-millimeter initial fork length juvenile originally tagged at Chorro Flats in October 2023.

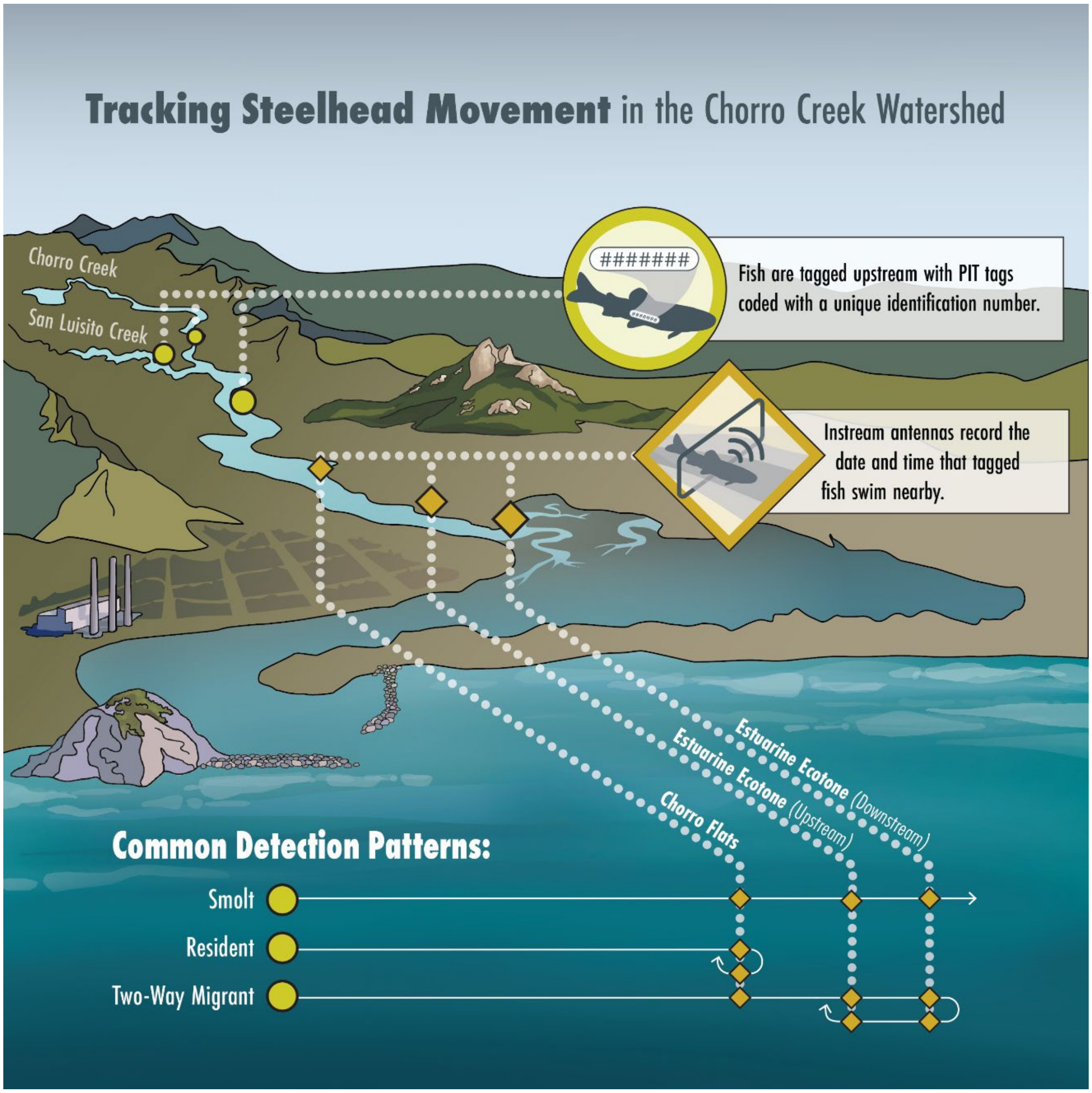


Figure 12. Variation of PIT-tag detection patterns observed in the Chorro Creek watershed.

In spring 2024, PIT-tag detections at the Estuarine Ecotone occurred between January 18 and April 29 (Figure 13). In spring 2025, PIT-tag detections began on February 5 and continued through April 29 (Figure 13). In 2025, no flow events occurred prior to the first fish detection. There appears to have been a peak in downstream movement during a flow event around March 13. As of June 9, 2025, no new fish have been detected at the Estuarine Ecotone. Based on these data, it appears the window for smolting in the Chorro Creek watershed is roughly January–April, but that the initiation of downstream movement may depend on the occurrence of a flow event.

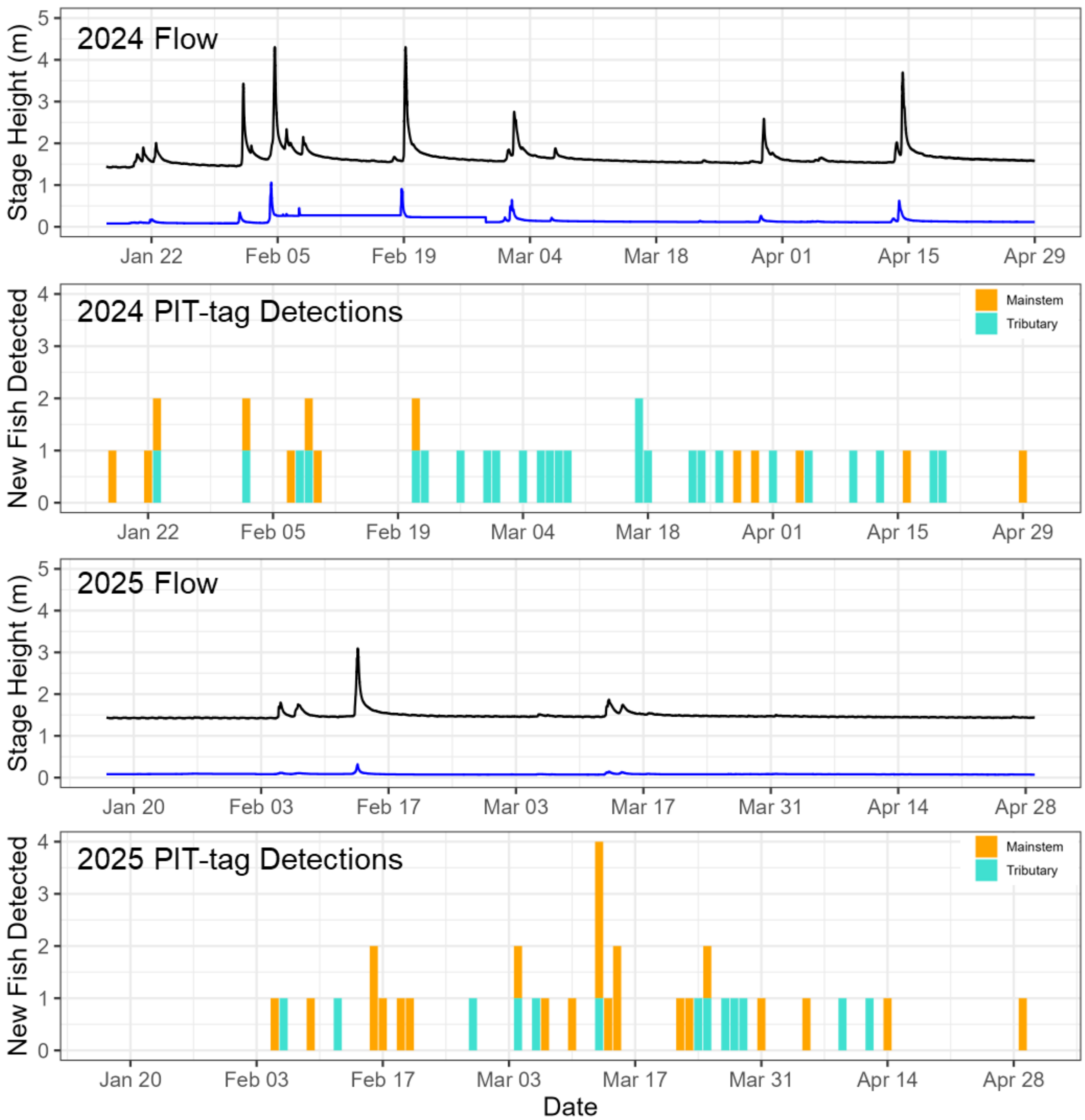


Figure 13. Stream stage height at Canet (black lines) and at San Luisito (blue lines) and timing of PIT-tag detections of fish tagged in Chorro Creek (orange) and in San Luisito (turquoise) at the Estuarine Ecotone in spring 2024 and 2025.

6 DISCUSSION

Chorro Creek contained suitable habitat conditions for resident rearing and anadromous steelhead production across a spatially diverse portion of the watershed during the period of study, both of which are critical to the resilience and persistence of the population in Chorro Creek. Growth rates of age 0+ fish in the mainstem were significantly higher than those observed in San Luisito Creek, likely owing to lower fish densities and warmer stream temperatures within the mainstem study reach. Fish densities within index sites on San Luisito Creek were consistently at the upper end of the range documented at index sites across all sampling events, with markedly high densities in October 2024. These densities were likely high enough to negatively influence growth rates of rearing *O. mykiss*, particularly age 0+ fish (Sogard et al. 2009). Several upstream passage impediments in San Luisito Creek, including the Adobe Road crossing, which is located between the San Luisito index sites, should be addressed to allow for increased habitat access during low flow periods. Furthermore, these passage barriers may preclude anadromous adults from accessing tributary habitats during dry water year types.

Multiple recaptures of PIT-tagged fish over the course of this study indicate high site fidelity by juvenile steelhead rearing in both the mainstem and tributary habitats. Most recaptured fish were captured within the same or adjacent index site to where they were initially tagged. Additional recapture events would be needed to assess whether recaptured fish are expressing a resident life history. Thirteen PIT-tagged fish were observed moving from upper Chorro Creek downstream past the Chorro Flats PIT-tag antenna, presumably to rear within this reach. Chorro Flats appears to provide both rearing habitat for resident *O. mykiss* and an important migratory corridor for smolts.

Two-way migrants were detected moving downstream past the Estuarine Ecotone antennae and reared within downstream habitats for several days to weeks before being detected at the Chorro Flats antenna (Figure 11). Additionally, several smolts were detected at the Estuarine Ecotone antennae over the course of several weeks before presumably migrating out to the ocean (Figure 10). Stillwater Sciences conducted nighttime snorkel surveys downstream of the Estuarine Ecotone antennae in spring 2025 and observed a high abundance of *O. mykiss* from multiple age classes (including smolts) within an approximately 300-m reach. This Estuarine Ecotone appeared to be highly productive, with large numbers of invertebrates including amphipods and shrimp (*Neomysis* spp.) observed along the substrate. This relatively small, tidally influenced reach may be providing critical habitat for steelhead smolts completing the smoltification process and also may be providing resident and juvenile *O. mykiss* with a highly productive environment that allows for rapid growth, similar to those observed in Scott Creek Lagoon (Hayes et al. 2008, Bond et al. 2008). Additional investigation of the residency duration and growth rates within this ecotone is recommended.

Despite varying water year types during the period of study (2024: normal; 2025: dry), Chorro Creek produced a similar number of smolts across years in both mainstem and tributary habitats. Interestingly, while the majority of smolts detected in 2024 (67%) were originally tagged in San Luisito Creek, detections in 2025 showed a shift, with most smolts (64%) originating from Chorro Creek. The underlying mechanism of this shift could be related to water year type, with mainstem study reaches providing more opportunities for downstream migration and better rearing conditions due to higher flows and stream temperatures relative to San Luisito Creek (see Figure 13). However, these findings indicate habitat conditions for anadromous smolt production are found throughout the watershed, which is critical to the resiliency of the population in Chorro Creek. Consistent smolt production observed during the period of study, combined with regular connectivity to the ocean via an open bar at the mouth of Chorro Creek, indicates this population may contribute to the maintenance of steelhead throughout the DPS. These findings suggest that the Chorro Creek steelhead population likely functions as an “independent population,” despite its designation as a Core 2 watershed under NMFS (2013) criteria.

The Chorro Creek watershed currently provides a spatially distributed mosaic of habitats that support the full range of steelhead life history strategies. This diversity of habitat and life history strategies is critical to sustaining population resiliency (Moore et al. 2014, Hall et al. 2016). While the results of this study provide important insights into key areas of juvenile production and growth, significant data gaps remain—especially within the other tributary streams, particularly San Bernardo, Dairy, and Pennington creeks. The extent to which these tributaries support the Chorro Creek steelhead population is largely unknown. Field surveys are planned for 2025 to PIT tag additional fish in San Bernardo Creek, with the goal of assessing migration patterns and fish densities within an additional tributary stream. Ideally, Stillwater Sciences and the Morro Bay National Estuary Program will continue to monitor and initiate PIT tagging in other tributaries, including Dairy and Pennington creeks, to assess how densities vary across the watershed and whether all tributaries are contributing to smolt production.

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