Steelhead Smolt Outmigration and Survival Study: Year 2 Stream Surveys

Final Report

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Introduction

The New Almaden Mercury Mining District, established 1845 in the hills south of San Jose, California, was the first mercury mine in the state (Snell 1964). It was located at the headwaters of the Guadalupe River which flows into the Alviso Marsh at Guadalupe Slough and Alviso Slough. Over 34.5 $x10^6$kg quicksilver were excavated from the area. Intense cinnabar mercury mining, through the early 20th century, ultimately resulted in the contamination of the entire watershed (nps.gov). Following the closure of the facility in 1912, the abandoned mines continued to erode and deliver hundreds of kilograms of mercury per year. It was estimated that between 1845 and 1975 the New Almaden Mercury Mine District had contributed over 3.7 x 10^7 kg (a mass equivalent to 240 blue whales) to the river and marshes at their terminus (Cargill et al. 1980). In concordance with the 1972 Federal Clean Water Act, the state of California has classified the Guadalupe River as contaminated by mercury and has included them in State 303(d) listings.

In more recent years, the Alviso Marsh salt ponds, connected to the Guadalupe watershed and downstream of the New Almaden mercury mine, have been the subject of restoration activities by a consortium of state and federal agencies, as well as private cooperation *http://www.southbayrestoration.org*. In 2003, the South Bay Salt Pond Restoration Program ("SBSPRP") initiated the restoration of ~15,000 acres of former salt production ponds. Some of these areas contain highly contaminated mercury laden sediments due to previous activities at New Almaden (Mckee et al 2010, Thomas et al. 2010). Pond A8, the upstream most pond on Alviso Slough, is one of these "hotspots". Restoration of this pond raised significant concerns over legacy mercury remobilization and the potential impacts to the biota downstream of the pond. An operable tide gate system was constructed at the upstream connection to Alviso Slough. The A8 "armored notch" tide gate system allows for adaptive management of tidal flow to the adjacent slough should mercury contamination have observable effects on biota. After the completion of this structure, approximately 1,400 acres of former salt pond was opened to Alviso Slough starting in June of 2011.

The "armored notch" located in the south-east corner of pond A8 consists of eight

gates 5-foot wide cement bays each with 10 removable aluminum doors per tide gate separating the pond from Alviso Slough (Figure 1). Currently, the eight tide gates allow for complete operational control and implementation of specific management objectives based on conditions within and surrounding this location. However, opening the pond to tidal action during the migratory period of Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) has the potential to entrain smolts in the Pond A8 and creates a potential risk of trapping. Threatened CCC steelhead are known to inhabit the watershed (Federal Register 1997, 2000).

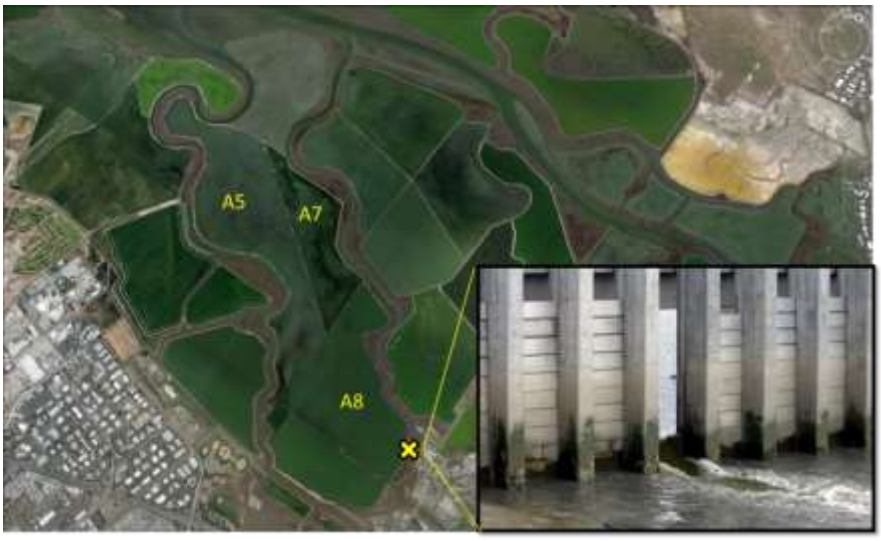

Figure 1. The "armored notch" on Pond A8 in the Alviso Marsh showing the removable aluminum doors/gates within the 8 bays. Each opening is approximately 4 feet wide by 10 feet tall.

Due to the presence of CCC steelhead, consultation pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq*) was conducted for the SBSPRP. The biological opinion, issued by NOAA/NMFS, covered Phase 1 actions and included future maintenance operations of the A8 notch to protect the threatened CCC steelhead (NOAA/NMFS Biological Opinion 2009). A specific management and operation schedule for pond A8, as well as two connected ponds, A7 and A5, were included to reduce the risk of steelhead smolt mortality due to fish trapping in the pond. In its implementation, the eight operable 5-ft bays at the armored notch were scheduled to function in two seasonal modes. A winter/spring operational mode, between December 1 and May 31, at which time all bays are closed, and a

summer/fall operational mode, June 1 to November 30, when five of the eight bays are open. Starting in March of 2014, the 3 gates were opened early, with approval from NMFS. The three gates remained open until September 2014 when two additional gates were open, for a total of 5 out of the 8 gates open. The 5 gates remained open through the remainder of this Year 2 study when steelhead smolt would be expected to out-migrate, except for a brief closure in May of 2015 to install additional antennas.

The South Bay Salt Pond Restoration Program proposed to conduct fish monitoring, water quality, mercury studies and measurement of scouring in Alviso Slough to inform the operation and ongoing configuration of the Pond A8 notch. The biological opinion issued by NMFS requires all monitoring and applied studies proposals that involve fish sampling be submitted to NMFS for review and approval. The muted tidal action at Pond A8 was designed to function so that if unacceptable ecological impacts occur, i.e. an increase in mercury bioavailability, tidal exchange in Pond A8 will be reduced or eliminated to mitigate long-term adverse impacts. In such an event, water management of ponds A5 and A7 will revert to initial operations. Phase 1 obligates the SBSPRP to operate the complex as a managed pond with muted tidal conditions following previously stated seasonal modes.

Managing the pond according to Phase 1 ensures that CCC steelhead have the opportunity to successfully out-migrate the Guadalupe River through Alviso Slough before opening the tide gates. However, keeping the pond closed through springtime, when temperatures are rising rapidly, poses the risk of increasing the bioavailability of the inorganic mercury load present in the pond. Warmer water temperatures can result in over production of primary producers. Phytoplankton in highly productive areas is subject to massive die offs after the sun has set and photosynthesis has stopped. Dying phytoplankton then settles to the benthos stimulating microbial production. This can lead to increased methylation of inorganic mercury resulting in higher bioavailability and toxicity (Ackerman et al. 2013).

The Steelhead Smolt Outmigration and Survival study was proposed to address the impacts that operating the armored notch with three to five bays open year round would have on both CCC steelhead entrainment and the methylation of mercury within the A8, A7, and A5

complex. The study facilitates an earlier opening schedule for the gates, to combat increasing water temperatures within the pond via tidal flushing. Since the peak emigration period for steelhead smolts is April and May, we have focused our efforts on the spring time period. This study employed Passive Integrated Transponder (PIT) tags injected into wild *O. mykiss* collected in the Guadalupe River and Radio Frequency Identification (RFID) remote antenna interrogation systems to detect fish passage from the river and into/out of the pond A8 armored notch, A5 and A7 water control structures. This report details year two of the pilot effort and attempts to address the issues surrounding the potential trapping of outmigrating CCC steelhead smolts in Pond A8, A7 and A5.

In 2014, a pilot study was conducted with the support of the Santa Clara Valley Water District, to sample a select number of sites within the main stem Guadalupe River to tag Steelhead Trout. Over 5 surveys from December through March 2014, 70 *O. Mykiss* in condition suggestive of the potential to undergo migration to the ocean, were tagged with PIT tags. Only 6 individuals were detected migrating out of the Guadalupe River, and a single individual was detected at the pond A8 armored notch. In fall 2014, additional stream surveys were conducted and *O. mykiss* were tagged to further examine, Steelhead Trout smolt outmigration from the Guadalupe River and entrainment into the pond A8 restoration.

Survey Sites

Beginning October 13th 2014, Dr. Hobbs (operating as an independent contractor for the SCVWD) and CDFW biologist (Michelle Leicester) conducted a survey of 20 existing electrofishing stations surveyed by the Santa Clara Valley Water District between 2004 and 2012 (J.Nishijima personal communication). In addition, a series of sites where California Department of Fish and Wildlife (CDFW) had surveyed in the past with Dr. Jerry Smith of San Jose State University were visited to assess sampling feasibility. Of the 12 sites located in the main stem Guadalupe River, only one site (Skyport Blvd) had water with conditions conducive to residence of *O. mykiss.* An area near Bascome Avenue on Los Gatos Creek had water with appropriate conditions, and two sites in Los Alamitos Creek (Greystone Park) and Vichy Springs

were sampled. Guadalupe Creek above Hicks Road had the longest contiguous area of flowing freshwater with appropriate conditions for residence of *O.Mykiss*. A majority of the sampling effort in fall 2014 was focused in this area.

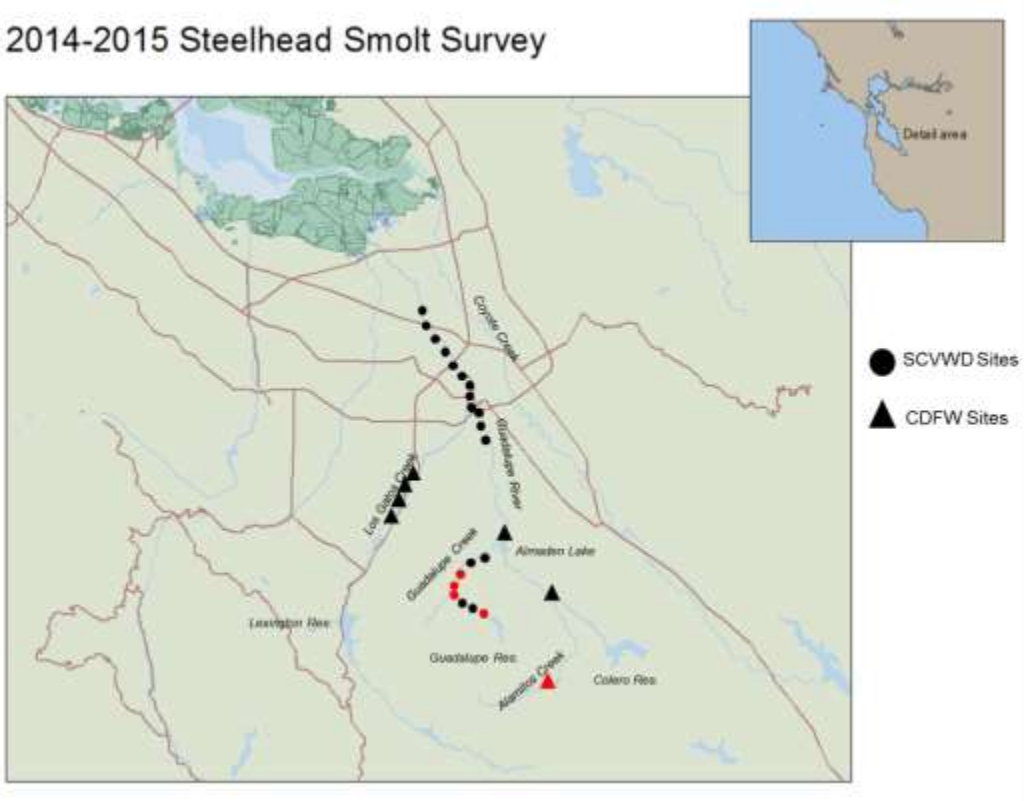

Figure 1. Map of sites visited during initial scouting surveys in October 2014. Circles represent historic sites sampled by the Santa Clara Valley Water District, triangles sites sampled historically by California Department of Fish and Wildlife. Red fill denotes sites where O. mykiss were encountered.

Methods

When possible, three-pass electrofishing along a reach of 100 linear feet was sampled with block nets set above and below the reach. In each stream system, up to 8 100-ft reaches were sampled in October-November of 2014. Fish were collected using a Smith Root model LR-24

backpack electrofishing unit using the standard voltage level of 25 watts average power output between the electrodes at a frequency of 30 Hz. All *O.mykiss* captured were placed into a live car, held in stream and process at the end of the three pass procedure. All other species were counted and immediately released to the stream. Once measured, a determination was made regarding which tag size was suitable for each individual fish, based on fork length. Bateman et al (2006) explored survival rates for ≤90 mm SL *O. mykiss* tagged with 23 mm HDX tags and found survival of 86%. To be conservative, we chose a threshold of 100 mm FL since survival was a priority.

Tags were implanted on the mid-ventral line posterior to the pectoral fins using an insertion made with a fine scalpel (Gries and Letcher 2002). All tagging was conducted by Dr. Hobbs. After implantation, fish were immediately returned to an in-stream live car and allowed to recover. They were released after they became capable of remaining upright in the water column and self-oriented into the current independently. This usually occurred within the first 5 minutes of return to the live car.

Antenna System

To detect passage of CCC steelhead, we employed Radio Frequency Identification (RFID) technology on the armored notch bays in pond A8. RFID has been used extensively throughout the Pacific North West for determining out-migration timing in streams and estuarine residence time of salmonids (see www.ptagis.org). RFID works by emitting an alternating magnetic field in a radio frequency range from a reader (detector) through a conductive metal (e.g. copper or aluminum). The detection range of RFID tags can vary depending on the gage of wire used, the power (volts) used to create the radio frequency, the conductance of the water, and the size and orientation of the tag used.

Pond A8

The three antennas on Pond A8, approximately 5 feet wide by 8 feet tall, designed to encompass the entire water column irrespective of tide height were constructed in spring of 2014. The antennas utilized a frame constructed of 2 inch plastic PVC piping. Inside of the PVC,

cut corrugated plastic material (Polygal Inc.) was inserted and 2 runs of 8 AWG fine stranded copper wire was installed within the corrugations as recommended by Oregon RFID (*Warren Leach personal communication*). This configuration helped to ensure that the spacing of the internal wiring of the antenna remained consistent and led to a more effective read range. The 3 antennae are operated by 3 single HDX readers (Oregon RFID Inc.), which had been synchronized to reduce interference, and powered by six 12-V marine batteries.

In the year 2 study, the three antennas installed by UCD on the pond A8 armored notch, were operated by Santa Clara Valley Water District (SCVWD) employees beginning February 24th , 2015. However; five gates were open, thus two bays were not covered. In addition the middle antenna was inoperable during the 2015 survey. SCVWD staff constructed two additional antennas, using the design by UCD, and installed them on the two additional gates between May 12th and May 18th. SCVWD staff downloaded the antenna reader boxes weekly, exchanged 12V-deep cycle marine batteries and checked the antennas for detection efficiency. The antenna for the Pond A5 structure, connecting to Guadalupe Slough, was destroyed and damaged or lost beyond repair as was the stream antenna located in the Guadalupa River near Trimble Avenue. This likely occurred when the A5 water control structure was broken. That structure is not repairable. Similarly, the antenna and housing for the Pond A7 structure, connecting that pond to Alviso Slough were destroyed and the PVC housing was lost. Although the A7 water control structure is intact and still operable, the antenna and housing could not be replaced and re-installed in time for this Year 2 study. In summary, for the Year 2 study, antennas on the A5 and A7 structures were not in place; 2 of the A8 gates had operational antennas turned on starting February 24, 2015, two additional gates at A8 had antennas that were installed and operational by May 18th, and one of the bays on A8 did not have an operational antenna during this Year 2 study.

Results

Catch Data

We counted and measured a total of 32 *O. mykiss* from 55-173mm standard length (mean = 100 ±28.9σ standard deviation) during the 4 surveys between October 19th and November 3rd 2014 among 4 stream and 9 total sites (Table 1). No *O. mykiss* were encountered within the main stem of the Guadalupe River. Fish catch was highest in

Guadalupe Creek (GC) near Pheasant Creek (N = 12), followed by the U-Frame Channel (N=9) and lower GC (N=5) near Hicks Rd, and at station gauge 43 (N= 3), and a site directly below the Guadalupe Reservoir dam (N =1). The only site outside of GC were *O. mykiss* were observed was at Vichy Springs (VS) (N=2). Temperatures were generally lower in GC compared to other sites, ranging from 10.8 to 15.5°C, except at Pheasant Creek, and other sites which ranged from 17.1 to 19.1 °C. (Table 1). Blackspot disease ranks score was observed, and was high in the lower GC reach (scores ranging 2-3;moderate to severe infection), while only one fish at station 43 was ranked as a score of 1; mild infection and a single fish in the U-Fram Channel with a score of 1. Other species encountered during the surveys included Riffle Sculpin California Roach, and Sacramento Sucker in GC and VS. In Los Gatos Creek and Skyport, Largemouth Bass were encountered in large numbers along with Sacramento Sucker and Prickly Sculpin (Table 1).

Table 1. Sample sites, water quality and raw catch information. Rainbow Trout/Steelhead Trout = *O. Mykiss*

Date	Creek	Station	Temp	Salinity	Sp.Con	DO (mg/L)	DO (%)	California Roach	Largemouth Bass	Prickly Sculpin	Rainbow Trout/Steelhead	Riffle Sculpin	Sacramento Sucker
10/19/2014	Main	Skyport	18.5	0.4	1193	7.4	79	4	0	4	0	0	4
10/19/2014	Los Alamitos	Greystone	18.1	0.2	850	7.5	80	3	0	3	0	0	3
10/19/2014	Los Alamitos	Vichy Springs	17.1	0.1	500	8.4	98	3	0	3	2	0	3
10/19/2014	Guadalupe Creek	Pheasant	19.1	0.2	745	6.3	68	0	0	0	7	4	0
10/25/2014	Los Gatos	Bascome	18.6	0.5	2234	8.2	98	0	5	1	0	0	2
11/2/2014	Guadalupe Creek	St. 43	13.2	0.2	771	10.6	102	5	0	0	3	89	0
11/3/2014	Guadalupe Creek	Pheasant	10.8	0.5	740	10.6	97	0	0	0	5	65	8
11/3/2014	Guadalupe Creek	U-Frame Channel	11.7	0.2	777	10.8	100	0	0	0	9	9	4
11/3/2014	Guadalupe Creek	Below Dam	15.5	0.5	888	7.4	75	0	0	0	1	29	9

We encountered a total of 32 O.mykiss and successfully tagged and released a total of 28 fish in October and November of 2014 (Table 2). One fish was not tagged due to small size and poor general condition and three individuals were recaptured from the survey conducted just a few weeks prior. Eight reaches in Pheasant Creek were sampled on November 2, 201; 3

individuals were recaptured from the first survey on October 19th. A majority of fish were visually assessed to be in good physical condition, had low disease scores, however; fish collected in Lower GC and at station 43 in GC had high incidence of blackspot disease and were visually thin (Table 2). SCVWD staff conducted a survey in Guadalupe Creek at the U-Frame Channel on November 18th using a back-pack RFID antenna wand. Six fish tagged on November 3rd were detected near the original tag and release sites (Chris Van Amburg, SCVWD personal communication). An additional survey with the RFID back-pack wand was conducted by Stephen Andersen SCVWD, in Spring 2015 and several tags were again detected, however only the tags were recoverd, thus the fish had either shed the tag or died and decomposed.

Stream Flows

In 2014, California was experiencing the third year of an unprecedented drought. A majority of stations were either completely dry or only a few inches deep, when survey in early October (Table 1). Sites along the main stem of the Guadalupe River downstream of Woz Park was experiencing anoxia, where dissolved oxygen concentration were < 1mg/L down to Skyport Parkway where water from the Norman Mineta Internation Airport basement is discharged into the river. Sites above Woz Park to the Almaden Lake were dry as well as the majority of Colero-Alamitos Creek, and the lower reach of Los Gatos Creek. Storms were infrequent in the water year 2015, with a total of 6 events that resulted in flows above baseline. Peak flows occurred on December 11th, when CFS topped out at 5,180 CFS for an hour. Up until this time, Guadalupe Creek was disconnected to the main stem Guadalupe River. A second pulse flow occurred on February 6th maxing out at 1,970 CFS and a third storm on April 7, peaked at only 646 CFS. Flows in 2015 were generally very short in duration and would have led to very short windows of opportunity for fish to migrate downstream. Unfortunately, the SCVWD was unable to install a stream antenna during the 2015 out-migration period.

Table 2. Location, condition and PIT tag codes.

Date	Time	Creek	Station	Reach	Latitude	Longitude	SL	Tag Code	Blackspot	Comments of fish condition
10/19/2014	12:30	Alamitos Creek	Vichy Springs	1	37.174172	-121.824221	105	000-362992-262	0	Thin
10/19/2014	12:30	Alamitos Creek	Vichy Springs	2	37.174549	-121.824022	98	000-362992-300	0	Thin
10/19/2014	15:30	Guadalupe Creek	Pheasant	1	37.12494	-121.54447	110	000-362992-288	0	good
10/19/2014	15:30	Guadalupe Creek	Pheasant	1	37.12494	-121.54447	110	000-362992-271	0	good
10/19/2014	15:30	Guadalupe Creek	Pheasant	1	37.12494	-121.54447	65	000-362992-351	0	good
10/19/2014	15:30	Guadalupe Creek	Pheasant	1	37.12494	-121.54447	110	000-362992-281	0	good
10/19/2014	15:30	Guadalupe Creek	Pheasant	1	37.12494	-121.54447	90	000-362992-331	0	good
10/19/2014	15:30	Guadalupe Creek	Pheasant	1	37.12494	-121.54447	81	000-362992-285	0	good
10/19/2014	15:30	Guadalupe Creek	Pheasant	1	37.12494	-121.54447	55	Not Tagged	0	good
11/2/2014	12:20	Guadalupe Creek	Lower	4	37.13148	-121.54311	146	000-362655-573	3	bad
11/2/2014	12:20	Guadalupe Creek	Lower	4	37.13148	-121.54311	100	000-362992-305	2	Thin
11/2/2014	12:46	Guadalupe Creek	Lower	5	37.13135	-121.54314	117	000-362992-280	2	Thin
11/2/2014	13:25	Guadalupe Creek	Lower	7	37.13131	-121.54329	173	000-362654-463	2	Thin
11/2/2014	13:46	Guadalupe Creek	Lower	8	37.13131	-121.54329	124	000-362654-546	2	Thin
11/2/2014	15:00	Guadalupe Creek	St. 43	2	37.13033	-121.54349	86	000-362992-307	1	Thin
11/2/2014	15:00	Guadalupe Creek	St. 43	2	37.13033	-121.54349	67	000-362992-342	0	Thin
11/2/2014	15:30	Guadalupe Creek	St. 43	0	37.13033	-121.54349	96	000-362654-480	1	Thin
11/3/2014	10:41	Guadalupe Creek	Pheasant	2	37.12494	-121.54447	NA	000-360826-977	0	Thin
11/3/2014	11:31	Guadalupe Creek	Pheasant	1	37.12495	-121.54448	81	000-362992-285	0	Recapture
11/3/2014	11:47	Guadalupe Creek	Pheasant	4	37.12489	121.54443	87	000-362992-331	0	Recapture
11/3/2014	11:47	Guadalupe Creek	Pheasant	4	37.12489	121.54443	106	000-362992-288	0	Recapture
11/3/2014	11:47	Guadalupe Creek	Pheasant	4	37.12489	121.54443	93	000-362992-308	0	good
11/3/2014	13:45	Guadalupe Creek	U-Frame Channel	1	37.12361	-121.54135	85	000-360826-958	1	good
11/3/2014	14:20	Guadalupe Creek	U-Frame Channel	2	37.12361	-121.54135	72	000-362992-287	0	good
11/3/2014	14:20	Guadalupe Creek	U-Frame Channel	2	37.12361	-121.54135	123	000-362655-643	0	good
11/3/2014	14:20	Guadalupe Creek	U-Frame Channel	2	37.12361	-121.54135	120	000-362655-612	0	good
11/3/2014	14:20	Guadalupe Creek	U-Frame Channel	2	37.12361	-121.54135	78	000-362992-353	0	good
11/3/2014	14:20	Guadalupe Creek	U-Frame Channel	2	37.12361	-121.54135	139	000-362655-554	0	good
11/3/2014	14:20	Guadalupe Creek	U-Frame Channel	2	37.12361	-121.54135	168	000-362655-626	0	good
11/3/2014	14:20	Guadalupe Creek	U-Frame Channel	2	37.12361	-121.54135	72	000-362992-295	0	good
11/3/2014	14:20	Guadalupe Creek	U-Frame Channel	2	37.12361	-121.54135	65	000-362992-317	0	good
11/3/2014	15:30	Guadalupe Creek	Below Dam	1	37.12506	-121.56251	88	000-362992-310	0	good

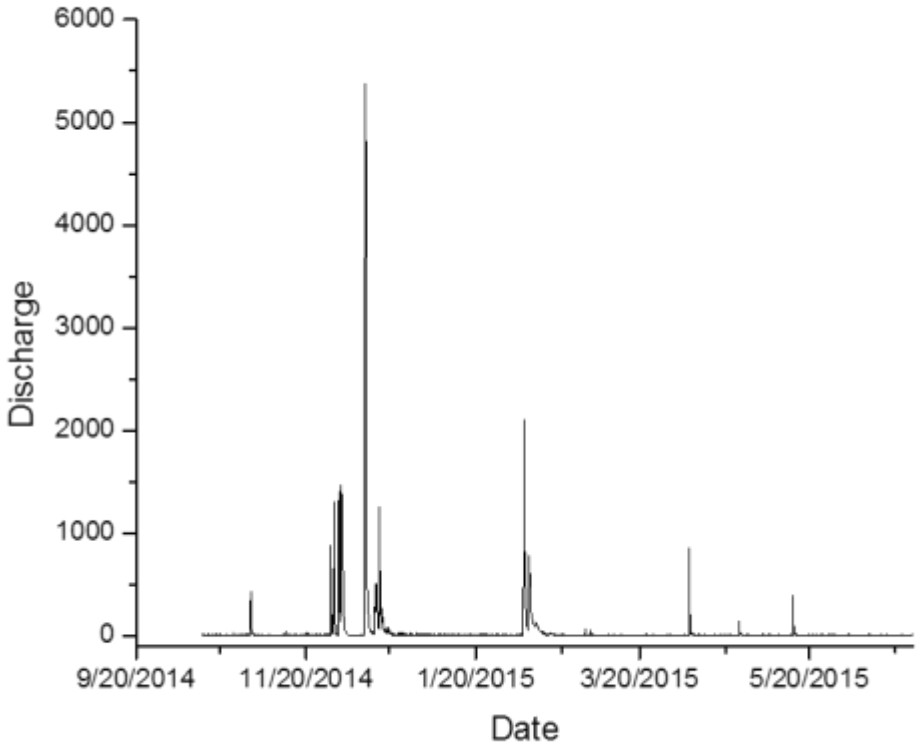

Figure 2. Discharge in cubic feet per second (CFS) from USGS station gauge 11169025 for water year 2015

Pond A8 Antennae Operations.

The SCVWD operated the three initial antennas installed by UCD beginning on February 24th, and an additional two antennas were installed in mid-May. No Steelhead was detected at the pond A8 notch in 2015. However; Striped Bass were detected passing through the notch in March, shortly after the antennas reader boxes were re-installed (Table 3). In March and April of 2014 we set gillnets at the pond A8 notch and collected and tagged 18 Striped Bass to assess predation risk at the notch (See Year 1 Report for details). In total 3 different Striped Bass were detected passing the A8 notch, one individual on multiple events. This individual

982_000362654458 was detected during 3 distinct events on March 10th, once at 12:33 PM for approximately 43 seconds, and a second time at 11:28 PM for only a few seconds. This individual was detected again on March 20th between 9:49 AM and and 10:21AM. The other two Striped Bass were only detected for a few seconds, suggesting they were merely passing through, while individual 982_000362654458, was likely lingering around the notch for a long period of time foraging.

Table 3. PIT tag detections on the pond A8 antennas in 2015. All fish were striped bass tagged in May of 2014. Data in the table represent the number of distinct detection events.

PIT tag code	3/6/2015	3/10/2015	3/20/2015	3/24/2015
982_000361656287	1			
982_000362654458		3	10	
982_000362655543				1

Discussion

In the fall of 2014 (October-November), we spent two weeks surveying the Guadalupe River Watershed, and tagged a total of 28 O.Mykiss; 26 in Guadalupe Creek and two in Los Alamitos Creek-Vichy Springs. Winter freshwater flow conditions in 2014-15 were generally poor statewide, although flows in the Guadalupe were slightly less than average. Fish rearing in the upper watershed have few opportunities to out-migrate, and on one occasion SCVWD biologists detected 3 PIT tags in Guadalupe Creek at a fixed located, near the U-frame channel and suggested the fish were dead (Appendix A). The extreme drought conditions, warm winter temperatures and general condition of the watershed likely resulted in a loss of a majority of the fish tagged in fall 2014. No Steelhead were detected at the pond A8 antennas during their limited operation in 2015. Three of the original 18 Striped Bass were detected on multiple occasions at the pond A8 notch in 2015. These fish has been tagged in May of 2014, suggesting

Striped Bass reside in the pond A8 notch year-round. Note in 2014, one Striped Bass was detected leaving pond A8 and returned later, thus the fish near the notch appear to freely move between the pond and slough. During antenna maintenance in spring 2014, we encountered several local fisherman that target the outfall at the pond A8 notch. Fishers reported frequently capture Striped Bass, up to 50lbs, year round during outgoing tides on the slough side and inside the pond on incoming tides. One fisherman encountered in October of 2014 reported catching as much as 50 fish per day at the pond A8 notch.

We encountered several obstacles in the 2014-15 year 2 study that contributed to the unproductive study. First, our proposal to the National Fish and Wildlife Foundation was rejected, and thus no funding was provided by the South Bay Salt Pond Restoration Project (SBSPRP). The Santa Clara Valley Water District provided funding via a private contract to Dr. Hobbs to facilitate stream sampling. With the assistance of CDFW biologist, Michelle Leicester back-pack electrofishing was conducted on several dates between October 13th and November 3rd. Unfortunately few fish were encountered. Since funding was not available from the SBSPRP, the SCVWD was requested to operate and maintain the antenna system installed by UCD in spring 2014, as well as construct and install two additional antennas on the pond A8 notch. The existing antennas were operated from February 24h to June 1st, with the additional two antennas coming online in mid-May. Due to the late request and difficulty in training a new staff intern, an antenna in Guadalupe River was not installed (it was destroyed by early rains) and the antennas on pond A5 and A7 were not deployed. Further complicating the situation, the antennas installed on the A5 and A7 water control structures in spring 2014 were both destroyed by failing infrastructure.

Given the effects of a 3rd year of extreme drought and the resulting low water flows and poor water quality, along with the presence of predators throughout the watershed, it was unlikely a significant out-migration occurred in 2015. While the shortcoming of the efforts in 2014/2015 are not an acceptable outcome for adaptive management, ultimately the results would have been the same if adequate funding was available and the parties involved were able to provide the necessary support to conduct an effective study. In light of the ongoing

drought, and the status of the Steelhead population in the Guadalupe River Watershed, we (Dr. James Hobbs) recommend moving this study in a different direction. The primary concern regarding the Pond A8-7-5 restoration is that out-migrating smolts would be entrained and be subject to high mortality, either through poor passage or predation. Future studies could be designed to more directly address these concerns using surrogate species. We would recommend using a native species that is common in the Alviso Marsh Complex in studies of a fish passage nature and studies designed to address the predation risk for fish encountering the pond A8 notch and water controls structures. To better understand these potential impacts, we further recommend comparing such studies with fully tidal restoration ponds and the existing sloughs in the Alviso March Complex. We are hoping to continue these studies in 2016 by continuing to operate the Pond A8 and A7 antennas to detect any migrating tagged adult steelhead that might return to the watershed, given the predictions for a wet year if an El Nino conditions continue to form. We are also interested in studying predation risk on steelhead entering Pond A8. We have prepared a proposal for a series of experiments that will address these concerns and submitted it to the National Fish and Wildlife Foundation. We anticipate being notified of a funding decision from NFWF by the end of August 2015. We are also continuing to search out new funding sources.

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Appendix A. E-mail communication between Dr. Hobbs and Stephen Andersen on July 1 2015.

Hey Jim,

I took the backpack reader out to the Guad Creek yesterday and detected 3 PIT tags. All three of them were in fixed positions and weren't moving, so I assumed that these fish died and the PIT tags were buried somewhere in the sediment. One of the tags was within an undercut bank, and it is possible that the fish is still alive but I'll need to go out again and double check. All three tags were from when you guys PIT tagged fish last Oct/Nov. Do you have the data from the other fish you previously PIT tagged? I only have the data from last Oct/Nov. I'm planning on taking the backpack reader out some more to try and find more tags. I'll keep you posted.

Thank you,

Stephen Anderson