Petaluma Watershed Steelhead Monitoring Report
2020/2021 Spawning Surveys

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ACRONYMS

NOAA's National Marine Fisheries Service……. NMFS
Federal Endangered Species Act…….. ESA
Central California Coast steelhead…… CCC
Distinct population segment…….. DPS
California Department of Fish and Wildlife…….. CDFW
Evolutionary Significant Unit……... ESU
Sonoma Resource Conservation District……... RCD

Acknowledgements

We would like to thank all of the landowners whom granted us access to their land to conduct spawner surveys. We would also like to thank all the United Anglers students of Casa Grande High School and Volunteers that helped collect data on surveys.

INTRODUCTION

Background

The Petaluma River watershed is located in southern Sonoma County at the boundary with Marin County, California. The watershed consists of several tributaries that drain into the tidally influenced portions of the Petaluma River. These tributaries include: Adobe Creek, Lynch Creek, Washington Creek, Ellis Creek, Willow Brook Creek, Lichau Creek, and San Antonio Creek - the only tributary that drains the west side of the watershed (Figure 1). The Petaluma River watershed is approximately 150 square miles and experiences a Mediterranean climate, characterized by warm summers and mild wet winters with an average yearly rainfall of approximately 26.6 inches. Over 90 percent of annual precipitation occurs during the wet season (between November and April). Stream flows within the watershed are highly variable and can go quickly from low base flow conditions to high flows and then quickly recede again. Many tributaries to the Petaluma River are dry in late summer and in fall. The Petaluma River drains to San Pablo Bay, a sub-embayment in the northern portion of San Francisco Bay. The Petaluma Marsh is the largest remaining tidal brackish marsh in California (CDFW 2007) and is an important rearing area for many aquatic species (Goals Project 1999).

The Petaluma River was historically a narrow, shallow, and difficult to navigate tidal slough. Starting in the 1850's, it has been repeatedly dredged, widened, and straightened in order to facilitate the transport of goods from northern San Francisco Bay to San Francisco. In 1959, the tidal slough was designated a river, which authorized the Army Corps of Engineers to conduct periodic dredging to maintain a navigable channel. Most of the land within the watershed is privately owned and used primarily for agriculture such as cattle ranching, egg, and grape production (SSRCD 1999).

NOAA's National Marine Fisheries Service (NMFS) is the federal agency, a division of the Department of Commerce, responsible for the stewardship of the nation's living marine resources and their habitat. Under the Federal Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*), NMFS recovers protected marine and anadromous[1] species without unnecessarily impeding economic and recreational opportunities. In 2014, NMFS initiated spawner abundance monitoring to assess the abundance and distribution of steelhead (*Oncorhynchus mykiss*) in the watershed. Since 2014, the United Anglers of Casa Grande, Inc. (United Anglers) has taken over all monitoring and reporting in this area. Steelhead are anadromous forms of rainbow trout. Steelhead that occur in the Petaluma River watershed belong to the Central California Coast (CCC) "distinct population segment" (DPS) and are listed as a threatened species under the, ESA (Figure 2).

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[1] Anadromous fish are born in fresh water, migrate to the ocean to grow into adults, and then return to fresh water to spawn.

The United Anglers is a local non-profit group that has been active in the watershed since the early 1980's. The United Anglers mission, continues to be, to promote environmental awareness and activism through hands-on habitat restoration that supports the survival and recovery of steelhead in the Petaluma River watershed. The United Anglers largely consists of Casa Grande High School students that carry out habitat restoration activities and fish population monitoring. Past efforts of the United Anglers have resulted in the restoration of Adobe Creek from a state of nearly complete degradation to a stream that has consistently supported adult and juvenile steelhead since the early 1990's. The United Anglers operate a small, education-focused hatchery at the Casa Grande High School campus where they are currently rearing steelhead eggs (sourced from the Warm Springs Hatchery in Geyserville, California) to fingerlings that are then returned to the Warm Springs Hatchery to be imprinted and released back into the Russian River watershed.

Steelhead observation data from the past 50 years suggests that this population has been reduced significantly from its historical abundance and distribution, largely due to watershed wide habitat destruction. The anecdotal information collected by the United Anglers from 1987 to 2018 continues to indicate a declining **population (Figure 3). The results of 2017/2018 spawner surveys, corroborate this with only two live adult steelhead and one carcasses observed.**

In 2013, United Anglers staff and students received training from NMFS and CDFW to standardize spawning survey efforts in the watershed following the protocols of the American Fisheries Society (AFS) Salmonid Field Protocols Handbook (Gallagher et al. 2007). The main objective of the spawner surveys is to estimate the current abundance, productivity, spatial structure, and genetic diversity of CCC steelhead in the Petaluma River watershed; and to evaluate steelhead habitat conditions of the Petaluma River watershed. The information obtained from spawner surveys will be used to inform future actions targeting the recovery of steelhead in the watershed. Preliminary observations by NMFS suggest that the population of steelhead in the watershed is at a very high risk of extirpation because of very low abundance and extremely limited distribution of individuals in the watershed. As such, United Anglers immediate objective is to work with the NMFS to conduct the monitoring necessary to support the evaluation of developing a "conservation" hatchery in the watershed, which would sustain the population until large-scale habitat restoration is achieved within the Petaluma watershed.

Steelhead Life History

Steelhead are anadromous forms of rainbow trout (*O. mykiss*), spending some time in both fresh- and saltwater. The older juvenile and adult life stages occur in the ocean, until the adults ascend freshwater streams to spawn. Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death (Busby et al. 1996). Although one-time spawners are the great majority, Shapovalov and Taft (1954) reported that repeat spawners are relatively numerous

(17.2 percent) in California streams. Eggs (laid in gravel nests called redds), alevins (gravel dwelling hatchlings), fry (juveniles newly emerged from stream gravels), and young juveniles all rear in freshwater until they become large enough to migrate to the ocean to finish rearing and maturing to adults. General reviews for steelhead in California document much variation in life history (Barnhart 1986; Busby et al. 1996; McEwan 2001; Shapovalov and Taft 1954). Although variation occurs, coastal California steelhead usually live in freshwater for 1 to 2 years, then spend 1 or 2 years in the ocean before returning to their natal stream to spawn. Steelhead may spawn one to four times over their life. Adult steelhead typically migrate from the ocean to freshwater between December and April, peaking in January and February (Fukushima and Lesh 1998). Juvenile steelhead migrate as smolts to the ocean from January through May, with peak migration occurring in April and May (Fukushima and Lesh 1998).

Steelhead fry rear in edgewater habitats and move gradually into pools and riffles as they grow larger. Cover is an important habitat component for juvenile steelhead, both as a velocity refuge and as a means of avoiding predation (Meehan and Bjorn 1991; Shirvell 1990). Steelhead, however, tend to use riffles and other habitats not strongly associated with cover during summer rearing more than other salmonids. Young steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles. Rearing steelhead juveniles prefer water temperatures of 7.2-14.4°C and have an upper lethal limit of about 25°C (Barnhart 1986; Bjornn and Reiser 1991). However, they can survive in water up to 27°C with saturated dissolved oxygen conditions and a plentiful food supply. Fluctuating diurnal water temperatures also aid in survivability of salmonids (Busby *et al*. 1996). Juvenile steelhead emigration from their natal streams occurs episodically during fall, winter, and spring months, and generally occurs during high flow events. Barnhart (1986) reported that steelhead smolts in California typically range in size from 140 to 210 millimeters (fork length).

Historically, approximately 70 populations[2] of steelhead existed in the CCC steelhead DPS (Spence et al. 2008; Spence et al. 2012). Many of these populations (about 37) were independent, or potentially independent, meaning they had a high likelihood of surviving for 100 years absent anthropogenic impacts (Bjorkstedt et al. 2005). The remaining populations were dependent upon immigration from nearby CCC steelhead DPS populations to ensure their viability (Bjorkstedt et al. 2005; McElhany et al. 2000).

[2] Population as defined by Bjorkstedt *et al.* 2005 and McElhaney *et al.* 2000 as, in brief summary, a group of fish of the same species that spawns in a particular locality at a particular season and does not interbreed substantially with fish from any other group. Such fish groups may include more than one stream. These authors use this definition as a starting point from which they define four types of populations (not all of which are mentioned here).

Status of CCC Steelhead and Critical Habitat

Recent viability assessment of CCC steelhead concluded that populations in watersheds that drain to San Francisco Bay are highly unlikely to be viable, and that the limited information available did not indicate that any other CCC steelhead populations could be demonstrated as viable[3] (Spence *et al.* 2008). Monitoring data from the last ten years of adult CCC steelhead returns in Lagunitas and Scott creeks show steep declines in adults in 2008/2009. In 2011/2012 population levels began to increase, but still remained lower than levels observed over the past ten years (The Nature Conservancy 2013). The most recent status update found that the status of the CCC steelhead DPS remains "likely to become endangered in the foreseeable future" (Williams et al. 2011), as new and additional information available since Good et al. (2005), does not appear to suggest a change in extinction risk. On December 7, 2011, NMFS chose to maintain the threatened status of the CCC steelhead (76 FR 76386).

Critical habitat was designated for CCC steelhead on September 2, 2005 (70 FR 52488) and includes PCEs essential for the conservation of CCC steelhead. These PCEs include estuarine areas free of obstruction and excessive predation with the following essential features: (1) water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (2) natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and (3) juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation (70 FR 52488).

The condition of CCC steelhead critical habitat, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. NMFS has determined that present depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat[4]: logging, agricultural and mining activities, urbanization, stream channelization, dams, wetland loss, and water withdrawals, including unscreened diversions for irrigation. Impacts of concern include alteration of streambank and channel morphology, alteration of water temperatures, loss of spawning and rearing habitat, fragmentation of habitat, loss of downstream recruitment of spawning gravels and large woody debris, degradation of water quality, removal of riparian vegetation resulting in increased streambank erosion, loss of shade (higher water temperatures) and loss of nutrient inputs (Busby *et al.* 1996, 70 FR 52488). Water development has drastically altered natural hydrologic cycles in many of the streams in the DPS. Alteration of flows results in migration delays, loss of suit-

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[3] Viable populations have a high probability of long-term persistence (> 100 years).

[4] Other factors, such as over fishing and artificial propagation have also contributed to the current population status of steelhead. All these human induced factors have exacerbated the adverse effects of natural factors such as drought and poor ocean conditions.

able habitat due to dewatering and blockage; stranding of fish from rapid flow fluctuations; entrainment of juveniles into poorly screened or unscreened diversions, and increased water temperatures harmful to salmonids. Overall, current condition of CCC steelhead critical habitat is degraded, and does not provide the full extent of conservation value necessary for the recovery of the species.

The ESA mandates NMFS to develop and implement plans for the conservation and survival of NMFS listed species, i.e., recovery plans. Recovery is the process by which listed species and their ecosystems are restored and their future safeguarded to the point that protections under the ESA are no longer needed. The recovery plan serves as a road map for species recovery – showing where we need to go and how best to get there (NMFS Interim Recovery Plan Guidance 2006). The recovery plan for CCC steelhead is currently in development. It will identify the major threats that impact steelhead and priority actions to be implemented to recover CCC steelhead.

Status of Steelhead and Critical Habitat in the Petaluma River Watershed

Limited information exists regarding the historic abundance of steelhead in the Petaluma River watershed. The physical attributes of the watershed suggest that populations were likely plentiful. NMFS estimates approximately 59 miles of potential habitat suitable for steelhead is present within the watershed.

Contemporary information suggests that steelhead occur in Adobe, Lichau, Lynch, Willow Brook, and San Antonio creeks. Of these listed tributaries, Adobe, Lynch, and Lichau Creeks have had the highest number of recent steelhead observations (personal communication, Dan Hubacker 2014). A visual survey of Adobe Creek by CDFW in 1968 reported juvenile steelhead abundances at 150 individuals per 30-meters (Skinner 1962). Another 1968 CDFW survey reported juvenile steelhead in Lichau Creek as well (Leidy et al. 2005). Steelhead adults have been observed in Adobe Creek, Lynch Creek, Lichau Creek and Willow Brook Creek by the United Anglers (personal communication, Dan Hubacker 2014). Surveys conducted in 2007 by CDFW confirmed the presence of juvenile steelhead in Adobe Creek, Lichau Creek and Lynch Creek and stated that steelhead may have been present in Willow Brook Creek but the fish observed were not identified (CDFW 2007). The United Anglers have conducted informal visual surveys of adult steelhead in Adobe Creek since 1987 and have observed adult steelhead every year, with numbers ranging from 1 – 60 fish per year (Figure 3). These surveys have shown that Chinook salmon (*Oncorhynchus tshawytscha*) are also present in the watershed, primarily in the tidally influenced portions of tributaries and the mainstem of the Petaluma River. The Chinook salmon occurring in the Petaluma River watershed are believed to be individuals of the Central Valley Fall-run Evolutionary Significant Unit (ESU). This population is not listed as threatened or endangered under the ESA.

Human activities in the watershed have impaired steelhead habitat conditions throughout the watershed. Within the survey area, quality spawning sites were limited. Altered sediment transport from high road densities within the riparian zone has limited spawning gravel recruitment and impacted spawning gravel quality. According to CDFW habitat typing surveys (2007), no streams within the watershed met optimal criteria for embeddedness. Most streams rated fair, and Ellis and Washington creeks rated poor. Gravel embeddedness affects the survivability of incubating eggs through decreased oxygenation, and the release of metabolic wastes from the redd, and can also inhibit emergence of alevins from the redd. The riparian canopy has been reduced to less than 70 percent in Adobe, Washington and Ellis creeks (CDFW 2007). The majority of the riparian canopy that is present in the watershed does not contain the hardwood species necessary for bank stabilization and future recruitment of large woody debris (LWD). Unrestricted cattle grazing has significantly reduced the riparian canopy along all major creeks in the watershed. There are several passage impediments in the watershed that limit the ability for adult steelhead to migrate at all stream flows. These include culverts, bridges, small dams and farm ponds. Passage barriers are discussed in more detail below. Low stream flow conditions due to the consecutive drought years has been suggested to have greatly restricted ability of adult steelhead movement in the watershed.

In the draft Recovery Plan for CCC steelhead, NMFS has identified priority recovery actions that should be implemented in this watershed which include: improving riparian and canopy, reducing the input of sand and silt, improving stream flows in tributaries, removing passage barriers, addressing water pollution problems, and increasing population numbers through supplementation efforts following significant habitat restoration to address the above issues. San Antonio, Ellis, Adobe, Lynch, Lichau, and Willow Brook creeks are high priority areas for implementing such recovery actions. The potential for habitat restoration in this rural watershed is higher than other more urbanized watersheds within the CCC steelhead population area, due to its relatively low degree of urban development and lack of large water impoundments. United Anglers is consistently helping to identify key restoration sites within the watershed and working with local landowners to improve habitat within the watershed.

METHODS

Survey Locations

Because a major portion of the land in the Petaluma River watershed is privately owned (94 percent), the survey area for spawner surveys was largely dictated by landowners granting the United Anglers permission to access their property. At the beginning of the 2020 spawner season, United Anglers contacted landowners by letter and/or phone to confirm previously granted permission from the previous survey season. Attempts for gaining additional property access were

made by contacting new landowners and landowners that were unresponsive during the last request.

Adobe Creek

Approximately 4.5 miles of Adobe Creek under typical circumstances are surveyed from the point of tidal influence (adjacent to Alman Marsh) upstream to a ranch road crossing 1.6 miles northwest of Manor lane. This entire stream segment has a gain in elevation of approximately 680 feet. This stream segment was divided into three reaches, with each reach surveyed on different days. Reach 1 began at the rock wall in the beginning of the tidal influence and ended at Ely road. Reach 2 started at Ely road and ended at the end of the Adobe State Park. Reach 3 is Fred Clines property located down stream of Manner Lane to the Manner Lane crossing. Reach 4 is the Sartori property starting at the Manor Lane crossing upstream to the end of the Sartori property line. The city owned property known as Lafferty continues to be evaluated as a potential location site for future surveys.

Adobe Creek meanders through the city of Petaluma, passing along and under urban streets, through housing developments, a golf course, Petaluma Adobe State Historic Park, and through several privately-owned ranches north of the city.

Lynch Creek

Approximately 2.8 miles of Lynch Creek were surveyed from its confluence with the Petaluma River along the Lynch Creek Trail upstream to a point approximately one mile north of Old Adobe road, skipping over properties immediately adjacent to either side of Old Adobe road. The entire stream segment has an elevation gain of approximately 220 feet. The Lynch Creek survey reach runs adjacent to walking and biking trails, passes under city streets and US Highway 101, and flows through city parks, housing developments, a golf course, and ranch land in East Petaluma. Reach 1 begins at the tidal confluence to Maria Drive. Reach 2 starts at Maria Drive and ends at Rooster Run golf course down stream of Adobe road.

In addition, access to the headwaters of Lynch creek has been granted. This reach isn't subject to observe spawners due to habitat challenges such as poison oak, safety issues linked to steepness of the banks and limited access. There is potential for juvenile summer habitat. Summer sampling will be conducted during the summer months. Currently, no samples have been collected by juvenile at this time.

Lichau Creek

Approximately 1.65 miles of Lichau Creek was surveyed from Stony Point Rd. to the Brian's property upstream of Petaluma Hill Rd. Sections of creek were left unsurveyed due to private property restrictions and habitat with very deep water and/or dense vegetation that remains unnavigable. Reach 1 started at the crossing of Stony Point road upstream of farm ponds and ended

at Old Redwood highway. Reach 2 begins at Petaluma Hill rd. crossing and ends at a private property line on the Brian's Property.

Lichau Creek runs under a highway and major roadways, through farmland, as well as city and privately owned property.

San Antonio Creek

We have been given permission to survey approximately 4.3 miles of San Antonio Creek. Due to the spacing between land access we have currently held off of any spawner surveys. We were limited on conducted summer surveys in search of summering juveniles due to Covid restrictions and the stay at home order put in place by the governor in the late spring and summer. No samples have been collected at this point.

Redd, Carcass and Live Adult Fish Surveys

Following the first storm event of the year, which has trended toward the first week of February, United Anglers director, volunteers and students walked Adobe, Lynch, and Lichau creek surveying each individual reach. Surveys were conducted every 7-14 days (with the exception of San Antonio creek), or as soon as possible following a storm event (i.e., when stream flows and water visibility were suitable for surveys). Gaps in survey data represent an inability to access survey reaches, conditions not conducive to conducting a survey (ie. limited visibility due to recent storms, or lack of flow leaving creeks disconnected). The last survey of the season for most streams were conducted in early March due to the stay-at-home order. Each team of 2-4 surveyors walked upstream searching for redds, live fish, and carcasses. Surveys were conducted according to protocols published in the American Fisheries Society (AFS) Salmonid Field Protocols Handbook (Gallagher *et al.* 2007). During all surveys, if there was a presence of live steelhead adults, steelhead carcasses, and redds it would be recorded. The GPS coordinates or the physical location (in reference to landmarks, road crossings, or properties) of each observation would be recorded. Other information collected during surveys included weather, water temperature, water clarity, the sex and length of any spawner observed, any mark codes on the carcasses (such as adipose fin clip), type of sample collected (e.g., tissue, scales, otolith, head), the position of each redd in the stream (i.e., right bank, left bank, or midstream), the age of the redd, the species believed to have created the redd (Chinook do occasionally occur in the watershed). If it was a definite or test redd, dimensions of the redd, and the number and species of any fish observed on the redd.

If live fish are encountered, care is taken not to disturb the fish. The location, species and sex of the fish would be noted and the size visually estimated. We also record spawning behavior or fish interactions. The location of each carcass would be recorded and assigned a unique sample ID number. Other information recorded would include: the standard length, sex, and the presence of any tags, adipose fin clips or other marks. To help determine the sex of a fish we would

examine the carcass for any retained eggs or milt. A tissue sample would be collected from each carcass according to NOAA Southwest Fisheries Science Center (SWFSC) Collection Protocols. Either a 1 cm square clip from the operculum or tail fin, or complete scales would be removed and placed in folded over blotter paper in a labeled paper envelope. No otolith samples or heads would be collected from carcasses. Tissue samples would be allowed to air dry as soon as possible upon leaving the field and later submitted for genetic testing. The tail of the carcass would be cut to mark it as "processed" as to avoid double counting. The carcass would be left in the stream where it was found.

Each redd would be given a unique identification number, which would include the date of first observation, and be marked with flagging in the field. Flags would be positioned in line with the tailspill of the redd. Each flag would be marked with the redd ID, the overall length and width of the redd or a note of "not measured", the location in the stream (right side, left side or mid-stream), and the species of fish. If a redd did not appear complete, it would be classified as a test redd, which was recorded and noted on the flag. If fish were not present on redds or within the immediate area of the redd, the redd would be measured. Width and length measurements would be taken of each redd's pot and tailspill. To determine if a redd was created by a steelhead or Chinook salmon we would use the size and shape of the redd. Steelhead redds are usually small and round in shape whereas Chinook redds are generally much larger and often have a branching shape.

RESULTS

Live Steelhead, Redds, and Carcarcass

Covid restrictions limited this years teams from conducting field surveys with any consistency. No live fish were observed during the limited time in the field in Adobe, Lynch, and Lichau creek. Due to the limited number of surveys conducted for both spawners and juveniles no conclusions can be made at this time.

Habitat Observations

<u>Adobe Creek</u>

There are a few partial barriers to steelhead movements on Adobe creek, such as the silt dam at McDowell Blvd, which may impede the passage of adults and juveniles during low flows. A bridge abutment upstream of Adobe Road is possibly a significant barrier to upstream movement for smaller fish. During low flows, the abutment requires a fish to jump 4 feet vertically through protruding rebar stakes onto a concrete shelf. Adult fish are clearly able to traverse these barriers as we observed adults and redds above the bridge in earlier seasons, but juvenile fish are not able to move upstream of this barrier. This years wet season was one of the driest the state has had on record. Even though all of the creeks we observed we affected, Adobe was by far a point of em-

phasis. For the last forty years observations have been made of juvenile Steelhead holding in pools scattered throughout the tributary, often found higher up the mountain as low flows set in. By April, the previous years smolts tend to make their way to the lower reaches of the creek to acclimate to the higher salinity. During the summer of 2020 Sonoma Water removed built up sediment from the downstream crossing of Casa Grande Rd to the first upstream property line. *This section of the creek makes up about a hundred yards. From where the sediment work was conducted to where the private property fence, a clear increase in gradient was created. Under a normal wet season flows would have potentially pushed bed-load down the hill and reduced this gradient. However, because of the lack of rainfall, the creek was left disconnected earlier than previous years with an impassable stretch of creek for both adults and juveniles. (Figure 5)

Lynch Creek

A significant barrier to steelhead movements continues to exists at the confluence of Lynch Creek with the Petaluma River that may impede fish passage at most stream flows. Fish attempting to enter Lynch Creek at low tide are required to traverse a steep, 10 foot tall structure to reach the creek bed (Figure 4A). While at a significant high tide, the required jump shrinks to less than a couple feet making this jump more likely overcome. But, at low tide the structure may constitute a significant barrier to some individuals (Figure 4B). It is likely that the lack of steelhead observed in the surveyed portion of Lynch Creek is due to this barrier. We continue to observe numerous illegal campsites and water quality issues in both reaches. There is room for small scale habitat improvements in the future.

Lichau Creek

Stream depth and vegetation growth continue to be the two large factors prohibiting surveys in the areas of Lichau creek that are accessible to us. There are several portions that even during low flows remain too deep to be passed through by surveyors. Downed tree blockages, dense Himalayan blackberry, *Rubus armeniacus*, and Western poison oak, *Toxicodendron diversilobum*, make areas impassable to surveyors. Lichau creek runs through many private properties and therefore has greatly limited the access that United Anglers has to conduct surveys. Many of the inaccessible stretches are anticipated to experience erosion, polluted runoff, and loss of vegetative cover due to farming practices. Reach 2 consists of flat farmland that has opportunities for habitat improvement which is being discussed by the Petaluma Round Table. Within that Reach, from Petaluma Hill road to Railroad avenue, dense vegetation makes monitoring this stretch difficult. Approximately halfway through this reach the creek jumped its bank and splits into two streams and then rejoins back up after approximately one hundred yards. The water flowing out of the original creek bed is typically over 20 degrees celsius. In late December, eleven Chinook salmon were observed attempting to spawn in this reach. Based off of the condition, survival rates will most likely to be low if any at all. This reach has a supportive landowner willing to

work with outside agencies. Our hope is that in the near future possible restoration efforts can be explored.

San Antonio Creek

Due to the limited access no further information was gathered for this year.

The following information is based on 2015/2016 data. There were no obvious fish barriers in our surveyed section of San Antonio Creek. San Antonio Creek has a much gentler slope than Adobe or Lynch Creek and our surveyed section appeared to have a much greater overall depth than these two creeks. There is anecdotal information from a long-time resident that San Antonio Creek was heavily gravel mined in the past, which probably explains some of its entrenchment. After speaking to an additional long-time resident, it was brought to our attention that San Antonio creek historically experienced a water diversion that now makes the creek into two separate streams and where this diversion occurred is now a large blockage that may be impassable to fish.

In San Antonio Creek, water visibility following storms was poor for at least a week. Baseline water visibility was much lower in San Antonio Creek than Lynch, Lichau, and Adobe creeks. Water depths were much deeper in San Antonio Creek. Surveyors often had to exit the creek due to extreme depths and walk significant distances upstream around dense Himalayan blackberry, *Rubus armeniacus*, covered banks in order to regain access to the creek. Where possible, surveyors would backtrack in the creek to survey skipped sections. Overall, San Antonio Creek was much deeper, had more slack water sections and fewer shallow riffle sections than did Adobe or Lynch creeks.

Other Aquatic Species Observations

Native Species	**Previously Observed**	**Observed this Season**
Foothill Yellow-legged Frog (*Rana boylii*) – adults, juveniles, and egg masses	ADC, LYC, SAC	
Pacific Treefrog (*Pseudacris regilla*) – adults, egg masses	ADC, LYC, SAC	
Three spined sticklebacks (*Gasterosteus aculeatus*)	ADC, LYC, SAC	ADC, LYC
California roach (*Hesperoleucus symmetricus*)	ADC, LYC, SAC	ADC, LYC, LHC
Western Toad (*Bufo boreas*) – tadpoles, egg masses	ADC	ADC, LHC
California Red-sided Garter Snake (*Thamnophis sirtalis infernalis*) – adult	ADC, SAC	ADC
Western Pond Turtle (*Clemmys marmorata*) – adults, juveniles	SAC, LHC	
Rough-skinned Newt (*Taricha granulosa*) – adults	SAC,ADC,LYC	ADC, LYC
Non-Native Species	**Previously Observed**	**Observed this Season**
Bullfrog (*Rana catesbiana*)	ADC, SAC	ADC, LHC,LYC

Adobe Creek – ADC, Lynch Creek – LYC, Lichau Creek – LHC, San Antonio Creek – SAC

DISCUSSION

Most of the land in the Petaluma River watershed is privately owned (94 percent), the survey area is largely dictated by landowners granting access to their property. We were granted access to approximately 12.95 miles of continuous stream in 4 different tributaries: 4.5 miles in Adobe Creek, 4 miles in Lynch Creek, 1.65 miles in Lichau Creek. Overall, this constituted 19 percent of the total potential habitat in the watershed. Due to such a limited survey area, it is difficult to draw watershed-wide conclusions on the abundance and distribution of steelhead in the watershed. However, data continues to suggest that Adobe Creek may contain some of the highest quality habitat in the watershed for spawners and summer habitat.

We continue to survey Lichau and Lynch creek but have observed zero O.mykiss, and there has been no apparent redds. These findings corroborate NMFS' preliminary conclusions that the population of steelhead in the Petaluma River watershed is at very low abundance and extremely limited in distribution. A major factor that likely influenced the low abundance of steelhead observed could be consecutive seasons with minimal precipitation and extremely low stream flows.

Throughout the surveys we continue to observe significant habitat degradation related to urban infrastructure, cattle grazing, direct human disturbance of the stream bed (e.g., small rock dams

and heavy machinery in the creek), illegal camping, poaching, and vegetation removal. As mentioned previously, the rural nature of this watershed makes its restorability more achievable than restoration in more urbanized watersheds. Given the high incidences of poaching, human disturbance of the stream, and illegal camping observed during surveys; education and outreach to residents on ways to conserve and protect steelhead and their habitat in the watershed, and focused enforcement would likely make a significant impact in this watershed.

Other priorities we identified are working with landowners to restrict livestock access to streams by finding alternative off-stream water sources, replacing and implementing livestock fencing along creeks to limit disturbance. We feel this is key role that the Petaluma Roundtable will play in the recovery plan. This group's focus is to prioritize potential areas for habitat improvement, community outreach and more. We are hopeful that by bringing in more stake holders we will be able to address some of these lingering problem in the near future.

We plan to return to conduct spawner surveys during the 2021/2022 spawner season to gain additional information that will be useful in assessing overall trends of the adult steelhead population in the Petaluma River watershed and the habitat conditions over varying water year types (e.g. wet, dry, average). We continue to try and expand our survey area in future seasons to include the upper reaches of Lynch, Adobe, and Lichau creeks. This last fall, there was a change in ownership on the private property located upstream of Manner lane. We hope to make contact with the new owner to continue our partnership as we had with the previous family.

A few seasons ago, access was granted to the headwaters of Adobe, Lynch, Lichau and Willow Brook. These areas had limited amounts of monitoring in 2019 through 2021 season. However, with the support of a few landowners who have excessive knowledge of the watershed, we were able to collect the first tissue samples from Lynch creek. Although there were only a few sample taken due to warm increasing water temperatures we are optimistic we will be able to use this as a starting point for the upcoming season.

In the 2021/2022 season, we plan to increase the amount of monitoring in these areas when conditions and resources are favorable for surveys to be conducted. This summer our plan is to continue to identify summering habitat for O.mykiss while increasing the number of tissue samples collected . By collecting genetic samples from juveniles we can supplement for the limited numbers of live adult and carcusses observed during the spawning season to help provide additional findings regarding abundance, distribution, and the overall composition of the diversity of genetics found in this O. mykiss population found in the Petaluma watershed.

TABLES AND FIGURES

Figure 1 – Map of Petaluma Watershed and UACG property access as of January 2021. Dark blue lines indicate creeks while the light blue line indicates the Petaluma River. Green indicates access granted, red indicating access denied, and beige showing no response from landowner.

Figure 2– Map depicting Central California Coast Distinct Population Segment Diversity Strata from Spence *et al.* 2008.

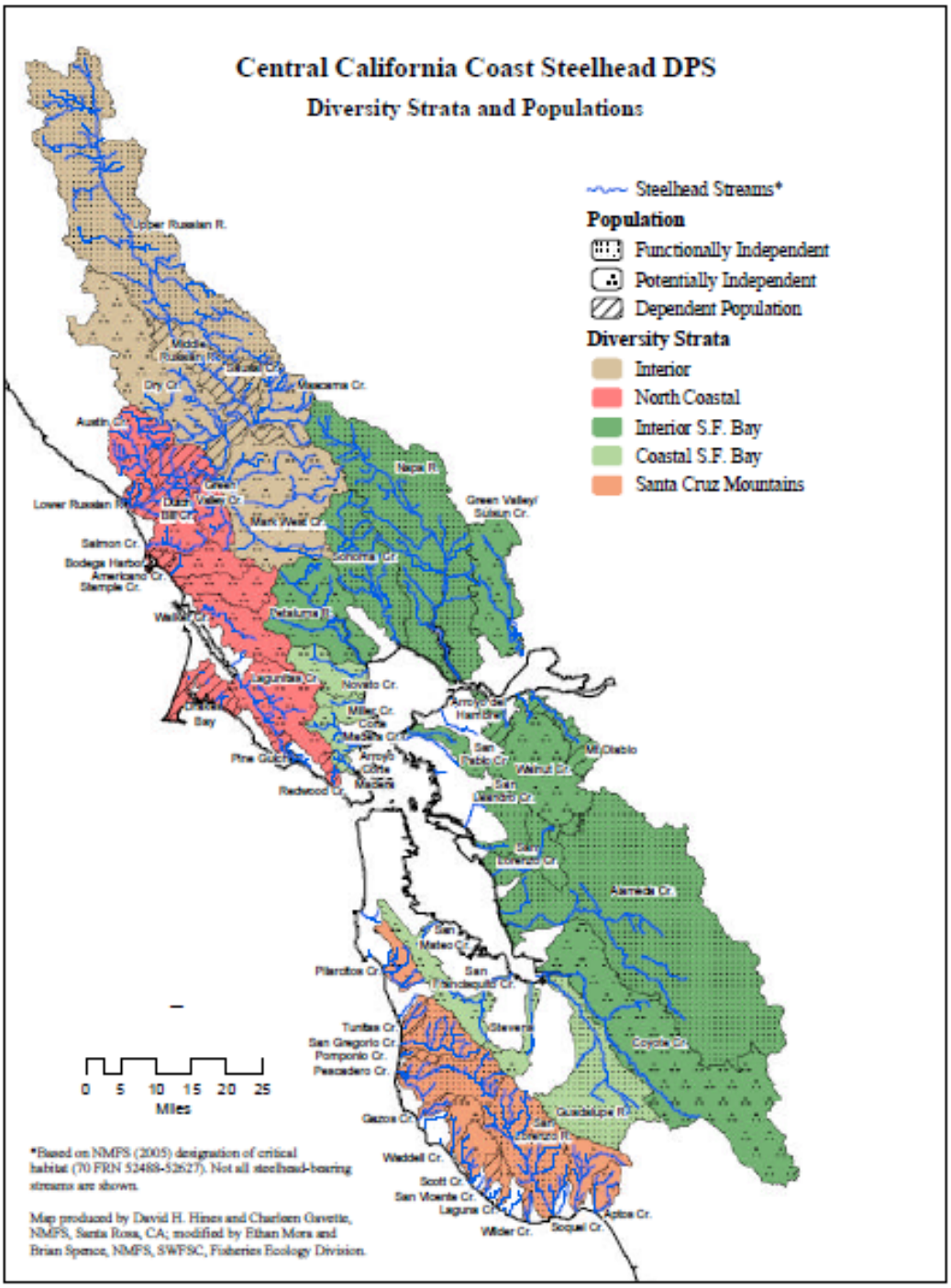

Plate A6. Diversity strata for populations of Central California Coast steelhead. Based on Bjorkstedt et al. (2005) with modifications described in Appendix A.

Figure 3 – Historic adult Steelhead observations in Adobe Creek from 1967 to 2018. Spreadsheet created by student Rachel Lucine. There have been no adjustments made to this a graph as no adults continue to be observed up through 2021.

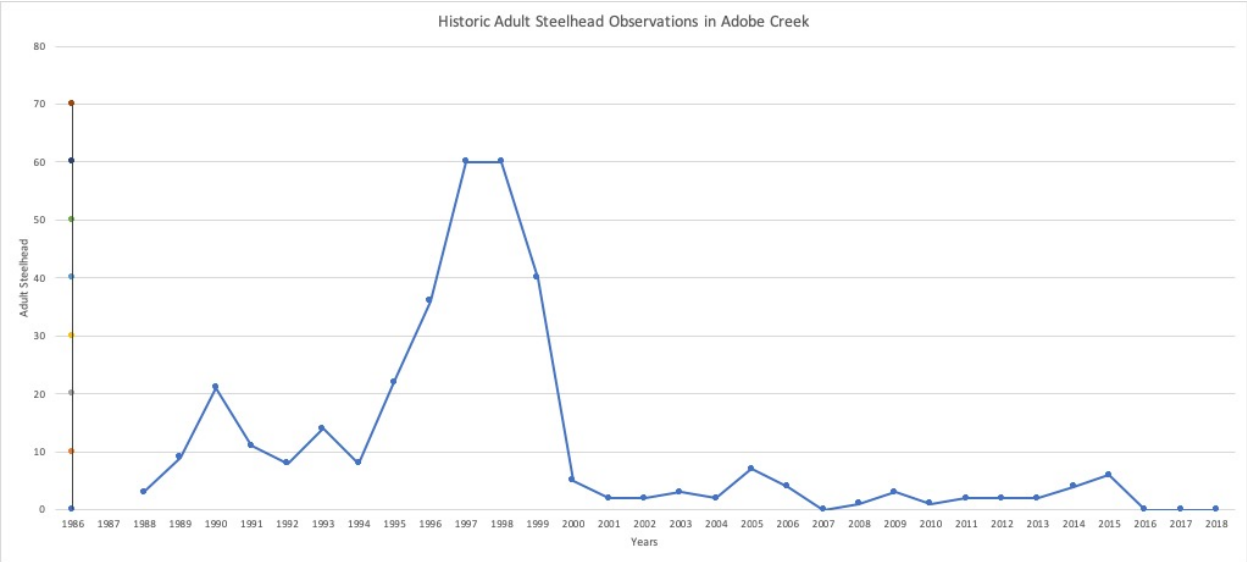

Figure 4 – (A and B). (A) Lynch Creek at the confluence with the Petaluma River at low tide and low stream flow. (B) Lynch Creek at the confluence with the Petaluma River at high tide and moderate stream flow conditions.

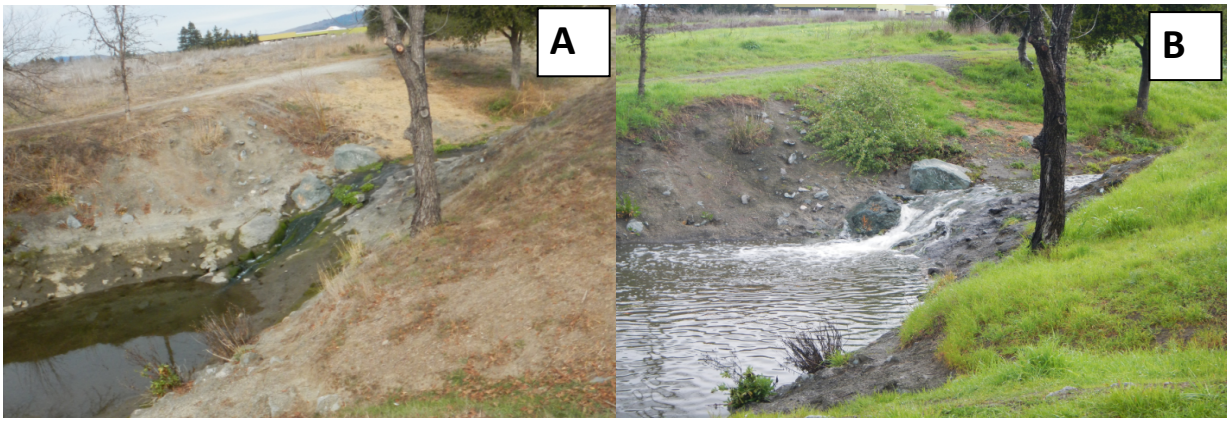

Figure 5- Adobe Creek under low flow condition due to 2021 drought. Concerns raised about out migrating smolts.

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