2010 Robles Fish Passage Facility
Progress Report

Casitas Municipal Water District
1055 Ventura Avenue
Oak View, California 93022

TABLE OF CONTENTS

Page

1.0 EXECUTIVE SUMMARY 3

2.0 INTRODUCTION 4

3.0 FISHERIES MONITORING AND EVALUATION 5

3.1 Upstream Fish Migration Impediment Evaluation 6

3.1.1 Sandbar Monitoring 15

3.2 Fish Attraction Evaluation 17

3.3 Fish Passage Monitoring 23

3.4 Downstream Fish Passage Evaluations 32

3.5 Downstream Fish Migration through the Robles Reach 36

4.0 FACILITY OPERATION 39

4.1 Facility Status 39

4.2 Flow Observations and Control... 40

4.3 Costs Associated with Operation and Monitoring 42

4.4 Assessment of the Effectiveness to Provide Fish Passage 42

4.5 Recommendations Regarding the Prioritization of Future Activities 43

4.6 Recommendations on Revisions Deemed Necessary to the Operations 43

5.0 LITERATURE CITED 44

6.0 APPENDIXES 50

1.0 EXECUTIVE SUMMARY

Casitas Municipal Water District (CMWD) is implementing the Robles Fish Passage Facility Project (Robles Fish Facility) described in the Biological Assessment (BA) proposed by Bureau of Reclamation (USBOR 2003). The BA was later analyzed in the Biological Opinion (BO) prepared by the National Marine Fisheries Service (NMFS 2003a). This 2010 Robles Fish Passage Facility Progress Report, as described by the BO, is the culmination of monitoring, evaluation, and operational data collected during the reporting period of 01 July 2009 to 30 June 2010.

The monitoring and evaluation studies related to the Robles Fish Facility conducted during the 2009-2010 reporting period are included in two main sections of this progress report. The Fisheries Monitoring and Evaluation section contains: upstream fish migration impediment evaluation, sandbar monitoring at the mouth of the Ventura River, fish attraction evaluation, fish passage monitoring, downstream fish passage evaluations, and downstream fish migration through the Robles Reach. The Facility Operation section contains: information and data on the facility status, flow observations and control, costs associated with operation and monitoring, assessment of the effectiveness to provide fish passage, recommendations of priorities for future activities, and revisions deemed necessary to the operations.

A total of 48 transects at seven monitoring sites were completed for the upstream fish migration impediment evaluation in 2010. The sandbar at the mouth of the Ventura River was only closed for short periods during mid September and was open for potential volitional steelhead passage during the remainder of the reporting period. A total of 147 *O. mykiss* juveniles were counted in the area upstream and downstream of the Robles Fish Facility during the fish attraction evaluations in 2010. This number represents multiple counts of some *O. mykiss* due to smolting rates and migration behavior. During the fish passage monitoring evaluations, 54 *O. mykiss* were detected migrating upstream through the Robles Fish Facility in 2010. Five *O. mykiss* smolts were captured migrating downstream below the Robles Fish Facility.

2.0 INTRODUCTION

NOAA Fisheries listed the southern California steelhead, *Oncorhynchus mykiss*, as endangered in 1997 (NMFS 1997) under the Endangered Species Act (ESA) of 1973. Steelhead were organized into stocks (i.e., groups) of evolutionary significant units (ESU) that were considered to be substantially isolated from other steelhead stocks reproductively and were an important part of the evolutionary legacy of the species. The southern California steelhead ESU included, at that time, steelhead populations from the Santa Maria River in San Luis Obispo County south to Malibu Creek in Los Angeles County. The ESU was later extended to the US/Mexican border in San Diego County during 2002 (NMFS 2003b). In a later delineating approach, NOAA Fisheries recognized the anadromous life history form of *O. mykiss* as a distinct population segment (DPS) as described under the ESA (NMFS 2005). The DPS policy differs from the ESU by delineating a group of organisms by "marked separation" rather than "substantial reproductive isolation". In the case of *O. mykiss* of the southern California steelhead ESU, this marked separation between the two life history forms was considered valid because of physical, physiological, ecological, and behavioral factors related to its anadromous life history characteristics. Both resident and anadromous *O. mykiss*, where the two forms co-occur and are not reproductively isolated, are still part of the ESU; however, the anadromous *O. mykiss* (i.e., steelhead) are now part of a smaller subset identified as the southern California steelhead DPS.

Rainbow trout can be generally organized into four large groupings (Behnke 1992; Scott and Crossman 1973): 1) coastal rainbow trout that extend from northern Baja California to northern Alaska near the Kuskokwim River and also the Kamchatkan Peninsula of northeastern Asia, 2) redband trout of the inland Columbia and Frazer River basins, 3) redband trout of the central valley of California, and 4) trout of the Gulf of California drainages. The taxonomic group of coastal rainbow trout, *O. m. irideus*, exhibit two life history forms; anadromous and resident. The common name for the anadromous life history form is termed steelhead trout and the resident form is generally termed rainbow trout. Throughout the range of coastal rainbow trout, there is a widespread occurrence

of the anadromous life history form (Behnke 1992). There are two general life history patterns exhibited by adult anadromous steelhead when they return from the ocean to spawn in fresh water. The patterns are grouped by either summer or winter spawning runs. There are many exceptions to this pattern, but this general characterization has been used to group steelhead spawning runs by the season in which the peak occurs as they return from the ocean (Busby et al. 1996). Summer steelhead are generally found in river systems that drain from farther inland, such as the Columbia River basin. Winter steelhead runs are typically found in the coastal systems where the river systems are not as large. The winter steelhead life history pattern is the most abundant anadromous life history within the natural range of the species (Busby et al. 1996).

3.0 FISHERIES MONITORING AND EVALUATION

The monitoring and evaluation studies and activities related to the modification of the Robles Facility, as outlined in the BO (NMFS 2003a), were intended to achieve three main objectives:

I. Monitor Fish Passage Facility operations and performance.
II. Determine if the Fish Passage Facility functions and operates in such a fashion that migrating steelhead:
    a. Successfully navigate into and through the facility, and
    b. Move through the facility in good physical condition.
III. Determine if the operations at the Robles Diversion are enhancing the opportunity for:
    a. Adult steelhead to migrate upstream to the Robles Facility, and
    b. Smolts and kelts to migrate downstream through the Robles Reach.

5-year Reevaluation of Initial Evaluation and Monitoring Activities

As described in the BO, a 5-year reevaluation of the initial fish flow operations would be conducted to determine if monitoring and evaluations have been completed (NMFS

2003a). The initiation of the 5-year period began in 2006, which was the first year the Robles Fish Facility was fully operational. This would necessitate a reevaluation after the 2010 fish passage season. Through the Cooperative Decision Making Process, the Robles Biological Committee would review each of the specific monitoring and evaluations and determine if they have addressed the original objectives and could be discontinued or if additional study would be needed. It is recommended that all aspects of the monitoring and evaluation for the Robles Fish Facility be continued at this time. Because of the variable water conditions and insufficient number of adult and juvenile steelhead, the objectives of the monitoring and evaluation program have not yet been accomplished. Beginning in 2011, each aspect of the program will be evaluated to determine if sufficient information exist to complete the objectives.

3.1 Upstream Fish Migration Impediment Evaluation

Introduction

The ability of adult steelhead to swim upstream can be impeded during the migration season at times of low-river flow (NMFS 2003a). Evaluations at shallow water habitat units (i.e., critical riffles) have been commonly used as a method to determine if impediments exist for adult and juvenile steelhead in California rivers (Dettman and Kelley 1986; Bratovich and Kelley 1988; Hager 1996). The Robles Reach, which extends downstream from the Robles Fish Facility approximately 6.5 km (NMFS 2003a) to just upstream of the San Ana Boulevard bridge (Appendix 1), is a wide alluvial section of the Ventura River that is composed of active wash deposits of unconsolidated silt, sand, gravel, and boulders (Tan and Jones 2006). Due to this type of channel morphology and geology, alluvial channels like the Robles Reach have high infiltration rates that cause channel surface flow to rapidly recede and cease shortly after storm events (Cooke et al. 1992).

An initial assessment of potential passage impediments in relation to river discharge was completed by ENTRIX (1999). The physical characteristics of seven potential

impediments were evaluated using the Thompson (1972) passage criteria. The Thompson (1972) passage criteria for adult steelhead at critical riffles is a water depth of 0.6 ft for 25% of the total transect width and a continuous portion equal to 10% of the total transect width. The potential impediments were also evaluated using a criteria of 0.5 ft and 0.6 ft depth for 25% of the total width and a total of 8 ft width for both depths. The resulting discharge required was estimated to be between 40 and 65 cfs. There have been several modifications to the Thompson passage criteria by other researchers; Dettman and Kelly (1986) on the Carmel River used a depth of 0.6 ft over a 5 ft continuous section, a criteria of 0.6 ft depth over an 8 ft section was used on the Santa Ynez River (SYRTAC 2000), and Harrison et al. (2006) used a criteria of 0.6 ft depth over a 10 ft section on the Santa Clara River. Thompson's (1972) depth criterion of 0.6 ft was not based on actual migration observations and was not evaluated. It has been observed that adult salmonids can successfully move through shallower riffles than the 0.6 ft criterion (Mosley 1982). The final evaluation of potential impediments will use one of the aforementioned criteria or a yet to be determined criteria that will be developed by the Biological Committee through the Cooperative Decision Making Process as described in the BO.

The objective of the impediment evaluation is to assess factors that may impede steelhead's ability to migrate to the fish passage facilities (NMFS 2003a). Because of the potential for low-river flows to impede upstream fish migration, the Robles Reach will be the primary focus of the impediment evaluations (NMFS 2003a).

Methods

Selected channel features that may pose an impediment to upstream passage were surveyed multiple times during the fish migration season (January through June) to measure water depth, velocity, and channel width along a transect at each site. The selected sites were surveyed over a range of discharges from approximately 20-100 cfs (the upper limit was dependent on the ability to safely conduct the surveys), which was correlated with discharge at the Robles Fish Facility. The number of repeated surveys

was dependent on the number and duration of significant rain events, rate of hydrograph recession, and time constraints due to other aspects of the monitoring and evaluation program. The impediment surveys will most likely be conducted over a period of 3-4 years given the natural variation of water conditions. The selected impediment sites will be resurveyed as many times as needed to develop a statistically rigorous data set to evaluate fish passage in relation to Robles Fish Facility discharge.

During the initial phase, the Ventura River was surveyed from the mouth to the Robles Fish Facility (23 km) using standard stream survey techniques and was completed in 2008 (CMWD 2008). This provided physical measurements of all habitat units for the selection process. The survey methodology followed Moore et al. (2002) and was equivalent to a level IV survey as described in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 2002).

Over the course of three meetings and one conference call between 24 January and 18 June of 2009, the Biological Committee (BC) for the Robles Fish Facility completed an impediment site selection process that culminated in the selection of eight sites that would be monitored for the impediment evaluation. The BC reviewed physical parameters of the 376 habitat units surveyed and general river characteristics that included: unit type, length, width, water depth, slope, longitudinal location (river km), step height on step units, discharge at Foster Park and the Robles Fish Facility at the time of the surveys, and a river profile for the 23 km of the Ventura River surveyed. Upon completing an initial assessment of this data, a list of potential sites was developed that the BC visited in the field on 27 May 2009 to determine if monitoring was warranted. This data and field assessment included regular BC members Mike Kinsey (BOR), Stan Glowacki (NMFS), Mary Larson (CDFG), and Scott Lewis (CMWD). Hydrologists Bob Hughes (CDFG) and David Crowder (NMFS) were also involved in this assessment and selection process. At the completion of the habitat survey, 379 units were identified. Changes were due to incorrect unit numbering, separating out the Foster Park weir, resurveying several areas so that the correct primary channel was followed, and elimination of several step units that did not warrant separation. Because

of these changes, there was a net loss of three units to the survey. This resulted in a change to the unit ID numbers from what the BC reviewed and selected; however, the actual units did not change.

An attempt was made to locate and determine the current status of the ENTRIX (1999) sites during 2009. Because there had been numerous bed-mobilizing runoff events after the study was completed, the present status of the sites was unknown and needed to be determined. Based on the site descriptions in the ENTRIX (1999) study report, field surveys were conducted to locate and describe the existing channel conditions at the original site locations.

2009 Results

Due to the important nature of the selected sites and original ENTRIX evaluations, selected portions of the 2009 results have been included to provide context, background, and comparisons for the 2010 results.

Of the 376 habitat units surveyed, a subset of eight sites (7 units plus the sandbar) were selected by the BC for the impediment evaluation that were thought to be representative of potential impediments throughout the 23 km reach (Appendix 2). Three riffles, two rapids, and two cascades were selected. The sandbar at the mouth was also selected since it is the first potential impediment to adult steelhead entering the Ventura River and is highly variable in nature due to shifting sands, tidal state, wave action, and river discharge. The mean length and slope of the selected sites were approximately 20 m and 5%, respectively. Substrate of the selected sites was composed of cobbles and boulders and represented 87% of the total area. The sandbar was not surveyed due to its variable nature.

A baseline set of photos was taken of each site after the final selection was completed to provide a method for determining qualitative changes over time. However, this first set of photos was not able to fully reveal site characteristics due to the heavy vegetation

growth that has occurred because the last significant discharge event in January 2008 (CMWD 2008). The vegetation growth has occurred primarily in areas that tend to have longer periods of flowing surface water, which is primarily in the mainstem Ventura River downstream of the Robles Reach. After the next significant discharge event removes this vegetation, and subsequent impediment surveys are completed, it will be easier to view and document the impediment sites.

Of the seven sites originally identified by ENTRIX (1999), only four sites were able to be relocated with any degree of certainty. Of those four sites, all are no longer in the primary low-flow channel. Sites 1-3 were originally located between the Robles Fish Facility and the Hwy 150 bridge. The river channel in the general area where these sites were located has migrated naturally due to bed-mobilizing runoff events (primarily during a 2005 flood event) since the study was completed. The area where sites 1-3 were located may indeed still be within the river channel, but because of GPS field measurement errors (Larry Wise, ENTRIX, personal communication), their exact locations and status could not be determined. Even if those three sites are still within the river channel, there could have been longitudinal migration of the channel features over the last 10 years. Site 4 was originally located just upstream of the Hwy 150 bridge. The channel since then, based on photos from 2003, has migrated laterally approximately 20 m towards the left bank (looking upstream) caused from natural channel meandering. Site 5 was originally located just downstream of Santa Ana Blvd bridge. Based on photos from 2003, the channel has moved latterly approximately 30 m from the right bank towards left bank. This could be partly due to channel modifications that were made by CalTrans near the bridge in recent years (Mary Larson, CDFG, personal communication). Sites 6 and 7 were both originally located near the community of Casitas Springs. Site 6 was located behind the Arroyo Trailer Park and site 7 was located approximately 200 yards downstream (ENTRIX 1999). Again based on aerial photos of this area prior to the 2005 flood event, the river channel was located considerably closer to the left bank than it is presently. The main low-flow river channel is now located on the right bank against the levee that protects Casitas Springs from high water runoff events. This represents approximately a 30 m shift to the right bank

for site 6 and a 50 m shift for site 7. The main low-flow channel at sites 6 and 7 appears to have switched between preexisting channels and was not the result of natural meandering over the last 10 years. Of the four original sites that could be relocated, all would be inundated at higher flows; however, because low-flow river conditions are the focus of the upstream fish impediment evaluation (NMFS 2003a), new sites were needed for future evaluations.

2010 Results

During 2010, a total of 48 water depth transects were completed at Robles discharges that ranged from 25 to 100 cfs. Because several passage criteria have been commonly used to evaluate potential passage impediments, analysis of the 2010 transect data was evaluated with four different criteria.

Site 2 was surveyed four times at Robles discharges ranging from 21 to 64 cfs. In general, Site 2 produced poor linear correlations. In order to evaluate Site 2 at the different passage criteria, the regression was forced through the origin to produce plausible results (Appendix 3). The resulting minimum discharges required to meet the four criteria ranged from 5 to 37 cfs. Site 3 was surveyed five times with discharges at Robles ranging from 21 to 82 cfs and produced similar results as Site 2. Site 3 regression was also forced through the origin in order to produce plausible results (Appendix 4). The resulting minimum discharges required to meet the four criteria ranged from 32 to 85 cfs. Site 4 was surveyed seven times with Robles discharges ranging from 21 to 100 cfs; standard linear regression was used (Appendix 5). The resulting minimum discharges required to meet the four criteria ranged from 46 to 74 cfs. Surface water at Site 5 was initially thought to be confined to one channel at lower flow, however, a secondary channel was used once surface water reached the site. To evaluate this condition, the secondary channel was also surveyed in the same manner as other sites. Site 5-1, the original site, was surveyed eight times with discharges at Robles ranging from 21 to 100 cfs and both standard and origin forced regression were conducted (Appendix 6). The evaluation method did not produced plausible results

because the resulting minimum discharges required to meet the four criteria ranged from 431 to 3,289 cfs. Site 5-2, the secondary channel, was surveyed five times and at Robles discharges ranging from 23 to 64 cfs and standard linear regression was conducted (Appendix 7). The resulting minimum discharges required to meet the four criteria ranged from 52 to 138 cfs. Site 6 was surveyed eight times at Robles discharges ranging from 23 to 100 cfs and standard linear regression was conducted (Appendix 8). The resulting minimum discharges required to meet the four criteria ranged from 25 to 68 cfs. Site 7 was surveyed seven times at Robles discharges ranging from 31 to 100 cfs and both standard and origin-forced linear regression was conducted (Appendix 9). The resulting minimum discharges required to meet the four criteria ranged from 17 to 70 cfs. Site 8 was surveyed seven times at Robles discharges ranging from 21 to 100 cfs and both standard and origin forced linear regression was conducted (Appendix 10). The resulting minimum discharges required to meet the four criteria ranged from 19 to 26 cfs. Photos of the potential impediment sites at a Robles discharge of 30 or 40 cfs are in Appendix 11a-h for reference. The regression equations and statistics for the four passage criteria are in Appendix 12. The calculated minimum discharges to meet the four passage criteria are in Appendix 13.

In addition to the above analysis, a set of linear regressions were developed for the same impediment sites evaluating the Thompson criteria against individual site discharge estimates instead of Robles discharge (Appendix 29a-g). For regressions that did not produce plausible results, as some did in the previous analysis, no regressions were forced through the origin for this analysis. This resulted in some regressions that were not accurate descriptions of the relation intended to be modeled. For example, two of the sites produced an inverse relation between discharge and passage conditions (i.e., an increase in discharge resulted in a decrease in passage conditions). Additionally, resulting equations had y-intercepts that were larger than expected (Appendix 30a-b).

Discussion

The survey and analytical methods used to evaluate the potential impediments in the Ventura River appear to be able to produce reasonable estimates of minimum discharge needed for adult steelhead passage. The intent of evaluating the impediments using the aforementioned criteria was simply to validate the methods and determine if similar results could be obtained as that of those by ENTRIX (1999) on the Ventura River.

ENTRIX (1999) used the criteria developed by Thompson (1972) for adult steelhead at critical riffles, which is a water depth of 0.6 ft for 25% of the total transect width and a continuous portion equal to 10% of the width. ENTRIX also evaluated the critical riffles using a modification that would produce a water depth of 0.6 ft over a continuous width of 8 ft. The transect that required the highest minimum discharge to meet the two criteria was used to determine the discharge needed for adult steelhead passage, which was a range of 40-65 cfs. It appears that during the development of the initial minimum flows for the Robles Biological Opinion, NMFS averaged these two numbers to come up the initial minimum flow of 50 cfs (NMFS 2003a). By applying this same criteria and flow selection method to data collected during 2010, a minimum discharge of 70 cfs was estimated. However, as stated by Thompson (1972), the selected sites should be averaged to determine the final minimum discharge estimate. This would result in a minimum discharge estimate of 27-60 cfs for the four criteria. Of the adult passing through the Robles Fish Facility to date, the deepest body depth has been 0.41 ft. If this depth was used instead of the 0.6 ft, the resulting discharge would be even less. Sites 2, 3, and 5 were not included in this estimate because of the lack of plausible estimates and poor statistical results they produced. The discharge estimates by ENTRIX (1999) were generally lower than those produced by field measurements during 2010. There appears to be several possible reasons for the differences that could include: (1) ENTRIX used a modeling approach that was based on data collected from a dry channel. At the time of site selection and survey, any potential side channels were not evident and therefore all of the modeling would have assumed the flowing

water would have passed only through the primary channel. (2) Several of the sites surveyed during 2010 included areas that developed secondary and even tertiary channels. These sites were also selected when there was no surface water flowing and led to the same potential error. However, the field surveys during 2010 revealed that as the discharge increased, surface water began to flow in the side channels resulting in higher discharge estimates. Lastly, (3) vegetation at the lower river sites caused surface channel water to spread out into shallow areas that resulted in higher estimates. Field measurements, like that during 2010, would be able to detect these types of changes that modeling could not. The vegetation in the lower river is likely due to the rising ground water downstream of the Robles Reach and inflow from San Antonio Creek that provides perennial water for vegetation establishment and growth.

The additional analysis of site discharge to Thompson criteria produced results that were not plausible for some sites. The inverse relations, negative discharge, and statistically insignificant results could have been due to several reasons. The previously mentioned possible causes would still be applicable for this analysis. Additional data would likely improve some of the regression models. However, it seems that the Thompson method and criteria has limitations that could be exceeded at channel and basin scales.

Regardless of the passage criteria ultimately used, the survey and analytical methods used to evaluate the potential impediments appeared to produce reasonable estimates of minimum discharge needed for adult steelhead passage. Several of the lower river sites should be replaced with new sites that would produce usable estimates for future evaluations.

3.1.1 Sandbar Monitoring

Introduction

The Ventura River, like many other California rivers, typically develops a seasonal sandbar at the mouth during the late spring or summer that is breached by higher river flows in the late fall or winter. If a sandbar does develop, which occurs more often during dry years, the resulting lagoon can provide important rearing habitat for steelhead juveniles because of the abundant food resources available that can facilitate the physiological and behavioral changes associated with smoltification (Cannata 1998) and can also enhance marine survival (Bond et al. 2008).

The primary objective of the sandbar monitoring is to determine if the criteria for initiation of the fish passage augmentation season have been met (NMFS 2003a). As stipulated in the BO, the fish passage augmentation season will extend from 01 January through 30 June of each year and will commence after the sandbar has been breached at least once during the current year's fish flow operations season. During the fish passage augmentation season, several Robles Fish Facility operation criteria must also be implemented (see NMFS 2003a for a complete list of operational criteria).

Methods

During each sandbar inspection, observations and recordings were made that included: date, time, status of the sandbar, general location of the mouth, tidal stage, water temperature, discharge at the Robles Fish Facility and the USGS Foster Park gauge station, and an index count of piscivorous birds. Because the sandbar was open at the first of the year, its status was monitored once every two weeks for the remainder of the fish passage season. During the remainder of the year, the sandbar was monitored at least monthly.

Results

During the reporting period, July 2009 through June 2010, the mouth of the Ventura River was inspected 21 times to determine if the sandbar was open or closed. Thirteen of the observations occurred during the fish passage augmentation season (01 January to 30 June) and eight were outside of the fish passage augmentation season. The sandbar was only closed during the September observation; however, this closure was brief in nature because it only occurred during low tides. During high tides, the surface water was reaching the Pacific Ocean (Appendix 14). In mid December of 2009, the sandbar was open and the Ventura River was able to flow into the Pacific Ocean allowing fish to volitionally enter or exit the estuary. On 04 January 2010, the sandbar was also open, which officially initiated the beginning of the fish passage augmentation season. The sandbar was open for the remainder of the 2010 fish passage augmentation season. On the days the sandbar was inspected, the river discharge at the USGS Foster Park gauge station ranged from approximately 2 to 67 cfs and 0 to 44 cfs at the Robles Fish Facility. The river was observed exiting primarily from the west side of the estuary during the reporting period.

A total of 3,881 piscivorous birds were counted during 18 index surveys of the Ventura River estuary (Appendix 15). Gulls represented approximately 70% of the bird observations at 2,737, followed by terns at 447, cormorants at 351, and pelicans at 296. Egrets, grebes, herons, mergansers, and kingfishers were each counted at total of less than 24 times during the same period.

Discussion

The sandbar at the mouth of the Ventura River tends to remain open during average and above average precipitation years and is closed more often during years with few significant rain events (Lewis et al. 2010). During 2005 and 2006, the sandbar remained open and did not close until April of 2007 after an extended period of low precipitation (Appendix 16). During 2008, the sandbar was only closed during October

and November and reopened in December. During the period that the sandbar was closed in December of 2007, the lagoon had a surface area of 4.7 ha. During an open period in August of 2008, the estuary had a surface area of 2.8 ha, which represents an approximately 70% increase in surface area during periods when the sandbar was closed (Lewis et al. 2010). The status of the sandbar indicates changes in the estuary/lagoon that may help determine potential juvenile steelhead rearing conditions.

3.2 Fish Attraction Evaluation

Introduction

River discharge has been shown to be one of several key environmental factors initiating and facilitating steelhead and other salmonid adult and juvenile migrations in natural fluvial environments (Shapovalov and Taft 1954; Banks 1969; Spina et al. 2005). As adults and juveniles approach fish passage facilities, sufficient discharge and water velocities become even more important to ensure successful passage through any facility (Clay 1995; Beeman and Maule 2001).

The entrance of the fish ladder at the Robles Fish Facility is located approximately 20 m downstream of the spillway gates and is where fish migrating upstream enter and where fish migrating downstream exit. The downstream end of the ladder is adjacent to a large pool (entrance pool) that was scoured out and maintained by high discharges through the spillway gates. Maximum discharge at the exit of the ladder is 170 cfs (50 cfs through the entire ladder and an additional 120 cfs can be supplemented at the lower end of the ladder). The distance from the entrance pool downstream to the lower most interim rock weir is approximately 200 m. This reach includes all four rock weirs and the facility's low flow road crossing, which is also the weir used to measure discharge for the Robles Fish Facility. The habitat unit types that could be used by migrants in this reach includes the four pools created by the weirs, a glide created by the low flow road crossing, a riffle, and the entrance pool.

The objective of the fish attraction evaluation is to determine if adult or juvenile steelhead were holding immediately downstream of the Robles Fish Facility during the fish passage augmentation season (NMFS 2003a).

Methods

The fish attraction surveys were conducted on a weekly basis during the fish passage season from January through June of 2010. The particular survey methodology used was determined based on water visibility, river discharge, and expected steelhead life history stage present at the time of the survey. From January through March, which is when the vast majority of adults are expected to be migrating upstream (Shapovalov and Taft 1954), bank surveys were the predominant method used. Beginning in March through the remainder of the fish passage season, snorkel surveys were the predominant method used, which is when steelhead smolts are expected to migrate downstream (Shapovalov and Taft 1954; Spina et al. 2005). Bank surveys were conducted by one or two surveyors in an upstream direction. The surveyors wore polarized sunglasses to reduce water surface reflection. Snorkel surveys were conducted by one or two surveyors in an upstream direction. All fish species were identified and enumerated to the greatest extent possible that the river conditions and fish densities allowed at the time of the surveys. Lengths of each *O. mykiss* were estimated to the nearest cm if only a few individuals were present. At times of greater abundance, *O. mykiss* were grouped and assigned to the nearest length (cm) category. In order to collect additional information that may help determine *O. mykiss* upstream and downstream movements through the Robles Fish Facility, an upstream study reach was added in 2009. The upstream study reach included observations in the screenbay of the facility and the area immediately upstream of the low-flow fish exit in the forebay. The total distance of this upstream reach was approximately 140 m.

Results

A total of 147 *O. mykiss* were counted from January through June of 2010 in the 340 m study reach (Appendix 17). One large 58 cm *O. mykiss* was observed during the fish attraction surveys. A total of 8,160 m were surveyed by either bank or snorkel methodologies during the 6-month period. The water temperatures during the study period ranged from 10 °C in January to 25 °C in June and turbidity was less than 11 NTUs. *O. mykiss* were first observed in March and peaked in late April and early May at 20 fish (Appendix 18). After peaking, *O. mykiss* counts declined at the end of May and ranged from 2 to 6 *O. mykiss* through the end of June 2010. The discharge at the Robles Fish Facility ranged from about 0 to 588 cfs. During the period that *O. mykiss* counts began to increase, the discharge was generally receding.

The 200 m reach downstream of the fish facility was surveyed on 24 separate occasions, 6 bank and 18 snorkel surveys. A cumulative total of 4,800 m were surveyed from January through June. A total of 53 *O. mykiss* were observed downstream of the Robles Fish Facility (Appendix 19). The peak count for the downstream reach was 9 *O. mykiss*, which declined to about 3 *O. mykiss* for the remainder of the study period.

The 140 m reach upstream was surveyed on 24 separate occasions, 6 bank and 18 snorkel surveys. A cumulative total of 3,360 m were surveyed from January through June. A total of 94 *O. mykiss* were observed in the upstream reach. Observations of *O. mykiss* upstream of the Robles Fish Facility were somewhat similar to downstream counts. The general pattern of increasing counts in early March and receding to lower levels in late May was similar for both upstream and downstream counts, but the upstream counts peaked about 3 weeks earlier (Appendix 19). The peak count for the upstream reach was 16 *O. mykiss*, which declined to about 3 *O. mykiss* for the remainder of the season.

An additional fish attraction survey method was conducted in 2010. This entailed surveying three times per day for five consecutive days following a BO-defined storm event after a Secchi depth of 1 m was reached in the entrance pool. These surveys were conducted for the three storm events and no adult steelhead were observed. Only bank surveys were conducted because the turbidity was too high to conduct snorkel surveys.

Discussion

The total count of 147 *O. mykiss* in the upstream and downstream reaches was in all likelihood the result of repeated counts of *O. mykiss* over the course of the survey season. Because the surveys were conducted weekly, some *O. mykiss* likely remained in the 340 m reach for more than one week and were counted at least one additional time; most likely several times. Without tracking individual *O. mykiss* (e.g., mark/recapture, telemetry, or other tagging studies), the time spent by *O. mykiss* in close proximity to the Robles Fish Facility cannot be determined by observations alone. It is clear, however, that *O. mykiss* are migrating from the upper Ventura Basin and passing through the Robles Fish Facility successfully and continuing downstream.

From observational counts alone, the ability to interpret the fine-scale migration behavior of the *O. mykiss* near the Robles Fish Facility is limited. The abundance trends were similar for upstream and downstream observations (Appendix 19). The three-week earlier increase of upstream counts may indicate a downstream migration of *O. mykiss*. The decreased counts for both the upstream and downstream reaches in mid May indicates that they were obviously moving downstream and upstream out of the study reaches. Some of the *O. mykiss* in the upstream reach most likely migrated back upstream as water temperature increased above 22 °C. Even though the snorkel counts in the downstream reach were less than 5 *O. mykiss* later in the season, there were at least 38. This was evident after a rescue of *O. mykiss* was conducted in late August. The reason for the difference is that turbidity and the difficulty of snorkeling a pool up to 4.5 m (15 ft) deep can cause the counts to be underestimated. Additionally,

on two occasions, snorkeling inside of the fish ladder (i.e., the entrance box) revealed as many as 30-40 *O. mykiss*; this alone could have accounted for the difference. The *O. mykiss* may be residing inside the lower portion of the ladder during the day and moving back out at night.

O. mykiss tended to accumulate in the entrance pool at the outlet of the fish ladder. This is likely due to several reasons, acting alone or together, that resulted in this accumulation. As discharge decreased, *O. mykiss* could have had difficultly moving back upstream through the ladder. During these periods, discharge can be as little as 2-5 cfs and the facility operational design criterion for functional fish passage was estimated to be a minimum of 10 cfs (CMWD et al. 2002). Additionally, water temperature related effects could have played a role. As discharge recedes, the surface water temperature increases. When given a choice between the cooler water of the thermally stratified entrance pool (4.5 m deep) and the warmer water discharged from the ladder, *O. mykiss* most likely preferred to stay in the entrance pool. During late August, surface water in the entrance pool was approximately 26 °C and 19 °C near the bottom (Lewis et al. 2010). At that same time, the dissolved oxygen remained about 8-9 mg/L from the surface to the bottom. *O. mykiss* are known to use thermally stratified pools as a means to escape warmer surface water temperatures (Matthews et al. 1994). However, deep pools can develop low concentrations of DO at times of the year, and depending on their hydraulic connection to subsurface flows, *O. mykiss* may face a tradeoff between warmer surface water and low DO in the cooler water of deep pools (Matthews and Berg 1997). Given that the DO throughout the water column in late May was within the range acceptable to *O. mykiss*, they did not face this tradeoff between low DO and high temperatures. Thus, fish could have been restricted to the deeper water of the entrance pool by a thermal blockage and unable or unwilling to move through it. This effect was likely only exacerbated with receding river discharges.

There was a surface water connection to the lower Ventura River for 16 weeks, from late January to early May (Lewis et al. 2010). The surface water connection to the lower Ventura River was lost near the time when the peak counts occurred at the

Robles Fish Facility. The majority of the steelhead smolts likely had an opportunity to migrate downstream and enter the ocean, but a significant portion did not.

Based on qualitative observations during the snorkel surveys, it appeared that most of the *O. mykiss* were progressing through smoltfication. The onset of smoltification can be identified by vanishing parr marks, silvering of the body, and darkening of the margins of the fins among other characteristics (Chrisp and Bjornn 1978; Hasler and Scholz 1983; Quinn 2005; Spina et al. 2005). During the survey period, 93% of the *O. mykiss* observed were categorized into five classifications that included parr, three transitional phases (T-1, T-2, and T-3), and full smolts following the methods of Hasler and Scholz (1983). This classification method has been used successfully for smolting steelhead (Allen Scholz, Eastern Washington University, personal communication). Of the classified *O. mykiss*, 35% were T-2 stage, 51% were stage T-3, and 3% full smolts (Lewis et al. 2010). With a total of 89% of *O. mykiss* in mid to late smoltification stages, it would indicate that a downstream smolt migration behavior was the likely reason for their occurrence in the fish attraction study reach. Based on snorkel observations during June, it appeared the remaining *O. mykiss* were beginning to revert to a resident form (i.e., lightening of the margin of the fins, coloring across lateral line, and reappearance of parr marks). During this period of smolt reversal, the mean water temperature during snorkel observations was measured at 22 °C, which exceeded the temperature limit of smolt regulating enzymes and hormones (Allen Scholz, Eastern Washington University, personal communication) and could explain the residualization observations.

The total number of *O. mykiss* observed during 2010 was substantially less than in 2009. During same period in 2009, 807 *O. mykiss* juveniles were counted as compared to the 147 during 2010 (CMWD 2009). The dramatic decrease was most likely because no adult steelhead were able to migrate upstream in 2009. The observed *O. mykiss* were likely a combination of 2+ smolts from the 2008 steelhead brood and resident rainbow trout produced progeny that smolted and migrated downstream in attempt to

reach the ocean. However, the downstream counts peaked earlier than the upstream counts suggesting a general movement of *O. mykiss* from downstream areas.

3.3 Fish Passage Monitoring

Introduction

Monitoring of migratory fish moving through fish passage facilities has been conducted using many different methods that include: visual counting, trapping and hand counting, continuous video recording, PIT tagging, radio telemetry, and acoustical telemetry. In each fish passage application, the particular physical and biological conditions (e.g., variable discharge, turbidity, debris, size of facility, and number of fish) usually dictate which method would be most effective. New technologies have been employed to improve fish passage monitoring in turbid conditions specifically. One such monitoring device is the Vaki Riverwatcher® (Riverwatcher). The Riverwatcher has the capability to operate in greater turbidity than more traditional monitoring equipment. Because of this advertised capability, the Riverwatcher was selected to be used in the Robles Fish Facility by the Technical Advisory Group.

The primary objective of fish passage monitoring is to provide an index of upstream adults and downstream kelts migrating through the Robles Fish Facility (NMFS 2003a). The Riverwatcher was advertised to detect fish down to a fish body depth of about 40 mm (Vaki 2003) and it was not known how well it would work for smolt-sized fish given the debris load in the Ventura River (NMFS 2003a).

Methods

Upstream and downstream migrating fish were monitored passing through the Robles Fish Facility using the Riverwatcher. The Riverwatcher is located in the fish bypass channel, which is the channel between the fish ladder and fish screens. The Riverwatcher consists of two scanner plates with light diodes that transmit beams of

infrared light through the water to a corresponding receiver plate. When a fish swims (or debris drifts) through the infrared light beams, it breaks the light signal and a silhouette of the fish is recorded on a computer. Other data recorded when the Riverwatcher scanner is triggered are: date and time, total length (TL) of the fish (from a length/height ratio), swimming speed (m/sec), and direction of the fish movement (upstream or downstream). In addition, the scanner triggers an underwater camera to record a 10-second video clip (25 frames/sec). Only fish swimming upstream can be recorded in the Riverwatcher computer system because it was only designed for one camera, and that camera is on the upstream side of the scanner. An additional two cameras were installed in 2008-09 so that video of downstream fish could be captured on a digital video recorder (DVR). Both downstream cameras are located upstream of the Riverwatcher scanners in an aluminum tunnel along with the upstream Riverwatcher camera. The downstream digital cameras recorded continuously at 12 frames/sec and captured about 2-3 weeks of data until the DVR data storage drive was full (each week of data required approximately 4 h to review). These two downstream cameras are independent of the Riverwatcher and have to be reviewed separately for downstream detections. Once the DVR memory is full, it is exchanged with a second DVR and the data are reviewed before the DVRs have to be exchanged again.

The Riverwatcher scanner and cameras are positioned at the bottom of an aluminum frame covered with 1/2 inch aluminum bars, spaced 1 1/2 inches on center resulting in 1 inch spacing between the bars (crowder), which directs the fish to swim between the scanner plates. The crowder can be raised and lowered in guide slots of the fish bypass channel with the aid of an A-frame hoist for cleaning or repair. The Riverwatcher is usually operated during the entire flow augmentation season as long as sufficient water elevations in the fish bypass are present and debris and turbidity are low enough so that the crowder will not be damaged and the Riverwatcher will function. The Riverwatcher was operated continuously from mid December 2009 through June 2010 during the reporting period. During this time, the crowder was removed from the fish bypass channel and cleaned or inspected 90 times. During times of higher debris, the cleaning and inspections occurred multiple times per day, and at times of low debris,

cleaning and inspections occurred only once every 2-3 days. The crowder was removed for cleaning for a combined total of approximately 8 h during the operation period.

Prior to 2010, each upstream and downstream Riverwatcher detection was reviewed and classified as an adult steelhead, *O. mykiss* non-adult steelhead, other species if identifiable, unknown fish, fish probable, or false detection (see Appendix 20 for detection classification flow chart). At the request of NMFS, this classification system was modified during the review process for this report (see Appendix 31 for Biological Committee discussions). All confirmed *O. mykiss* were classified solely as *O. mykiss*. The classifications were determined by using a combination of the silhouette images, estimated lengths, and video clips. In addition, if larger adult sized *O. mykiss* were detected and useful video clip was recorded, a measurement of eye diameter and standard length (SL) were estimated from the video clip to calculate morphometric ratios that were compared to known steelhead and rainbow trout. A commonly used method is to develop ratios of body measurements for comparison to remove the effects of body size so actual differences can be determined (Strauss and Bond 1990). This was done by comparing SL to the ratio of eye diameter in linear regression. Standard length is the length from the snout to the end of the hypural plate near the end of the fleshy caudal peduncle, which is unaffected by caudal fin deformities (Anderson and Neumann 1996). Previous to 2010, the adult steelhead classification was used if the fish observed was an *O. mykiss* and displayed the typical characteristics of an anadromous adult steelhead, such as black spotting on dorsal, adipose, and caudal fins, black spotting on dorsal side of body, slivery body, vertical edge to caudal fin, ≥ 38 cm TL (Shapovalov and Taft 1954), and had an eye diameter/SL ratio ≤ 0.045 (CMWD 2008). This new classification method likely included juvenile resident, smolts, adult resident, and adult anadromous *O. mykiss* migrating throughout the basin. Conceivably, after more data are collected from the downstream trapping component of the monitoring and evaluation, or from other Ventura River basin research projects, a more detailed classification of Riverwatcher detections could be used again. The fish unknown classification was used if the detection was identified to be a fish based on video

evidence, but the species identity could not be determined due to high turbidity or the fish not swimming through the camera field of view. The fish probable classification was used if no fish was observed in the video, but the silhouette was similar to that of a typical fish silhouette based on previous experience. Even with reasonably good video coverage, smaller fish were still able to pass through the Riverwatcher undetected by the video cameras. This can occur if the fish swim very close, high, or low to the cameras. In addition, this can happen if an upstream fish swims through the scanners then stops before entering the video field of view. High turbidity can also obscure the video detection and identification of fish. The false detection classification was used when no fish was observed in the video and the silhouette was not similar to that of a typical fish silhouette based on previous experience. Because false detections tended to occur frequently during higher discharges when turbidity and debris were also high, it was likely that most false detections were caused by debris, high turbidity, and water turbulence. When turbidity exceeds about 100 NTUs, hundreds of false detections per hour can occur and not until turbidity falls below about 30 NTUs is the Riverwatcher fully operational (Table 1).

Table 1. Riverwatcher operational status over a range of water turbidity (NTUs).

Turbidity (NTU)	Riverwatcher status
> 200	Not operational
100-200	Many false detections
30-100	Scanner operational, but unable to confirm with video
< 30	Video grid detectable
0-30	Riverwatcher fully operational

Results

During the 2010 fish migration season, the Riverwatcher recorded 2,831 total detections, of which 879 were upstream and 1,952 were downstream (Appendix 21). Of the total upstream detections, 7% (n = 58) were determined to be fish (excluding largemouth bass) and included 54 *O. mykiss* and 5 probable fish. Of the total

downstream detections, 2% (n = 42) were determined to be fish (excluding largemouth bass) and included 39 *O. mykiss* and 3 probable fish.

The one large *O. mykiss* (58 cm TL) passed upstream through the ladder on 20 March 2010 at 0550 h at a discharge of 36 cfs. The mean daily temperature was 15 °C and the turbidity was 1 NTU. It passed downstream through the fish ladder between 29 March and 14 April without being detected. This could have occurred during times the Riverwatcher and fish crowder were removed for cleaning (total time about 3 h) or during a 12 h period that had high turbidity and the crowder was also removed. It could have also escaped detection if it was swimming tail first downstream at a velocity too slow for the Riverwatcher to detect. At the time it first passed upstream, it drifted downstream and was not detected by the Riverwatcher, it was not until that downstream DVR was reviewed that this type of error was detected (Table 2).

Table 2. Date and location of all seven confirmed sightings of the 58 cm *O. mykiss* observed during 2010 migration season.

Date (2010)	Time (h)	Location	Method	Direction
20 March	0550	Robles fish ladder	Riverwatcher	Upstream
20 March	0551	Robles fish ladder	Underwater video	Downstream
20 March	0555	Robles fish ladder	Riverwatcher	Upstream
30 March[1]	NA	North Fork Matilija Cr.	Snorkeling	NA
14 April	1343	Ventura R. @ OVLC pool	Snorkeling	NA
15 April	0955	Ventura R. @ OVLC pool	Snorkeling	NA
20 April	1050	Weir pool #3 DS of Robles	Snorkeling	NA

[1]Stoecker 2010

The mean date for the upstream migrating *O. mykiss* was 02 May and 14 May 2010 for the downstream migrating *O. mykiss* (Appendix 21). During the migration season, there was a general increase of fish detections for both upstream and downstream (Appendix 22).

The time of upstream detections occurred essentially at all times of the day, but the modal time was 1500 h (Appendix 23). The majority of downstream detections ranged from about 03:00 h to 09:00 h. Of the *O. mykiss* migrating downstream, 77% were detected in the morning from 0100-0900 h.

The mean total lengths for upstream and downstream *O. mykiss* were estimated to be 34 and 32 cm, respectively (Appendix 21). Upstream and downstream *O. mykiss* lengths overall ranged from 20 to 58 cm (Appendix 24). The software program that operates the Riverwatcher estimates the TL of a fish detection based on a ratio of height to length (Vaki 2003). This ratio can be changed depending on available data for the target species. Based on morphometric measurements of *O. mykiss* mortalities over the last several years, an *O. mykiss* height to TL ratio was estimated to be 5.1 for fish ranging from about 10 to 28 cm. During a validation and calibration pilot study, it was estimated that the Riverwatcher was underestimating the fish heights by about 10 mm. A correction was added to the TL to height ratio to calibrate it to the known fish heights. This calibrated ratio was used to estimate the TL of Riverwatcher detections from January through June of 2010. However, the resulting TL estimates appeared to be over estimated when compared to known *O. mykiss* lengths that were measured in 2009. It was decided that a more accurate method would be to use a regression model to convert Riverwatcher estimated fish heights to lengths. Again, from the morphometric measurements, a sigmoid regression was conducted to develop a model for converting the Riverwatcher fish heights to total lengths ($TL = 687.68 / (1 + \exp(-(D - 50.78)/23.97)) / 10$, $p < 0.0001$, $r^2 = 0.99$, $n = 59$, D = body depth). This regression model will continue to be improved upon as more data becomes available. In general, the Riverwatcher was inefficient at detecting smolt-sized fish passing upstream or downstream and underestimated the size of fish that it did detect.

The physical river conditions of temperature, turbidity, and discharge at the time of passage were similar for upstream and downstream migrating *O. mykiss* and other fish classifications (Appendix 21). The mean water temperature for upstream migrating *O. mykiss* was approximately 18 °C and was 18.5 °C for downstream *O. mykiss*. The

mean turbidity levels at the time of passage for upstream and downstream *O. mykiss* non-adult steelhead was about 4 NTU. The mean turbidity at the time of the false detections in both upstream and downstream directions was approximately 50-60 NTU. The discharge at the Robles Fish Facility at the time of upstream passage for *O. mykiss* was a mean of 23 cfs and 19 cfs for downstream migrating *O. mykiss*. Like turbidity, the periods of false detections coincided with times of higher discharge. For a list of all fish detections, see Appendix 25. The total time the Riverwatcher was not operational because of high turbidity was 5.5 days.

Discussion

Approximately 2,800 false detections occurred and were likely due to the greater river discharges, associated turbidity and debris, and settings of the Riverwatcher to detect smaller fish. In addition, the Riverwatcher and crowder were left in the ladder for longer periods at high turbidity. This was done to increase the chance of detecting any adult steelhead migrating during those times of higher turbidity. Given that the Riverwatcher is recommended to be set at a minimum of no less than 40 mm (Vaki 2003), it appears that overestimation of fish passage was likely given that all false detections could not be identified and eliminated. For the 2010 season, the minimum height was set at 28 mm so that large numbers of false detections could be eliminated while still attempting to detect steelhead smolts. The height was determined to be similar to some of the smallest steelhead smolts that might be expected to emigrating downstream through the Robles Fish Facility based on available data from the Ventura Basin. The height of 28 mm corresponds to 146 mm TL and 139 mm FL. *O. mykiss* mortalities found and measured during the course of ongoing field monitoring efforts, and subsequently turned over to NMFS, were all larger than 146 mm TL. The estimated fish detection rate from the validation pilot study and the comparison of snorkel counts to Riverwatcher detections both indicate that as much as 78-88% of smolt sized *O. mykiss* are not able to be detected by the Riverwatcher. During the 2009 validation pilot study, larger sized fish (i.e., height > 60 mm) appeared to be detected nearly 100% of the time. This height is equal to about 300 mm TL and is larger than what would be expected to

be migrating downstream through the Riverwatcher. Before a detection rate correction could be applied to downstream detections, more data would need to be collected on detection efficiency. The highly variable results from the pilot study were not sufficient to develop a correction factor with enough confidence. Like the detection efficiency, the Riverwatcher estimated fish heights were also highly variable and the true error could not be determined. The data collected to date would indicate that the Riverwatcher is not able to sufficiently monitor steelhead smolt emigration, and given the manufacture's operational recommendations, these results should not be surprising. However, additional Riverwatcher validation/calibration tests will be conducted during 2011 in an attempt to further identify the operation limitations of the Riverwatcher.

From general observations over the last several years, and supported by observations during the 2009 validation pilot study, *O. mykiss* juveniles do not move through the fish crowder and Riverwatcher quickly. *O. mykiss* tend to swim downstream and back upstream repeatedly before ultimately moving in one direction. This lack of aggressive and rapid directional movement is supported by observations during the fish attraction monitoring. *O. mykiss* juveniles were observed holding in general areas for extended periods of time before either moving downstream or back upstream, which is commonly found in all salmonid smolts (Quinn 2005). During the fish attraction surveys, of the *O. mykiss* that were categorized into smolt transformation stages, all stages were present. Because the smolt migration rate is positively correlated with the smoltification process (Quinn 2005), some holding and lack of aggressive downstream migration would be expected.

The detection of *O. mykiss* passage by the Riverwatcher did not show the same diel migration pattern through the Robles Fish Facility as in 2009 where *O. mykiss* primarily passed downstream just before dawn then passed back upstream just before and after dusk. The downstream pattern was similar; however, the upstream *O. mykiss* were migrating throughout the day and night. The reasons are not clear at this time for the differences. The early morning movement of downstream migrating smolts is common among steelhead throughout its range (Dauble et al. 1989). However, monitoring

upstream movements of smolts has not been studied specifically and little available data exists to make comparisons. Most smolt monitoring studies do not have volitional passage with passive monitoring like that used at the Robles Fish Facility. Therefore, the opportunity to examine upstream movements is not usually available. The distance of daily migrations were unknown; however, it is likely the fish remained within, or near, the Robles Fish Facility before continuing their downstream migration.

As previously discussed, the Riverwatcher's ability to accurately estimate fish lengths is an area that will need more work to fully determine its usefulness in monitoring smolt-sized *O. mykiss*. However, the use of the regression model to estimate TL from the Riverwatcher's estimate of height produced reasonable results. The mean TL of *O. mykiss* detections was larger than what others have documented for steelhead smolts in central and southern California. Shapovalov and Taft (1954) estimated a mean FL for 2+ and 3+ age smolts at approximately 17 cm. Spina et al. (2005) also measured a mean smolt FL of approximately 17 cm. This difference could be due to several reasons. The error associated with the Riverwatcher estimates could be one possible cause. In addition, the regression model used does appear to result in an over estimate when compared to video estimates. Regardless, the Ventura River smolts are indeed larger and this is probably due to faster growth rates in the warmer water as compared to the more northern basins. Age of the migrants might also explain the differences observed; however, no scales of *O. mykiss* were collected for aging.

As mentioned above, the combination of the Riverwatcher error and body depth to TL over estimation, likely resulted in the *O. mykiss* being smaller than reported. There appears to have been many larger resident *O. mykiss* spawning in the basin during 2010 (Lewis et al. 2010), which likely accounted for detection of larger *O. mykiss* in the 30-45 cm range. Shapovalov and Taft (1954) document adult steelhead in the 38-40 cm range, but given that scales have not been collected and analyzed for Ventura River *O. mykiss* in this size range, their life history form could not be conclusively determined and therefore some of the larger *O. mykiss* documented could have been adult

anadromous steelhead. However, the 58 cm *O. mykiss* detected was in all likelihood an adult anadromous steelhead.

3.4 Downstream Fish Passage Evaluations

Introduction

Passage evaluations of migrating salmonid through fish passage facilities have been conducted throughout the western United States for many years. Methods to determine if a facility is operating as designed and not causing harm to the intended fish species vary. Early work typically entailed trapping and tagging fish before entering a facility and recapturing them after exiting. Trapping and visual inspections for injuries, PIT tagging, radio telemetry, and acoustical telemetry has been conducted extensively as well.

There are two objectives for the downstream fish passage evaluation. The first objective is to determine if steelhead are successfully passing through the Robles Fish Facility. The second objective is to capture and examine steelhead smolts and kelts and determine if there are any injuries that may have been caused by downstream passage through the Robles Facility (NMFS 2003a).

Methods

A weir trap was placed and operated approximately 100 m downstream of the Robles Fish Facility. The weir trap consisted of a live-box (120 cm on all three sides) with an internal fyke and the trap was situated in the center of the river channel and thalweg. The live-box internal frame was constructed out of PVC pipe and covered with plastic fencing with 1.9-cm diagonal openings. A plastic fence (3-cm openings) supported by T-bar fence posts was extended upstream on both sides of the live-box at 30° angles into the river channel and ended near each bank leaving gaps of approximate 1 m so adult steelhead could pass upstream by the trap location (Appendix 26). Two-meter

deflector wings positioned approximately 14 m upstream of the trap were also used to guide shore-orientated smolts toward the thalweg. Because the vast majority of downstream steelhead migrants were expected to be captured from mid-March through mid-June (Shapovalov and Taft 1954; Dettman and Kelley 1986), the trap was planned to be operated from mid-March through June or until water temperatures exceeded a daily mean of 22°C, which could negatively impact captured fish (SYRTAC 2000).

The trap was intended to be operated only at lower river flows when it would be effective at capturing downstream migrants. The upper limit of river flow operation will be determined after successive seasons. Because base-flow conditions are more likely to be used for downstream passage by steelhead (NMFS 2003a), a weir trap was chosen as the method for this evaluation rather than a rotary screw trap. After assessing representative hydrographs from previous years, evaluating potential screw trap sites, and the potential for capturing downstream migrants with a screw trap at the higher discharges, a screw trap was determined to be much less effective at gathering the data needed to address the objectives of the downstream passage evaluation.

When the trap was operational, it was checked twice per day (in the morning and late afternoon). The trap generally operated from Sunday afternoon through Saturday morning. Data collected included: fork length (mm), weight (g), and a subsample of scale and tissue samples for aging and genetic analysis. Fish that were to be handled were put into an aerated container with a solution of tricaine methanesulfonate (MS-222) and Stress Coat®. The anesthesia MS-222 is registered by the US Food and Drug Administration for use with food fish (Summerfelt and Smith 1990). The level of anesthesia needed is generally stage 2-4, which is a deep sedation to a total loss of equilibrium (Summerfelt and Smith 1990). To achieve a short induction time of 3-4 minutes, as recommended by Summerfelt and Smith (1990), a concentration of 60-100 mg/L of MS-222 was used. This concentration allows for a recovery time of less than 5 minutes (Summerfelt and Smith 1990), but from previous experience, anesthetized steelhead smolts will most likely recover in less than 3 minutes. Stress Coat® is a synthetic slime coating that replaces the naturally secreted protective slime that is lost

during capture and handing of fish. Stress Coat was added to both the anesthetizing and recovery containers at the manufacture's recommended concentration of 0.25 ml/L.

Scale loss was assessed by examining captured fish and estimating scale loss over three zones on each side of the fish. The three zones were: 1) the caudal zone that included the area above and below the lateral line from the caudal fin to the posterior end of the dorsal fin, 2) the dorsal zone that included the area anterior of the caudal zone to the operculum and above the lateral line, and 3) the ventral zone that included the area anterior of the caudal zone to the operculum and below the lateral line (Marine and Gorman 2005). The percentage of scale loss in each zone was estimated and then weighted by each zone's area proportional to the total area of all six zones. Summing of the resulting weighted scale loss yielded the total area of each fish with scale loss. Any physical injury was noted and categorized among the fins, skin, eyes, and head. Within each anatomical category, there are 2-3 types of injuries that could be documented. In general, the scale loss and physical injury methods followed those of Marine and Gorman (2005) and McNabb et al. (1998). Only one weir trap will be used initially to determine if there are any significant physical injuries or scale loss occurring. If significant scale loss or physical injuries are occurring, and the Robles Biological Committee deems it necessary, then a second trap will be installed and operated upstream of the Robles Fish Facility. If an upstream trap is operated in the future, steelhead will be captured, marked, and released before they enter the Robles Fish Facility and then recaptured in a trap downstream of the facility to determine if the injuries were the result of passage through the facility.

Prior to the operation of the downstream weir trap, an annual fish handling training class was conducted with seasonal fisheries technicians and full-time biologists. This training class was conducted with hatchery rainbow trout and all techniques and procedures were practiced until the fisheries personnel were fully proficient with each. Additional, annual training and review occurred with all other aspects of the monitoring and evaluation program so personnel are proficient at each task that they may be assigned to conduct.

Results

The weir trap was operated from 16 March through 07 May 2010 when the mean daily water temperatures exceeded 22 °C. A total of 5 smolts were captured with the first two being captured on 18 March; three were then captured on 25 March. The mean FL was 187 mm and mean weight was 69 g. The smolts all appeared to be undergoing smoltification; one was a T-2, three were T-3, and one was a full smolt. The mean water temperature was 15.8 °C during the 53-day trapping period and 13.9 °C on the two days smolts were captured. The stream discharge ranged from 24 to 44 cfs during the trapping period and was a mean of 33 cfs at the time the 5 smolts were captured. The *O. mykiss* smolts were not tagged with radio transmitters. It was anticipated that more would be trapped and tagged; however, no other smolts were captured. Four of the five smolts showed signs of descaling and one did not. Using the descaling assessment methods described, the descaling ranged from 1.9% to 9.6% with a mean of 6.1%. Four of the smolts had small but noticeable skin damage to the head region.

Discussion

The first objective of the downstream fish passage evaluation is to determine if steelhead are successfully passing downstream through the Robles Fish Facility (NMFS 2003a). If determined using downstream trapping data alone, this objective cannot be fully evaluated with the limited data collected to date. However, from the fish attraction data alone, it is clear that *O. mykiss* juvenile are successfully navigating downstream through the Robles Fish Facility during the expected steelhead smolt migration period (Shapovalov and Taft 1954; Dettman and Kelley 1986; Spina et al. 2005).

The second objective of downstream fish passage evaluation is to capture and examine steelhead smolts and kelts and determine if there are any injuries that may be caused by passing downstream through the Robles Fish Facility (NMFS 2003a). Also, like the first objective, this could not be fully evaluated due to a lack of data. The five *O. mykiss* smolts captured in the trap had a mean descaling of 4.9%. It is not known how much of

this could have been due to passage downstream through the Robles Fish Facility or the trapping and handling procedures. A pilot test will be conducted in 2011 with hatchery fish to help determine how much descaling might occur during trapping and handling of fish. Additionally, a literature research will be conducted to determine what other researchers have estimated for steelhead smolts passing through fish facilities versus trapping and handling.

3.5 Downstream Fish Migration through the Robles Reach

Introduction

When the number of fish to be physically handled in a study is of concern, such as with an endangered species, the method of radio telemetry can be a useful method over others like extensive trapping (Hockersmith et al. 2000). Telemetry migration information of steelhead smolts in the Ventura River would allow for the determination of survival, travel time and rates through select reaches, migration relative to river discharge, habitat use, and passage success through critical riffles. By tracking the fish until the batteries die, it is anticipated that downstream migration can be monitored all the way to the Ventura River estuary/lagoon, which could provide important data on estuary rearing and emigration behavior.

The purpose of the downstream migration evaluation is to determine how successfully smolts are migrating through the Robles Reach (NMFS 2003). Because of the limited number of steelhead smolts most likely passing downstream through the facility at this time, a pilot study using radio telemetry will be used for evaluations.

Methods

During the estimated smolt migration period of mid-March through mid-June, up to 15 steelhead smolts captured in the weir trap downstream of the Robles Fish Facility were to be tagged with radio transmitters and released downstream of the weir trap. Only

steelhead smolts that exhibit steelhead smolt characteristics and in good physical condition were to be tagged. The smolting characteristics include: increased skin reflectance, larger heads, slimmer bodies, longer caudal peduncle, loss of parr marks, and darker margin of the dorsal fin (Beeman et al. 1995; Haner et al. 1995; Ando et al. 2005). These characteristics have been used in southern California to identify steelhead smolts migrating downstream (Spina et al. 2005).

The radio transmitters intended be used were manufactured by Advanced Telemetry Systems (ATS) and had transmitter radio frequencies ranging from 149.000 to 150.999 MHz, a pulse rate of 30 per minute, and a pulse width of 18 ms. Each tag had a unique radio frequency so that individual fish, if needed, could be tracked during their downstream migration. The transmitters weighed 0.85 g and had an expected operational life of about 48 days. The dimensions of ATS tags (model number F1435) were 14 mm long with a diameter of 7 mm. The ratio of tag weight to steelhead weight in the air will be less than 5%, which will ensure that physiological stress will be minimized (Jepsen et al. 2001) and swimming performance will not be altered (Brown et al. 1999). Based on the expected sizes of captured smolts; estimated from steelhead smolts captured in the Santa Clara River (ENTRIX 2000), the maximum tag-to-weight ratio will be closer to approximately 3%. The steelhead were anesthetized with a solution of MS-222 and placed on a water and Stress Coat® soaked foam pad ventral side up and the tags were gastrically inserted (Adams et al. 1998). The tag was lubricated with food-grade glycerin to prevent abrasion (Adams et al. 1998; Hockersmith et al. 2000) and gently inserted through the mouth and into the stomach using a rigid small-diameter tube. The fish were allowed to fully recover to assure they are behaving normally before they were released downstream for migration tracking; typical recovery occurs in approximately 3 minutes. The estimated time for tagging and recovery were based on previous radio telemetry studies with steelhead smolts (Lewis 2001, 2002, and 2003).

After tagging and recovery, the steelhead were released downstream of the weir trap. Tagged steelhead were located on a daily basis as they migrate downstream for the first

week after release and then at least weekly until the batteries die, the fish was lost, the fish entered the ocean, was found dead, or the tag was regurgitated. Mobile tracking was done using an ATS radio telemetry receiver (model R2100) and 3-element Yagi antennae. Initial broad scanning was accomplished from locations at higher elevations accessed by a vehicle driven on roads near the Ventura River. Once a general location of a tagged steelhead was found, the final location was determined on foot. This method can yield locations of ± 10 m (Lewis 2001). All determined locations were recorded on a map and datasheet. Every reasonable effort was made to determine the ultimate final location of each radio tagged steelhead and if any mortality occurred, the cause of the mortality was determined if possible. It is estimated, that at the most, one tag would be lost due to regurgitation during the study period; Hockersmith et al. (2000) measured a short-term regurgitation rate of 1.3% using the gastric method, Adams et al. (1998) measured a regurgitation rate of 4.2%, and Jepson et al. (2001) measured a 5.0% regurgitation rate. Beyond the 30-40 day period, the regurgitation rate typically increases dramatically.

Using the method of radio telemetry to monitor migration through the Robles Reach will provide more usable information while using fewer fish to gather that information; compared to using an additional weir trap at the downstream end of the Robles Reach. It is estimated that no more than one steelhead mortality will occur due to the method and this initial sample size. Hockersmith et al. (2000) measured a mortality rate of 2.4% using the gastric method. Gastric implanted fish also have similar survival rates, overall health, and similar physiological stress as fish with surgically implanted radio or PIT tags (Adams et al. 1998; Hockersmith et al. 2000; Jepsen et al. 2001).

Results

As stated before, the five smolts captured were not radio tagged. It was anticipated that more smolts would have been captured during the normal migration period and most of the tagging would have occurred then. However, the five smolts were captured at the first part of the migration period and no additional smolts were captured.

4.0 ROBLES FACILITY OPERATIONS

4.1 Facility Status

The Robles Fish Passage Facility started the 2009-2010 season in a fully functional mode. The 2009-2010 season was characterized by a slightly above average rainfall year as measured at Casitas Dam. 31.13 inches of rain were measured at Casitas Dam. The average rainfall at the dam is 24.06 inches. Three peak flows, as defined by the BA/BO occurred during the year. Two water diversion periods occurred during the year. The diversions occurred from January 18 through March 31, 2010 and from April 12 through April 29, 2010. The diversion periods included water that was downloaded from Lake Matilija. Some surface flow continued over the measurement weir until late August 2010. The surface flow through the Robles Reach stopped in briefly during a hot period in late August but resume briefly once cooler temperatures returned.

The 2009 Report identified several projects to be completed during the summer and fall. The principal projects were:

- Adjust the notch on interim weir two.
- Removal of reeds from fish passage facility.
- Install additional limit switches on the brush system
- Replace the brush cables

A brief description of each project and the project's status is listed below:

Adjust the notch on interim weir two -The agencies had previously requested some adjustments to the low flow notch in weir number to facilitate easier fish passage. Adult fish have moved past this weir in previously years. Casitas personnel attempted to place an additional rock in the notch to remove a "whoopee" flow that would occur. The rock addition removed the "whoppee" but created a higher notch sill. While adult steelhead were able to pass over the weir, the passage could be made easier with some additional modifications. Casitas will make some additional modifications this summer and fall to weirs 2 and 3 to further improve fish passage.

Removal of reeds from fish passage facility –The silt and reeds were removed from the fish passage facility and the screens were cleaned.

Install additional limit switches on the brush system-Additional limit switches were added to the brush control system. However, the mechanical limit switches continued to be unreliable. Casitas has purchased optical switches to replace the limit switches. The optical switches will be installed this summer and fall.

Replace the brush cables-The drive cables were replaced.

4.2 Flow Observations and Control

Casitas collected flow information and verified flows where and when reasonably safe conditions existed in the Ventura River. Flow and level measurement devices are also located at various locations within the Robles Fish Passage Facility. The primary points of measuring and recording stream flows entering, flowing through and leaving the Robles Fish Passage Facility are:

- Matilija Creek at Matilija Hot Springs – located approximately 2,100 feet downstream of Matilija Dam – good rating for low to moderate flows – operated by Casitas Municipal Water District, formerly a USGS station;
- Matilija Dam Stage Bubbler-Located at the dam, this gage provides the lake elevation. Under high flows, the dam acts as a weir. This is the primary flow measurement location under high flows and to determine if a peak has occurred.
- North Fork Matilija Creek – located approximately 3,000 feet upstream of its confluence with Matilija Creek – good rating for low to moderate flows – operated by the Ventura County Watershed District;
- Robles-Casitas Diversion Canal – located on the diversion canal approximately 1,300 feet downstream of the Robles Diversion Dam – trapezoidal channel with a good rating for flows up to 600 cfs;

- Ventura River near Meiners Oaks (VRNMO) – located approximately 540 feet downstream of the Robles Fish Passage spillway – concrete weir section – good rating to 70 cfs, use of equations above 70 cfs with poor ratings above 1000 cfs (no verifications at higher flows).
- Fish Ladder-A 4 path flow meter by Accusonics located near the Riverwatcher. This flow meter has not been accurate since the installation of the replacement Vaki shroud. Turbulence from the shroud is believed to be the cause of the inaccurate measurements. The transducer will be relocated this summer in the hopes of obtaining better measurements.
- Auxiliary Water Supply-An American Sigma flow meter. This meter did not function during this period. The problem is believed to be that the transducer mounting hardware has failed. Casitas will complete the inspection and hopefully, the repair of this instrument.

All of the instruments can suffer from inaccuracies from time to time. The inaccuracies can be caused by clogging of bubbler lines, electronic creep, debris accumulating on sensors, changes to the measured cross sections, and equipment problems. For this reason, the data is verified against field measurements and observations. The information gathered from each of these locations has been reduced to the daily reporting of flows in the form of average cubic-feet per second. The spreadsheets are in Appendix 27, entitled “Ventura River Flow Assessment for the Robles Fish Passage Facility – FY 09-10” and general trends can be found in Appendix 28.

Three storm peaks occurred this year that triggered BA/BO required supplemental flow releases. The peaks occurred on January 18, January 21and on February 5, 2010. The April rain storm did not produce a peak as defined by the BA/BO. The fish screens remained in place for the entire year.

Facility Testing

Casitas has entered into an agreement with HydroScientific West to complete the first phase of the hydraulic testing. Performance testing was begun on January 25th and 26th. Casitas augmented the flows with water that was downloaded from Lake Matilija. Unfortunately, the flows did not remain at sufficient levels to complete the screen testing.

4.3 Costs Associated with Operation and Monitoring

The BA/BO specified that the District provide the costs that are associated with the activity. The following is a summary of the direct costs incurred by the District during the 2009-10 fiscal years:

- **Fisheries Monitoring**:

Salaries & Benefits	$262,032
Equipment/Material	$ 57,539
	$319,571

- **Facility Operations**:

Salaries & Benefits	$74,002
Equipment/Materials	$13,639
Outside Contracts	$22,915
Utilities	$ 3,397
Permit	$ 1,050
	$115,003

- **Capital Improvements**: No capital improvements were made during this fiscal year.

4.4 Assessment of the Effectiveness to Provide Fish Passage

Performance testing of the Fish Passage began on January 25. Work on the performance testing was halted on January 26 because of inadequate surface flows.

Flows were augmented on January 25 and 26 with flow from Lake Matilija. Hydro Scientific West performed the testing.

One large 58 cm *O. mykiss* was recorded swimming through the facility demonstrating that the facility is capable of providing fish passage for adult steelhead.

4.5 Recommendations Regarding the Prioritization of Future Activities

The District has completed its fifth season with the fish passage fully operational. Several projects have been identified to improve the functionality and reliability of the system. Other items require repairs. The summer and fall work list includes:

- Adjust interim weir two and three to improve fish passage.
- Replace the mechanical limit switches with optical switches on the brush system.
- Repair or replace the auxiliary water flow meter.
- Relocate the fish passage flow meter to minimize turbulence from the Vaki shroud.
- Update and improve the automated controls for the facility.

4.6 Recommendations on any Revisions Deemed Necessary to the Operations

Casitas continues to recommends that the construction of the 15-weir portion of the project be put on hold at least until the Matilija Dam Removal Project is completed. Preliminary plans for the High Flow Sediment Bypass and High Flow Fish Passage require this area to be graded to new elevations. The existing temporary weir system has proven to be passable by adult O Mykiss.

5.0 LITERATURE CITED

Adams, N. S., D. W. Rondorf, S. D. Evans, and J. E. Kelly. 1998. Effects of surgically and gastrically implanted radio transmitters on growth and feeding behavior of juvenile Chinook salmon. Transaction of the American Fisheries Society, 127:128-136.

Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 477-482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

Ando, D., T. Kitamura, and S. Mizuno. 2005. Quantitative analysis of body silvering during smoltification is masu salmon using chromameter. North American Journal of Aquaculture, 67:160-166.

Banks, J. W. 1969. A review of the literature on the upstream migration of adult salmonids. Journal of Fish Biology, 1:85-136.

Beeman, J. W., and A. G. Maule. 2001. Residence time and diel passage distribution of radio-tagged juvenile spring Chinook salmon and steelhead in a gatewell and fish collection channel of a Columbia River dam. North American Journal of Fisheries Management, 21:455-463.

Beeman, J. W., D. W. Rondorf, M. E. Tilson, and D. A. Venditti. 1995. A nonlethal measure of smolt status of juvenile steelhead based on body morphology. Transactions of the American Fisheries Society 124:764-769.

Behnke, R. J. 1992. Native trout of western North America. American Fisheries Society Monograph 6.

Bond, M. H., A. A. Hayes, G. V. Hanson, and R. B. MacFarlane. 2008. Marine survival of steelhead (*Oncorhynchus mykiss*) enhanced by a seasonally closed estuary. Canadian Journal of Fisheries and Aquatic Sciences, 65: 2242-2252.

Bratovich, P. M., and D. W. Kelley. Investigation of salmon and steelhead in Lagunitas Creek, Marin County, California. Volume 1. Migration, spawning, embryo incubation and emergence, juvenile rearing, emigration. Marin Municipal Water District. Corte Madera, California.

Brown, R. S., S. J. Cooke, W. G. Anderson, and R. S. McKinley. 1999. Evidence to challenge the “2% rule” for biotelemetry. North American Journal of Fisheries Management, 19:867-871.

Busby, P. B., T. C. Wainwright, G. J. Bryant, L. J. Lierheimer, R. S. Waples, F. W. Waknitz, and Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. National Marine Fisheries Service. NOAA technical memorandum NMFS-NWFSC-27, August 1996.

Cannata, S. T. 1998. Observations of steelhead trout (*Oncorhynchus mykiss*), coho salmon (*O. kisutch)* and water quality pf the Navarro River estuary/lagoon, May 1996 to December 1997. Draft report, Humboldt State University Foundation. Humboldt, CA.

Chrisp, E. Y., and T. C. Bjornn. 1978. parr-smolt transformations and seaward migration of wild and hatchery steelhead trout in Idaho. Idaho Cooperative Fishery Research Unit, University of Idaho, Moscow, Idaho. Final project report F-49-R.

Clay, H. C. 1995. Design of fishways and other fish facilities, 2nd edition. CRC Press, Inc., Boca Raton, FL.

Cooke, R. U., A. Warren, and A. S. Goudie. 1992. Desert geomorphology. UCL Press, London.

CMWD. 2005. 2005 progress report for the Robles Diversion Fish Passage Facility. Casitas Municipal Water District, Oak View, CA.

CMWD. 2006. 2006 progress report for the Robles Diversion Fish Passage Facility. Casitas Municipal Water District, Oak View, CA.

CMWD. 2007. 2007 progress report for the Robles Diversion Fish Passage Facility. Casitas Municipal Water District, Oak View, CA.

CMWD. 2008. 2008 progress report for the Robles Diversion Fish Passage Facility. Casitas Municipal Water District, Oak View, CA.

CMWD, Wood Rogers, and ENTRIX Inc. 2002. Preliminary draft technical memorandum of operation constraint assessment of the Robles Fish Passage Facility. Prepared for US Bureau of Reclamation.

Dauble, D. D., T. L. Page, and W. Hanf. 1989. Spatial distribution of juvenile salmonids in the Hanford Reach, Columbia River. Fishery Bulletin, 87:775-790.

Dettman, D. H., and D. W. Kelley. 1986. Assessment of the Carmel River steelhead resource, Volume 1. biological investigations. Monterey Peninsula Water Management District, Monterey, CA.

ENTRIX. 1999. Evaluations of natural passage barriers on the Ventura River downstream of Robles Diversion. ENTRIX, Walnut Creek, CA.

ENTRIX. 2000. Results of fish passage monitoring at the Vern Freeman diversion facility Santa Clara River, 1994-1998. ENTRIX, Walnut Creek, CA.

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 2002. California salmonid stream habitat restoration manual, Volume I, 3rd edition. California Department of Fish and Game. Inland Fisheries Division, Sacramento, CA.

Hagar, J. 1996. Salinas River steelhead status and migration flow requirements. Monterey County Water Resources Agency. Salinas, California.

Haner, P. V., J. C. Faler, R. M. Schrock, D. W. Rondorf, and A. G. Maule. 1995. Skin reflectance as a nonlethal measure of smoltification for juvenile salmonids. North American Journal of Fisheries Management, 15:814-822.

Hockersmith, E. E., W. D. Muir, S. G. Smith, B. P. Sandford, N. S. Adams, J. M. Plumb, R. W. Perry, and D. W. Rondorf. 2000. Comparative performance of sham radio-tagged and PIT-tagged juvenile salmon. US Army Corps of Engineers, Walla Walla District.

Harrison, L. R., E. A. Keller, E. Kelley, and L. A. K. Mertes. 2006. Minimum flow requirements for southern steelhead passage on the lower Santa Clara River, CA. University of California, Santa Barbara.

Hasler, A. D., and A. T. Scholz. 1983. Olfactory imprinting and homing is salmon. Springer-Verlag, New York.

Jepsen, N., L. E. Davis, C. B. Schreck, and B. Siddens. 2001. The physiological response of Chinook salmon smolts to two methods of radio-tagging. Transactions of the American Fisheries Society 130:495-500.

Lewis, S. D. 2001. Movements of hatchery steelhead smolts in Lake Billy Chinook and Squaw Creek during 2000. Portland General Electric. Portland, Oregon.

Lewis, S. D. 2002. Movements of hatchery steelhead smolts in Lake Billy Chinook and Squaw Creek during 2001. Portland General Electric. Portland, Oregon.

Lewis, S. D. 2003. Movements of hatchery steelhead smolts in Lake Billy Chinook and Squaw Creek during 2002. Portland General Electric. Portland, Oregon.

Lewis, S. D. M. W. Gibson J. L. Switzer. 2010. Ventura River basin *Oncorhynchus mykiss irideus* monitoring, evaluation, and research: 2010 annual program report. Casitas Municipal Water District, Oak View, California.

Marine, K. R., and M. Gorman. 2005. Monitoring and evaluation for the A-Canal fish screen and bypass facility; scale loss and physical injury test, 2005. Bureau of Reclamation, Klamath Falls, OR.

Matthews, K. R., and N. H. Berg. 1997. Rainbow trout responses to water temperature and dissolved oxygen stress in two southern California stream pools. Journal of Fish Biology, 50:50-67.

Matthews, K. R., N. H. Berg, D. L. Azuma, and T. R. Lambert. 1994. Cool water formation and trout habitat use in a deep pool in the Sierra Nevada, California. Transactions of the American Fisheries Society, 123:549-564.

McNabb, C. D., C. R. Liston, and S. M. Borthwick. 1998. In-plant biological evaluation of the Rd Bluff Research Pumping Plant on the Sacramento River in Northern California: 1995 and 1996. Red Bluff Research Pumping Plant Report Se4arries, volume 3. US Bureau of Reclamation, Denver, CO.

Moore. K., K. Jones, and J. Dambacher. 2002. Methods for stream habitat surveys, Version 12.1. Oregon Department of Fish and Wildlife, Aquatic Inventories Project, Natural Production Program, Corvallis, OR.

Mosley, M. P. 1982. Critical depths for passage in braided river, Canterbury, New Zealand. New Zealand Journal of Marine and Freshwater Research, Vol. 16:351-357.

National Marine Fisheries Service. 1997. Endangered and Threatened Species: Listing of Several Evolutionary Significant Units (ESUs) of West Coast Steelhead. Federal Register, 50 CFR Parts 222 and 227 [Docket No. 960730210–7193–02; I.D. 050294D] RIN 0648–XX65. Vol. 62, page 43937.

National Marine Fisheries Service. 2003a. Biological opinion for the Robles diversion fish passage facility, Ventura River, CA. Protected Resource Division, Southwest Region, March 31, 2003.

National Marine Fisheries Service. 2003b. Endangered and Threatened Species: Range Extension for Endangered Steelhead in Southern California. Federal Register, 50 CFR Part 224 [Docket No. 001025296-2079-02; I.D. 072600A] RIN 0648-AO05. Vol. 67 page 21586.

National Marine Fisheries Service. 2005. Endangered and Threatened Species: Request for Comment on Alternative Approach to Delineating 10 Evolutionarily Significant Units of West Coast Oncorhynchus mykiss. 50 CFR Parts 223 and 224 [Docket No. 040525161–5274–05; I.D. No. 052104F] RIN No. 0648–AR93. Vol. 70 page 67130.

National Marine Fisheries Service. 2009. Letter addressed to Scott Lewis (Casitas Municipal Water District) addressing the downstream fish passage evaluation. Letter dated 28 April 2009, SWR/2002/1871:SCG.

Quinn, T, H. 2005. The behavior and ecology of pacific salmon and trout. American Fisheries Society, Bethesda, Maryland.

Scott, W. B. and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada, Ottawa, Bulletin 184.

Shapovalov, L. and A. C. Taft. 1954. The life histories of the steelhead rainbow trout (*Salmo gairdneri gairdneri*) and silver salmon (*Oncorhynchus kisutch*), with special reference to Waddell Creek, California, and recommendations regarding their management. State of California Department of Fish and Game, fish bulletin No. 98.

Spina, A. P., M. A. Allen, and M. Clarke. 2005. Downstream migration, rearing abundance, and pool habitat associations of juvenile steelhead in the lower main stem of a south-central California stream. North American Journal of Fisheries Management, 25:919-930.

Stoecker, M. 2010. North Fork Matilija Creek adult steelhead below Ojai Quarry barriers. Letter sent on 30 March 2010 about adult steelhead observations, 5 p.

Strauss, R. E., and C. E. Bond. 1990. Taxonomic methods: In Schreck C. B. and P. B. Moyle, editors. Methods for fish biology. AFS, Bethesda, Maryland.

Summerfelt, R. C., and L. S. Smith. 1990. Anesthesia, surgery, and related techniques. Pages 213-272 in C. B. Schreck and P. B. Moyle, editors. Methods for Fish Biology. American Fisheries Society, Bethesda, Maryland.

SYRTAC (Santa Ynez River Technical Advisory Committee). 1999. Adult steelhead passage flow analysis for the Santa Ynez River. Santa Ynez River Consensus Committee, Santa Barbara, CA.

SYRTAC (Santa Ynez River Technical Advisory Committee). 2000. Lower Santa Ynez River fish management plan. Santa Ynez River Consensus Committee, Santa Barbara, CA.

Tan, S. S., and T. A. Jones. 2006. Geologic map of the Matilija 7.5' quadrangle Ventura County, California: a digital database. Version 1.0, Los Angeles, CA.

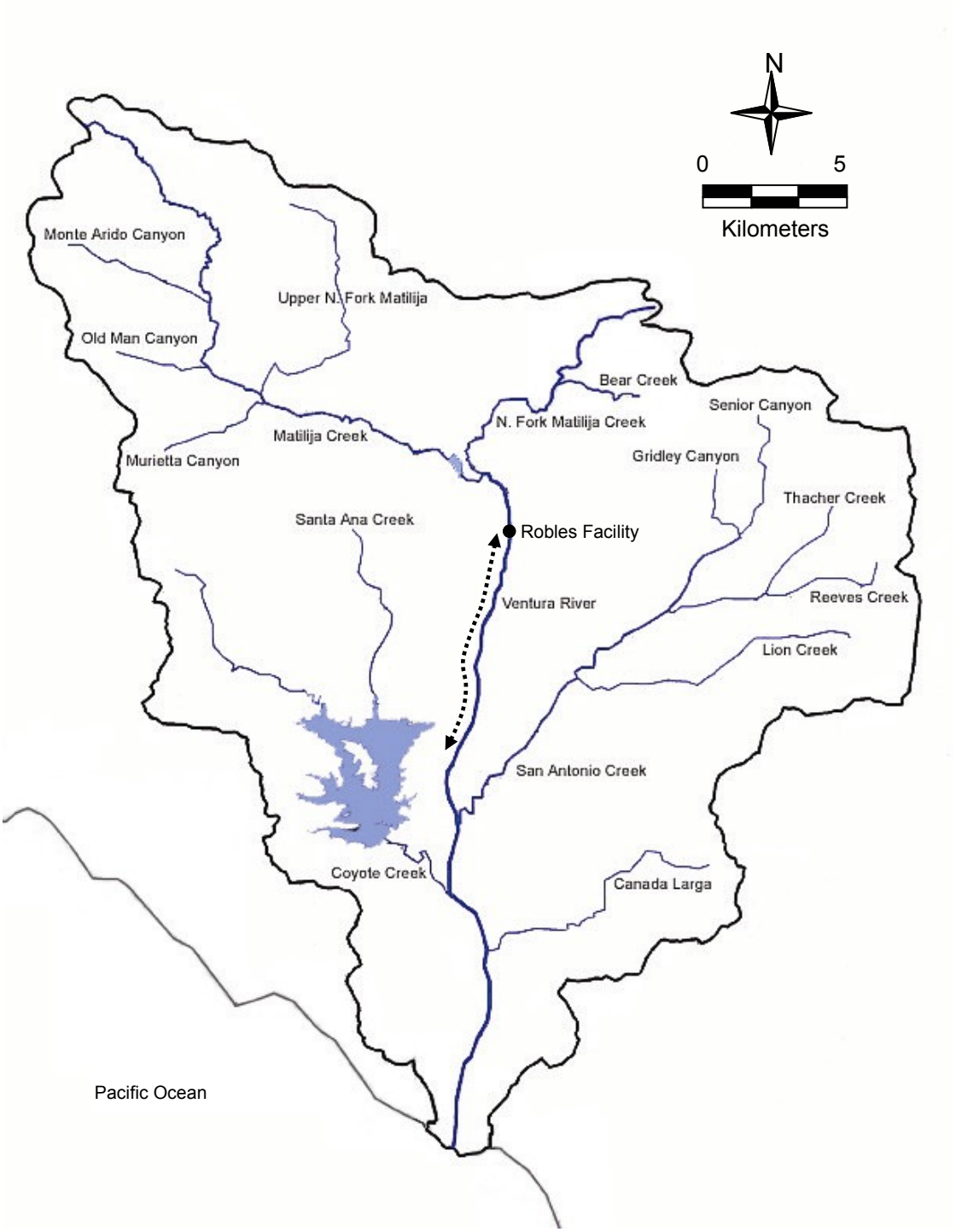
Thompson, K. 1972. Determining stream flows for fish life. Pacific Northwest River Basins Commission, instream flow requirements workshop. Portland, Oregon. Proceedings: 31-50.

U.S. Bureau of Reclamation. 2003. Revised biological assessment for diversion operations and fish passage facilities at the Robles Diversion, Ventura River, CA. South-Central California Area Office, February 21, 2003.

Vaki. 2003. User manual for Riverwatcher. Vaki Aquaculture Systems Ltd., Iceland.

Wagner, H. H., R. L. Wallace, and H. J. Campbell. 1963. The seaward migration and return of hatchery-reared steelhead trout, *Salmo gairdneri* Richardson, in the Alsea River, Oregon. Transactions of the American Fisheries Society, 92(3):202-210.

6.0 APPENDIXES



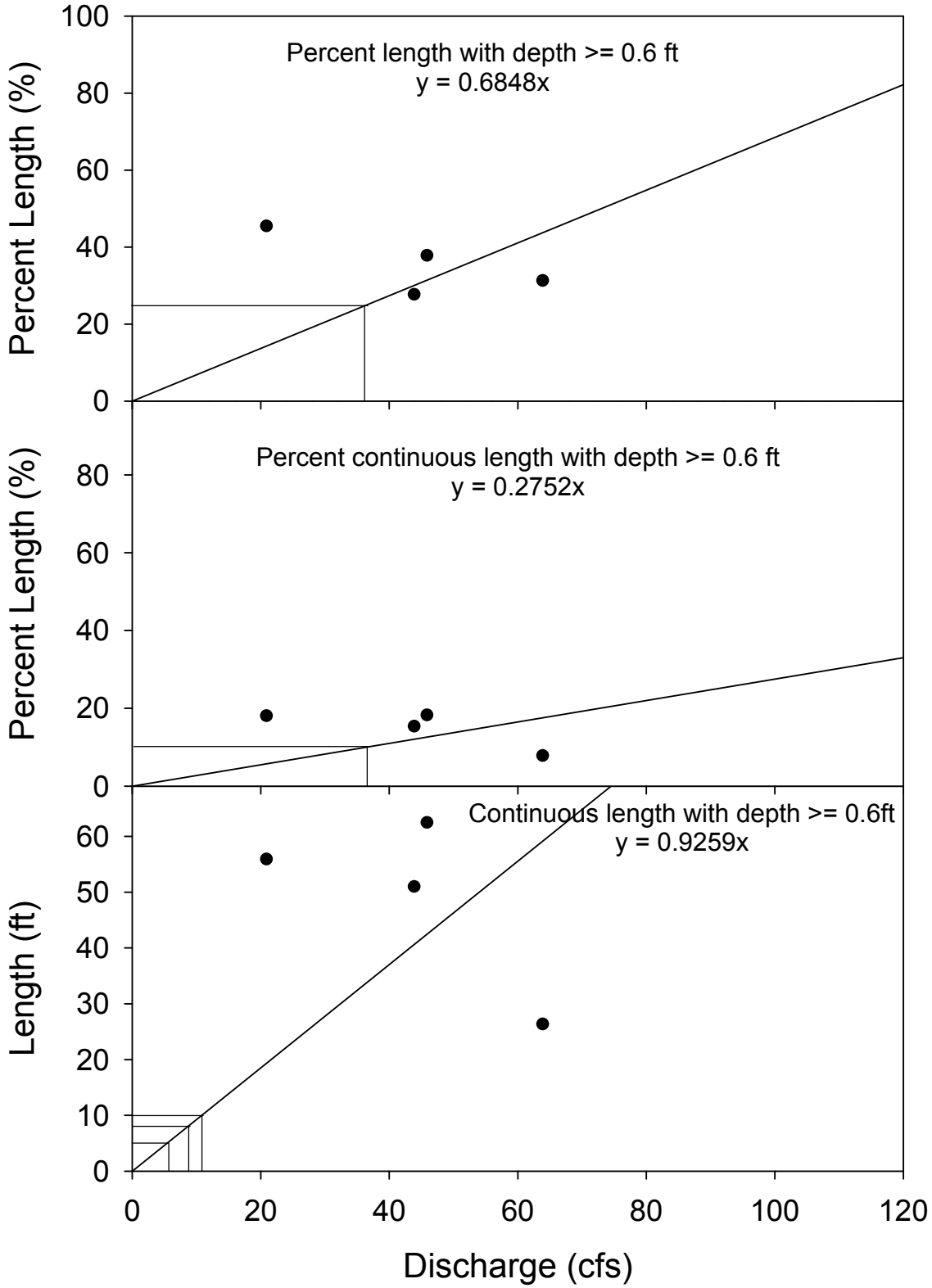
Appendix 1. Basin map of the Ventura River. The Robles Fish Passage Facility is identified by the black dot and the Robles Reach is identified by the dashed line downstream of the Robles Facility.

Appendix 2. Summary data of impediment sites selected for upstream fish migration impediment evaluations.

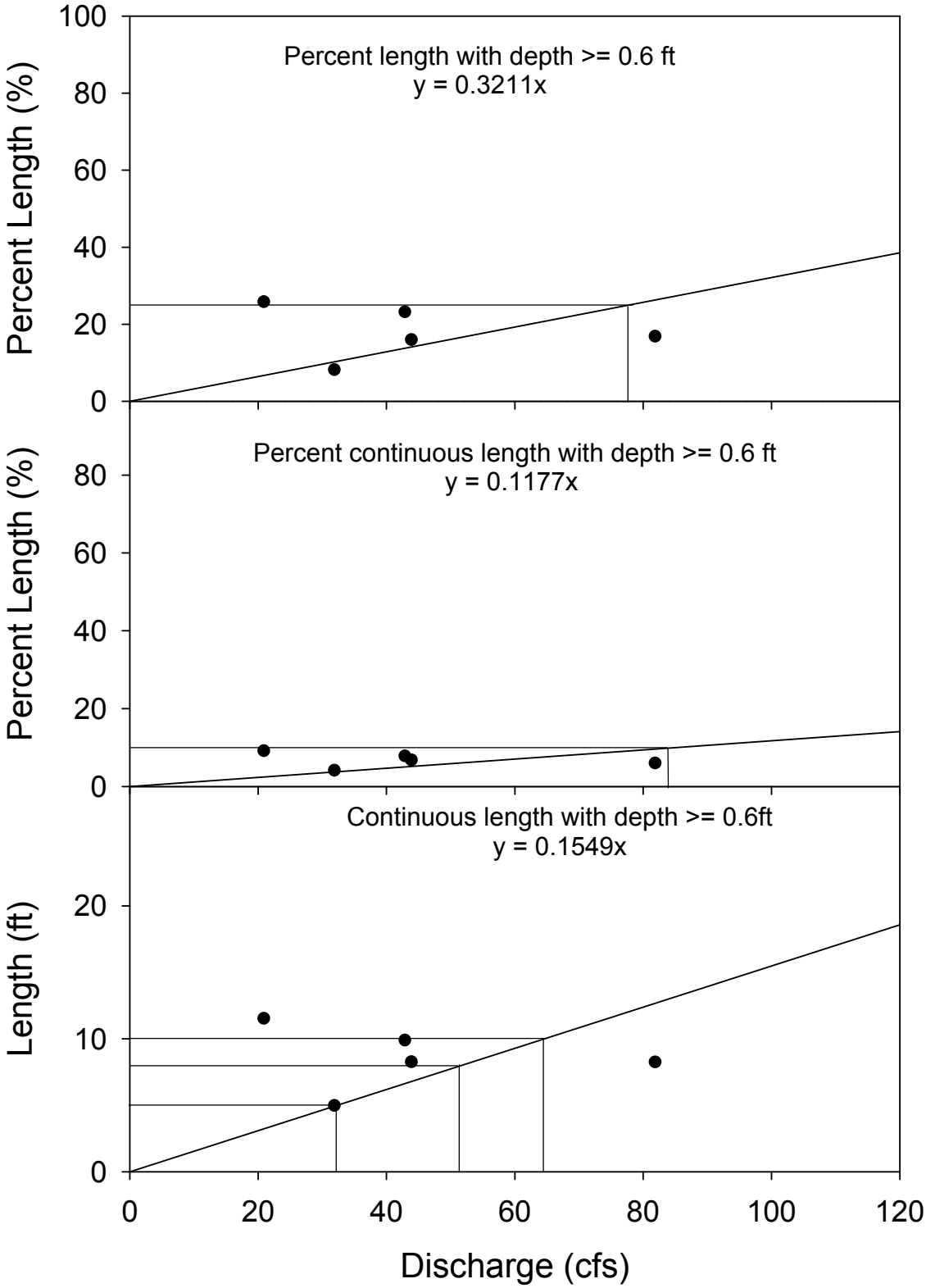
Site	Latitude (N)	Longitude (W)	km	Habitat Type[a]	Site Description	Length (m)	Slope (%)	Percent Substrate[b]						Active Channel Width (m)
								SO	SD	GR	CB	BD	BR	
1			0		River mouth				100					
2	34°20'27"	119°17'53"	7.5	RI	Near treatment plant	16.4	2.8	10	10	15	45	20	0	31.3
3	34°22'07"	119°18'34"	11	RB	Near Casitas Springs at end of levy	22.0	3.7	10	5	10	65	10	0	27.0
4	34°23'05"	119°18'36"	13	RI	0.5 km upstream of San Antonio Cr. confluence	23.8	5.0	0	0	0	15	85	0	27.9
5	34°23'46"	119°18'33"	15	RI	0.4 km downstream of Santa Ana Blvd. bridge	8.4	7.0	0	5	5	45	45	0	50.6
6	34°24'39"	119°18'06"	17	CB	1.4 km upstream of Santa Ana Blvd. bridge	26.1	5.0	0	0	0	65	35	0	33.8
7	34°26'04"	119°18'00"	19	RB	1.1 km upstream of Hwy 150 bridge	31.6	2.0	5	0	10	40	45	0	65.9
8	34°12'15"	119°17'36"	22	CB	1.2 km downstream of Robles Fish Facility	9.2	10.0	0	0	10	45	45	0	32.4

[a]The habitat types are: RB = rapid with protruding boulders, RI = riffle, and CB = cascade over boulders.

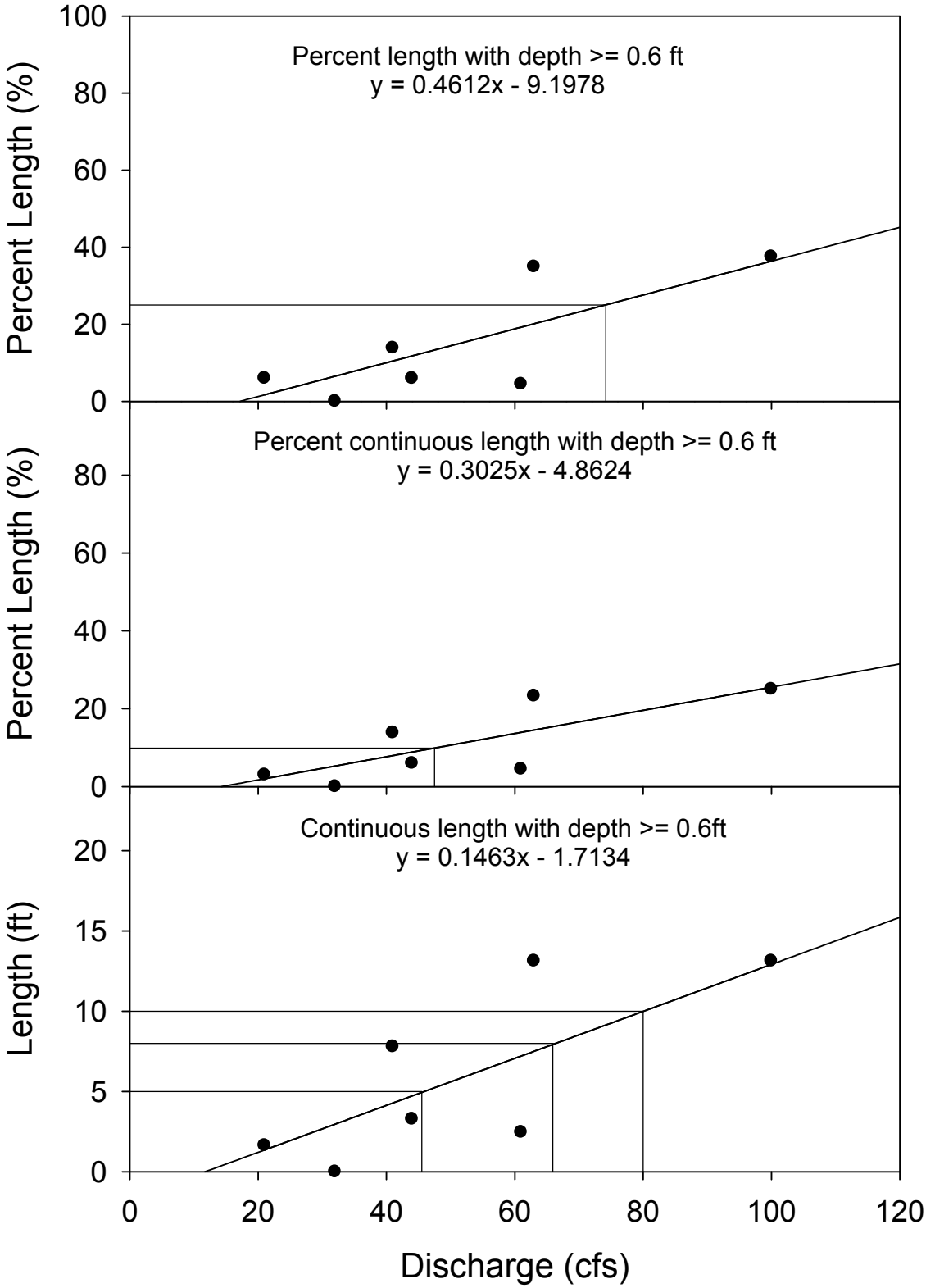
[b]The substrate types are: SO = silt and organics, SD = sand, GR = gravel, CB = cobble, BD = boulders, and BR = bedrock.



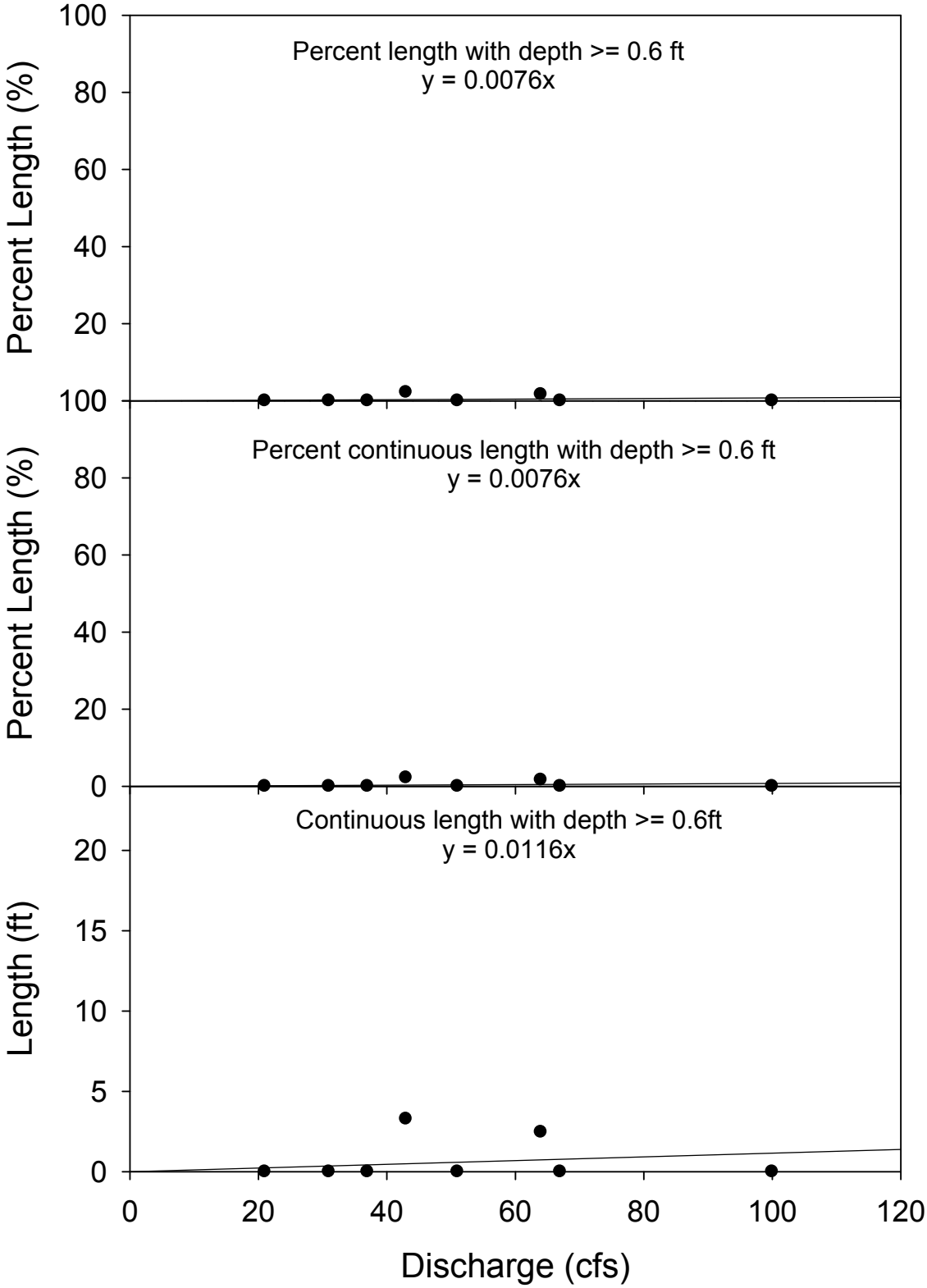
Appendix 3. Relation between Robles discharge and water depth at site 2 downstream of the wastewater treatment plant and resulting discharge for various passage criteria.



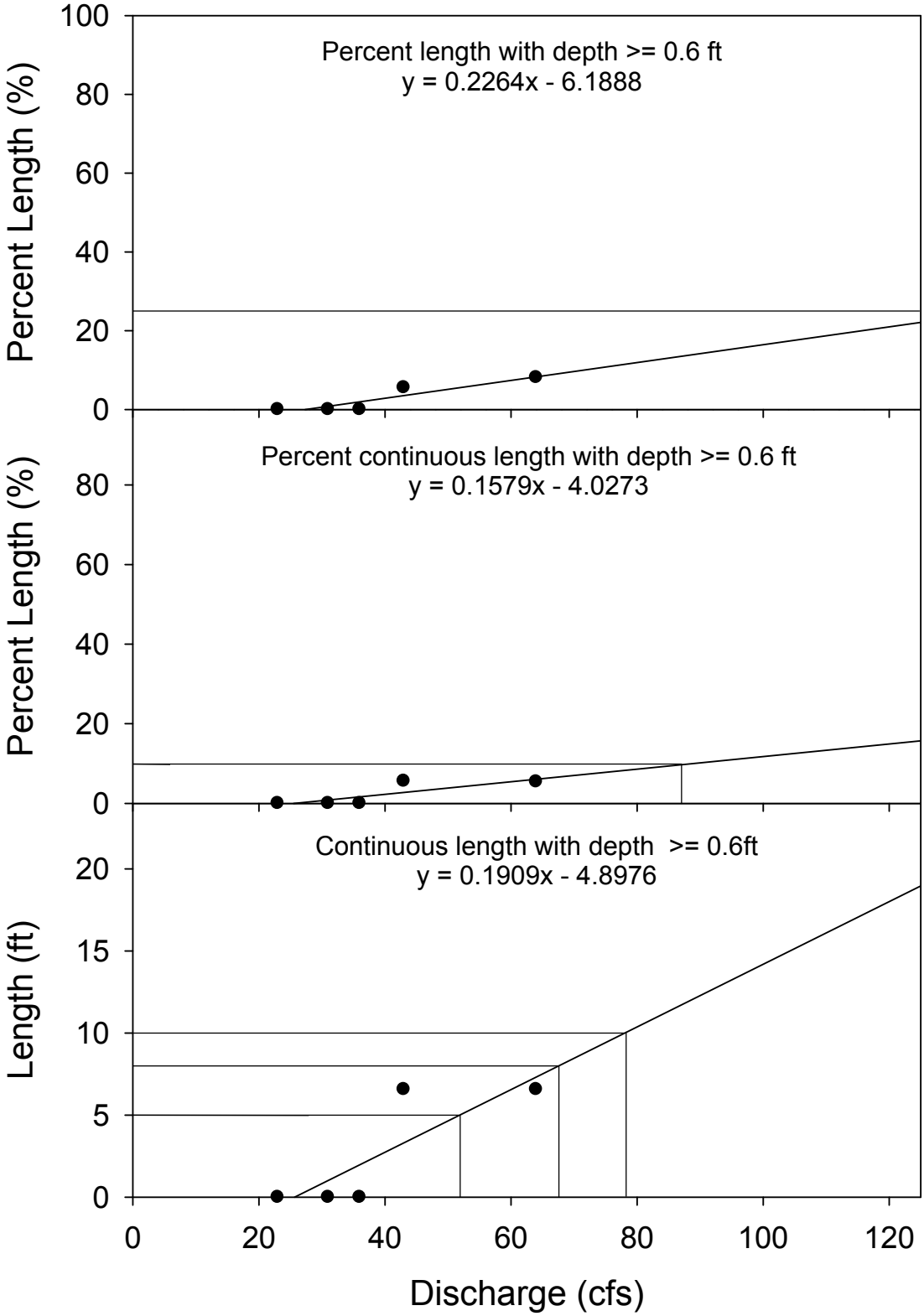
Appendix 4. Relation between Robles discharge and water depth at site 3 near Casitas Springs and resulting discharge for various passage criteria.



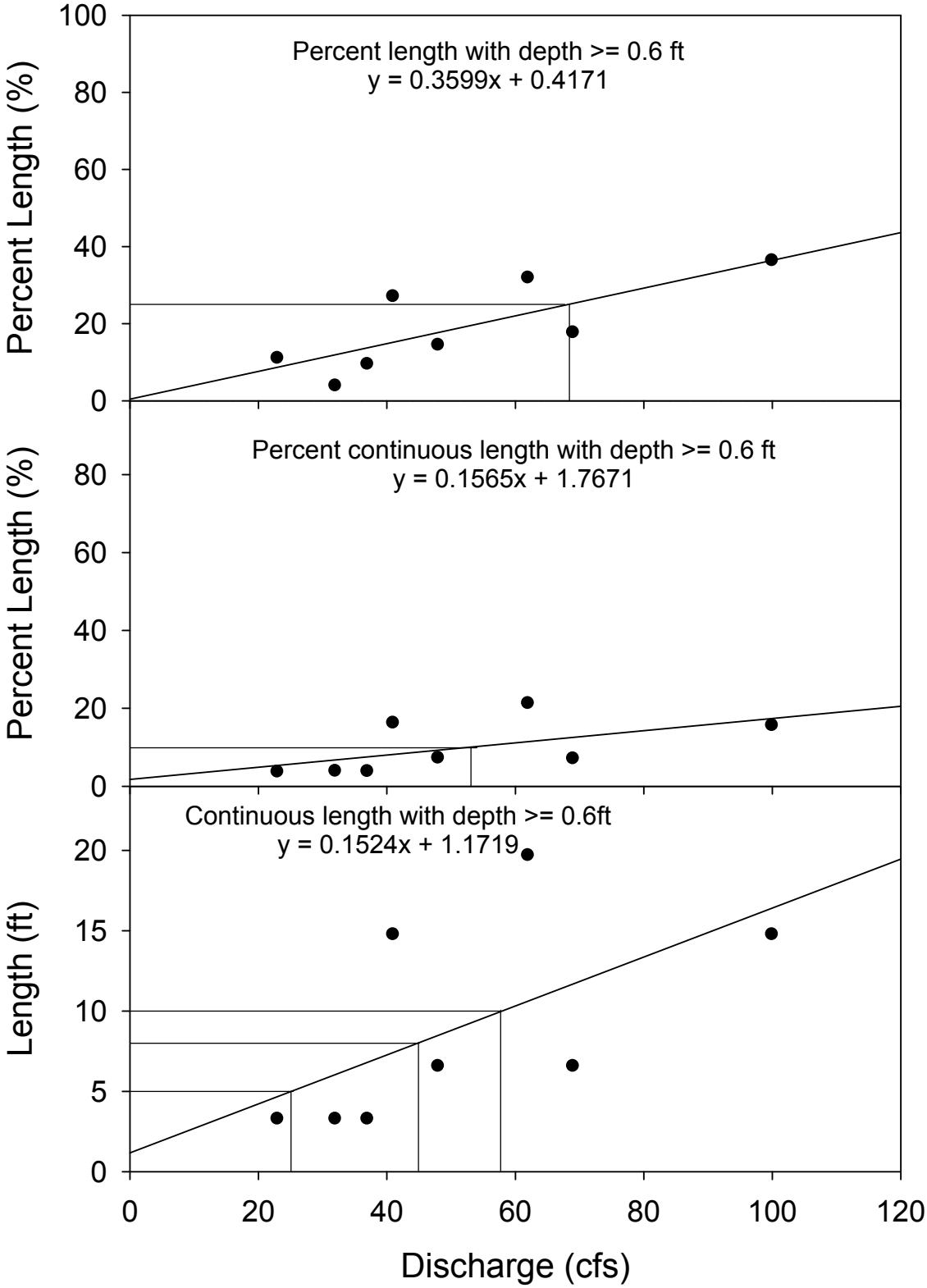
Appendix 5. Relation between Robles discharge and water depth at site 4 upstream of San Antonio Creek and resulting discharge for various passage criteria.



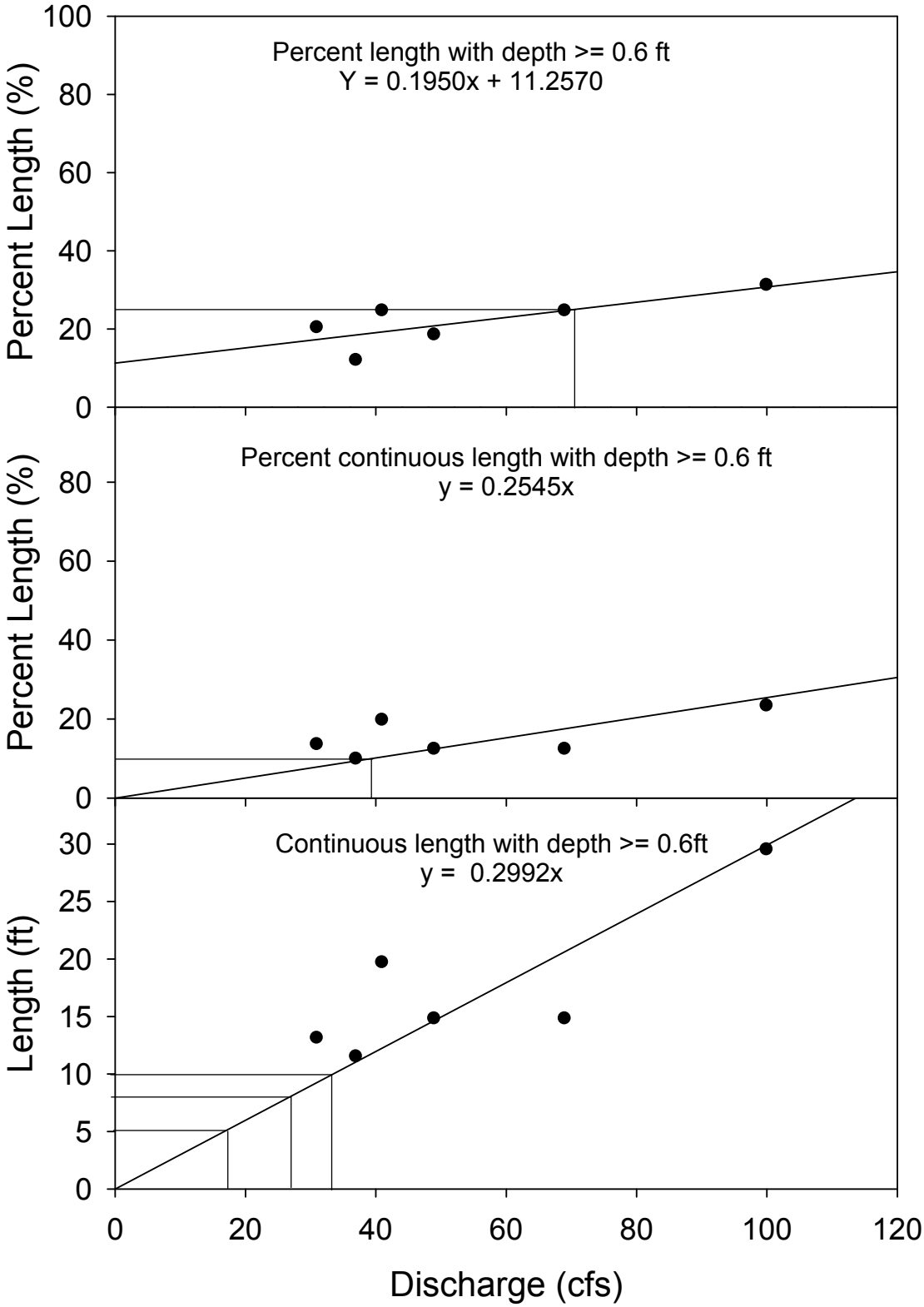
Appendix 6. Relation between Robles discharge and water depth at site 5-1 downstream of Santa Ana bridge and resulting discharge for various passage criteria.



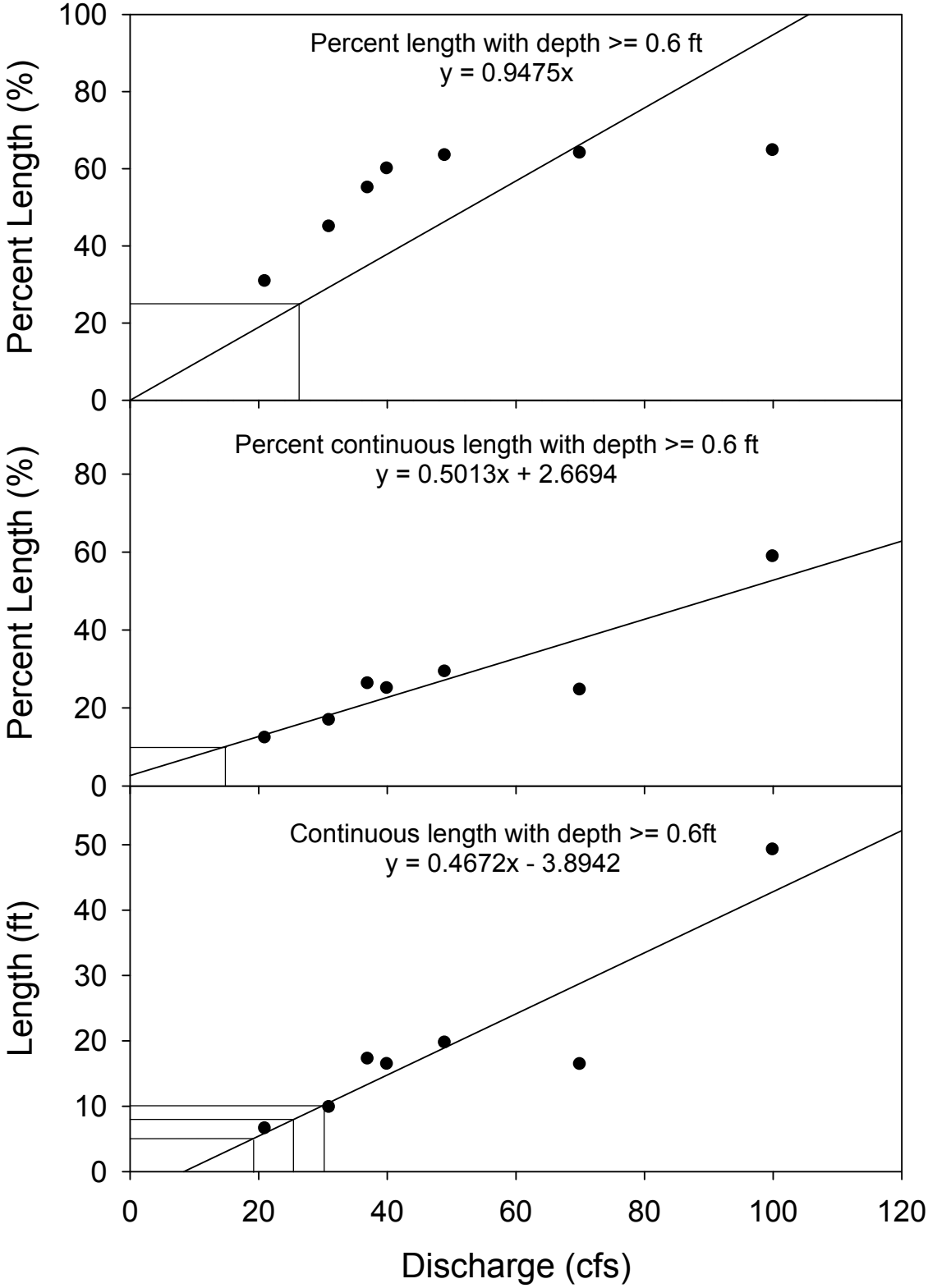
Appendix 7. Relation between Robles discharge and water depth at site 5-2 downstream of Santa Ana bridge and resulting discharge for various passage criteria.



Appendix 8. Relation between Robles discharge and water depth at site 6 upstream of Santa Ana bridge and resulting discharge for various passage criteria.



Appendix 9. Relation between Robles discharge and water depth at site 7 upstream of Hwy 150 bridge and resulting discharge for various passage criteria.



Appendix 10. Relation between Robles discharge and water depth at site 8 downstream of the Robles Fish Facility and resulting discharge for various passage criteria.

A.

B.

C.

D.

Appendix 10a. Photos of impediment site number 2 on February 2, 2010 during 40 cfs discharge releases from Robles fish facility, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

A.

B.

C.

D.

Appendix 10b. Photos of impediment site number 3 on February 22, 2010 during 30 cfs discharge release from Robles fish facility, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

A.

B.

C.

D.

Appendix 10c. Photos of impediment site number 4 on February 22, 2010 during 30 cfs discharge release from Robles fish facility, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

A.

B.

C.

D.

Appendix 10d. Photos of potential impediment site number 5-1 on February 04, 2010 during 30 cfs discharge release from Robles fish facility, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

A.

B.

C.

D.

Appendix 10e. Photos of potential impediment site number 5-2 on February 04, 2010 during 30 cfs discharge release from Robles fish facility, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

A.

B.

C.

D.

Appendix 10f. Photos of impediment site number 6 on February 22, 2010 during 30 cfs discharge release from Robles fish facility, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

A.

B.

C.

D.

Appendix 10g. Photos of impediment site number 7 on February 04, 2010 during 30 cfs discharge release from Robles fish facility, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

A.

B.

C.

D.

Appendix 10h. Photos of impediment site number 8 on February 04, 2010 during 30 cfs discharge release from Robles fish facility, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

Appendix 12. Regression equations and statistics of the four passage criteria evaluated at potential impediment sites.

	% Total Length (ft) with Depth ≥ 0.6 ft			% Continuous Length (ft) with Depth ≥ 0.6 ft			Continuous length (ft) with depth ≥ 0.6 ft		
Site	Equation	R^2	P-Value	Equation	R^2	P-Value	Equation	R^2	P-Value
2	y = 0.6848x	N/A[a]	N/A[a]	y = 0.2752x	N/A[a]	N/A[a]	y = 0.9259x	N/A[a]	N/A[a]
3	y = 0.3211x	N/A[a]	N/A[a]	y = 0.1177x	N/A[a]	N/A[a]	y = 0.1549x	N/A[a]	N/A[a]
4	y = 0.4612x - 9.1978	0.61	0.04	y = 0.3025x - 4.8624	0.61	0.04	y = 0.1593x - 2.3217	0.57	0.05
5-1	y = 0.0076x	N/A[a]	N/A[a]	y = 0.0076x	N/A[a]	N/A[a]	y = 0.0116x	N/A[a]	N/A[a]
5-2	y = 0.2264x - 6.1888	0.84	0.03	y = 0.1579x - 4.0273	0.67	0.09	y = 0.1909x - 4.8976	0.68	0.08
6	y = 0.3599x + 0.4171	0.59	0.03	y = 0.1565x + 1.7671	0.32	0.14	y = 0.1524x + 1.1719	0.34	0.13
7	y = 0.1950x + 11.2570	0.60	0.07	y = 0.2545x	N/A[a]	N/A[a]	y = 0.2992x	N/A[a]	N/A[a]
8	y = 0.9475x	N/A[a]	N/A[a]	Y = 0.5013x + 2.6694	0.82	0.01	y = 0.4672x -3.8942	0.82	0.01

[a]Regression statistics are not applicable if forced through the origin.

Appendix 13. Calculated discharge (cfs) required from Robles facility to meet various adult passage criteria.

Site	25% Total length with depth ≥ 0.6 ft[a]	10% Continuous length with depth ≥ 0.6 ft[a]	Minimum discharge to meet Thompson criteria[a]	10ft Continuous length with depth ≥ 0.6 ft[b]	8ft Continuous length with depth ≥ 0.6 ft[c]	5ft Continuous length with depth ≥ 0.6 ft[d]
2	37	36	37	11	9	5
3	78	85	85	65	52	32
4	74	49	74	77	65	46
5-1	3,289	1,316	3,289	862	690	431
5-2	138	89	138	78	68	52
6	68	53	68	58	45	25
7	70	39	70	33	27	17
8	26	15	26	30	25	19
Mean (all sites)	473	210	474	152	122	78
Mean (4,6,7,8)	60	39	60	50	40	27

[a]Thompson (1972).
[b]Harrison et al. (2006).
[c]Santa Ynez River Technical Advisory Committee (2000).
[d]Dettman and Kelly (1986).

Appendix 14. Ventura River sandbar monitoring data from July 2009 through June 2010.

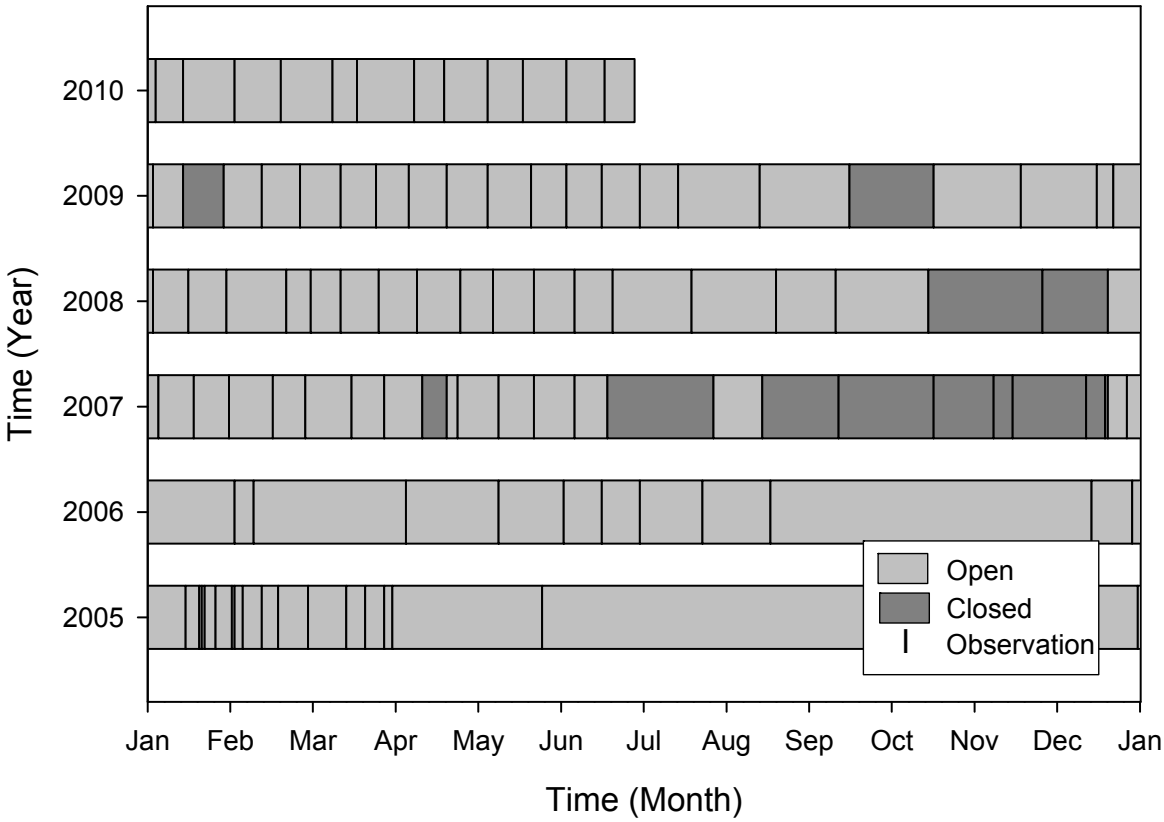
					High Tide		Low Tide					
Date	Sandbar Breeched (Y/N)	Time (24h)	Tide Height (ft)	Tidal State	Time (24h)	Height (ft)	Time (24h)	Height (ft)	Temp (°C)[a]	Discharge at Foster (cfs)[b]	Discharge at Robles (cfs)	Notes
07/14/2009	Y	12:50	3.8	flood	15:09	4.6	08:09	1.4	19.7	3.9	0	Open on east bank
08/13/2009	Y	14:50	5.1	slack	15:01	5.1	07:23	2.4	20.9	3.0	0	Open on east bank
09/15/2009	N[c]	13:10	1.9	ebb	19:29	6.1	13:33	1.9	21.3	2.9	0	If breach, open on EB
10/16/2009	Y	08:40	6.0	slack	08:34	6.0	15:05	0.0	21.1	3.3	4	Open on east bank
11/17/2009	Y	09:15	6.2	ebb	08:34	6.4	16:02	-0.7	13.4	2.4	0	Open on east bank
12/15/2009	Y	14:00	-0.4	ebb	07:47	6.2	15:18	-0.9	12.6	5.8	23	Open on west bank
12/21/2009	Y	11:15	4.6	slack	11:12	4.6	18:43	0.4	12.6	4.2	12	Open on west bank
12/30/2009	Y	12:40	0.2	ebb	07:22	6.8	14:55	-1.5	11.6	4.2	8	Open on west bank
01/04/2010	Y	09:00	4.0	flood	11:24	5.4	05:36	1.7	10.6	3.8	5	Open on west bank
01/14/2010	Y	10:30	4.5	ebb	08:15	5.9	15:35	-0.8	13.6	4.4	4	Open on west bank
02/02/2010	Y	14:11	3.2	ebb	12:11	4.0	18:17	0.7	15.1	50.0	39	Open on west bank
02/19/2010	Y	12:30	2.9	ebb	12:07	2.9	17:32	1.6	16.5	55.0	35	Open on west bank
03/10/2010	Y	11:30	0.5	ebb	05:56	4.6	13:11	-0.1	14.6	67.0	50	Open on west bank
03/19/2010	Y	14:25	0.6	ebb	12:21	3.2	17:33	1.6	19.1	40-50[d]	36	Open on west bank
04/09/2010	Y	09:17	3.4	ebb	07:11	4.2	13:49	0.4	19.3	37.0	31	Open on west bank
04/20/2010	Y	14:10	2.3	flood	17:54	3.5	10:42	-0.1	16.7	40.0	31	Open on west bank
05/06/2010	Y	12:20	0.9	flood	05:16	3.8	11:22	0.7	18.6	30.0	26	Open on west bank
05/19/2010	Y	15:00	3.6	flood	16:00	3.8	08:55	-0.3	17.9	24.0	20	Open on west bank
06/04/2010	Y	13:45	2.8	flood	16:59	4.1	09:52	1.0	18.5	17.0	7	Open on west bank
06/18/2010	Y	14:45	4.5	flood	16:49	5.2	09:57	0.9	18.8	15.0	4	Open on west bank
06/29/2010	Y	14:35	3.4	ebb	13:28	3.9	18:30	2.5	20.5	14.0	3	Open on west bank

[a]Main St. bridge temperature logger at time of observation, approximately 800 m upstream of estuary/lagoon.
[b]USGS gauging station number 11118500, downstream of Foster Park.
[c]Sandbar was closed at low tide and open during some high tides.
[d]Data missing from Foster Park USGS web site. Range represents the nearest provisional data.

Appendix 15. Ventura River estuary piscivorous bird survey data from July 2009 through June 2010.

		Common Name and Quantity of Observed Birds									
Date	Time	Pelican	Gull	Cormorant	Merganser	Egret	Tern	Grebe	Heron	Kingfisher	Total
07/14/2009	12:50	3	152	27	0	1	9	0	1	0	193
08/13/2009	14:50	19	315	42	0	2	12	0	0	0	390
09/15/2009	13:10	0	37	18	0	0	9	0	2	0	66
10/16/2009	08:45	0	21	9	0	3	3	0	0	0	36
11/17/2009	09:30	0	187	34	3	1	0	1	0	0	226
12/15/2009	14:15	0	59	36	0	0	0	1	1	0	97
01/14/2010	10:15	4	62	17	0	0	0	0	0	0	83
02/02/2010	14:11	0 (1)	53 (250)	12 (2)	0	2	0	0	1	1	69 (253)
02/19/2010	12:30	0 (8)	10 (150)	20 (4)	7	1	0	0	1	0	39 (162)
03/10/2010	11:30	0 (22)	19 (400)	18	0	0	0	0	0	0	37 (422)
03/19/2010	14:25	20 (45)	17 (200)	0 (9)	0	0	0	0	1	0	38 (254)
04/09/2010	09:20	12	31 (2)	13	2	0	0	0	0	0	58 (2)
04/20/2010	13:50	0 (89)	1 (250)	0 (15)	0	11	375 (11)	0	1	0	388 (365)
05/06/2010	12:10	0 (61)	0 (150)	1 (27)	0	0	0 (11)	0	1	0	2 (249)
05/19/2010	15:00	0 (12)	0 (200)	0 (35)	0	1	0	0	1	0	2 (247)
06/04/2010	13:40	0	0 (88)	0 (2)	0	2	0 (17)	0	1	0	3 (107)
06/18/2010	14:40	0	6 (7)	0	0	0	0	0	0	0	6 (7)
06/29/2010	14:25	0	0 (70)	10	0	0	0	0	0	0	10 (70)
Total		58 (238)	970 (1767)	257 (94)	12	24	408 (39)	2	11	1	1,743 (2,138)

Normal observation point on east bank of estuary, counts within parentheses denotes observations on west bank at river mouth.



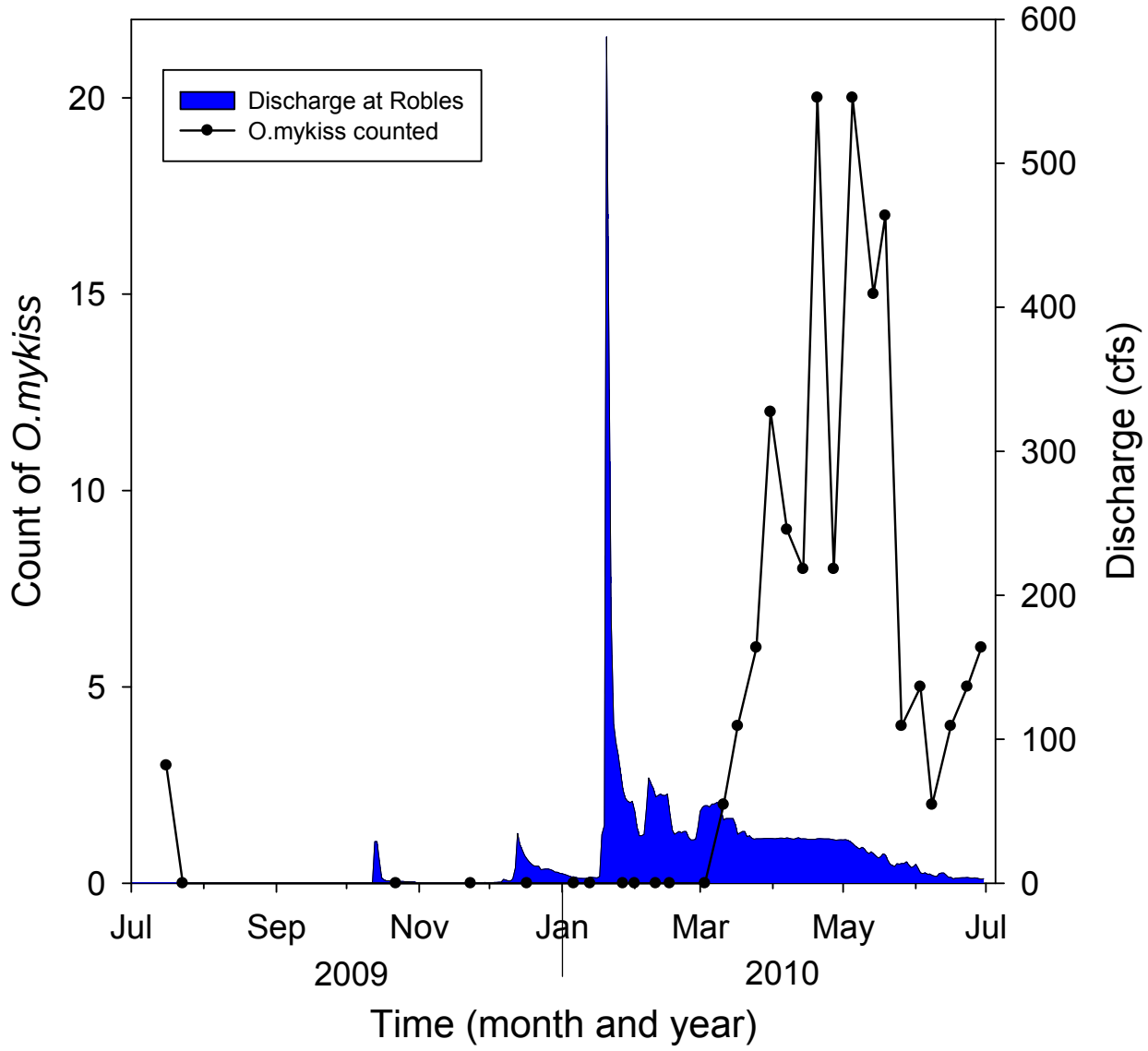
Appendix 16. Sandbar status at the mouth of the Ventura River from 2005 through June of 2010. Each observation is indicated by vertical lines and the sandbar status was assumed to remain the same until the next observation (Lewis et al. 2010).

Appendix 17. Fish attraction counts of *O. mykiss* in close proximity to the Robles Fish Facility from January through June of 2010.

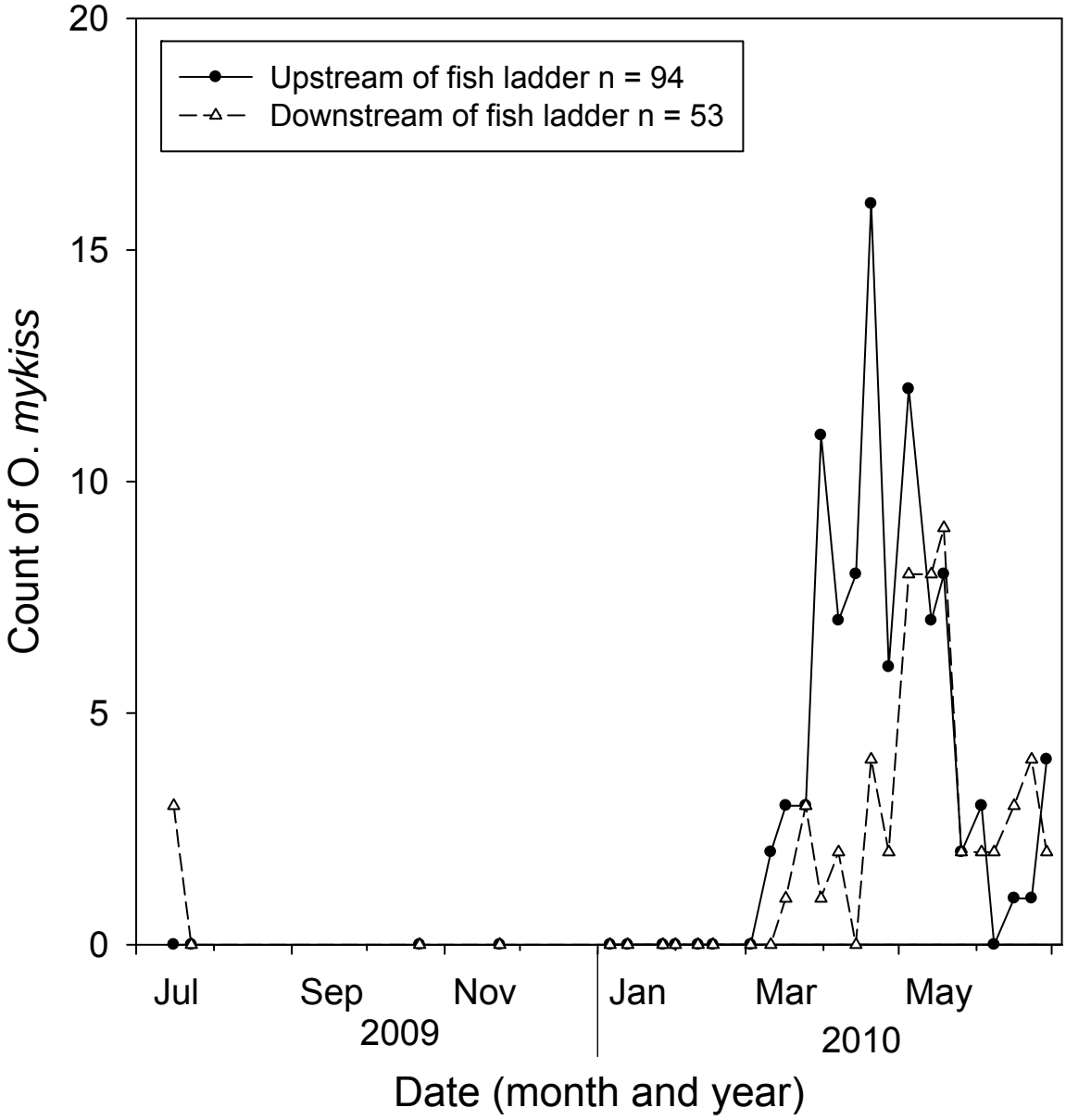
Date	Method	Direction	Length (m)	Temp (°C)	Turbidity (NTU)	Robles Discharge (CFS)	Species[a]	Count
6-Jan-2010	BANK	Downstream	200	10.5	1	4	NFO	0
6-Jan-2010	BANK	Upstream	140	11.5	2	4	NFO	0
13-Jan-2010	SNORKEL	Downstream	200	13.5	2	4	NFO	0
13-Jan-2010	SNORKEL	Upstream	140	15.3	2	4	NFO	0
27-Jan-2010	BANK	Downstream	200	10.0	11	65	NFO	0
27-Jan-2010	BANK	Upstream	140	10.0	11	65	NFO	0
1-Feb-2010	BANK	Downstream	200	10.0	3	50	NFO	0
1-Feb-2010	BANK	Upstream	140	10.0	3	50	NFO	0
10-Feb-2010	BANK	Downstream	200	12.5	7	60	NFO	0
10-Feb-2010	BANK	Upstream	140	12.5	7	60	NFO	0
16-Feb-2010	SNORKEL	Downstream	200	14.8	2	49	NFO	0
16-Feb-2010	SNORKEL	Upstream	140	15.4	2	49	NFO	0
3-Mar-2010	BANK	Downstream	200	11.8	2	54	NFO	0
3-Mar-2010	BANK	Upstream	140	11.8	2	54	NFO	0
11-Mar-2010	BANK	Downstream	200	14.2	1	44	NFO	0
11-Mar-2010	BANK	Upstream	140	14.2	1	44	OMY	2
17-Mar-2010	SNORKEL	Downstream	200	16.7	1	34	OMY	1
17-Mar-2010	SNORKEL	Upstream	140	16.7	1	34	OMY	3
25-Mar-2010	SNORKEL	Downstream	200	13.8	1	31	OMY	3
25-Mar-2010	SNORKEL	Upstream	140	13.8	1	31	OMY	3
31-Mar-2010	SNORKEL	Downstream	200	18.0	4	31	OMY	1
31-Mar-2010	SNORKEL	Upstream	140	18.0	4	31	OMY	11
7-Apr-2010	SNORKEL	Downstream	200	18.0	1	32	OMY	2
7-Apr-2010	SNORKEL	Upstream	140	18.0	1	32	OMY	7
14-Apr-2010	SNORKEL	Downstream	200	17.4	1	31	NFO	0
14-Apr-2010	SNORKEL	Upstream	140	18.6	1	31	OMY	8
20-Apr-2010	SNORKEL	Downstream	200	15.0	1	31	OMY	4
20-Apr-2010	SNORKEL	Upstream	140	15.0	1	31	OMY	16
27-Apr-2010	SNORKEL	Downstream	200	16.9	1	30	OMY	2
27-Apr-2010	SNORKEL	Upstream	140	17.1	2	30	OMY	6
5-May-2010	SNORKEL	Downstream	200	15.0	2	28	OMY	8
5-May-2010	SNORKEL	Upstream	140	15.0	2	28	OMY	12
14-May-2010	SNORKEL	Downstream	200	17.0	2	21	OMY	8
14-May-2010	SNORKEL	Upstream	140	17.0	2	21	OMY	7
19-May-2010	SNORKEL	Downstream	200	17.6	3	20	OMY	9
19-May-2010	SNORKEL	Upstream	140	17.0	2	20	OMY	8
26-May-2010	SNORKEL	Downstream	200	21.4	2	14	OMY	2
26-May-2010	SNORKEL	Upstream	140	22.7	6	14	OMY	2
3-Jun-2010	SNORKEL	Downstream	200	22.8	5	7	OMY	2
3-Jun-2010	SNORKEL	Upstream	140	22.8	5	7	OMY	3
8-Jun-2010	SNORKEL	Downstream	200	23.2	3	6	OMY	2
8-Jun-2010	SNORKEL	Upstream	140	25.9	6	6	NFO	0
16-Jun-2010	SNORKEL	Downstream	200	18.9	2	4	OMY	3
16-Jun-2010	SNORKEL	Upstream	140	18.90	7	4	OMY	1

23-Jun-2010	SNORKEL	Downstream	200	20.30	2	4	OMY	4
23-Jun-2010	SNORKEL	Upstream	140	21.40	3	4	OMY	1
29-Jun-2010	SNORKEL	Downstream	200	20.00	3	3	OMY	2
29-Jun-2010	SNORKEL	Upstream	140	20.90	3	3	OMY	4
		Upstream	3,360				Upstream	94
		Downstream	4,800				Downstream	53
		Total	8,160				Total	147

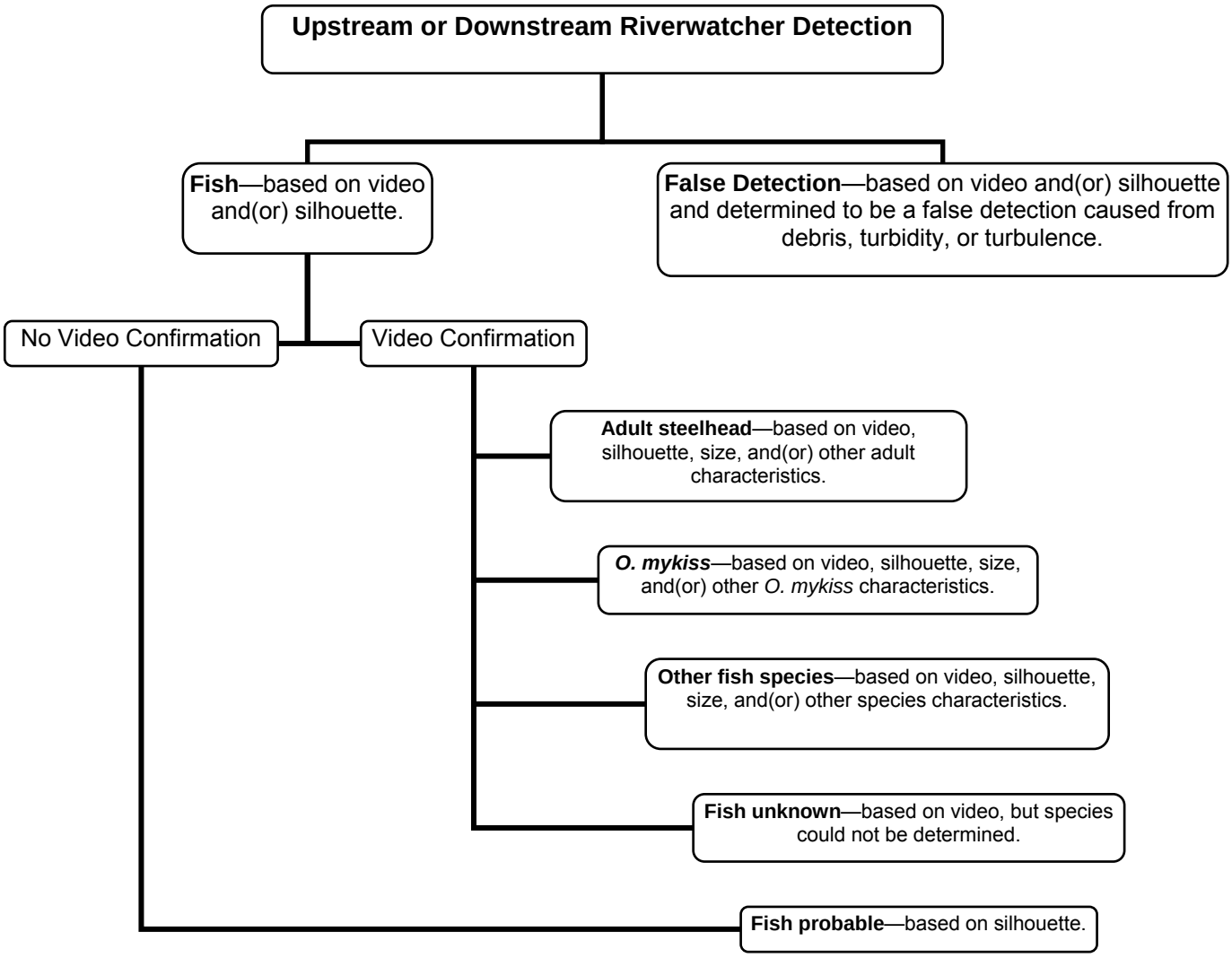
[a]OMY = *O. mykiss* and NFO = no fish observed.



Appendix 18. Total count of *O. mykiss* observed during fish attraction surveys during the reporting year from July 2009 through June 2010 and discharge from the Robles Facility.



Appendix 19. Count of *O. mykiss* observed during fish attraction surveys upstream and downstream of the Robles Fish Facility during the reporting year from July 2008 through June 2009.

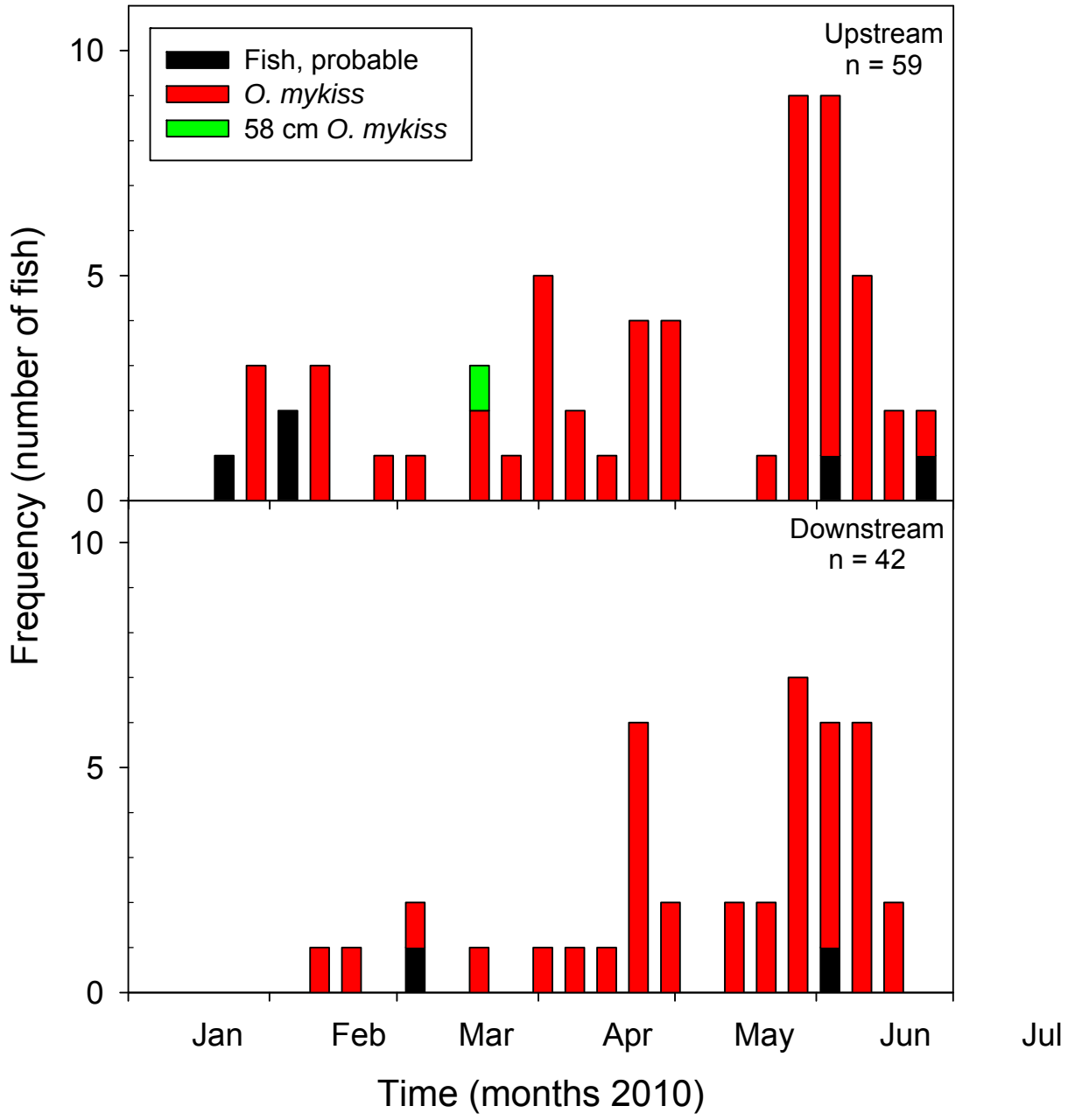


Appendix 20. Riverwatcher detection classification flow chart that outlines the pathways for upstream and downstream detections. For the 2010 report, adult steelhead were not classified and instead included in the *O. mykiss* category.

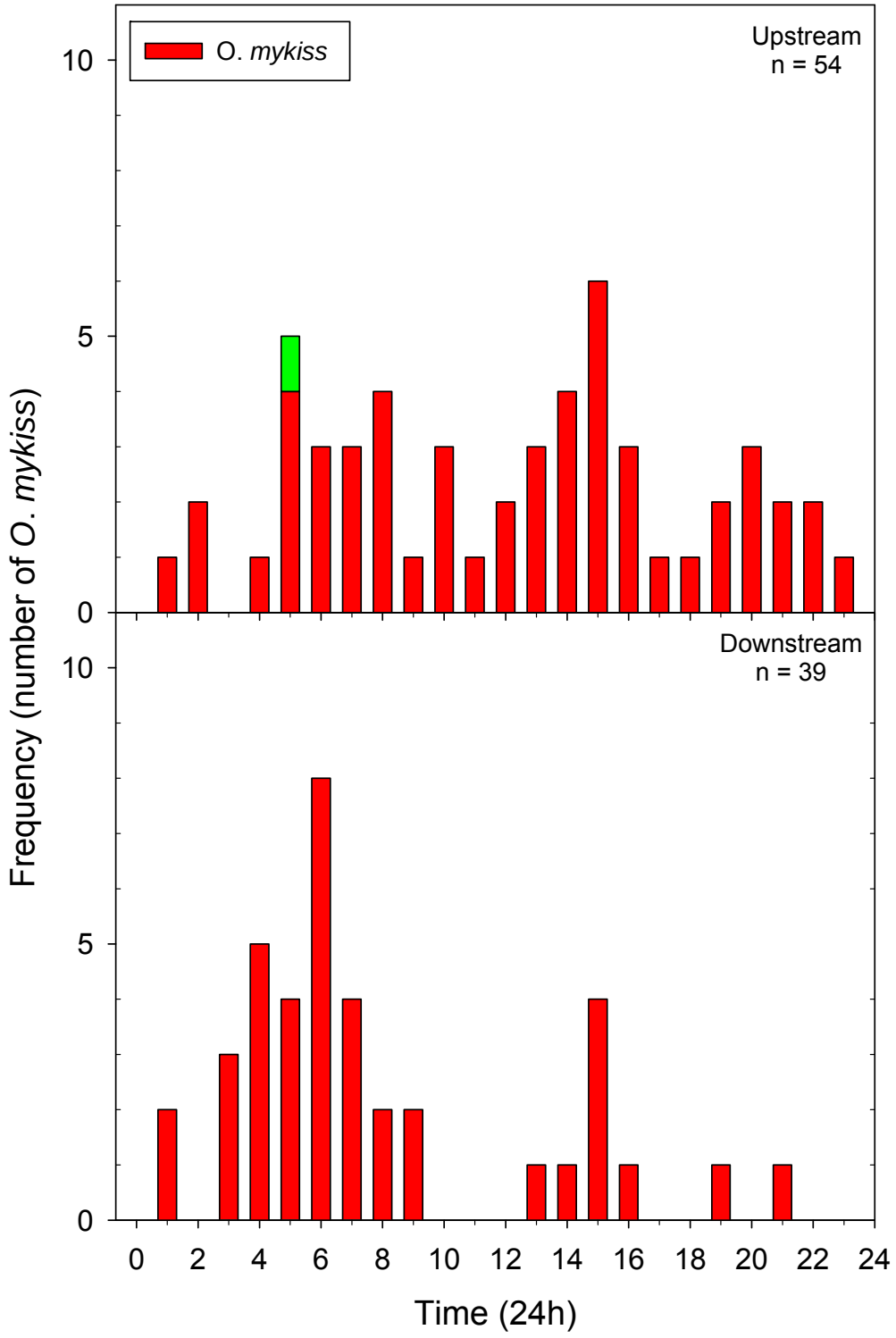
Appendix 21. Summary of Riverwatcher detections classified as fish probable and *O. mykiss* from January through June of 2010.

	Upstream	Downstream
58 cm O. *mykiss*	1	1[a]
Other *O. mykiss*	53	39
Fish, probable	5	3
False detections	820	1,910
Total	879	1,952
Date-58 cm O. *mykiss*	20-Mar-10	
Mean date- Other *O. mykiss*	2-May-10	14-May-10
Mean date-fish, probable	27-Mar-10	14-May-10
Time-58 cm O. *mykiss* (24h)	5:50	
Mean time- Other *O. mykiss* (24h)	12:45	8:19
Mean time-fish, probable (24h)	11:10	11:02
Length -58 cm O. *mykiss* (cm)	58.0	
Mean length- Other *O. mykiss* (cm)	34.3	32.3
Mean length-fish, probable (cm)	31.0	38.5
Daily temperature-58 cm O. *mykiss* (°C)	15.3	
Mean daily temperature- Other *O. mykiss* (°C)	18.0	18.5
Mean daily temperature-fish, probable (°C)	15.2	18.4
Daily turbidity-58 cm O. *mykiss* (NTU)	1	
Mean daily turbidity- Other *O. mykiss* (NTU)	4	4
Mean daily turbidity-fish, probable (NTU)	27	3
Mean daily turbidity-false detections (NTU)	57	47
Daily discharge-58 cm O. *mykiss* (cfs)	36.0	
Mean daily discharge- Other *O. mykiss* (cfs)	22.5	18.8
Mean daily discharge-fish, probable (cfs)	46.8	18.3
Mean daily discharge-false detections (cfs)	23.9	19.4

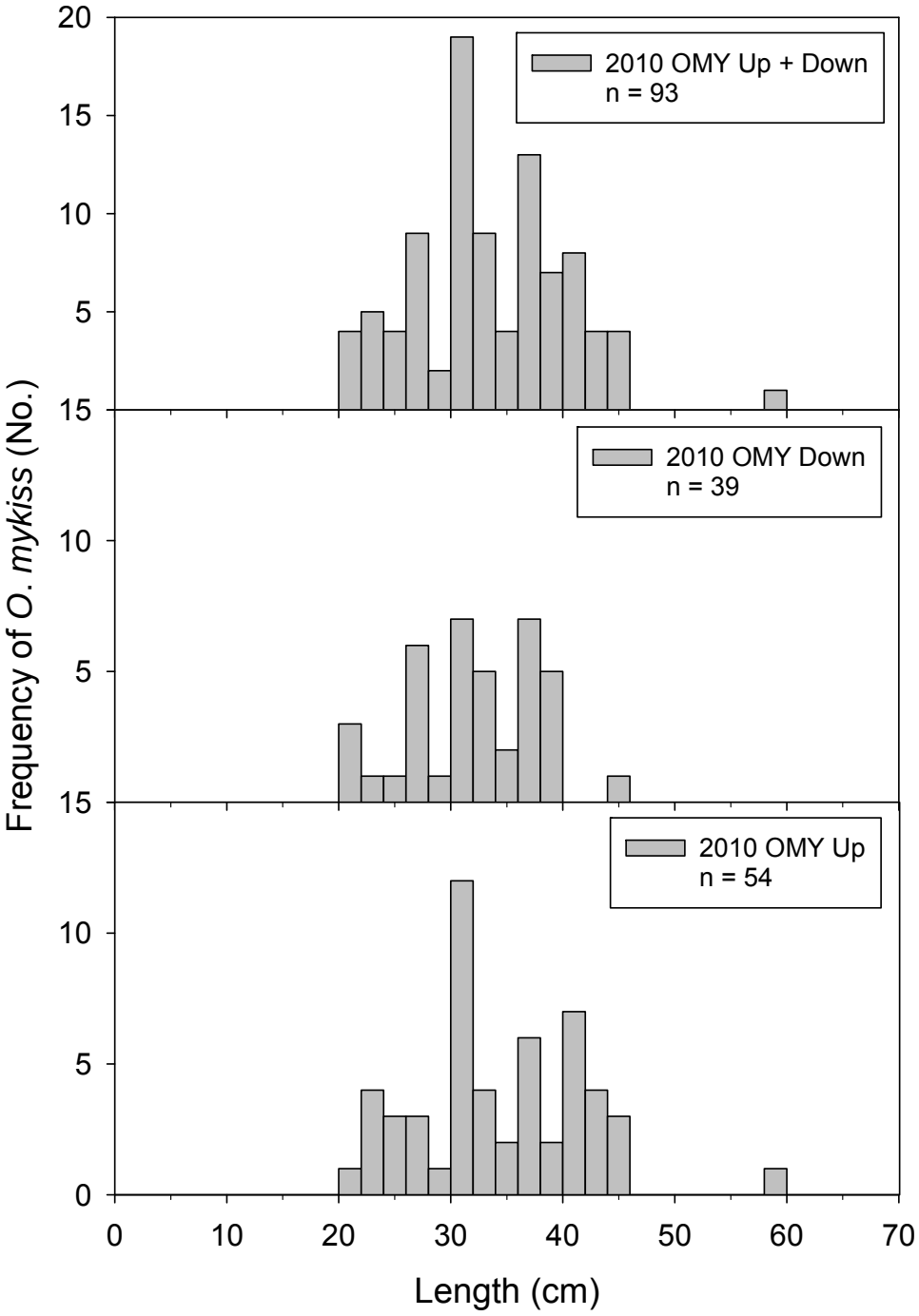
[a]The 58 cm *O. mykiss* was not detected passing downstream through the ladder; however, it was observed on two snorkeling surveys downstream of the ladder.



Appendix 22. Weekly Riverwatcher upstream and downstream detections classified as *O. mykiss* and fish probable from January through June of 2010.



Appendix 23. Time (24h) of *O. mykiss* passage through the Riverwatcher in upstream and downstream directions from January through June of 2010. The 58 cm *O. mykiss* is identified by the green bar.



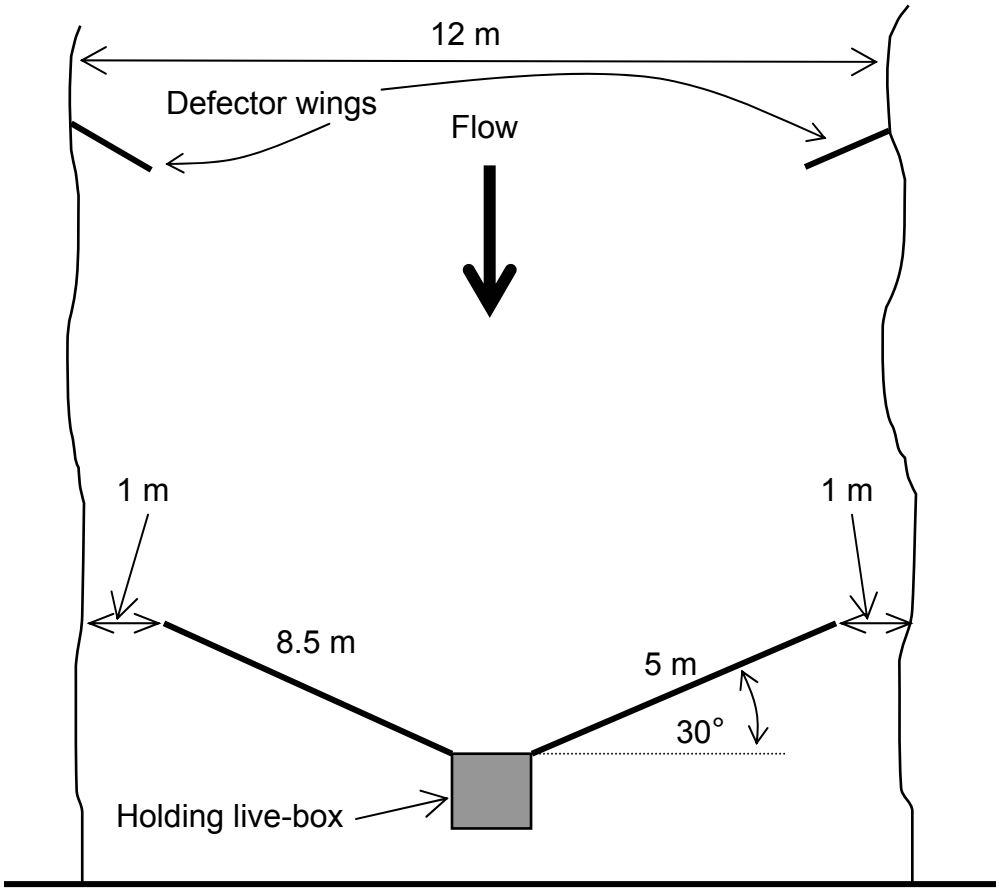
Appendix 24. Length frequency distribution of *O. mykiss* detected passing through the Riverwatcher from January through June of 2010.

Appendix 25. Date, time, TL, direction, discharge, turbidity, and temperature at time of all upstream and downstream Riverwatcher detections that were determined to be fish.

Date	Time (24h)	Fish Category	Total Length (cm)	Direction	Mean Daily Discharge (cfs)	Mean Daily Turbidity (NTU)	Mean Daily Temperature(°C)
24-Jan-2010	10:05	Fish Probable	20	Up	98	37	9.63
29-Jan-2010	15:40	O. mykiss	32	Up	39	6	11.60
30-Jan-2010	13:45	O. mykiss	25	Up	39	5	11.48
4-Feb-2010	15:57	O. mykiss	42	Up	33	5	12.15
6-Feb-2010	17:06	Fish Probable	25	Up	52	58	11.53
7-Feb-2010	10:18	Fish Probable	34	Up	73	32	11.05
14-Feb-2010	8:32	O. mykiss	41	Up	61	4	12.20
14-Feb-2010	13:48	O. mykiss	39	Down	61	4	12.20
15-Feb-2010	8:38	O. mykiss	27	Up	62	3	12.35
17-Feb-2010	13:33	O. mykiss	39	Up	37	2	13.28
21-Feb-2010	4:02	O. mykiss	37	Down	35	2	12.58
2-Mar-2010	10:16	O. mykiss	37	Up	53	2	13.38
8-Mar-2010	3:15	O. mykiss	20	Down	56	1	9.43
11-Mar-2010	8:31	O. mykiss	30	Up	44	2	11.48
11-Mar-2010	12:12	Fish Probable	35	Down	44	2	11.48
19-Mar-2010	7:03	O. mykiss	34	Up	36	2	15.23
20-Mar-2010	5:50	O. mykiss	58	Up	36	1	15.28
23-Mar-2010	1:41	O. mykiss	34	Down	31	3	15.48
24-Mar-2010	10:53	O. mykiss	27	Up	31	1	15.63
27-Mar-2010	22:29	O. mykiss	23	Up	31	1	15.63
4-Apr-2010	16:24	O. mykiss	30	Up	31	1	14.83
7-Apr-2010	11:07	O. mykiss	30	Up	32	1	16.20
7-Apr-2010	19:09	O. mykiss	22	Down	32	1	16.20
8-Apr-2010	16:40	O. mykiss	23	Up	31	1	16.93
8-Apr-2010	17:11	O. mykiss	22	Up	31	1	16.93
8-Apr-2010	22:10	O. mykiss	37	Up	31	1	16.93
9-Apr-2010	4:00	O. mykiss	23	Down	31	1	17.23
11-Apr-2010	19:54	O. mykiss	32	Up	31	35	16.20
13-Apr-2010	7:30	O. mykiss	27	Up	31	10	13.68
20-Apr-2010	19:13	O. mykiss	41	Up	31	1	15.60
21-Apr-2010	6:48	O. mykiss	32	Down	31	2	14.60
25-Apr-2010	3:55	O. mykiss	46	Down	31	2	16.80
27-Apr-2010	6:43	O. mykiss	27	Down	30	2	16.30
27-Apr-2010	8:38	O. mykiss	30	Down	30	2	16.30
28-Apr-2010	6:22	O. mykiss	32	Up	30	2	17.30
28-Apr-2010	8:46	O. mykiss	35	Up	30	2	17.30
28-Apr-2010	9:19	O. mykiss	34	Down	30	2	17.30
28-Apr-2010	9:34	O. mykiss	37	Up	30	2	17.30
28-Apr-2010	9:35	O. mykiss	34	Down	30	2	17.30
28-Apr-2010	10:28	O. mykiss	28	Up	30	2	17.30
29-Apr-2010	1:15	O. mykiss	28	Down	30	1	16.20
30-Apr-2010	6:45	O. mykiss	27	Down	30	1	16.20
30-Apr-2010	7:24	O. mykiss	27	Down	30	1	16.20

30-Apr-2010	7:45	O. mykiss	34	Up	30	1	16.20
30-Apr-2010	12:45	O. mykiss	30	Up	30	1	16.20
30-Apr-2010	21:14	Bullfrog	30	Down	30	1	16.20
2-May-2010	14:55	O. mykiss	35	Up	30	1	17.70
5-May-2010	13:08	O. mykiss	25	Up	28	2	18.90
16-May-2010	7:46	O. mykiss	30	Down	18	3	19.50
18-May-2010	6:44	O. mykiss	37	Down	21	3	17.70
25-May-2010	6:22	O. mykiss	27	Down	13	4	17.80
26-May-2010	6:09	O. mykiss	39	Down	14	5	18.80
26-May-2010	6:17	O. mykiss	30	Up	14	5	18.80
30-May-2010	12:29	O. mykiss	39	Up	11	5	19.80
30-May-2010	14:33	O. mykiss	34	Up	11	5	19.80
30-May-2010	14:33	O. mykiss	30	Down	11	5	19.80
30-May-2010	14:39	O. mykiss	30	Up	11	5	19.80
30-May-2010	15:19	O. mykiss	32	Down	11	5	19.80
30-May-2010	15:20	O. mykiss	37	Up	11	5	19.80
30-May-2010	15:33	O. mykiss	25	Down	11	5	19.80
30-May-2010	15:54	O. mykiss	32	Up	11	5	19.80
31-May-2010	2:04	O. mykiss	23	Up	12	6	20.30
1-Jun-2010	7:36	O. mykiss	35	Down	13	5	19.50
1-Jun-2010	16:12	O. mykiss	34	Down	13	5	19.50
1-Jun-2010	18:02	O. mykiss	41	Up	13	5	19.50
3-Jun-2010	5:54	O. mykiss	27	Down	7	5	20.60
3-Jun-2010	6:35	O. mykiss	37	Up	7	5	20.60
3-Jun-2010	15:08	O. mykiss	32	Down	7	5	20.60
3-Jun-2010	15:30	O. mykiss	32	Up	7	5	20.60
4-Jun-2010	4:56	O. mykiss	32	Up	7	5	21.60
4-Jun-2010	15:29	O. mykiss	34	Up	7	5	21.60
4-Jun-2010	15:42	O. mykiss	30	Down	7	5	21.60
4-Jun-2010	16:52	Fish Probable	30	Up	7	5	21.60
4-Jun-2010	16:52	Fish Probable	32	Down	7	5	21.60
4-Jun-2010	16:56	O. mykiss	25	Up	7	5	21.60
4-Jun-2010	21:02	O. mykiss	22	Down	7	5	21.60
6-Jun-2010	5:24	O. mykiss	41	Up	6	5	22.50
6-Jun-2010	7:04	O. mykiss	37	Down	6	5	22.50
6-Jun-2010	14:42	O. mykiss	23	Up	6	5	22.50
7-Jun-2010	5:47	O. mykiss	42	Up	6	5	22.20
7-Jun-2010	8:29	O. mykiss	39	Down	6	5	22.20
9-Jun-2010	5:59	O. mykiss	41	Up	5	4	21.20
9-Jun-2010	6:58	O. mykiss	37	Down	5	4	21.20
10-Jun-2010	20:28	O. mykiss	41	Up	5	5	20.50
11-Jun-2010	6:04	O. mykiss	27	Down	7	4	20.70
11-Jun-2010	21:12	O. mykiss	44	Up	7	4	20.70
12-Jun-2010	5:44	O. mykiss	37	Down	7	5	20.80
12-Jun-2010	20:58	O. mykiss	37	Up	7	5	20.80
13-Jun-2010	3:55	O. mykiss	37	Down	7	7	21.30
13-Jun-2010	5:27	O. mykiss	44	Up	7	7	21.30
13-Jun-2010	5:51	O. mykiss	35	Down	7	7	21.30
13-Jun-2010	20:32	O. mykiss	43	Up	7	7	21.30
14-Jun-2010	5:45	O. mykiss	39	Down	6	5	22.10

14-Jun-2010	23:07	O. mykiss	42	Up	6	5	22.10
16-Jun-2010	4:39	O. mykiss	37	Down	4	5	21.20
18-Jun-2010	2:19	O. mykiss	41	Up	4	4	21.30
19-Jun-2010	4:46	O. mykiss	34	Down	4	3	21.40
21-Jun-2010	21:00	O. mykiss	40	Up	4	4	21.40
22-Jun-2010	4:49	O. mykiss	39	Down	4	3	21.40
27-Jun-2010	1:33	Fish Probable	46	Up	4	3	22.20
27-Jun-2010	1:39	O. mykiss	46	Up	4	3	22.20
27-Jun-2010	4:03	Fish Probable	49	Down	4	3	22.20



Low-flow road crossing and measurement weir

Appendix 26. Top view of downstream migrant smolt trap layout in the Ventura River below the Robles Fish Facility.

Appendix 27. Annual Flow Summary - Robles Fish Passage Facility
Water Year 2009 - 2010

	* (1) Source Stream Daily Flows Matilija Ck D/S Dam (cfsd)	* (2) Source Stream Daily Flows North Fork Matilija Ck.* (cfsd)	(1)+(2) Sum of Creek Flows (cfsd)		** (3) Robles Facility Daily Flows Fishway Ladder (cfsd)	(4) Robles Facility Daily Flows VRNMO Weir (cfsd)	(5) Robles Facility Daily Flows Diversion Canal (cfsd)	*** (4)+(5) Total Inflow (cfsd)
Jul-09	89	16	105		0	0	0	0
Aug-09	61	16	76		0	0	0	0
Sep-09	56	72	72		0	0	0	0
Oct-09	69	121	191		0	0	0	0
Nov-09	116	40	156		1	1	0	1
Dec-09	193	118	310		289	289	3	292
Jan-10	2778	933	3711		593	1961	1745	3706
Feb-10	1815	507	2322		965	1276	985	2261
Mar-10	1400	334	1734		976	1287	345	1632
Apr-10	781	265	1046		925	925	186	1110
May-10	462	141	603		609	609	0	609
Jun-10	235	76	311		158	158	0	158
Total	8055	2636	10635		4516	6505	3264	9769

* Preliminary flow information provided by the Ventura County Watershed Protection District. North Fork Data is estimated. To be confirmed by VCWPD. Refer to the Operations section of the Report to determine operational reasons for flow variances.

** Flow in the Fish Passage was too low to be measured by the Accusonics Flowmeter. Flow needs to be greater than 15 CFS for reasonable flow measurements.

*** This does not account for any flow being expelled from the spillway gates

Ventura River Flow Assessment
Water Year 2009 - 2010

Jul-09	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) Source Stream Daily Flows: North Fork Matilija Ck. (cfsd)	(1)+(2) Source Stream Daily Flows: Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) Robles Facility Daily Flows: VRNMO Weir (cfsd)	(5) Robles Facility Daily Flows: Diversion Canal (cfsd)	(4)+(5) Robles Facility Daily Flows: Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	Field Measurement: Matilija Creek (cfsd)	Field Measurement: VRNMO (cfsd)
1	5	1	5	0.8	0	0	0	0	0		
2	4	1	4	0.8	0	0	0	0	0		
3	4	1	4	0.8	0	0	0	0	0		
4	4	1	4	0.8	0	0	0	0	0		
5	4	1	4	0.8	0	0	0	0	0		
6	4	1	4	0.4	0	0	0	0	0		
7	3	1	3	0.4	0	0	0	0	0	2.61	
8	3	1	3	0.4	0	0	0	0	0		
9	3	1	3	0.3	0	0	0	0	0		
10	3	1	3	0.3	0	0	0	0	0		
11	3	1	3	0.3	0	0	0	0	0		
12	3	1	3	0.2	0	0	0	0	0		
13	3	1	3	0.2	0	0	0	0	0		
14	3	1	3	0.2	0	0	0	0	0		
15	3	1	3	0.2	0	0	0	0	0		
16	3	1	3	0.2	0	0	0	0	0		
17	3	1	3	0.2	0	0	0	0	0		
18	3	1	3	0.2	0	0	0	0	0		
19	3	1	3	0.1	0	0	0	0	0		
20	3	1	3	1.1	0	0	0	0	0		
21	3	1	3	0.1	0	0	0	0	0		
22	3	1	3	0.1	0	0	0	0	0		
23	3	1	3	0.0	0	0	0	0	0		
24	3	1	3	0.0	0	0	0	0	0		
25	3	1	3	0.0	0	0	0	0	0		
26	3	1	3	0.0	0	0	0	0	0		
27	3	1	3	0.0	0	0	0	0	0		
28	3	1	3	0.0	0	0	0	0	0		
29	3	1	3	0.0	0	0	0	0	0		
30	3	1	3	0.0	0	0	0	0	0		
31	3	1	3	0.0	0	0	0	0	0		
Totals	89	16	105		0	0	0	0	0		

Water Year 2009 - 2010

Aug-09	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) Source Stream Daily Flows: North Fork Matilija Ck. (cfsd)	(1)+(2) Source Stream Daily Flows: Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) Robles Facility Daily Flows: VRNMO Weir (cfsd)	(5) Robles Facility Daily Flows: Diversion Canal (cfsd)	(4)+(5) Robles Facility Daily Flows: Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	Field Measurement: Matilija Creek (cfsd)	Field Measurement: VRNMO (cfsd)
1	3	1	3	0.0	0	0	0	0	0		
2	3	1	3	0.0	0	0	0	0	0		
3	3	1	3	0.0	0	0	0	0	0		
4	3	1	3	0.0	0	0	0	0	0		
5	3	1	3	0.0	0	0	0	0	0		
6	3	1	3	0.0	0	0	0	0	0		
7	3	1	3	0.0	0	0	0	0	0		
8	3	1	3	0.0	0	0	0	0	0		
9	3	1	3	0.0	0	0	0	0	0		
10	3	1	3	0.0	0	0	0	0	0		
11	3	1	3	0.0	0	0	0	0	0		
12	3	1	3	0.0	0	0	0	0	0		
13	2	1	2	0.0	0	0	0	0	0		
14	2	1	2	0.0	0	0	0	0	0		
15	2	1	2	0.0	0	0	0	0	0		
16	1	1	2	0.0	0	0	0	0	0		
17	1	1	2	0.0	0	0	0	0	0		
18	1	1	2	0.0	0	0	0	0	0		
19	1	1	2	0.0	0	0	0	0	0		
20	1	1	2	0.0	0	0	0	0	0		
21	2	1	2	0.0	0	0	0	0	0		
22	2	1	2	0.0	0	0	0	0	0		
23	2	1	2	0.0	0	0	0	0	0		
24	2	1	2	0.0	0	0	0	0	0		
25	2	1	2	0.0	0	0	0	0	0		
26	2	1	2	0.0	0	0	0	0	0		
27	2	1	2	0.0	0	0	0	0	0		
28	2	1	2	0.0	0	0	0	0	0		
29	2	1	2	0.0	0	0	0	0	0		
30	2	1	2	0.0	0	0	0	0	0		
31	2	1	2	0.0	0	0	0	0	0		

Water Year 2009 - 2010

Sep-09	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) Source Stream Daily Flows: North Fork Matilija Ck. (cfsd)	(1)+(2) Source Stream Daily Flows: Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) Robles Facility Daily Flows: VRNMO Weir (cfsd)	(5) Robles Facility Daily Flows: Diversion Canal (cfsd)	(4)+(5) Robles Facility Daily Flows: Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	Field Measurement: Matilija Creek (cfsd)	Field Measurement: VRNMO (cfsd)
1	2	1	3	0.0	0	0	0	0	0		
2	2	1	2	0.0	0	0	0	0	0		
3	1	1	2	0.0	0	0	0	0	0		
4	1	1	2	0.0	0	0	0	0	0		
5	1	1	2	0.0	0	0	0	0	0		
6	2	1	3	0.0	0	0	0	0	0		
7	4	1	5	0.0	0	0	0	0	0		
8	3	1	4	0.0	0	0	0	0	0		
9	2	1	3	0.0	0	0	0	0	0		
10	2	1	3	0.0	0	0	0	0	0		
11	2	1	3	0.0	0	0	0	0	0		
12	2	1	3	0.0	0	0	0	0	0		
13	2	1	3	0.0	0	0	0	0	0		
14	2	1	3	0.0	0	0	0	0	0		
15	2	1	3	0.0	0	0	0	0	0		
16	2	1	3	0.0	0	0	0	0	0		
17	2	1	2	0.0	0	0	0	0	0		
18	1	1	2	0.0	0	0	0	0	0		
19	1	1	2	0.0	0	0	0	0	0		
20	1	1	2	0.0	0	0	0	0	0		
21	1	1	2	0.0	0	0	0	0	0		
22	1	1	2	0.0	0	0	0	0	0		
23	1	1	2	0.0	0	0	0	0	0		
24	2	1	2	0.0	0	0	0	0	0		
25	2	1	2	0.0	0	0	0	0	0		
26	2	1	2	0.0	0	0	0	0	0		
27	2	1	2	0.0	0	0	0	0	0		
28	1	1	2	0.0	0	0	0	0	0		
29	1	1	2	0.0	0	0	0	0	0		
30	1	1	2	0.0	0	0	0	0	0		
Totals	56	16	72		0	0	0	0	0		

Oct-09	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) Source Stream Daily Flows: North Fork Matilija Ck. (cfsd)	(1)+(2) Source Stream Daily Flows: Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) Robles Facility Daily Flows: VRNMO Weir (cfsd)	(5) Robles Facility Daily Flows: Diversion Canal (cfsd)	(4)+(5) Robles Facility Daily Flows: Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	Field Measurement: Matilija Creek (cfsd)	Field Measurement: VRNMO (cfsd)
1	0	0	1	0.0	0	0	0	0	0		
2	0	0	1	0.0	0	0	0	0	0		
3	0	0	1	0.0	0	0	0	0	0		
4	1	0	1	0.0	0	0	0	0	0		
5	1	0	1	0.0	0	0	0	0	0		
6	1	0	1	0.0	0	0	0	0	0		
7	1	0	1	0.0	0	0	0	0	0		
8	1	0	1	0.0	0	0	0	0	0		
9	1	0	1	0.0	0	0	0	0	0		
10	1	0	1	0.0	0	0	0	0	0		
11	1	0	1	0.0	0	0	0	0	0		
12	1	0	1	0.0	0	0	0	0	0		
13	2	24	26	0.3	29	29	0	29	0		
14	3	55	58	2.6	29	29	4	33	7		
15	2	7	10	2.1	15	15	0	15	0		
16	4	5	8	1.2	4	4	0	4	0		
17	4	3	7	1.0	2	2	0	2	0		
18	4	3	6	0.9	2	2	0	2	0		
19	4	2	6	0.9	2	2	0	2	0		
20	4	2	6	1.0	2	2	0	2	0		
21	4	2	5	9.2	2	2	0	2	0		
22	4	2	5	0.9	2	2	0	2	0		
23	4	2	5	0.9	1	1	0	1	0		
24	4	2	5	0.9	1	1	0	1	0		
25	4	1	5	0.9	1	1	0	1	0		
26	4	1	5	0.8	1	1	0	1	0		
27	4	1	5	0.9	1	1	0	1	0		
28	4	1	5	0.8	1	1	0	1	0		
29	4	1	5	0.8	1	1	0	1	0		
30	4	1	5	0.8	1	1	0	1	0		
31	4	1	5	0.7	0	0	0	0	0		
Totals	69	121	191		97	97	4	101	7		

Water Year 2009 - 2010

Nov-09	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) Source Stream Daily Flows: North Fork Matilija Ck. (cfsd)	(1)+(2) Source Stream Daily Flows: Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) Robles Facility Daily Flows: VRNMO Weir (cfsd)	(5) Robles Facility Daily Flows: Diversion Canal (cfsd)	(4)+(5) Robles Facility Daily Flows: Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	Field Measurement: Matilija Creek (cfsd)	Field Measurement: VRNMO (cfsd)
1	4	1	5	0.7	0	0	0	0	0		
2	4	1	5	0.7	0	0	0	0	0		
3	4	1	5	0.6	0	0	0	0	0		
4	4	1	5	0.7	0	0	0	0	0		
5	4	1	5	0.8	0	0	0	0	0		
6	4	1	5	0.8	0	0	0	0	0		
7	4	1	5	0.8	0	0	0	0	0		
8	4	1	5	0.8	0	0	0	0	0		
9	4	1	5	0.8	0	0	0	0	0		
10	4	1	5	0.8	0	0	0	0	0		
11	4	1	5	0.7	0	0	0	0	0		
12	4	1	5	0.6	0	0	0	0	0		
13	4	1	5	0.7	0	0	0	0	0		
14	4	1	5	0.7	0	0	0	0	0		
15	4	1	5	0.8	0	0	0	0	0		
16	4	1	5	0.8	0	0	0	0	0		
17	4	1	5	0.8	0	0	0	0	0		
18	4	1	5	0.8	0	0	0	0	0		
19	4	1	5	0.7	0	0	0	0	0		
20	4	1	5	0.7	0	0	0	0	0		
21	4	1	5	0.7	0	0	0	0	0		
22	4	1	5	0.7	0	0	0	0	0		
23	4	1	5	0.7	0	0	0	0	0		
24	4	1	5	0.7	0	0	0	0	0		
25	4	1	5	0.6	0	0	0	0	0		
26	4	1	5	0.8	0	0	0	0	0		
27	4	1	5	0.8	0	0	0	0	0		
28	4	1	5	0.8	0	0	0	0	0		
29	4	1	5	0.8	1	1	0	1	0		
30	4	1	5	0.8	0	0	0	0	0		
Totals	116	40	156		1	1	0	1	0		

Dec-09	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) Source Stream Daily Flows: North Fork Matilija Ck. (cfsd)	(1)+(2) Source Stream Daily Flows: Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) Robles Facility Daily Flows: VRNMO Weir (cfsd)	(5) Robles Facility Daily Flows: Diversion Canal (cfsd)	(4)+(5) Robles Facility Daily Flows: Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	Field Measurement: Matilija Creek (cfsd)	Field Measurement: VRNMO (cfsd)
1	4	1	5	0.7	0	0	0	0	0		
2	4	1	5	0.8	0	0	0	0	0		
3	4	1	5	0.8	1	1	0	1	0		
4	4	1	5	0.8	1	1	0	1	0		
5	4	1	5	0.9	1	1	0	1	0		
6	4	1	5	0.9	1	1	0	1	0		
7	4	3	7	1.2	3	3	0	3	0		
8	4	2	6	1.0	2	2	0	2	0		
9	4	2	6	1.0	2	2	0	2	0		
10	4	2	6	1.0	2	2	0	2	0		
11	4	3	7	1.3	3	3	0	3	0		
12	5	16	21	2.2	11	11	0	11	0		
13	6	17	23	5.1	35	35	3	38	6		
14	12	7	19	3.4	27	27	0	27	0		
15	10	5	15	2.9	23	23	0	23	0		
16	9	5	14	2.5	19	19	0	19	0		
17	9	4	13	2.3	17	17	0	17	0		
18	8	3	12	2.2	15	15	0	15	0		
19	8	3	11	2.1	13	13	0	13	0		
20	8	3	11	2.0	12	12	0	12	0		
21	8	3	11	2.0	12	12	0	12	0		
22	8	3	11	2.0	12	12	0	12	0		
23	7	3	10	1.9	9	9	0	9	0		
24	7	3	11	2.1	10	10	0	10	0		
25	7	3	10	2.1	10	10	0	10	0		
26	7	3	10	2.1	10	10	0	10	0		
27	7	3	10	2.1	10	10	0	10	0		
28	7	3	10	2.1	9	9	0	9	0		
29	6	3	9	2.0	8	8	0	8	0		
30	6	3	9	2.0	8	8	0	8	0		
31	6	3	9	2.0	7	7	0	7	0		
Totals	193	118	310		289	289	3	292	6		

Jan-10	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) Source Stream Daily Flows: North Fork Matilija Ck. (cfsd)	(1)+(2) Source Stream Daily Flows: Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Fishway Ladder (cfsd)	(4) Robles Facility Daily Flows: VRNMO Weir (cfsd)	(5) Robles Facility Daily Flows: Diversion Canal (cfsd)	(4)+(5) Robles Facility Daily Flows: Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	Field Measurement: Matilija Creek (cfsd)	Field Measurement: VRNMO (cfsd)
1	6	3	9	2.0	7	7	0	7	0		
2	5	3	9	2.0	6	6	0	6	0		
3	5	3	8	1.9	6	6	0	6	0		
4	5	3	8	1.9	5	5	0	5	0		
5	5	3	8	1.8	4	4	0	4	0		
6	5	3	8	1.8	4	4	0	4	0		
7	5	3	8	1.7	4	4	0	4	0		
8	5	3	8	1.6	3	3	0	3	0		
9	5	3	8	1.6	3	3	0	3	0		
10	5	3	7	1.5	3	3	0	3	0		
11	5	3	7	1.6	3	3	0	3	0		
12	5	3	7	1.6	4	4	0	4	0		
13	5	3	8	1.8	4	4	0	4	0		
14	5	3	7	1.7	4	4	0	4	0		
15	4	3	7	1.7	4	4	0	4	0		
16	4	3	7	1.7	4	4	0	4	0		
17	5	3	8	1.8	5	5	0	5	0		
18	163	90	253	4.4	34	34	86	120	170		
19	123	50	173	6.8	40	40	129	169	255		
20	367	174	541	7.8	36	588	213	801	422		
21	657	199	856	7.7	36	372	405	777	802		
22	415	130	545	8.0	41	184	383	567	759		
23	194	66	260	7.6	37	111	149	260	295		
24	129	45	174	7.5	36	98	72	170	143		
25	149	31	180	7.5	35	89	85	174	168		
26	169	23	192	7.6	36	77	112	189	222		
27	94	19	113	7.6	37	65	47	112	93		
28	72	17	89	8.0	37	59	26	85	52		
29	59	15	74	8.1	39	57	17	74	34		
30	52	13	65	8.1	39	56	11	67	21		
31	52	12	64	8.1	38	57	9	66	18		
Totals	2778	933	3711		593	1961	1745	3706	3455		

Ventura River Flow Assessment
Water Year 2009 - 2010

Feb-10	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) Source Stream Daily Flows: North Fork Matilija Ck. (cfsd)	(1)+(2) Source Stream Daily Flows: Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) Robles Facility Daily Flows: VRNMO Weir (cfsd)	(5) Robles Facility Daily Flows: Diversion Canal (cfsd)	(4)+(5) Robles Facility Daily Flows: Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	Field Measurement: Matilija Creek (cfsd)	Field Measurement: VRNMO (cfsd)
1	47	11	58	7.8	36	50	11	61	22		
2	41	11	52	6.1	33	39	15	54	29		
3	39	10	49	5.1	33	33	19	52	38		
4	38	10	48	5.1	33	33	13	46	26		
5	39	53	92	5.2	34	34	38	72	74		
6	153	50	203	7.5	36	52	153	205	302		
7	136	32	168	7.5	36	73	90	163	177		
8	105	25	130	7.5	36	69	58	127	114		
9	98	23	121	7.5	35	66	54	120	107		
10	88	21	109	7.5	35	60	45	105	89		
11	77	18	95	7.6	36	61	32	93	63		
12	71	16	87	7.6	37	62	24	86	48		
13	66	15	81	7.5	36	61	19	80	38		
14	61	14	75	7.5	36	61	14	75	29		
15	57	13	70	7.5	36	62	11	73	21		
16	53	13	66	7.1	32	49	18	67	36		
17	50	11	61	5.8	34	37	25	62	50		
18	44	11	55	5.1	34	34	20	54	40		
19	46	11	57	5.2	35	35	21	56	42		
20	46	11	57	5.2	36	36	20	56	40		
21	43	10	53	5.2	35	35	18	53	36		
22	41	10	51	5.2	36	36	15	51	29		
23	40	9	49	5.2	36	36	13	49	25		
24	40	9	49	5.3	32	32	13	45	26		
25	38	9	47	5.3	30	30	11	41	22		
26	36	9	45	5.3	30	30	9	39	19		
27	114	44	158	5.4	31	31	120	151	238		
28	108	28	136	6.8	36	39	86	125	171		
Totals	1815	507	2322		965	1276	985	2261	1950		

Mar-10	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) Source Stream Daily Flows: North Fork Matilija Ck. (cfsd)	(1)+(2) Source Stream Daily Flows: Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) Robles Facility Daily Flows: VRNMO Weir (cfsd)	(5) Robles Facility Daily Flows: Diversion Canal (cfsd)	(4)+(5) Robles Facility Daily Flows: Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	Field Measurement: Matilija Creek (cfsd)	Field Measurement: VRNMO (cfsd)
1	80	19	99	8.0	37	50	40	90	78		
2	71	16	87	8.0	37	53	28	81	55		
3	66	15	81	8.0	36	54	19	73	38		
4	62	14	76	8.1	34	54	15	69	30		
5	57	13	70	8.1	34	53	10	63	21		
6	56	13	69	8.1	36	55	10	65	20		
7	56	15	71	8.1	36	55	11	66	22		
8	50	13	63	8.0	33	56	6	62	12		
9	48	12	60	8.1	34	56	4	60	7		
10	46	12	58	7.4	32	50	10	60	19		
11	44	11	55	6.8	27	44	8	52	16		
12	42	11	53	6.8	26	45	6	51	11		
13	41	11	52	6.7	25	45	4	49	8		
14	39	10	49	6.7	25	45	2	47	4		
15	38	10	48	6.5	26	45	1	46	2		
16	36	10	46	6.1	26	41	4	45	7		
17	35	10	45	5.0	32	34	7	41	14		
18	34	10	44	5.0	32	35	5	40	11		
19	33	9	42	5.0	32	36	4	40	8		
20	32	9	41	5.0	32	36	3	39	6		
21	31	9	40	5.1	32	32	2	35	5		
22	44	9	53	5.1	33	33	11	44	22		
23	49	9	58	4.3	31	31	22	53	43		
24	49	8	57	3.9	31	31	22	53	44		
25	47	8	55	3.9	31	31	21	52	42		
26	42	8	50	3.9	31	31	17	48	34		
27	41	8	49	3.9	31	31	15	46	30		
28	41	8	49	3.8	31	31	15	46	30		
29	37	8	45	3.8	31	31	12	44	25		
30	29	8	37	3.7	31	31	7	38	14		
31	24	8	32	3.8	31	31	3	34	7		
Totals	1400	334	1734		976	1287	345	1632	684		

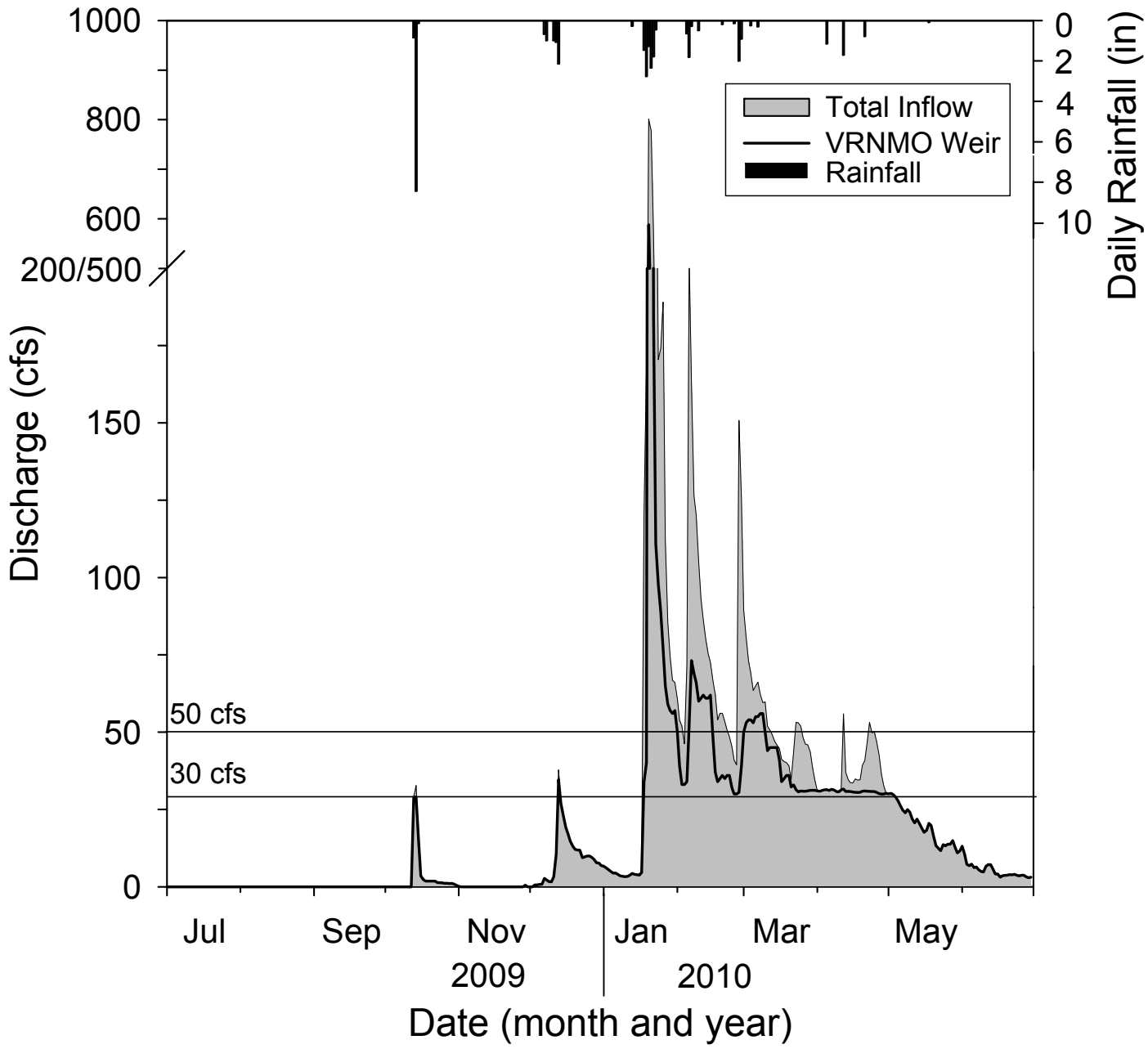
Water Year 2009 - 2010

Apr-10	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) Source Stream Daily Flows: North Fork Matilija Ck. (cfsd)	(1)+(2) Source Stream Daily Flows: Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) Robles Facility Daily Flows: VRNMO Weir (cfsd)	(5) Robles Facility Daily Flows: Diversion Canal (cfsd)	(4)+(5) Robles Facility Daily Flows: Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	Field Measurement: Matilija Creek (cfsd)	Field Measurement: VRNMO (cfsd)
1	22	8	30	3.7	31	31	0	31	0		
2	22	8	30	3.7	31	31	0	31	0		
3	22	8	30	3.7	31	31	0	31	0		
4	22	8	30	3.8	31	31	0	31	0		
5	23	9	32	3.9	31	31	0	31	0		
6	22	8	30	3.8	31	31	0	31	0		
7	22	8	30	3.9	32	32	0	32	0		
8	21	7	28	3.9	31	31	0	31	0		
9	21	7	28	3.6	31	31	0	31	0		
10	21	7	28	3.6	31	31	0	31	0		
11	21	14	35	3.8	31	31	0	31	0		
12	21	27	48	4.1	32	32	24	56	48		
13	21	12	33	3.7	31	31	6	37	12		
14	21	10	31	3.7	31	31	4	35	7		
15	21	9	30	3.8	31	31	3	34	6		
16	23	9	32	3.8	31	31	3	34	6		
17	25	8	33	3.8	31	31	4	35	8		
18	25	8	33	3.8	30	30	4	34	8		
19	25	8	33	3.8	31	31	4	35	8		
20	28	10	38	3.9	31	31	8	39	16		
21	31	9	40	4.0	31	31	10	41	20		
22	40	8	48	4.0	31	31	16	47	32		
23	43	8	51	4.0	31	31	22	53	44		
24	40	8	48	4.0	31	31	19	50	38		
25	40	7	47	4.0	31	31	19	50	38		
26	36	7	43	3.9	30	30	16	47	33		
27	31	7	38	3.8	30	30	13	43	25		
28	26	7	33	3.7	30	30	7	36	13		
29	23	6	29	3.7	30	30	3	33	5		
30	22	6	28	3.8	30	30	0	30	0		
Totals	781	265	1046		925	925	186	1110	367		

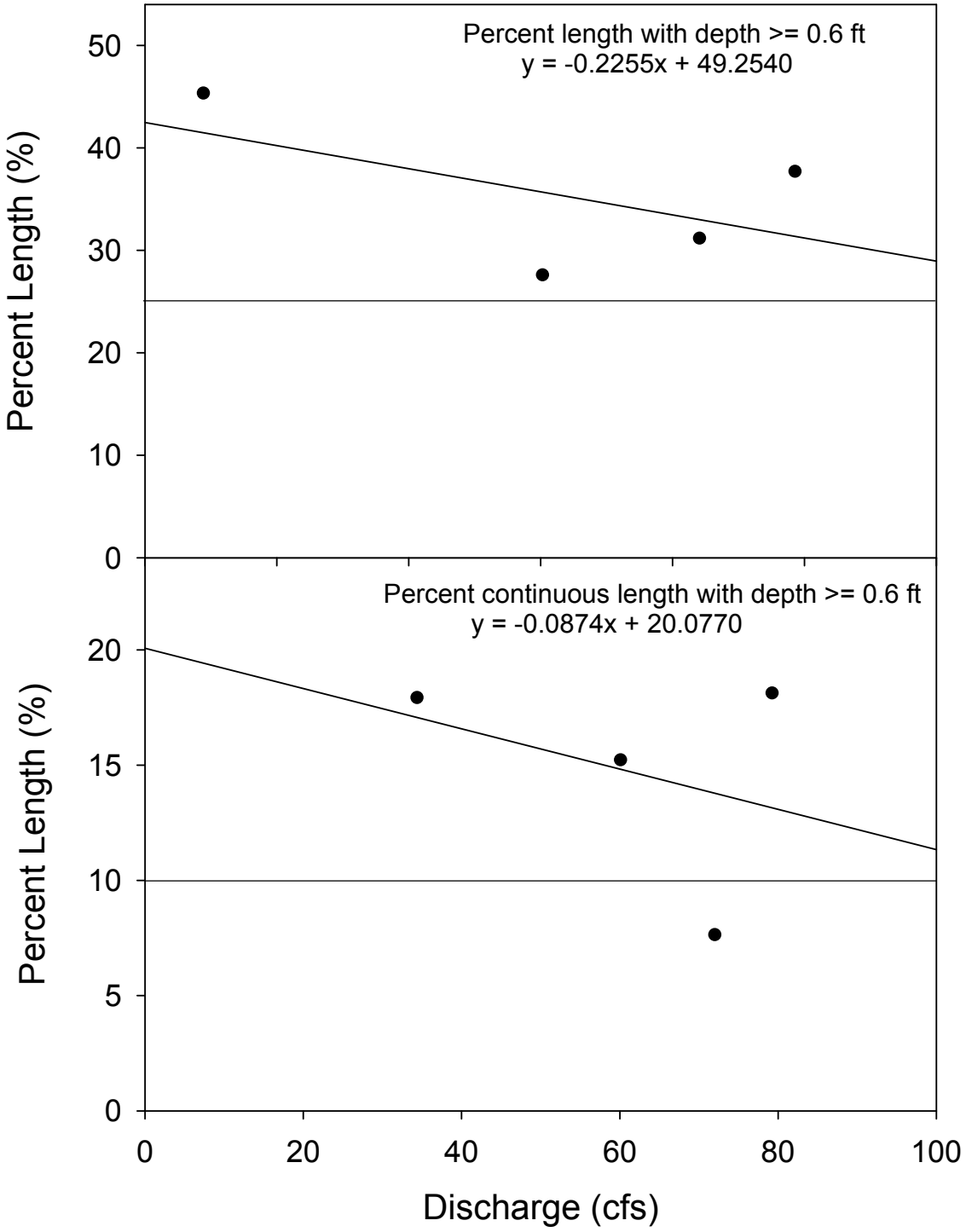
May-10	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) Source Stream Daily Flows: North Fork Matilija Ck. (cfsd)	(1)+(2) Source Stream Daily Flows: Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) Robles Facility Daily Flows: VRNMO Weir (cfsd)	(5) Robles Facility Daily Flows: Diversion Canal (cfsd)	(4)+(5) Robles Facility Daily Flows: Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	Field Measurement: Matilija Creek (cfsd)	Field Measurement: VRNMO (cfsd)
1	22	6	28	3.8	30	30	0	30	0		
2	22	6	28	3.9	30	30	0	30	0		
3	22	6	28	3.7	30	30	0	30	0		
4	20	6	26	3.5	29	29	0	29	0		
5	19	6	25	3.3	28	28	0	28	0		
6	17	5	22	3.1	26	26	0	26	0		
7	16	5	21	2.9	25	25	0	25	0		
8	16	5	21	2.9	24	24	0	24	0		
9	16	5	21	3.0	25	25	0	25	0		
10	16	5	21	2.9	24	24	0	24	0		
11	16	5	21	2.7	22	22	0	22	0		
12	15	5	20	2.6	21	21	0	21	0		
13	15	5	20	2.8	22	22	0	22	0		
14	15	5	20	2.7	21	21	0	21	0		
15	14	4	18	2.5	19	19	0	19	0		
16	14	4	18	2.5	18	18	0	18	0		
17	14	4	18	2.5	18	18	0	18	0		
18	14	5	19	2.7	21	21	0	21	0		
19	14	4	18	2.7	20	20	0	20	0		
20	13	4	17	2.4	16	16	0	16	0		
21	12	4	16	2.2	13	13	0	13	0		
22	12	4	16	2.2	12	12	0	12	0		
23	12	4	16	2.1	12	12	0	12	0		
24	12	4	16	2.2	14	14	0	14	0		
25	12	4	16	2.2	13	13	0	13	0		
26	12	4	16	2.3	14	14	0	14	0		
27	12	4	16	2.3	14	14	0	14	0		
28	12	4	16	2.3	15	15	0	15	0		
29	12	3	15	2.3	13	13	0	13	0		
30	12	3	15	2.1	11	11	0	11	0		
31	12	3	15	2.1	12	12	0	12	0		
Totals	462	141	603		609	609	0	609	0		

Water Year 2009 - 2010

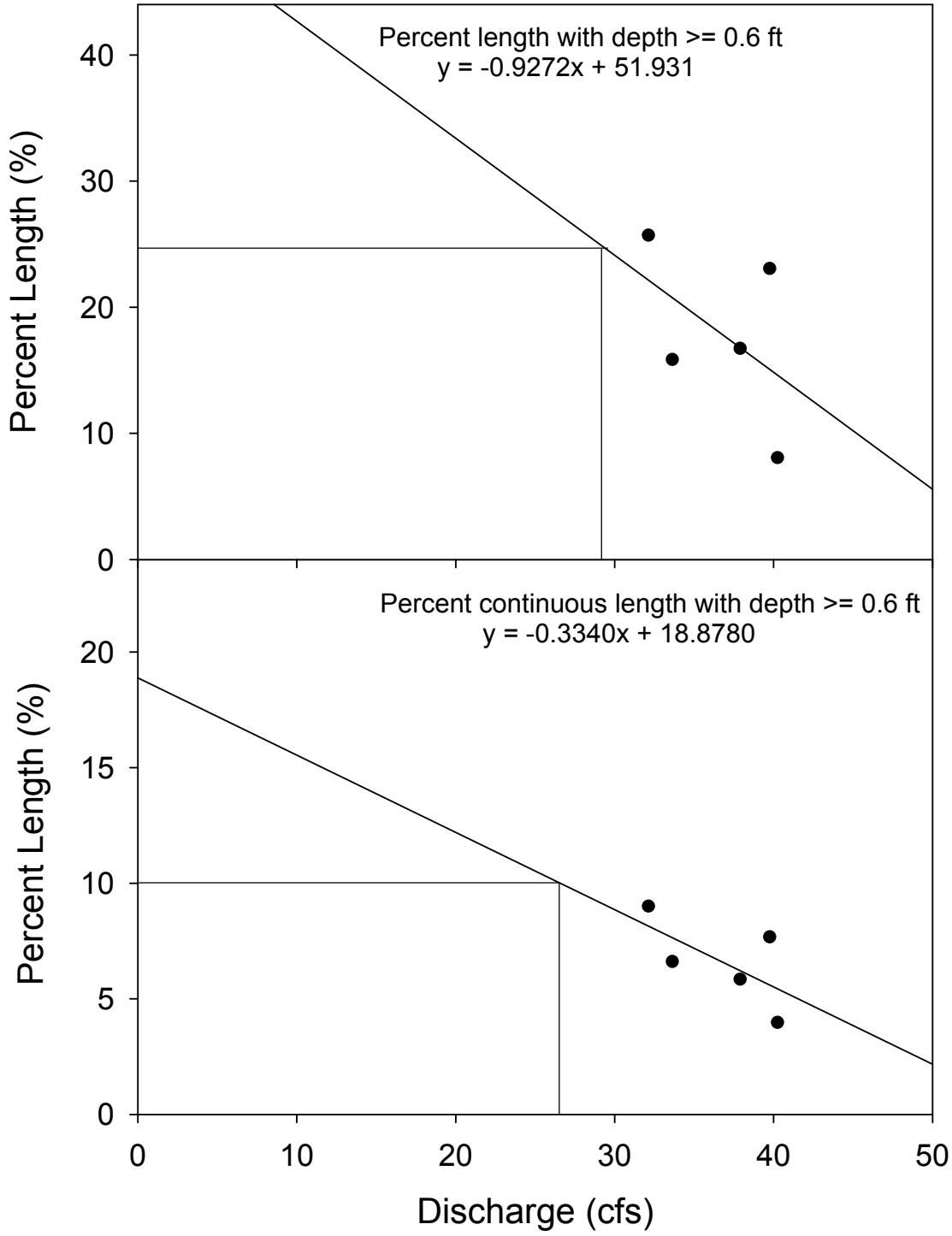
Jun-10	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) Source Stream Daily Flows: North Fork Matilija Ck. (cfsd)	(1)+(2) Source Stream Daily Flows: Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) Robles Facility Daily Flows: VRNMO Weir (cfsd)	(5) Robles Facility Daily Flows: Diversion Canal (cfsd)	(4)+(5) Robles Facility Daily Flows: Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	Field Measurement: Matilija Creek (cfsd)	Field Measurement: VRNMO (cfsd)
1	12	3	15	2.2	13	13	0	13	0		
2	10	3	13	2.1	11	11		11	0		
3	9	3	12	1.9	7	7		7	0		
4	9	3	12	1.9	7	7		7	0		
5	10	3	12	1.9	7	7		7	0		
6	10	3	12	1.8	6	6		6	0		
7	7	3	9	1.8	6	6		6	0		
8	7	3	10	1.8	6	6		6	0		
9	7	3	9	1.8	5	5		5	0		
10	7	3	10	1.8	5	5		5	0		
11	7	3	10	1.9	7	7		7	0		
12	7	3	10	1.9	7	7		7	0		
13	7	3	10	1.9	7	7		7	0		
14	7	3	10	1.8	6	6		6	0		
15	7	3	10	1.7	4	4		4	0		
16	7	3	10	1.6	4	4		4	0		
17	7	3	10	1.5	3	3		3	0		
18	8	2	11	1.5	4	4		4	0		
19	9	2	11	1.6	4	4		4	0		
20	9	2	11	1.6	4	4		4	0		
21	9	2	11	1.7	4	4		4	0		
22	9	2	11	1.6	4	4		4	0		
23	9	2	12	1.7	4	4		4	0		
24	9	2	12	1.6	4	4		4	0		
25	9	2	12	1.6	4	4		4	0		
26	6	2	8	1.6	4	4		4	0		
27	5	2	7	1.6	4	4		4	0		
28	5	2	7	1.5	3	3		3	0		
29	5	2	7	1.4	3	3		3	0		
30	5	2	7	1.5	3	3		3	0		
Totals	235	76	311		158	158	0	158	0		



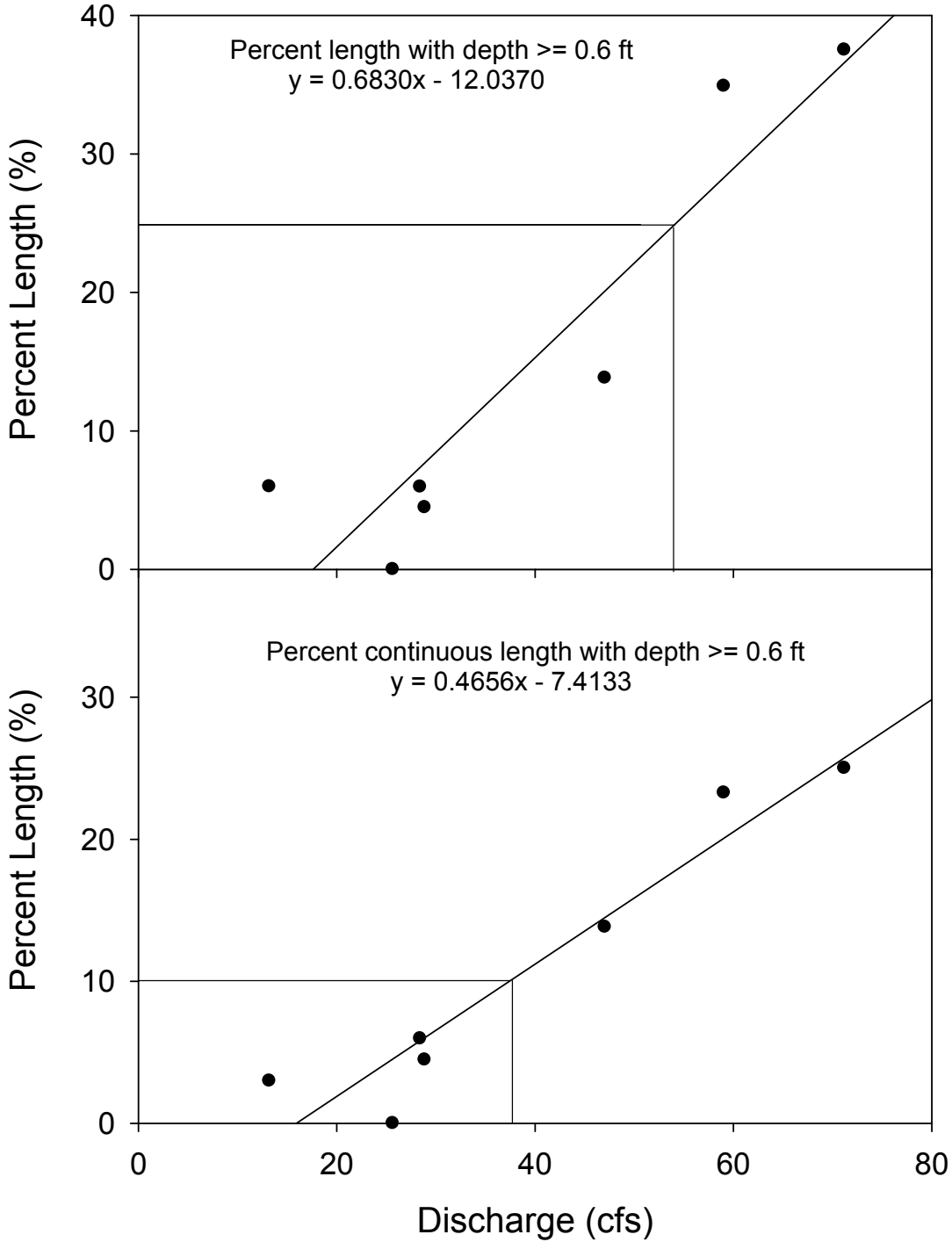
Appendix 28. Total inflow to Robles Fish Passage Facility, discharge downstream at measurement weir, and precipitation during the reporting period.



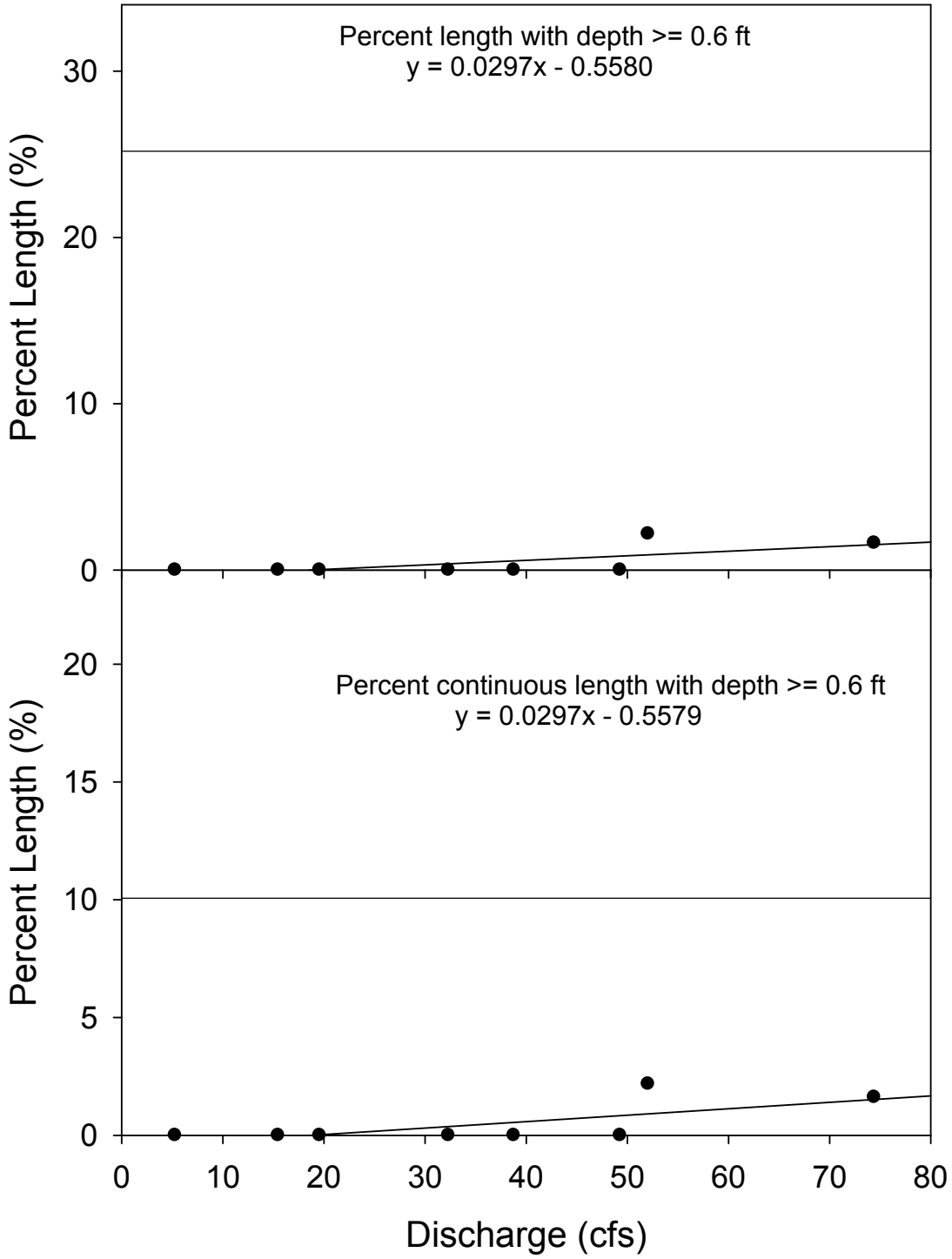
Appendix 29a. Relation between site discharge and water depth at site 2 downstream of the wastewater treatment plant and resulting discharge for Thompson passage criteria.



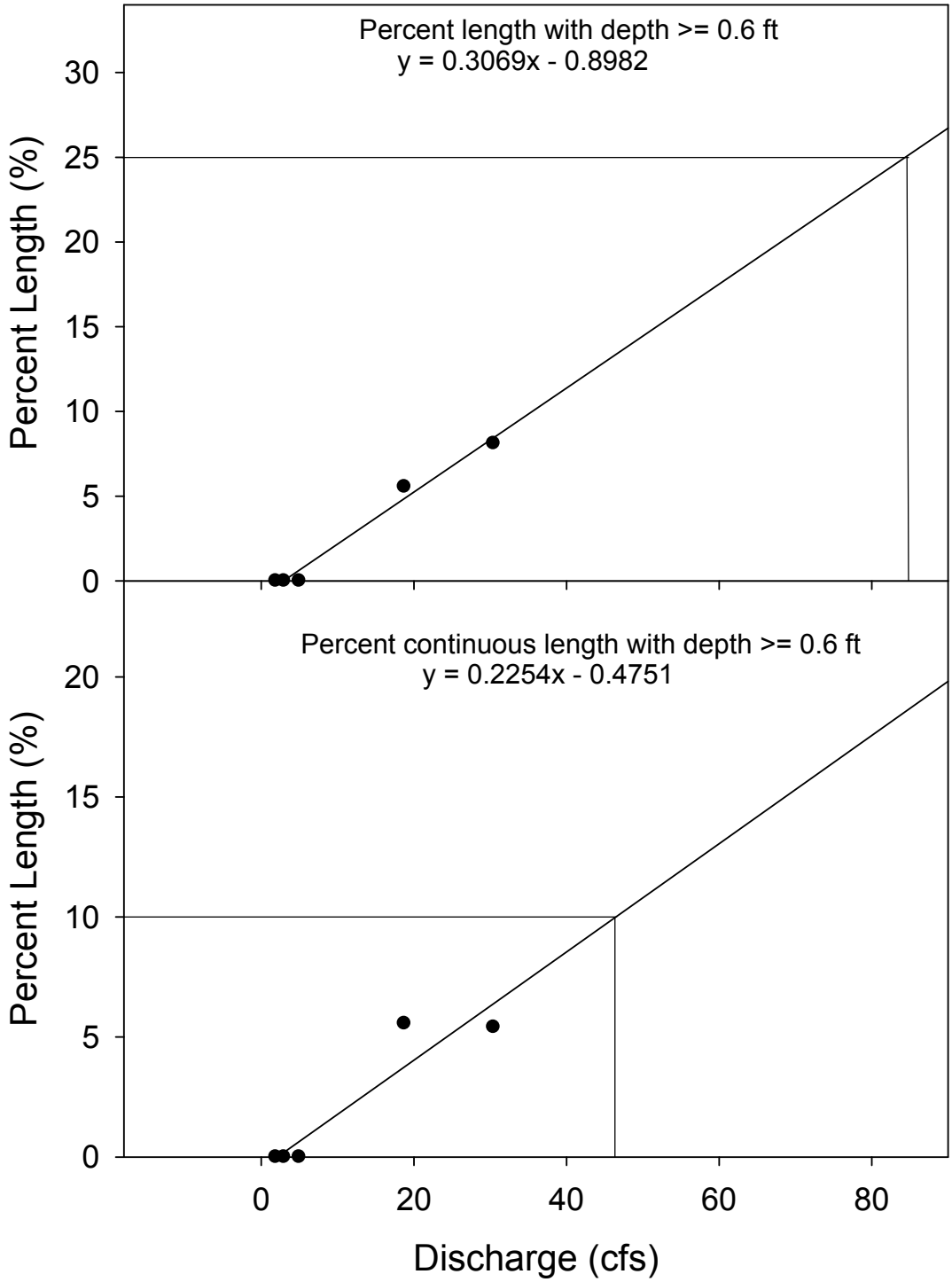
Appendix 29b. Relation between site discharge and water depth at site 3 near Casitas Springs and resulting discharge for Thompson passage criteria.



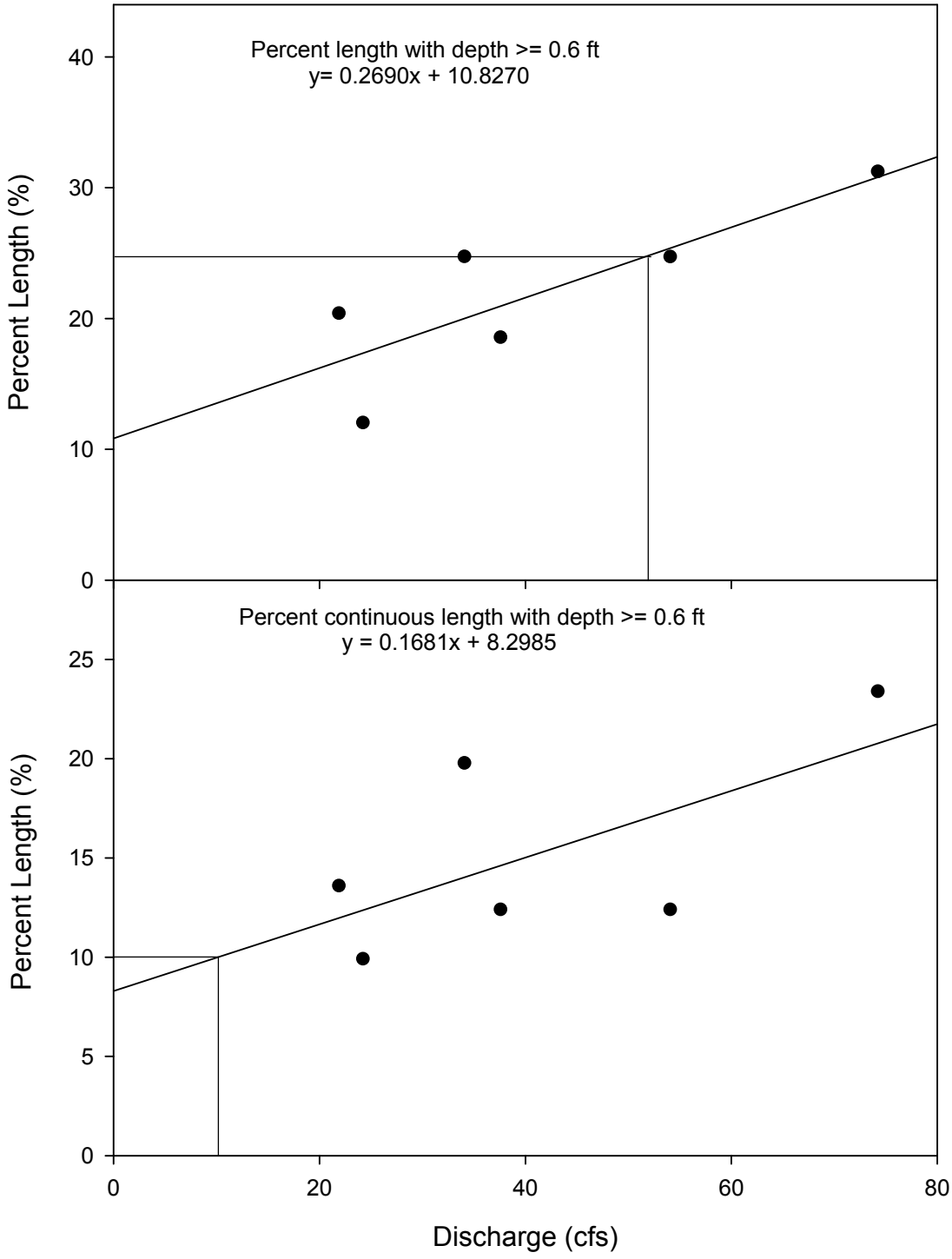
Appendix 29c. Relation between site discharge and water depth at site 4 upstream of San Antonio Creek and resulting discharge for Thompson passage criteria.



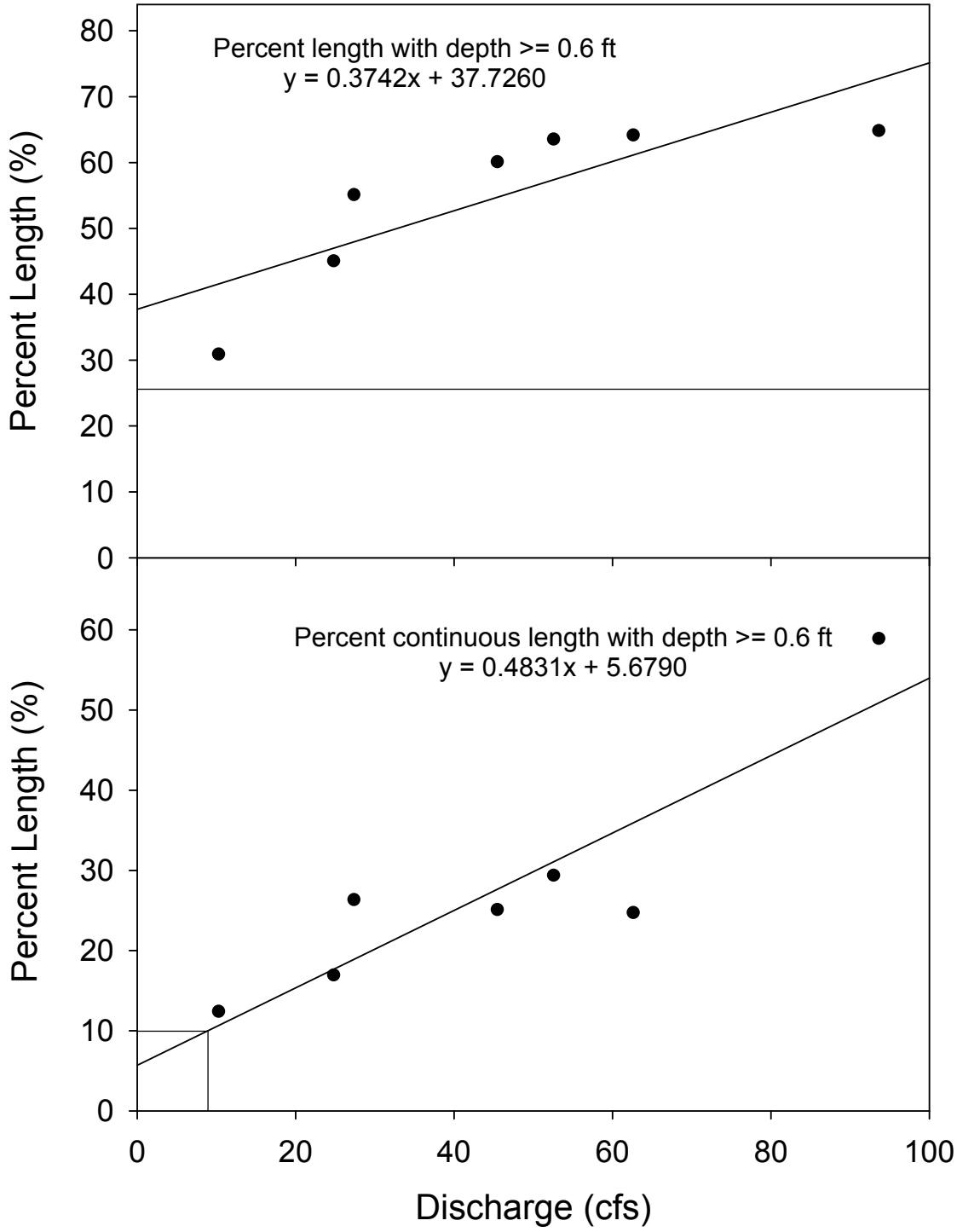
Appendix 29d. Relation between site discharge and water depth at site 5-1 downstream of Santa Ana bridge and resulting discharge for Thompson passage criteria.



Appendix 29e. Relation between site discharge and water depth at site 5-2 downstream of Santa Ana bridge and resulting discharge for Thompson passage criteria.



Appendix 29f. Relation between site discharge and water depth at site 7 upstream of Hwy 150 bridge and resulting discharge for Thompson passage criteria.



Appendix 29g. Relation between site discharge and water depth at site 8 downstream of the Robles Fish Facility and resulting discharge for Thompson passage criteria.

Appendix 30a. Regression equations and statistics for impediment site discharge evaluated using the Thompson (1972) passage criteria.

	% Total length with depth ≥ 0.6 ft			% Continuous length with depth ≥ 0.6 ft		
Site	Equation	R^2	P-value	Equation	R^2	P-value
2	y = -0.2255x + 49.2540	0.32	0.43	y = -0.0874x + 20.0770	0.12	0.65
3	y = -0.9272x + 51.931	0.24	0.40	y = -0.3340x + 18.8780	0.42	0.24
4	y = 0.6830x - 12.0370	0.85	0.00	y = 0.4656x - 7.4133	0.91	0.00
5-1	y = 0.0297x - 0.5580	0.46	0.06	y = 0.0297x - 0.5579	0.46	0.06
5-2	y = 0.3069x - 0.8982	0.98	0.00	y = 0.2254x - 0.4751	0.87	0.02
6	y = 0.4363x + 0.9446	0.74	0.01	y = 0.2329x + 0.2143	0.60	0.02
7	y = 0.2690x + 10.8270	0.67	0.05	y = 0.1681x + 8.2985	0.42	0.17
8	y = 0.3742x + 37.7260	0.68	0.02	y = 0.4831x + 5.6790	0.81	0.01

Appendix 30b. Calculated discharge (cfs) required at each impediment site to meet Thompson (1972) passage criteria.

Site	25% Total length with depth ≥ 0.6 ft	10% Continuous length with depth ≥ 0.6 ft	Minimum discharge to meet Thompson criteria
2	108	115	115
3	29	27	29
4	54	37	54
5-1	861	355	861
5-2	84	46	84
6	55	42	55
7	53	10	53
8	-34	9	9

Appendix 31. Correspondences among Biological Committee participants regarding the 2010 progress report and 2011 study plan.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

SWR/2002/1871: RAB

February 3, 2011

Ned Gruenhagen
Bureau of Reclamation
South-Central California Area Office
1243 N Street
Fresno, CA 93721-1813

Dear Mr. Gruenhagen:

NOAA's National Marine Fisheries Service (NMFS) and California Department of Fish and Game (CDFG) conferenced on Feb 1, 2011, to discuss the Casitas Municipal Water District (Casitas) monitoring activities related to the modification of the Robles Fish Facility, as outlined in the 2003 Robles biological opinion. The specific purpose of the meeting was to provide agency recommendations that address the 2011 upstream fish migration impediment evaluation changes proposed by Casitas on December 1, 2010, at the Robles Biological Committee Meeting. Listed below are NMFS and CDFG's collective recommendations for inclusion in the 2011 Monitoring and Evaluation Study Plan.

Robles Reach Definition
In accordance with the definition presented in the 2011 Monitoring and Evaluation Study Plan, the Robles Reach should consistently be defined as the reach extending downstream to the confluence of San Antonio Creek. The Robles Reach measures approximately 11 river kilometers.

Impediment Monitoring Site Selection
The 2011 monitoring should continue at all 7 sites identified in Appendix 13 (Casitas 2010). In addition to the collection of transect depths, we recommend that site-specific discharge measurements are recorded during each site visit. Site-specific flow information is necessary to accurately develop the relationship between stream flow and the stream width meeting the minimum depth criterion. It is also necessary to evaluate the relationship between water releases from the Robles facility and the corresponding flow conditions observed at the individual sites. The relationship between discharge at Robles and depths at the monitoring transects (provided in Appendices 3-10 of Casitas, 2010) is characterized by a high degree of scatter and lack of a clear trend at a number of the transects. This may be due to the issue that the discharge at Robles may not be representative of the streamflow at the study sites, due to gains and losses to groundwater. Ideally, a sufficient number of flow measurements may be obtainable in a single field season to develop a better correlation between flow at specific critical riffle monitoring sites and flow at

the Robles Diversion Facility. On a year-to-year basis, all relevant data gathered during the previous year would be reviewed, evaluated, and ultimately recommended to continue or discontinue through the Cooperative Decision Making Process as stated in the Robles biological opinion. In regard to site 5, the primary channel should be selected for measurement based on the expectation that a migrating steelhead will ascend the channel braid that carries the bulk of the flow.

Sandbar Impediment Monitoring

NMFS and CDFG agree with Casitas that impediment monitoring at Site 1 in Appendix 2 (Casitas 2010) is no longer necessary, but recommend that a single site be selected just upstream of the Highway 150 bridge as a replacement monitoring site that is consistent with site 4 identified by ENTRIX (1999). NMFS and CDFG Robles Biological Committee members (Mary Larson and Rick Bush) would like to accompany Casitas in the field for identification of this site.

Thompson Method (1972) Criteria

Thompson (1972) passage criteria for adult steelhead should be applied to the Ventura River at critical riffles including a water depth of 0.6-ft for 25% of the total transect width and a continuous portion equal to 10% of the width. NMFS previously commented on the limitations of the Thompson method used in the ENTRIX (1999) study, and the questionable modifications made to its criteria (i.e., 0.5-ft depth) for application to the Ventura River (NMFS 2003). The resulting minimum discharge should be equal to the critical-riffle measurement that presents the greatest passage difficulty, not by averaging results from all measurement sites. The results obtained from applying the 5-ft continuous length criterion should not be included in the 2011 data summary or analysis.

NMFS and CDFG greatly appreciate the opportunity to provide technical assistance to the District to ensure that the Robles Facility functions as analyzed in the March 31, 2003, biological opinion. Please contact Rick Bush at (562) 980-3562 to coordinate a field visit for site selection replacement of Site 1, or if you have any questions.

Sincerely,

for Rodney R. McInnis
Regional Administrator

cc: Scott Lewis, Casitas Municipal Water District
Mary Larson, California Department of Fish and Game
Bob Hughes, California Department of Fish and Game
Roger Root, U.S. Fish and Wildlife Service
Administrative file#: 151422SWR2002PR6168

Literature Cited

Casitas 2010. 2010 Robles Fish Passage Facility progress report. Casitas Municipal Water District, Oak View, CA.

ENTRIX, Inc.1999. Evaluation of natural passage barriers on the Ventura River downstream of the Robles Diversion. Prepared for Borcalli and Associates. December 2, 1999.

National Marine Fisheries Service. 2003. Biological opinion for the Robles diversion fish passage facility, Ventura River, CA. Protected Resource Division, Southwest Region, March 31, 2003.

Thompson, Ken. 1972. Determining stream flows for fish life. Proceedings from the Pacific Northwest River Basins Commission - Instream Flow Requirements Workshop. March 15-16, 1972.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802- 4213

2002/1871: RAB

March 22, 2011

Ned Gruenhagen
Bureau of Reclamation
South-Central California Area Office
1243 N Street
Fresno, CA 93721-1813

Dear Mr. Gruenhagen:

NOAA's National Marine Fisheries Service (NMFS) is contacting the Bureau of Reclamation (Reclamation) regarding the December 1, 2010, Robles Biological Committee (Committee) meeting for the Robles Diversion Fish Passage Facility (Facility). The Committee members in attendance included Ned Gruenhagen of Reclamation; Mike Gibson, Neil Cole, Scott Lewis of Casitas Municipal Water District; Mary Larson of California Department of Fish and Game (CDFG) and Rick Bush and Stan Glowacki of NMFS. Since the December 1, 2010, meeting, the Committee participated in a conference call with NMFS (Lee Harrison) and CDFG (Bob Hughes) hydrologists on February 1, 2011, to further refine the 2011 impediment evaluation monitoring. Please reference our letter of February 3, 2011, for our recommendations on this specific element of the Robles biological opinion (NMFS 2003) monitoring. A site visit was conducted on March 1, 2011, which allowed the new Committee members (Ned Gruenhagen and Rick Bush) to visit the seven 2010 impediment monitoring sites that have been re-proposed for monitoring in 2011. The attachment to this letter summarizes the meeting discussions pertaining to the 2010 Annual Report, and concludes with NMFS recommendations for the 2011 Monitoring and Evaluation Plan.

Please contact Rick Bush at (562) 980-3562 if you have any questions regarding the summary or if you would like additional information.

Sincerely,

for Penny Ruvelas
Southern California Area Office Supervisor
for Protected Resources

cc: Scott Lewis, Casitas Municipal Water District
Roger Root, U.S. Fish and Wildlife Service
Mary Larson, California Department of Fish and Game
Administrative file#: 151422SWR2002PR6168

NOAA's National Marine Fisheries Service' (NMFS) Summary of the Meeting Discussions Pertaining to the 2010 Annual Report for Operation of the Robles Diversion Fish Passage Facility

March 14, 2011

The following is a summary of the meeting discussions pertaining to the 2010 Annual Report (Report), and concludes with NMFS recommendations for the 2011 Monitoring and Evaluation Plan (Plan). This summary is based on discussion during the December 1, 2010, Robles Biological Committee (Committee) meeting for the Robles Diversion Fish Passage Facility (Facility). Additionally, this summary references discussion since the December 1, 2010, committee meeting, including a conference call with NMFS and CDFG on February 1, 2011, to further refine the 2011 impediment evaluation monitoring (see NMFS' letter of February 3, 2011, for specific recommendations on impediment evaluation monitoring), and a site visit on March 1, 2011, which allowed the new committee members (Ned Gruenhagen and Rick Bush) to visit the seven 2010 impediment monitoring sites that have been re-proposed for monitoring in 2011.

2010 Annual Report and Biological Meeting Summary

The central topics discussed during the Committee meeting include the upstream steelhead impediment evaluation in the Ventura River, fish attraction evaluation, upstream adult monitoring results and downstream smolt trapping.

Upstream steelhead impediment evaluation. — The 2010 monitoring season was the first year Casitas was able to collect a sufficient amount of impediment evaluation data at the 8 sites (i.e., critical riffles) selected by the Committee in 2009. A total of 48 water depth transect measurements were completed at Robles discharges that ranged from 25 to 100-cfs. The relationship between Robles discharge and water depth was plotted at the 7 riverine sites (sandbar results omitted). The transects that required the highest minimum discharge to meet the two Thompson criteria to determine the discharge needed for adult steelhead passage ranged from 79 - 123 cfs (Appendix 13, Site 5-1 excluded). In 2011, Casitas indicated they will measure site-specific discharge (at the selected monitoring sites) for the impediment evaluation monitoring. Casitas proposed the following site changes, 1) discontinue site 1 from evaluations, 2) move sites 2, 3, 4 upstream into the Robles Reach, and 3) move site 5 upstream near Santa Ana bridge. A Committee conference call was proposed with NMFS and CDFG hydrologist participation to discuss these changes in greater detail. The product of these meetings formed the recommendations that were conveyed to Casitas in the letter of February 3, 2011.

Fish attraction evaluation. — Fish attraction surveys in the 200-m reach downstream of the Facility were conducted on a weekly basis during the fish passage augmentation season from January through June 2010. Bank surveyors counted 1 adult steelhead, and snorkel surveyors enumerated a total of 53 juvenile *O. mykiss*. A total of 94 *O. mykiss* were observed in the 140-m reach upstream of the Facility (monitoring component added by Casitas in 2009). Following 2010 storm events, bank surveys were conducted three times per day when turbidity allowed per Committee recommendations. These surveys were conducted for three storm events and no adults were observed. Additional fish attraction survey modifications were discussed during the meeting that will be reiterated in the Monitoring Recommendation section of this letter.

Upstream adult monitoring results.— Casitas reported one 'adult' steelhead (estimated at 58-cm) observation in 2010, which passed through the Robles fish ladder on March 20, 2010. The Vaki Riverwatcher apparatus also documented 44 *O. mykiss* (and fish probable) ≥ 30-cm , of which 17 *O. mykiss* (and fish probable) were greater than 40-cm passing thru the Robles fish ladder during the steelhead migration and spawning season. The Report speculates that these fish are resident *O. mykiss* and hence their exclusion from the upstream adult steelhead count. In response to NMFS and CDFG disagreement over this anadromous versus resident life form uncertainty and unsubstantiated size cut-off of 40-cm, Casitas agreed to rewrite this section of the Report (Page 25-30) and submit a draft to the Committee using language that acknowledges that these adult *O. mykiss* may be adult steelhead. Casitas also agreed to provide a detailed data summary of the time the 58-cm adult steelhead spent in the Robles Facility from the time of initial observation until final upstream passage occurred (including any fall-backs). The third adult monitoring deliverable that NMFS requested at the meeting is the continuous Robles fish ladder turbidity record (i.e., raw data) from January 1 through June 30, 2010.

Downstream smolt trapping.— A modified fence weir trap was operated from March 16, 2010, through May 7, 2010, in the glide habitat immediately upstream of the Facility low-flow vehicle crossing. The trap wings that extend upstream to guide fish into the holding box stop short of the low-flow channel banks (approximately 1-meter) to allow for unimpeded adult steelhead passage. A total of five smolts were captured, and four of the smolts showed signs of descaling and skin damage to the head region. All fish were captured in the first week of trap operation. Casitas proposed to conduct their 2011 downstream fish passage evaluation in the same location as 2010. NMFS commented on the lack of suitable river noise (i.e., turbulence) and approach velocity in this reach, and questioned if there is a more appropriate trapping location that will produce better results. Casitas biologists indicated they feel they have situated the trap in the best possible location and that they are trapping effectively.

Similar to 2010, Casitas proposed to radio tag up to 15 steelhead smolts captured in the weir trap downstream of the Robles facility for the purpose of evaluating smolt migration from Robles to the estuary. Casitas has acquired fifteen ATS radio tags (~1-gram each) suitable for tagging *O. mykiss* weighing a minimum of 20-grams (tag weight will not exceed 5% fish weight). In addition to the 2010 tagging objectives, this year Casitas has requested to release eight of the radio tagged fish at a point on the mainstem Ventura River upstream of the Facility (e.g., Camino Cielo bridge) for the purpose of evaluating if the Fish Passage Facility functions and operates such that migrating smolts move through the facility in good physical condition (NMFS 2003). Casitas also asked the Committee for guidance on, 1) whether trapping should be discontinued if the Ventura River loses a surface connection downstream of the Facility, and 2) if both trap wings can be extended the entire distance to the river banks.

NMFS 2011 Monitoring Recommendations

Since the purpose of the Biological Committee is to serve an advisory role, NMFS requests that the schedule outlined in the NMFS (2003) biological opinion be adhered to in order to allow sufficient time for Committee review prior to the start of the monitoring activities. The opinion states that the Committee will meet annually each summer to review monitoring data from the preceding season's monitoring studies. Reclamation will submit the draft Plan to the Committee

for review on or before October 1 of each year. The Committee will have 1 month to review the Plan and submit recommended changes to Casitas. In addition to the annual Plan, Reclamation will prepare the annual progress Report. A draft Report will be provided by September 1 and the final will be completed by November 1.

With respect to the 2011 Plan, NMFS recommends the following monitoring activities to address the three main objectives outlined in the NMFS (2003) biological opinion:

1. Temporarily install an underwater video camera in the entrance pool focused on the open fish ladder entrance to conduct continuous *Fish Attraction Evaluation Monitoring* for the duration of all storm events (as defined in the biological opinion) and ramp down period (i.e., 12-days or less, unless overlapping storm events occur). Casitas agreed to write up this protocol at meeting.
2. Until sufficient scale and/or otolith analyses become available for reliably distinguishing juvenile and adult steelhead in the Ventura River, report all *Upstream Adult Monitoring* results such that *O. mykiss* ≥38-cm are classified as "adult steelhead" as defined in the 2011 Plan. Report all *O. mykiss* <38 to 20-cm as "adult *O. mykiss*", instead of "*O. mykiss* non-adult steelhead"; based on NMFS observations of 20-cm *O. mykiss* routinely spawning in the Ventura River watershed upstream of the Facility.
3. Report individual smolt fork length, weight and smolt index in *Downstream Fish Passage Evaluation* results instead of mean values.
4. Exclude Vaki Riverwatcher results and discussion for smolt emigration from Report Section 3.3 until the operating limits of the Riverwatcher are determined.
5. In regards to *Downstream Smolt Trapping*, NMFS agrees that tagged smolts should be released upstream of the Facility to assess if fish downstream migrants are successfully navigating through the facility and to evaluate fish damaged incurred during passage through the Facility. NMFS recommends PIT tags instead of radio tags be used for this specific monitoring activity for the following reasons: a) a larger percentage of the smolts could be tagged throughout the entire migration period which would provide better weir trap efficiency estimates (page 20, NMFS 2003), b) a greater size range of downstream migrants (74mm or larger) could be evaluated (Tatara 2009), and c) long-term survival estimates of salmonids tagged with gastrically implanted radio tags is lower relative to PIT-tagged fish (Hockersmith et al. 2000). Trapping from mid-March through June (or until water temperatures exceed a daily mean of 22° C) is acceptable regardless of the loss of a Ventura River surface connection downstream of the Facility.
6. In regards to *Downstream Fish Migration through the Robles Reach*, a pilot study using radio telemetry is agreeable with NMFS as long as a Ventura River surface connection with a depth of 0.5-feet is maintained for juvenile *O. mykiss* passage (Evans and Johnston 1980). If the mortality rate of radio tagged fish exceeds 2.4% (Hockersmith et al. 2000), NMFS should be contacted immediately and tagging activities should cease.
7. In the event the fence weir trap wings are extended the entire distance to both river banks, Casitas will need to modify the trap to allow for upstream passage of adult *O. mykiss*. The new trap modification will need to be approved by NMFS prior to operation.

Literature Cited

Evans, W.A. and B. Johnston. 1980. Fish migration and fish passage. USDA Forest Service, EM-7100-l2. Washinqton, D.C. 63 pp.

Hockersmith, E. E., W. D. Muir, S. G. Smith, B. P. Sandford, N. S. Adams, J. M. Plumb, R. W. Perry, and D. W. Rondorf. 2000. Comparative Performance of Sham Radio-Tagged and PIT-Tagged Juvenile Salmon. Report prepared for U.S. Army Corps of Engineers, Walla Walla District Contract W66QKZ91521282. December 2000. 36pp.

National Marine Fisheries Service. 2003. Biological opinion for the Robles diversion fish passage facility, Ventura River, CA. Protected Resource Division, Southwest Region, March 31, 2003.

Tatara, C. P. 2009. Size at Implantation Affects Growth of Juvenile Steelhead Implanted with 12-mm Passive Integrated Transponders. North American Journal of Fisheries Management, 29 (2), 417 – 422.

April 29th, 2011

Ned Gruenhagen
Bureau of Reclamation
South-Central California Area Office
1243 N Street
Fresno, CA 93721

Dear Ned,

This letter is in response to the NMFS and CDFG recommendation letter: SWR/2002/1871:RAB dated February 3rd of 2011 and NMFS' recommendation letter 2002/1871:RAB dated March 22nd of 2011. There are several issues related to the Robles Fish Passage Facility monitoring and evaluation studies that need to be addressed. Casitas' response regarding these issues has been included in this letter. In addition, there appears to be several instances where what was discussed in previous Biological Committee (BC) meetings was not characterized correctly by NMFS and CDFG. I have identified these below. It would seem a meeting of the Robles Biological Committee would be the most efficient manner to resolve these issues. Given that the issues are relevant to all future monitoring, and that this monitoring year is near the end, an expanded BC meeting could be conducted during the normal review process in the fall of 2011 to accommodate such a discussion. If BC committee members wish to do so, we could begin initial discussion sooner.

In reference to the NMFS letter dated February 3rd, 2011, pertaining to upstream fish migration impediment evaluations, below is Casitas' response to the four topics that comments and recommendations were provided.

Robles Reach Definition

The Robles Biological Opinion (BO) defines the Robles Reach as the 4 miles downstream of the Robles Fish Passage Facility (NMFS 2003; page 48); the downstream end of the reach is located upstream of Santa Ana Blvd Bridge. In an attempt to provide a convenient reference point to the Robles Reach, the confluence of San Antonio Creek was selected in the draft 2011 study plan (Lewis and Gibson 2011). This was not done to change the scope of the monitoring and evaluations required in the BO, but merely for identification convenience. Because the downstream end of the Robles Reach is located approximately 0.85 miles upstream of Santa Ana Blvd Bridge, perhaps the bridge would have been a better reference point to select. Because BO-required upstream and downstream fish passage monitoring and evaluation activities are clearly tied to the Robles Reach, further reference to the Robles Reach should be in agreement with the BO. As stated in the BO (NMFS 2003), "Conditions in this reach

[Robles Reach] have the greatest potential for low flows to impede upstream fish passage." The Robles Reach is a wide alluvial section of the Ventura River that is composed of active wash deposits of unconsolidated silt, sand, gravel, and boulders (Tan and Jones 2006). Due to this channel morphology and geology, alluvial channels like the Robles Reach have high infiltration rates that cause channel surface flow to rapidly recede and cease shortly after storm events (Cooke et al. 1992). Extending the downstream end of the Robles Reach to the confluence with San Antonio Creek would change the scope of BO monitoring and evaluations. The hydrology of Ventura River as it approaches San Antonio Creek is significantly different from the BO-defined Robles Reach. In fact, emerging groundwater makes the Ventura River perennial during most years in this area while the Robles Reach experiences annual dry channel conditions.

Impediment Monitoring Site Selection

As stated in the Casitas email to BC members dated March 4th, the impediment sites will continue to be monitored with some changes due to the March 20th high flows.

Site 2—The March 20th high flows changed site 2 substantially. It no longer appears to be a potential impediment. Three new channels were created through the site. A new site should be selected in the Robles Reach to replace this site. We are not currently monitoring this site.

Site 3—The high flows caused significant scour at the upstream end of where the two channels split. This has changed the primary channel to the left (looking upstream). Now there is approximately 80% of the flow in this new primary channel. After determining this, a new impediment site was selected (see Photo 1) on March 27th and monitoring began on March 28th. Casitas reasoned that a new site needed to be selected immediately to take advantage of post-storm flows rather than going through a likely long Biological Committee selection process and lose a data collection opportunity. Data detailing the new site and 2011 summaries will be included in the 2011 progress report for review by the BC.

Site 4—Some change occurred at this site, but not enough to require monitoring changes; monitoring has continued.

Site 5—The primary channel has now moved to the left channel. High flows scoured the old secondary channel and now approximately 60-70% of the flow is now in this new primary channel. Monitoring has continued, but now only in the new primary channel.

Site 6—Significant change occurred at site 6. A new channel was cut on the left side very near where the transect was located. Monitoring has continued, but the transect line was moved upstream approximately 20 ft to include the new channel.

Site 7—Little change occurred at this site and monitoring has continued.

Site 8—Little change occurred at this site and monitoring has continued.

Site-Specific Discharge Measurements

As normal procedure, during all impediment transect measurements, water velocity is also recorded so that discharge can be calculated. However, because site conditions (i.e., passage channels with certain water depths) are assumed to be the critical measurement to correlate with discharge from the Robles Fish Facility, it was believed that modeling directly between Robles discharge and site depth (Model 1) would include other sources of variability. By simply separating Model 1 into different models (i.e., site discharge and site depth, then Robles discharge and site discharge) does nothing to improve the analysis. The two models will each have less variability than Model 1, but only because the variability from Model 1 has been partitioned between two models; this is simply an unnecessary step and does not improve the current method. To test just that conclusion, the method as was discussed on the conference call on January 19th with BC regular members and NMFS and CDFG hydrologists and recommended in the February 3rd NMFS/CDFG letter, was applied to selected impediment sites. Sites 4, 6, 7, and 8 provided the best data sets to reanalyze because they showed good correlation with only one year of data collection. A site discharge and site depth model (Model 2) was first developed for each site, then a criteria of 10 ft width with 0.6 ft depth (Harrison et al 2006) was applied to estimate the site discharge needed to meet this criteria. A Robles discharge and site discharge model (Model 3) was then developed. The resulting estimated discharge from Model 2 was then run through Model 3 to estimate the Robles discharge needed for the site discharge to meet the criteria. This method was then applied to all four sites and the resulting Robles discharge for each site, using both methods, were compared (Table 1). The mean difference between the two model methods was 2.8 cfs. The greatest difference was for Site 4, where 6 cfs more was needed to meet criteria using Model 1; however, the overall differences between the two methods were relatively small.

Table 1. Discharge (cfs) from Robles Needed to Meet a 10 ft Width @ 0.6 ft Depth Criteria.

Site	Model 1 (cfs)	Model 2+3 (cfs)	Difference (cfs)
4	77	71	6
6	58	53	5
7	33	34	-1
8	30	29	1
		Mean	2.8

Casitas agrees that comparing site discharge with Robles discharge provides information about basin-scale hydrology; however, this is not necessary if the steelhead passage conditions at a potential impediment site are the primary interest. It is not clear to Casitas how understanding the general hydrology patterns will help directly determine the passage conditions at any particular impediment site in the Ventura River. The Robles BO operation criteria, related to fish passage augmentation flows, are controlled at the Robles Fish Facility. This is the only location where flows can be manipulated and therefore correlating back to this location directly, using a method as described for

Model 1, is the most direct approach. It's clear that the farther downstream a site is from Robles, non-project related factors such as losing and gaining reaches, urban drains, tributaries, ground water pumping, and effluent, increase the variability of any model developed. For these reasons, Casitas believes that the current method agreed to by the BC members in 2009 continues to be the best method and should be applied to sites in the Robles Reach.

Data Variability

Regarding the "high degree of scatter" of the first year of data in appendices 3-10, after further review of the data, it was determined that many of the Robles discharges used in the correlation were incorrect. This was because the mean daily discharges were used and no adjustment for hydraulic lag-time was included. During days when a post-storm ramp-down occurred, discharge changes normally occurred at 1200 h. Therefore, the mean discharge for a ramp-down day was the average of the two discharge numbers. In addition, depending on what time of the day an impediment site was measured and how far downstream from Robles it was, the discharge from Robles that resulted in the site conditions at the time of the measurement was at times incorrect. To correct this problem, the measurement time for all impediments was determined, and accounting for the distance downstream of Robles, a back calculation was done to determine what the discharge was at Robles. Based on observed changes in discharge measured at Robles after a change was made at Matilija Dam, a hydraulic travel time of 2.0 km/hr was estimated and used for making these corrections. Of the 48 total impediment measurements, 40 were corrected using this method. The corrections ranged from 1 to 14 cfs and the mean difference was 2.5 cfs; however, 7 measurements had a difference of 10-14 cfs. This corrected Robles discharge data resulted in a moderate improvement in the analyses. The final 2010 progress report will included all of these corrections and all future analyses will used this more accurate method of estimating Robles discharge at downstream sites. In addition, the hydraulic lag-time of the Robles Reach will continue to be updated and improved as data becomes available.

Primary Channel Selection

Casitas agrees that the primary channel should be selected for monitoring and will implement that recommendation as it applies to the Upstream Fish Migration Impediment Evaluation.

Sandbar Impediment Monitoring

The hydraulic conditions of the Ventura River as it passes over its sandbar are variable to say the least. Seasonal, tidal, and the aforementioned basin factors control the site conditions. For example, during one low-tide sampling event, the discharge at Robles was only 3 cfs while over 40% of the sandbar had measured depths greater than 0.6 ft deep. During subsequent high tides, the water over the sandbar at times was so deep that it was not even safe to enter and measure depths. For these reasons, it was clear

that the sandbar did not represent a potential impediment to upstream migrating steelhead and ultimately why it was recommended for elimination as a monitoring site. However, given that there are already seven sites, Casitas does not see the need for a replacement site in the Robles Reach (also see justification below in *NMFS' Modified Thompson Criteria*).

Thompson Method (1972) Criteria

Passage Criteria

Based on the first sentence in paragraph 3 on page 2 of NMFS and CDFG's February 3rd letter, it appears they are recommending that the Thompson (1972) criteria be used to evaluate potential passage impediments—**Casitas respectfully requests BOR to confirm this with NMFS and CDFG?** Previously, NMFS and CDFG have been reluctant to discuss which passage criteria they would ultimately recommend. However, during the January 19th BC conference call, NMFS and CDFG representatives suggested that a draft review document (SWRCB 2008) would be used for recommending passage criteria—**Casitas respectfully requests BOR to confirm with NMFS and CDFG that they are no longer recommending the criteria in the SWRCB (2008) document?** The SWRCB document was sent via email to Casitas by CDFG, therefore clarification is needed. It is difficult to analyze the impediment data without a clear criteria to apply. The application of several passage criteria in the draft 2010 progress report was done to simply show the range of possible results using previously used criteria. The questions related to criteria selection are important to Casitas as we move through the BO evaluation process. Casitas also has concerns about the limitations of the Thompson (1972) criteria, as well as other potential criteria, and how applicable they are to the Ventura River and believes an objective discussion is warranted. Casitas would like to have direct discussions with BOR, NMFS, and CDFG related to final criteria selection through the Cooperative Decision Making Process. We believe final criteria selection will expedite the evaluation process by providing a clear framework for all future impediment analyses.

ENTRIX Study

It appears that NMFS and CDFG may not clearly understand the results of the ENTRIX (1999) study, not only in their recent letter, but in previous letters and discussions as well. Because of this, Casitas felt a brief discussion of the study would be beneficial for clarification and future discussions related to the study and subject.

ENTRIX (1999) used the criteria developed by Thompson (1972) for adult steelhead at critical riffles, which is a water depth greater than or equal to 0.6 ft for 25% of a total transect width and a continuous portion equal to 10% of the width. ENTRIX also evaluated the critical riffles using a modification of a 0.6 ft water depth over a continuous width of 8 ft. The transect that required the highest minimum discharge to meet the two criteria were used to determine the discharge needed for adult steelhead

passage, which ranged between 40-65 cfs. In paragraph 3 on page 2 of the February 3rd letter, NMFS and CDFG questioned ENTRIX's modifications to the Thompson criteria. First, the 0.5 ft depth criterion modification was conducted and included in the final report; however, the results were not included in the final minimum flow conclusions. Additionally, the 40 cfs was the result of the 8 ft wide modification and the 65 cfs was the result of the 25% width, both at 0.6 ft of depth (ENTRIX 1999). It appears that during the development of the initial minimum flows for the Robles BO, NMFS may have averaged these two numbers to come up the initial minimum discharge of 50 cfs (NMFS 2003). However, it's not entirely clear to Casitas how NMFS decided on this flow rate.

NMFS' Modified Thompson Criteria

The 3rd sentence of paragraph 3 on page 2 of NMFS and CDFG's February 3rd letter, appears to be recommending a modified Thompson criteria be used for Robles BO impediment evaluations that does not average all impediments for a final flow determination. The Thompson (1972) method clearly states that "The results averaged from all transects is the minimum flow we have recommended for passage." Casitas feels that in a geomorphically variable river channel like the Ventura River, averaging the impediments would be more representative of likely potential impediments over a longer period of time. Basing future minimum discharge on a single transient channel feature seems to lack understanding of the dynamic nature of the fluvial process. As the March high-flow event clearly demonstrated, basing all future Robles operations on one site that might not exists in the near future, is questionable. However, if NMFS and CDFG are only interested in the most restrictive site, Casitas sees little need to evaluate all seven potential impediment sites. Several sites could be eliminated because it is evident, even with one year of data, that they are not as restrictive as others. Casitas believes that monitoring several sites best represents potential Ventura River passage impediments. Furthermore, if all seven sites are to be monitored, then the mean discharge should be calculated and used to determine minimum passage discharge from Robles.

5 ft Width at 0.6 ft Depth Criteria

As stated during the conference call on January 19th, Casitas would review the citation used for the 5 ft width at 0.6 ft depth criteria in Appendix 13 and make any changes necessary for the final report. In the text of the progress report, the proper citations were applied and the two citations were unintentionally switched in the table. The table will be corrected for the final report. More importantly however, it appears that NMFS and CDFG were implying that passage criteria that have not been applied in previous evaluations should not be used on the Ventura River and suppressed from the progress report, which seems irrational. If a new criterion or method is used, simple logic and justification for its use is all that is needed for inclusion into this type of report. It should be obvious, but all new criteria or methods were used for a first time initially.

In reference to the NMFS' letter dated March 22nd, 2011, pertaining to comments for the draft 2010 progress report and 2011 study plan, below is Casitas' response to the topics for which you provided comments and recommendations.

2010 Annual Report and Biological Meeting Summary

Upstream Steelhead Impediment Evaluation—Regarding sites 2, 3, 4, and 5, Casitas continues to believe that relocation for the previously describe reasons (at the December BC meeting and subsequent meetings) is still warranted. Also, see Casitas' response in previous sections above.

Fish Attraction Evaluation—See below in response # 1.

Upstream Adult Monitoring Results—Casitas agreed to rewrite this section of the draft progress report to incorporate NMFS and CDFG's level of uncertainty and submit that section before finalization. Casitas agreed to include a table of dates, times, and locations of the one adult steelhead observed migrating through the Robles Fish Facility in 2010. Casitas also agreed to include the percentage of time the Riverwatcher was not operation due to high turbidity, but not produce the raw turbidity data. It's not clear to Casitas if NMFS wants the raw turbidity data sent to them, or include it on a graph or table in the final progress report. **Casitas respectfully requests BOR to confirm with NMFS on this recommendation?**

Downstream Smolt Trapping—Yes, NMFS did suggest that the current trap location was not producing sufficient capture rates. However, as stated at the December BC meeting, there have not been a sufficient number of downstream migrating smolts when the trap was in and operational to come to that conclusion. During the first year (2009) of trap operation at the current location, NMFS requested that Casitas remove the trap due to loss of a surface water connection in the Robles Reach. This was before the peak count of *O. mykiss* in the area even occurred. During 2010, the total of potential downstream migrating smolts was substantially less, yet 5 smolts were still captured. During the review process for the draft 2011 progress report, we will have the opportunity to more thoroughly discuss the results of the trapping at this location.

Regarding the release location of the radio-tagged smolts, it is not accurate for NMFS to portray the proposal of an upstream release location entirely as Casitas'. Initially, the BC had discussions during 2009 about improving our understanding of downstream smolt passage through the facility. It was at that time discussions about releasing some of the tagged smolts upstream of the facility to gain information on these topics of interest initially occurred. Also at that time, BOR discussed funding additional telemetry equipment to allow a fixed station to be placed near the Robles Fish Facility. During the December 2010 BC meeting, we again discussed this topic collectively and all members contributed to the development of the modification. Therefore, to suggest that this was a Casitas request is not acknowledging NMFS and CDFG's involvement.

NMFS 2011 Monitoring Recommendations

Regarding draft report submittal, review, and finalization process, discussions at the 2009 BC meeting included a request by Casitas to change the submittal date of the draft progress report to October 1st along with the study plan. NMFS indicated at the meeting that if BOR would send NMFS a letter requesting the change, NMFS would likely accommodate that request. Due to changing BOR and NMFS representatives, apparently this is has "fallen through the cracks". More time is needed by Casitas to compete the annual data summaries, analyses, and draft report preparation. June 30th is the end of the BO described monitoring year, this provides only two months for preparation before September 1st, while providing BC members one month for review. Casitas would like to again discuss adjusting the draft submittal date with BOR, NMFS, and CDFG.

1) Casitas did not agree to underwater video camera monitoring as NMFS suggested. During the meeting, a discussion occurred related to the one adult steelhead observed during 2010 in the Fish Attraction study reach downstream of the facility. From that discussion, Casitas agreed to temporally install an underwater camera at the fish ladder entrance if an adult was again observed in the downstream study reach. The camera would remain in place for 7 days or until the adult was observed passing through the Riverwatcher. In addition, Casitas agreed to conduct fish attraction bank surveys two times per day if an adult steelhead was observed, again for 7 days or until it passes through the Riverwatcher. This would allow information to be gained as to how long an adult steelhead might hold downstream of the ladder before passing upstream.

2) It appears that there is some disagreement about what an adult steelhead fundamentally is. To Casitas' knowledge, an adult steelhead is only an *O. mykiss* that has entered the marine environment, matured, and returned to freshwater to spawn. Excluding half-pounders and other less prevalent life history patterns, this seems to be the clear definition of an adult steelhead in the literature. Casitas clearly stated in the draft 2010 Progress report that there was evidence of extensive resident *O. mykiss* spawning in the Ventura River basin during 2009 and 2010 and was not suggesting that *O. mykiss* in the 20-45 cm range were not mature/adult *O. mykiss*. Casitas was simply saying that due to the preponderance of evidence, they were most likely resident *O. mykiss* and not anadromous steelhead. For NMFS to suggest that "Until sufficient scale and/or otolith analyses become available…" that all *O. mykiss* larger than 38 cm should be classified as adult steelhead is contradictory with available evidence. On the Santa Ynez, for example, of the 16 adult steelhead captured in traps, the smallest adult was 49.6 cm (Scott Volan, Cachuma Operation & Maintenance Board, personal communication). NMFS must remember that Casitas' classification using the 38 cm threshold also includes other components (see draft 2011 study plan excerpt below). It seems clear that steelhead progeny will remain in the Ventura River, mature, and spawn as residents. Perhaps through more discussion among the BC members, an agreeable classification could be developed by all members through the Cooperative Decision Making Process.

Each upstream and downstream Riverwatcher detection will be reviewed and classified as an adult steelhead, *O. mykiss* non-adult steelhead, other species if fish are identifiable, fish unknown, fish probable, or false detection (Figure 3). The classifications will be determined by using the combination of silhouette images, estimated lengths, and video clips. In addition, if larger adult sized *O. mykiss* are detected, a measurement of eye diameter and standard length (SL) will be estimated from the video clip to calculate morphometric ratios that will be compared to known steelhead and rainbow trout. A commonly used method is to develop ratios of body measurements for comparison so that the effects of body size can be removed and actual differences can be determined (Strauss and Bond 1990). This will be accomplished by comparing SL to the ratio of eye diameter and SL in linear regression. Standard length is the length from the snout to the end of the hypural plate near the end of the fleshy caudal peduncle, which is unaffected by caudal fin deformities (Anderson and Neumann 1996). The adult steelhead classification will be used if the fish observed is an *O. mykiss* and displays the typical characteristics of an adult steelhead, such as black spotting on dorsal, adipose, and caudal fins, black spotting on dorsal side of body, slivery body, vertical posterior edge to caudal fin, ≥ 38 cm TL (Shapovalov and Taft 1954), and has an eye diameter/SL ratio ≤ 0.045 (CMWD 2008). *O. mykiss* non-adult steelhead classification will be used if the fish observed is an *O. mykiss* and displays the characteristics of a resident *O. mykiss*: lobed caudal fins and darker color. Because of the difficulty in distinguishing between resident and anadromous *O. mykiss* of smaller sizes, no further classifications will be used for *O. mykiss*. Even though many, if not most, of the *O. mykiss* documented are likely to be smolting, the uncertainty remains. Conceivably, after more data has been collected from the downstream trapping component of the monitoring and evaluation, a more detailed classification of Riverwatcher detections can be made in the future. (see draft 2011 study plan for citations)

3) Casitas will report individual smolt lengths, weights, and smolt index in future reports as NMFS has recommended.

4) NMFS' recommendation to completely eliminate any data and discussion related to downstream Riverwatcher detections seems illogical and unsubstantiated. The working limitations of the Riverwatcher have been evaluated and described in previous reports. As time permits, additional evaluations will be conducted to better understand the full limitations of the technology. However, Casitas has been clear about the uncertainty of the data recorded by the Riverwatcher, which is part of the scientific process, and simply suppressing it is unwarranted. All BC participants must remember that the Riverwatcher manufacturer did not design the equipment to be used for detecting smaller fish, in this case downstream migrating smolts.

5) Also see comments in *Downstream Smolt Trapping* section above. Casitas agrees that PIT-tagged smolts released upstream of the Robles Fish Facility would provide useful data to evaluate Robles downstream passage. However, the resolution of information would be much better using radio telemetry methods. With PIT tagging, only the travel time from the release point to the PIT tag antenna in the crowder and from the crowder to the smolt trap could be determined. Using telemetry, a fine-scale migration behavior could be developed. For clarification, radio-tagged smolts released upstream were not intended to be used for determining any Robles Fish Facility passage injuries. Regarding NMFS' reasons for recommending PIT tagging over telemetry: a) Casitas agrees that a larger percentage of smolts could be tagged and used for the evaluation. However, as stated by Casitas previously, the trap efficiency is

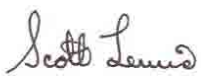
not necessary to conduct the related studies. Trap efficiencies are used for determining total smolt emigration and that is not the objective of the evaluations. b) Casitas agrees that smaller *O. mykiss* could be tagged using PIT tags; however, parr-sized *O. mykiss* have not been observed migrating downstream through the Robles Fish Facility during the last five years of evaluations. c) Casitas agrees that the long-term survival of PIT-tagged fish is much better; however, the passage of smolts through this proposed study reach would likely be rapid and well with in the acceptable range. Regardless of our exact agreement about the usefulness of the two methods, Casitas will agree to PIT tagging the smolts and releasing them upstream as previously discussed. Casitas also agrees to continue smolt trapping regardless of a surface water connection through the Robles Reach. However, this seems contrary to NMFS' # 6 recommendation.

6) Casitas agrees to continue radio tagging downstream migrating smolts to determine the Robles Reach passage behaviors. The exact method for applying the 0.5 ft criterion NMFS cited in their letter could not be located through a standard literature research. If NMFS could send Casitas an electronic copy if available, it would be greatly appreciated.

7) If needed, Casitas will agree to extend the smolt trap wings to each bank and make accommodations for upstream passage of *O. mykiss*.

Casitas is committed to conducting the monitoring and evaluation of the Robles Facility as specified in the Biological Opinion and participating in the Cooperative Decision Making Process to further improve aspects of studies as needed. If BOR, NMFS, or CDFG would like to discuss any of these issues further, please contact me at your convenience.

Respectfully,



Scott Lewis

Fisheries Program Manager
Casitas Municipal Water District
1055 Ventura Ave.
Oak View, CA 93022

Office: 541-546-0903
Cell: 805-798-7459
Email: slewis@casitaswater.com

CC: Rick Bush, National Marine Fisheries Service
Mary Larson, California Department of Fisheries and Wildlife

Literature Cited

Cooke, R. U., A. Warren, and A. S. Goudie. 1992. Desert geomorphology. UCL Press, London.

ENTRIX. 1999. Evaluations of natural passage barriers on the Ventura River downstream of Robles Diversion. Entrix, Walnut Creek, CA.

Harrison, L. R., E. A. Keller, E. Kelley, and L. A. K. Mertes. 2006. Minimum flow requirements for southern steelhead passage on the lower Santa Clara River, CA. University of California, Santa Barbara.

Lewis, S. D. and M. W. Gibson 2011. 2011 monitoring and evaluation study plan for the Robles Fish Passage Facility and related studies (draft). Casitas Municipal Water District, Oak View, CA.

National Marine Fisheries Service. 2003. Biological opinion for the Robles diversion fish passage facility, Ventura River, CA. Protected Resource Division, Southwest Region, March 31, 2003.

State Water Resources Control Board (SWRCB). 2008. Protectiveness of draft guideline alternatives. Appendix G, Approach for assessing effects of policy element alternatives on upstream passage and spawning habitat availability *in* North coast instream flow policy: scientific basin and development of alternatives protecting anadromous salmonids. California State Water Resources Control Board, Sacramento, California.

Tan, S. S., and T. A. Jones. 2006. Geologic map of the Matilija 7.5' quadrangle Ventura County, California: a digital database. Version 1.0, Los Angeles, CA.

Thompson, K. 1972. Determining stream flows for fish life. Pacific Northwest River Basins Commission, instream flow requirements workshop. Portland, Oregon. Proceedings: 31-50.

Photo 1. Photo of new site 3 looking downstream. Water is moving from right to left and across the transverse riffle/rapid. The yellow line represents approximate location of transect.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

2002/11871: RAB

JUN 22 2011

Ned Gruenhagen
Bureau of Reclamation
South-Central California Area Office
1243 N Street
Fresno, CA 93721-1813

Dear Mr. Gruenhagen:

NOAA's National Marine Fisheries Service (NMFS) is contacting the Bureau of Reclamation (Reclamation) regarding the draft 2010 Robles Fish Passage Facility Progress Report (Report). Scott Lewis of Casitas Municipal Water District (Casitas) redistributed the draft Report to the Biological Committee (Committee) members on May 23, 2011, for review. NMFS has completed our review of the document. Although NMFS is pleased to find that several of the concerns expressed in NMFS' letter of Mar 22, 2011, have been adequately addressed, the draft Report continues to contain information that requires revision and clarification. In this context, the attachment to this letter describes NMFS' specific remaining concerns with the draft Report and includes recommendations for revision. Once NMFS' comments have been addressed and the recommended revisions incorporated, the revised draft Report should be submitted to NMFS for further review.

Please contact Rick Bush at (562) 980-3562 if you have a question regarding the summary or if you would like additional information.

Sincerely,

Penny Ruvelas
Southern California Area Office Supervisor
for Protected Resources

cc: Scott Lewis, Casitas Municipal Water District
Roger Root, U.S. Fish and Wildlife Service
Mary Larson, California Department of Fish and Game
Administrative file#: 151422SWR2002PR6168

NOAA's National Marine Fisheries Service' (NMFS) Comments on the 2010 Draft Annual Report for Operation of the Robles Diversion Fish Passage Facility

June 16, 2011

The following is a summary of the draft 2010 Annual Report (Report). This summary is based on discussion during the December 1, 2010, Robles Biological Committee (Committee) meeting for the Robles Diversion Fish Passage Facility (Facility), and the May 23, 2011, draft Report revisions. Additionally, this summary references Casitas Municipal Water District (Casitas) letter received by NMFS on May 9, 2011.

NMFS experienced difficulty in comparing the draft Report to the older version because the changes Casitas made to the original document are not shown on the new draft. NMFS was asked to confine our review to pages 25-30 for changes made to the document; however, numerous sections in the Report were found to contain changes to the data figures presented without any justification for the changes. NMFS disagrees with Casitas that the Report is ready to be finalized. NMFS would like to see a working draft document detailing all of the May 23, 2011, edits that were made to the original, and our comments below incorporated before finalizing the document. NMFS has organized our comments below according to the order that the information is presented in the draft Report.

1. The description of the Robles Reach has changed in the latest document. The description of the Robles Reach in the previous Report indicated the reach extends 10-km downstream of the Facility. In the latest Report, the Robles Reach is now defined as extending 6.5-km (p. 6) downstream of the Facility. Regardless of how the Robles Reach is defined (addressed in our February 3, 2011 letter), NMFS continues to recommend that the critical riffle monitoring should continue to occur at the 7 sites that were previously selected by the biological committee using the Cooperative Decision Making Process described in the biological opinion (NMFS 2003). Since the selected impediment sites will be surveyed over a period of 3 to 4 years given the natural variation of water conditions (p. 8), continuing to relocate the sites and extend the duration of this monitoring element is illogical.
2. Based on our review of Mosley (1982), this paper does not provide any analytical data that support the statement made in the Report (p. 7) that adult steelhead successfully navigate through riffles measuring less than 0.6-ft deep. The author simply comments that he has observed jetboats and trout passing riffles of about 0.1-m deep. Mosley concludes by stating that empirical data for minimum passage depths must be more rigorously evaluated.
3. The resulting minimum discharge estimate has apparently changed from 43-62 cfs to 27-60 cfs in the latest version of the document (p.13) without any explanation for the reduced figures. Clarification is needed as to why 4 criteria are being referenced when a comparison is being made to the Entrix (1999) results that were calculated using the Thompson (1972) methodology of 0.6-ft at 25% width, and 0.6-ft over a continuous width of 8-ft.
4. In regard to the Vaki Riverwatcher (Vaki) discussion (p. 24), the statement, *"Even though many, if not most, of the O. mykiss documented were likely smolting"*, is uncorroborated information that should be excluded from the report. Unlike smolt trap captures that are visually categorized using a smolt index, the Vaki apparatus is unable to perform a reliable

assessment to determine whether fish are "smolting". As noted on the same page, *"after more data have been collected from the downstream trapping component ... a more detailed classification of Riverwatcher detections can be made."* NMFS recommends including a comparison table in the Report of daily smolt trap captures and Vaki detections of suspected smolts to allow the reader to make a direct comparison of the efficacy of the Vaki technology for documenting outmigrating smolt.

5. Casitas cites Shapavolov and Taft (1954) as justification for their adult steelhead size classification (p. 24), but close inspection of Shapavolov and Taft does not support Casitas' rationale. According to Shapavolov and Taft, in practically all cases sea-run fish are more than 300-mm in [fork] length and juveniles, stream fish, and resident fish are less than 300-mm in length. Shapavolov and Taft summarized 9-years of data to determine that the **mean size of Age-2** (1-yr stream/1-yr ocean) returning adult steelhead captured in Waddell Creek was 38-cm for males, and 40-cm for females. Therefore, many of the age-2 steelhead were smaller than 38-cm. The average 2-year old adult measured <38-cm for two of the study years. NOAA-NWFSC Tech Memo-27 suggests that southern California steelhead adults are likely spawning as 2-year-olds (1/1) in our region due to rapid freshwater growth rates (Busby et al. 1996). NOAA Fisheries biologists have determined that there is almost no overlap in the size distributions of anadromous adult steelhead (typically >35-cm) and *O. mykiss* that have not gone to sea (<25-cm) in central California coastal streams (Hayes et al. 2004, Pearse et al. 2009). Therefore, NMFS reiterates that the current methodology used by Casitas to document returning adult steelhead migrating through the Robles fish ladder does not accurately reflect the best available science.

6. The Fish Passage Monitoring results section (p. 26) still indicates with certainty that only one "*adult steelhead*", and 53 *O. mykiss* "*non-adult steelhead*" passed upstream through the Robles Facility fish ladder in 2010. The Vaki data presented in Appendix 25 suggest that many (44 > 30-cm, of which 17 ≥ 40-cm) of the fish classified as "*non-adult steelhead*" would likely be classified as adult steelhead based on the 9-years of scale analysis presented in Shapavolov and Taft (1954). NMFS requests that Reclamation correct this discrepancy, or provide the "preponderance of evidence" that was referenced in the Casitas May 9, 2011, letter used to ascertain that these fish were resident fish instead of anadromous steelhead.

7. NMFS recommended that Casitas rewrite Section 3.3 Fish Passage Monitoring (p. 25-30) to clarify the uncertainty that exists in regards to Casitas' exclusion of possible adult steelhead from their data summary. However, no changes were made to the discussion section (p. 30 - 31) that summarizes Casitas' biased explanation of the data. Specifically, Casitas classified 44 upstream migrating adult *O. mykiss* measuring 30 - 46cm as "*not considered to be adult steelhead*", which contradicts the best available science using scale analysis that indicates fish in this size range are often adult steelhead (Shapavolov and Taft 1954, Hayes et al. 2004, Pearse at al. 2009). In arriving at this conclusion, Casitas appears to rely upon circular logic, citing a separate Ventura River report authored by their in-house biologists that hypothesized that most of the spawning that occurred in the watershed in 2010 was credited to resident *O. mykiss*. No biological data was analyzed by Casitas (e.g., scales, DNA) because no datum is presented that would support this inference. By excluding all 44 of these fish from the anadromous steelhead spawning population, Casitas makes the assumption that age-2 steelhead do not spawn in the Ventura River. This assumption directly contradicts NMFS' assessment (which led to the listing of the species) that age-2 steelhead likely contribute

more in the southern California Distinct Population Segment than they do in northern populations (Busby et al. 1996).

8. Casitas also referenced the length-frequency data (p. 79) to base their exclusion of any potential age-2 adult steelhead from their Vaki detections. NMFS cautions that a single data point (i.e., 58-cm) on a length-frequency distribution does not reveal a bimodal distribution. NMFS reminds Reclamation that the Vaki failed to detect the downstream passage of that same 58-cm steelhead. Failure to randomly detect all adult fish using the Vaki system creates a biased length-frequency distribution of limited usefulness. Because larger fish are more powerful swimmers than smaller fish, which imparts the ability to migrate during periods when river discharge and turbidity concentrations are exceedingly elevated, the possibility exists that additional adults could have passed the Facility undetected. As described in the Report, the total time the Vaki was not operational because of high turbidity was 5.5 days, plus another 8-hrs when the system was removed from the fishway for cleaning.

9. Review of the Ventura River Flow Assessment in Appendix 27 (p. 83) indicates that the Ventura River experienced two threshold storm events in 2010 that required Casitas to augment streamflow downstream of the Facility for steelhead passage (NMFS 2003). Therefore, Casitas operation of the Facility provided steelhead with approximately 22 passage days when flow released downstream of Robles was $\geq$ 50-cfs. Assuming that the Vaki was non-operational for six of the days coinciding with the highest flow (i.e., highest turbidity and debris load), the Vaki may have been operable a little under 75-percent of the time when Casitas was augmenting flow for steelhead passage. Further review of Appendix 27 indicates that the highest flow recorded in the fish ladder was 41-cfs, and averaged approximately 36-cfs during the flow augmentation period. NMFS is interested to know why the entire 50-cfs augmentation flow was not routed through the fish ladder in 2010 as it was during the 2011 "fish flow operations" season?

Literature Cited

ENTRIX. 1999. Evaluations of natural passage barriers on the Ventura River downstream of Robles Diversion. ENTRIX, Walnut Creek, CA.

Hayes, S. A., M. H. Bond, C. V. Hanson and R. B. MacFarlane. 2004. Interactions between endangered wild and hatchery salmonids: can the pitfalls of artificial propagation be avoided in small coastal streams? Journal of Fish Biology: 65 (Supplement A), 101–121.

Mosley, M. P. 1982. Critical depths for passage in braided river, Canterbury, New Zealand. New Zealand Journal of Marine and Freshwater Research, Vol.16:351-357.

NMFS. 2003. Biological opinion for the Robles diversion fish passage facility, Ventura River, CA. Protected Resource Division, Southwest Region, March 31, 2003.

Busby, P. B., T. C. Wainwright, G. J. Bryant, L. J. Lierheimer, R. S. Waples, F. W. Waknitz, and I. V. Lagomarsino. 1996. Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-27: 261pp.

Pearse, D. E., S. A. Hayes, M. H. Bond, C. V. Hanson, E. C. Anderson, R. B. Mac Farlane, and J. C. Garza. 2009. Over the Falls? Rapid Evolution of Ecotypic Differentiation in Steelhead/ Rainbow Trout (*Oncorhynchus mykiss*). Journal of Heredity: 100 (5): 515–525.

Shapovalov, L., and A. C. Taft. 1954. The life histories of the steelhead rainbow trout (*Salmo gairdneri gairdneri*) and silver salmon (*Oncorhynchus kisutch*). California Department of Fish and Game, Fish Bulletin 98: 375pp.

Thompson, K. 1972. Determining stream flows for fish life. Pacific Northwest River Basins Commission, Instream Flow Requirements Workshop Proceedings: 31-50. Vancouver, WA.

Casitas Municipal Water District
1055 Ventura Ave.
Oak View, CA 93022
805-649-2251

11 August 2011

Ned Gruenhagen
Bureau of Reclamation
South-Central California Area Office
1243 N Street
Fresno, CA 93721-1813

Dear Ned,

This letter is a response to the NMFS recommendation letter: 2002/11871:RAB dated June 22nd of 2011, which was pertaining to the 2010 progress report for the Robles Fish Facility. There were numerous issues related to the Robles Fish Passage Facility monitoring and evaluation studies that NMFS commented on in their letter that need to be addressed. Casitas' response regarding these issues has been included in this letter.

In generally, NMFS appears to have spent little time reading, or did not understand, the Casitas letter dated April 29th, 2011. Many of NMFS' recommendations or requested clarifications appeared to be addressed in the Casitas April 29th letter. Therefore, where appropriate, the pertinent sections of that letter were reproduced in this letter. NMFS included several new comments on topics that they had previously reviewed in the first draft of the progress report, but did not provided comments for at that time. NMFS also included comments or recommendations that altered what they have previously stated. This indecisive approach by NMFS has caused the finalization process of the 2010 report to be drawn-out. For example, at the December 2010 BC meeting, NMFS asked for wording to be added that would indicate the uncertainty they have with the classification of larger *O. mykiss* as resident instead of anadromous in the draft progress report. In their letter from March 22nd, 2010, they instead asked that *O. mykiss* ≥ 38 cm be classified as adult steelhead. Finally, in their June 22nd letter, NMFS changed this to all *O. mykiss* ≥ 30 cm. The effect of this ever-shrinking adult size limit is to cause an inflation of the true adult steelhead population in the Ventura River. It seems ironic that during the steelhead recovery process, NMFS always decided on the precautionary approach that would result in the largest number of steelhead needed for the DPS to be considered "recovered." However, NMFS is now desiring an adult estimate in the Ventura River that would be the most optimistic that results in the largest number by using an overly inclusive size limit and rigid interpretation.

NMFS made numerous references to the "best available science" in their June 22nd letter. However, it appears that these references are based exclusively on two small and neighboring creeks of central California outside of the local DPS. To suggest that this represents the "best available science" is a rather bold statement considering its limited scope. The basins of Scott and Waddell creeks of Santa Cruz County are each only about 10% in area of the Ventura River basin. They are also situated in the cooler climate of the central coast of California. It would appear that more appropriate and relevant comparisons to the Ventura River could be made with steelhead data derived from local DPS systems such as the Santa Ynez River, Santa Clara River, Topanga Creek, and even the Ventura River.

Many of the issues NMFS has indicated could have likely been resolved with a simple phone call between NMFS and Casitas, instead of the lengthy and inefficient back and forth letter correspondence. As stated before, a meeting of the Robles Biological Committee would be the most efficient manner to resolve many of these issues. Given that the issues are relevant to all future monitoring and evaluations, and that this monitoring year has ended, an expanded BC meeting could be conducted during the normal review process in the fall of 2011 to accommodate such discussions. If BC members wish to do so, initial discussions could begin sooner.

NMFS stated they "experienced difficulty" in comparing the most recent draft with the earlier one. In previous years, the BC has not produced a "track-changes" type of document. If NMFS wishes to see the changes, perhaps they could simply do a "compare documents" in Adobe Acrobat. NMFS stated there were changes in the second draft that were not justified. It's not clear to Casitas which unjustified changes NMFS is referring to, but if they could clarify this, we would be happy to address them. NMFS also stated that Casitas asked them to "confine" their review to pages 25-30 of the most recent report draft. Casitas did send the email below referencing those pages in the attached second draft. However, it was only those pages that NMFS and CDFG specifically asked to review at the December BC meeting.

> Attached is the revised Robles 2010 progress report. It is essentially ready to be finalized in my opinion. Mary had requested a review of pages 25-30 regarding the language used in identifying anadromous/resident/adult fish. Please let me know as soon as you can regarding those pages so I can finalize it and send it to BOR.

Casitas' response to NMFS' June 22nd letter is detailed below. There were nine topics outlined in the NMFS letter and were followed here. The bold general topic headings were added for clarification.

1. Robles Reach Definition and Impediment Evaluations

Robles Reach Definition—The reason for the Robles Reach definition change from the first draft to the second was clearly explained in the April 29th Casitas letter sent to BOR and copied to NMFS and CDFG (note that this letter was inadvertently dated 2010 when distributed). NMFS is requesting a change to the description of the Robles Reach from

what they originally identified in their own Biological Opinion for the Robles Fish Facility (NMFS 2003). Casitas verbally discussed this briefly at the December 1st, 2010, BC meeting, a follow-up conference call on January 19th, 2011, with BC regular members and NMFS and CDFG hydrologists, and finally in writing in the April 29th letter. Casitas has made it clear as to why we feel the original Robles Reach description in the BO should be used to guide relevant aspects of the monitoring and evaluations. If NMFS could provide their rational for wanting to change their Robles Reach definition from the BO, it may facilitate the resolution of this issue. I have included the text related to the Robles Reach from the April 29th letter below for reference.

> The Robles Biological Opinion (BO) defines the Robles Reach as the 4 miles downstream of the Robles Fish Passage Facility (NMFS 2003; page 48); the downstream end of the reach is located upstream of Santa Ana Blvd Bridge. In an attempt to provide a convenient reference point to the Robles Reach, the confluence of San Antonio Creek was selected in the draft 2011 study plan (Lewis and Gibson 2011). This was not done to change the scope of the monitoring and evaluations required in the BO, but merely for identification convenience. Because the downstream end of the Robles Reach is located approximately 0.85 miles upstream of Santa Ana Blvd Bridge, perhaps the bridge would have been a better reference point to select. Because BO-required upstream and downstream fish passage monitoring and evaluation activities are clearly tied to the Robles Reach, further reference to the Robles Reach should be in agreement with the BO. As stated in the BO (NMFS 2003), "Conditions in this reach [Robles Reach] have the greatest potential for low flows to impede upstream fish passage." The Robles Reach is a wide alluvial section of the Ventura River that is composed of active wash deposits of unconsolidated silt, sand, gravel, and boulders (Tan and Jones 2006). Due to this channel morphology and geology, alluvial channels like the Robles Reach have high infiltration rates that cause channel surface flow to rapidly recede and cease shortly after storm events (Cooke et al. 1992). Extending the downstream end of the Robles Reach to the confluence with San Antonio Creek would change the scope of BO monitoring and evaluations. The hydrology of Ventura River as it approaches San Antonio Creek is significantly different from the BO-defined Robles Reach. In fact, emerging groundwater makes the Ventura River perennial during most years in this area while the Robles Reach experiences annual dry channel conditions.

Impediment Evaluations—The comments NMFS provided in the June 22nd letter only pertain to the 2011 study plan (i.e., they still recommend monitoring at the original sites 2-8). Regarding those sites, Casitas presented a description of changes resulting from the March 2011 high flows. Only two sites changed sufficiently to necessitate a relocation of the monitoring. NMFS stated in their June 22nd letter that they think it is "illogical" to relocated a site. Casitas disagrees with this statement and suggests that it is indeed logical to adapt to changing channel conditions as needed. It seems unscientific to continue to monitor a site that is no longer an impediment or is no longer even the primary channel. In NMFS' February 3rd, 2011, letter, they even stated that "the primary channel should be selected for measurement" and Casitas agreed. Therefore, it appears that NMFS is confused about their previous comments/recommendations and the information contained in Casitas' April 29th letter. Casitas will continue to work with BOR and NMFS to resolve any impediment evaluation issues. I have included the text related to impediment site changes from the April 29th letter below for reference.

As stated in the Casitas email to BC members dated March 4th, the impediment sites will continue to be monitored with some changes due to the March 20th high flows.

Site 2—The March 20th high flows changed site 2 substantially. It no longer appears to be a potential impediment. Three new channels were created through the site. A new site should be selected in the Robles Reach to replace this site. We are not currently monitoring this site.

Site 3—The high flows caused significant scour at the upstream end of where the two channels split. This has changed the primary channel to the left (looking upstream). Now there is approximately 80% of the flow in this new primary channel. After determining this, a new impediment site was selected (see Photo 1) on March 27th and monitoring began on March 28th. Casitas reasoned that a new site needed to be selected immediately to take advantage of post-storm flows rather than going through a likely long Biological Committee selection process and lose a data collection opportunity. Data detailing the new site and 2011 summaries will be included in the 2011 progress report for review by the BC.

Site 4—Some change occurred at this site, but not enough to require monitoring changes; monitoring has continued.

Site 5—The primary channel has now moved to the left channel. High flows scoured the old secondary channel and now approximately 60-70% of the flow is now in this new primary channel. Monitoring has continued, but now only in the new primary channel.

Site 6—Significant change occurred at site 6. A new channel was cut on the left side very near where the transect was located. Monitoring has continued, but the transect line was moved upstream approximately 20 ft to include the new channel.

Site 7—Little change occurred at this site and monitoring has continued.

Site 8—Little change occurred at this site and monitoring has continued.

2. Mosley Paper on Critical Depths

The use of the Mosley (1982) paper, as cited on page 7 of the progress report, was an acceptable usage. Contrary to NMFS' contention, the statement made on page 7 of the progress report was supported by the citation and its usage. The statement made in the progress report was, "It has been observed that adult salmonids can successfully move through shallower riffles than the 0.6 ft criterion (Mosley 1982)." This statement was made in context of the Thompson's (1972) criteria lacking validation with actually fish migration observations. Mosley (1982) simply stated:

> ...the writer recently observed, in side channels of the Ashley and Ahuriri Rivers...trout over 40 cm long passing up riffles with lengths of over 20 m, depths over the length of the riffles of about 0.1 m [0.33 ft], discharges less than 1 $m^3 s^{-1}$ [35 cfs], and with many cobbles exposed to the air.

This general description appeared to be very similar to biological and environmental conditions of the Ventura Basin and was appropriately used in that context. NMFS appears to be implying that any reference to adult salmonids passing upstream through water less than 0.6 ft deep can only be done if derived from "analytical data" and not

general observations. If NMFS' approach is to question any suggestion that steelhead can swim upstream in water < 0.6 ft deep, then they should also question the lack of "analytical data" to support any minimum depth criteria use of adult passage. As Casitas has stated previously, we are not aware of any research that has quantified what constitutes a steelhead impediment based on actual fish passage measurements/observations and, again, if NMFS is aware of known quantified impediments, Casitas would appreciate a reference to such work. After spending a great deal of time in the field conducting habitat surveys, spawning surveys, radio telemetry, snorkel surveys, and even recreational steelhead fishing, I have personally observed steelhead and other adult salmonids swimming upstream through riffles much less than 0.6 ft. I did not cite my own personal observations in this case because I considered the Mosley (1982) citation more appropriate.

3. Minimum Discharge Estimates

Data Corrections—The rationale for the data corrections was clearly explained in the April 29th letter sent to NMFS and was as follows:

> *Data Variability*
>
> Regarding the "high degree of scatter" of the first year of data in appendices 3-10, after further review of the data, it was determined that many of the Robles discharges used in the correlation were incorrect. This was because the mean daily discharges were used and no adjustment for hydraulic lag-time was included. During days when a post-storm ramp-down occurred, discharge changes normally occurred at 1200 h. Therefore, the mean discharge for a ramp-down day was the average of the two discharge numbers. In addition, depending on what time of the day an impediment site was measured and how far downstream from Robles it was, the discharge from Robles that resulted in the site conditions at the time of the measurement was at times incorrect. To correct this problem, the measurement time for all impediments was determined, and accounting for the distance downstream of Robles, a back calculation was done to determine what the discharge was at Robles. Based on observed changes in discharge measured at Robles after a change was made at Matilija Dam, a hydraulic travel time of 2.0 km/hr was estimated and used for making these corrections. Of the 48 total impediment measurements, 40 were corrected using this method. The corrections ranged from 1 to 14 cfs and the mean difference was 2.5 cfs; however, 7 measurements had a difference of 10-14 cfs. This corrected Robles discharge data resulted in a moderate improvement in the analyses. The final 2010 progress report will included all of these corrections and all future analyses will used this more accurate method of estimating Robles discharge at downstream sites. In addition, the hydraulic lag-time of the Robles Reach will continue to be updated and improved as data becomes available.

Passage Criteria—It's not entirely apparent to Casitas what clarification in the progress report that NMFS is asking for. However, if NMFS is referring to the statement,

> ...as stated by Thompson (1972), the selected sites should be averaged to determine the final minimum discharge estimate. This would result in a minimum discharge estimate of 27-60 cfs for the four criteria.

then this was simply applying the Thompson (1972) method of averaging the resulting discharge estimates from each site to determine the final minimum flow estimate for each of the four criteria used in the comparison (see appendix 13 of the progress report). If NMFS is referring to the statement below,

> ENTRIX (1999) used the criteria developed by Thompson (1972) for adult steelhead at critical riffles, which is a water depth of 0.6 ft for 25% of the total transect width and a continuous portion equal to 10% of the width. ENTRIX also evaluated the critical riffles using a modification that would produce a water depth of 0.6 ft over a continuous width of 8 ft. The transect that required the highest minimum discharge to meet the two criteria was used to determine the discharge needed for adult steelhead passage, which was a range of 40-65 cfs. It appears that during the development of the initial minimum flows for the Robles Biological Opinion, NMFS averaged these two numbers to come up the initial minimum flow of 50 cfs (NMFS 2003a). By applying this same criteria and flow selection method to data collected during 2010, a minimum discharge of 70 cfs was estimated.

then this was done simply to use similar analysis methods to ENTRIX (1999) so that resulting discharge estimates with the 2010 data could be compared with the ENTRIX (1999) results. Regardless, Casitas would be happy to clarify this in the final report.

4. Vaki Riverwatcher

NMFS' viewpoint that the statement in the progress report of "…many, if not most, of the *O. mykiss* documented were likely smolting…" was uncorroborated and should be excluded from the report is unjustified. Based on observations from the fish attraction evaluations, on page 21 of the progress report, a summary of *O. mykiss* smolt stage totaled 89% in mid to late states.

> With a total of 89% of *O. mykiss* in mid to late smoltification stages, it would indicate that a downstream smolt migration behavior was the likely reason for their occurrence in the fish attraction study reach.

This clearly supports the statement of "…many, if not most, of the *O. mykiss* documented were likely smolting…" This statement was made in the methods section of Fish Passage Monitoring and was simply referring to the results in the previous section of Fish Attraction Evaluation. It's unclear how NMFS could misinterpret this statement as being derived from Vaki Riverwatcher data since it was made in the methods section and not in the results or discussion sections. Casitas would be happy to clarify this in the final copy.

5. Size of Adult Anadromous Steelhead and Resident Rainbow Trout

Given the variation of steelhead life history traits (e.g., run timing, spawning, emergence, growth rates, freshwater residents, smolt migration timing, and saltwater residence—just to name a few), its difficult to understand why NMFS seems to believe that an inflexible classification system is available to distinguish anadromous adults

from resident adults without the add of scales or otoliths. Casitas believes that life history variations of steelhead and resident rainbow trout necessitate a flexible approach that may vary from year to year. This was the primary reason for the classification of the numerous larger *O. mykiss* as "non-adult steelhead" during 2010.

Lower Size Limit of Adult Steelhead

With respect NMFS' contention that the citation of Shapovalov and Taft (1954) does not support Casitas' use of use of 38 cm TL for adult steelhead, it was intended to provide at least some logical lower limit on the size of adult steelhead that may be detected in the Ventura River. NMFS failed to notice that Shapovalov and Taft (1954) used FL while the use of the 38 cm limit was TL. The difference between the two measurements is approximately 1 cm for fish close to this size range. Therefore, the more appropriate number to compare with Shapovalov and Taft (1954) would be 37 cm. Unfortunately, Shapovalov and Taft (1954) did not include a frequency distribution of each year or total lengths they measured. So for NMFS to suggest that "many" of the 1/1 steelhead adults were < 38 cm cannot be confirmed. In addition, NMFS did not specify their definition of "many" so their contention is a bit vague considering the specificity of their assertion. Regardless, a more objective approach would be a simple calculation of Shapovalov and Taft's (1954) standard deviation (SD) for the annual means to get some idea of the underline distribution. This was done and resulted in a SD = 1.3 cm, which can be applied to the total mean of 39.1 cm from page 130 of Shapovalov and Taft (1954). Two SDs would include approximately 95% of all means if the distribution was approximately normal. The distribution was remarkably normal and passed a normality test ($P > 0.20$, KS Dist. = 0.17, Kolmogorov-Smirnov test of normality). Two SDs below the mean resulted in a lower limit of 36.5 cm. This is only 0.5 cm less than the 38 cm TL (37 FL) that was used in the progress report. It seems NMFS is overreaching, to say the least, by suggesting that the 38 TL limit was not supported by Shapovalov and Taft (1954). Furthermore, one of the two Shapovalov and Taft study years that NMFS referred to as having a mean FL < 38 cm actually had only one steelhead (1936-37 at 37.5 cm), which would have had a TL of approximately 38 cm. While Shapovalov and Taft's research on steelhead was seminal and extensive, it was completed almost 70 years ago in the central coast of California, which clearly has a different climate and hydrology than the Ventura Basin. Therefore, NMFS must use caution when making comparisons to the Ventura River.

NMFS' reinterpretation of their own document (NOAA Tech Memo NMFS-NWFSC-27) appears to misrepresent the meaning of what Busby et al. (1996) stated to support their assertion in the June 22nd letter. In NMFS' letter, they state "...Tech Memo-27 suggests that southern California steelhead adults are likely spawning as 2-year-olds (1/1) in our region due to rapid freshwater growth rates (Busby et al. 1996)." By contrasting this with what Busby et al. (1996) actually stated, the reader is left with a very different impression as to the likely proportion of the DPS anadromous adults that spawn as one or two salts. The excerpt below is from Busby et al. (1996) on page 26.

> Central and southern California steelhead appear to spend less time in the ocean, and they are dominated by 3-year-old (2/1) spawner. Complete life history data for southern

> California steelhead are lacking: however, it appears that it is common for these fish to smolt in 1 year (CDFG 1995). If they only have one ocean year, as neighboring populations to the north do, then adults may be spawning as 2-year-olds (1/1) in this region.

Furthermore, NMFS' reference to other works to support for their contention is questionable. NMFS states in their July 22nd letter:

> NOAA Fisheries biologist have determined that there is almost no overlap in the size distributions of anadromous adult steelhead (typically >35-cm) and *O. mykiss* that have not gone to sea (<25-cm) in central California coastal stream (Hayes et al. 2004, Pearse et al. 2009).

On page 105 of Hayes et al. (2004), it was stated that "...the number of anadromous (typically >40 cm) and resident fish (typically <25 cm)..." In fact, upon further examination of Figure 6 in Hayes et al. (2004), approximately 98.6% of the adults were ≥ 37 cm FL. Additionally, the citation of Pearse et al. (2009) by NMFS was flawed. Pearse et al. (2009) was a genetic study and only cited Hayes et al. (2004) in their method section but changed the lower limit from 40 cm to 35 cm. Pearse et al. (2009) states: "There is almost no overlap in the size distributions of anadromous adults (typically >35 cm) and fish that have not gone to sea (<25 cm) Hayes et al. (2004)." It's not clear why the change of the wording was done since Sean Hayes was a coauthor of Pearse et al. (2009); however, his statement that anadromous steelhead typically are greater than 40 cm was clear in Hayes et al. (2004).

Finally, as noted in Casitas April 29th letter sent to NMFS, there are other more applicably reference streams which could be compared to the Ventura River. "On the Santa Ynez, for example, of the 16 adult steelhead captured in traps [during 2008], the smallest adult was 49.6 cm (Scott Volan, Cachuma Operation & Maintenance Board, personal communication)." Even current data yielded similar results; through March 2011, the smallest adult steelhead captured was 48 cm.

Upper Size Limit of Resident Rainbow Trout

NMFS again relied on Hayes et al. (2004) and Pearse et al. (2009) as justification for their speculation that the upper limit for resident rainbow trout would be 25 cm in the Ventura River. The misuse of the Pearse et al. (2009) citation has already been addressed above. In regards to Hayes et al. (2004), the growth rate in Scott Creek is slower than what has been found in more southern streams. In addition, the maximum attainable size of resident rainbow trout is smaller. When more applicable data are reviewed, it's clear that small central coastal California streams are not the best available reference locations to use when trying to make extrapolations to the Ventura River. In Topanga Creek, Stillwater Sciences et al. (2010) documented *O. mykiss* between 35 cm and 60 cm FL that they presumed to be resident adults. In the Santa Ynez River, large resident rainbow trout have been document, in many cases are larger than some anadromous adult steelhead, that were in the 40-50 cm range (Scott Volan, Cachuma Operation & Maintenance Board, personal communication).

6. Classification of *O. mykiss* Riverwatcher Detections as Non-Adult Steelhead

Upon further review of the December BC committee notes, NMFS' March 22nd letter, and the previous two drafts of the 2010 progress report, the level of uncertainty as to the life history form of the *O. mykiss* that the Riverwatcher detected ≥ 30 cm was not sufficiently incorporated into the most recent draft to NMFS' satisfaction. Casitas will make that correction and incorporate additional text to indicate that level of uncertainty as recommended in NMFS' March 22nd letter. However, in NMFS' June 22nd letter, they are now recommending not just an acknowledgement of uncertainty in the *O. mykiss* classification, but reclassification to inflate the estimated number of anadromous adults.

The classification of one of the detected *O. mykiss* passing upstream through the Riverwatcher in 2010 as the only adult steelhead was done in an attempt to interpret available data (past and present), observations, and literature in a logical manner to determine the most likely correct classification. It is clear that overlapping lengths between life history stages of different life history forms (and even changing life history forms) make any consistent separation difficult. NMFS' most recent suggestion in their June 22nd letter that an additional 44 *O. mykiss* (≥ 30 cm) passing upstream should be reclassified as adult steelhead appears to dramatically inflate the estimated number of anadromous adult steelhead passing upstream through the Robles Fish Facility. The "non-adult steelhead" classification was used to address the uncertainty in the detections of *O. mykiss* by the Riverwatcher and not an attempt to classify the detections into parr, smolt, resident juvenile, or resident adult fish. Casitas made it clear that as more data becomes available, changes to increase the classification resolution could be made. As stated in the most recent draft:

> Conceivably, after more data are collected from the downstream trapping component of the monitoring and evaluation, or from other Ventura River basin research projects, a more detailed classification of Riverwatcher detections can be made.

Below is a generalized discussion of Casitas' rationale for not classifying the larger *O. mykiss* as adult anadromous steelhead. In addition, the specific number of 44 fish that NMFS has now suggested be reclassified is discussed relative to the potential error.

1. The Riverwatcher overestimates TL, as Casitas has pointed out several times, and therefore many of the larger fish are smaller than estimated. Even after attempting corrections and body depth to TL conversion, this overestimate seems likely. In addition, there appears to be large variability in Riverwatcher body depth estimates. One way to learn about the error and variability is to compare Riverwatcher estimated lengths to known fish lengths. This was reported on by Casitas in earlier progress reports and we have indicated that additional tests and verifications will be done. In relation to the actual fish in question during 2010, only 5 smolts were captured in the downstream smolt trap, which did not provide a sufficient sample for comparison to the Riverwatcher. However, during the rescue of *O. mykiss* from the receding entrance pool at the Robles Fish Facility by NMFS and CDFG (with Casitas assistance) during September of 2010, 38 *O. mykiss* were captured and moved downstream to a perennial reach of the river. *O. mykiss* FL were measured and the largest was about 38 cm.

Compared to Riverwatcher estimated lengths of known *O. mykiss*, the largest was approximately 46 cm TL; this yields a difference of approximately 7 cm. If the 44 fish ≥ 30 cm that NMFS thinks should be classified as adult steelhead were 7 cm shorter, than only 24 would have been ≥ 30 cm. In addition, that difference would also make virtually all of the larger *O. mykiss* detected by the Riverwatcher below the original 38 cm limit.

2. There appears to have been many larger resident *O. mykiss* spawning in the basin during 2010 (Lewis and Gibson 2010), which is a more plausible explanation for the larger fish detected and not the result of additional adult steelhead. The 2010 basin spawning estimate for steelhead accessible areas was 164 spawners (which represented an 865% increase over the estimated 17 spawners in 2009); however, it was concluded that the vast majority of the redds were created by resident *O. mykiss* due to redd length and other characteristics (Lewis and Gibson 2010). Approximately 90% of the redds observed during 2010 were located in San Antonio Creek (Lewis and Gibson 2010), which is downstream of the Robles Fish Facility. These resident *O. mykiss* appear to be the progeny of adult steelhead that spawned during 2008. A large portion of that 2008 year class likely did not complete the smoltification process and migrate to the ocean. They instead residualized, matured, and spawned in significant numbers beginning in 2010. As part of a basin-wide *O. mykiss* snorkel monitoring program, Casitas collects length estimates at comparable locations. At one location, in lower San Antonio Creek, the growth of some individuals from the 2008 cohort began to approach 30 cm after about 16 months of growth (Figure 1). It is therefore plausible that some portion of this 2008 cohort remained in the basin and continued to grow and represented fish in the 30-40 cm range detected migrating upstream through the Robles Fish Facility during 2010.

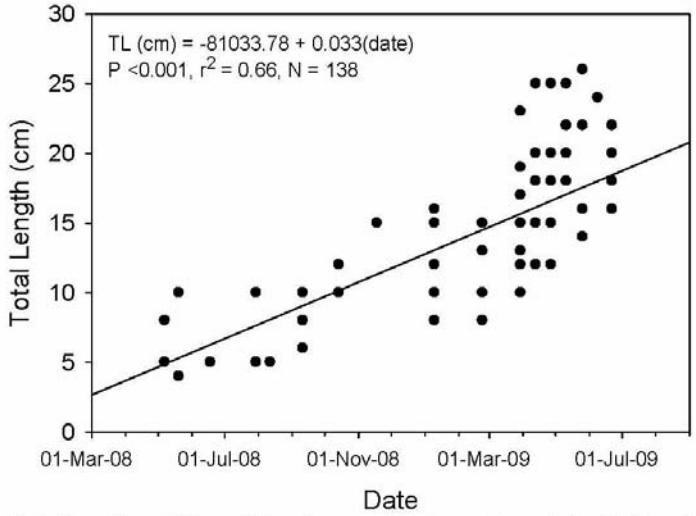


Figure 1. Total lengths of *O. mykiss* observed in lower San Antonio Creek. Each datum point represents from one to several length estimates.

3. Casitas stated in the progress report that "In addition, the length frequency distribution did not clearly indicate that the grouping of fish up to 45 cm included other anadromous adults." What was intended by this was that the Appendix 24 frequency distribution from 20 to 46 cm did not clearly indicate a modal peak that could represent some underlying distribution representing a relatively large grouping of adult steelhead as proposed by NMFS.

4. Of the *O. mykiss* in question by NMFS, most (30 of the 44) were detected after the period when adult steelhead would be expected to be migrating upstream given the precipitation pattern during 2010. In addition, this was later than adult steelhead have been observed migration upstream in the Ventura River (CMWD 2008). Furthermore, 24 of the fish in question by NMFS were detected passing upstream through the Robles Fish Facility 21-53 days past the time when a surface water connection was lost in the Robles Reach (Figure 2). This type of migration behavior would be difficult to attribute to adult steelhead. In addition, the total number of *O. mykiss* detected by the Riverwatcher can be misleading. As it has been pointed out before, it appears that the fish are moving upstream and downstream through the Robles Fish Facility on a daily basis. This would exaggerate any estimate of *O. mykiss* moving in either direction. It's anticipated the PIT tagging effort started in 2011 will develop data to better understand this behavior.

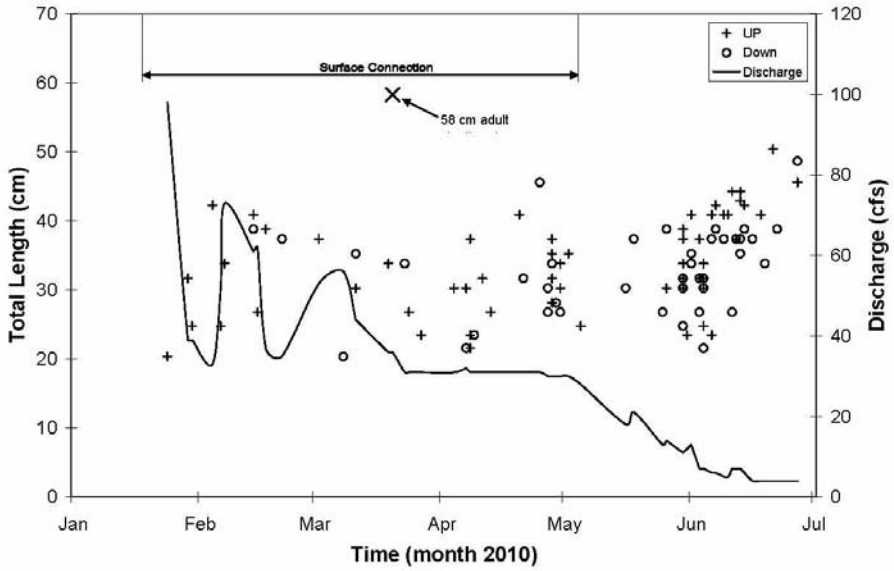


Figure 2. Time and total lengths of Riverwatcher detected *O. mykiss* during 2010 migration season with discharge downstream of Robles Fish Facility. (+) = upstream fish and (o) = downstream fish. The period when there was a surface water connection in the Robles Reach is indicated by the arrowed horizontal line.

5. If the 44 fish in question were to be reclassified as adult steelhead, the estimated number of adult steelhead passing upstream through the Robles Fish Facility would increase dramatically from 1 to 45 adults. Given that no other surrounding basins experience such an increase that we are aware of, reclassification would result in a drastically inaccurate estimate of the true number of adult steelhead during 2010. The rational for this type of regional pattern association is based on the 2008 run year. During that year, there were six adult steelhead detected passing through the Robles Fish Facility; this represented a large increase over previous years. That same year, the surrounding regional basins also experienced relatively large increases in adult steelhead observations, which suggested a correlation of freshwater and/or ocean survival among the regional basins. This pattern should not be too surprising since there are similar geologic, climatic, hydrologic, and near shore oceanic conditions among the basins.

6. If the 44 fish in question were to be reclassified as adult steelhead, then logic would dictate that there would have been a relatively large smolt emigration during 2009 from the Ventura River (unless NMFS is suggesting that they would all be strays) to produce that many returning adults. The data that Casitas has collected would not suggest that. If a smolt to adult survival ratio (SAR) were applied to the 44 fish, an approximate number of emigrating smolts needed could be estimated. From the literature, the SARs for steelhead range widely. For winter steelhead populations along the west coast, SARs from as little of 1% up to 10% can be found. Obviously many factors play into the survival rate that vary from year to year; however, a few hypothetical examples can be developed. A SAR of 1% and 10% would require an emigration of 4,400 and 440 smolts, respectively. If a more likely SAR in the range of 2.5% were used, 1,760 smolts would have emigrated from the Ventura River. Adult steelhead in the size range of the fish in question would in all likelihood have to be 1/1 (i.e., one year in the freshwater and one year in saltwater). The number of smolts attempting to migrate downstream did appear to be substantially higher in 2009; however, due to the lack of precipitation, the surface water connection in the Robles Reach was lost before any appreciable number could have migrated downstream (CMWD 2009).

7. NMFS suggested in their June 22nd letter that the 44 fish in question were likely 1/1 adult steelhead. They cited Busby et al. (1996) and Shapovalov and Taft (1954) as justification. The irregular use of the Busby et al. (1996) citation has already been addressed in section "5. Size of Adult Anadromous Steelhead and Resident Rainbow Trout." Shapovalov and Taft (1954) did document 1/1 life history patterns, which Casitas thinks are likely to occur in the Ventura River as well; however, the percentage in their study was only 4.7%. For NMFS to suggest that the 1/1 percentage for the 2010 run year was 97.7% seems extremely unlikely and unsubstantiated. Casitas is not aware of any data from regional basins, or any other steelhead population, that would indicate such a radical life history shift. Considering that during 2008 there were 6 adult steelhead larger than 49 cm detected passing upstream through the Robles Fish Facility, a change of that magnitude seems very unlikely only two years later.

7. Rewrite of Section 3.3, Circular Logic, and 1/1 Life Histories

Regarding the rewrite of section 3.3 in the progress report, this has been addressed in section "6. Classification of *O. mykiss* Riverwatcher Detections as Non-Adult Steelhead." Concerning NMFS' claim of "circular logic" by Casitas, we were simply using the most current available data to make our determination. Moreover, it would seem hypocritical for NMFS to suggest that the use or citation of ones own data or reports would be considered "circular logic." Regarding the NMFS statement that Casitas assumed that no 1/1 steelhead spawn in the Ventura River, this is simply an inaccurate assumption by NMFS.

8. Length Frequency Interpretation and Undetected Adult Steelhead

The length frequency interpretation issue was clarified in section 6.3 above. NMFS misunderstood what was stated in the progress report. No reference to the 58 cm adult was intended as they have assumed in their June 22nd letter. NMFS should review the report and section 6.3 above for clarification.

With regards to NMFS' suggestion that some unknown but significant number of adult steelhead could have passed upstream without being detected, it is simply unsupported speculation. The 58 cm adult in 2010, that was not detected moving downstream occurred because it moved very slow backwards through the Riverwatcher scanners, which is outside of the Riverwatcher detection capabilities. Casitas believes the circumstances of this occurrence were abnormal and the likelihood of not detecting an upstream migrating adult steelhead is very low. In fact, that same steelhead was detected both times it passed upstream through the Riverwatcher.

The suggestion by NMFS that because adult steelhead are large fish that they will migrate upstream during times of high turbidity is baseless. As discussed in previous progress reports, the Riverwatcher operates up to about 100 NTUs; the video is simply not able to capture an image until the turbidity decreases to about 30 NTUs. For example, during 2008 there were 6 adult steelhead detected passing upstream. The turbidity during the period steelhead passed upstream ranged from 5 to 23 NTUs ($\bar{x}$ = 13.5, 95% CI = 9.4) and the number of days past the peak discharge ranged from 4 to 26 days. The conditions when the crowder is usually removed from the fish bypass coincided with times that there is very high discharge and turbidity. This is usually just before the peak discharge and within 24-48 hours after the peak. The crowder is usually reinstalled before the turbidity drops below the 100 NTU upper limit so any fish that may pass during higher turbidity (100-30 NTUs) could be detected. However, no fish have been detected to date. Casitas is not aware of any literature that would indicate that steelhead migrate upstream in turbidity greater than about 40 NTUs. NMFS should provide more credible evidence than just the chain-of-reasoning in their June 22nd letter that "...larger fish are more powerful swimmers...which imparts the ability to migrate during periods when river discharge and turbidity...are exceeding elevated..." to suggest that the probability of not detecting adult steelhead at higher

turbidity (> 100 NTUs) is anything but exceedingly remote. The total of 8 hours that the crowder was removed for cleaning was a more likely time when an adult steelhead could have passed upstream without being detection; however, given that the 8 hours only represented about 0.2% of the total time the crowder could have been installed would indicate the probability was very small.

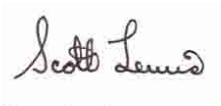
9. Flow Assessment

There were actually three BO defined storm peaks that required supplemental flow releases and not two as NMFS stated in their June 22nd letter. Therefore, the Riverwatcher was operational approximately 85% of the time there were releases downstream ≥ 50 cfs. However, NMFS is assuming that adult steelhead are only able to migrated upstream when the discharge is ≥ 50 cfs. This does not reflect the available data available from the Ventura River. For example, during 2010, the 58 cm adult steelhead was detected passing upstream when the discharge was 36 cfs. Ironically, most of the fish in question by NMFS were actually detected passing upstream when the discharge was < 30 cfs (Figure 2).

Regarding the ladder flow discrepancy between 2010 and 2011, the flow estimates of the ladder have not been accurate since the instillation of the new fish crowder. The new crowder creates a head difference greater than the original crowder did. The flow transducers upstream of the crowder need to be moved upstream far enough out of the new crowder's influence. This is planned to be completed in the late summer or fall during the annual maintenance period. This error was corrected in the flow data that was sent to NMFS for 2011.

Casitas is committed to conducting the monitoring and evaluation of the Robles Facility as specified in the Biological Opinion and participating in the Cooperative Decision Making Process to further improve aspects of studies as needed. If BOR, NMFS, or CDFG would like to discuss any of these issues further, please contact me at your convenience.

Respectfully,



Scott Lewis

Fisheries Program Manager
Casitas Municipal Water District
1055 Ventura Ave.
Oak View, CA 93022

Office: 541-546-0903
Cell: 805-798-7459
Email: slewis@casitaswater.com

CC: Rick Bush, National Marine Fisheries Service
Mary Larson, California Department of Fisheries and Wildlife

Literature Cited

Cooke, R. U., A. Warren, and A. S. Goudie. 1992. Desert geomorphology. UCL Press, London.

CMWD. 2008. 2008 progress report for the Robles Diversion Fish Passage Facility. Casitas Municipal Water District, Oak View, CA.

CMWD. 2009. 2009 progress report for the Robles Diversion Fish Passage Facility. Casitas Municipal Water District, Oak View, CA.

ENTRIX. 1999. Evaluations of natural passage barriers on the Ventura River downstream of Robles Diversion. Entrix, Walnut Creek, CA.

Harrison, L. R., E. A. Keller, E. Kelley, and L. A. K. Mertes. 2006. Minimum flow requirements for southern steelhead passage on the lower Santa Clara River, CA. University of California, Santa Barbara.

Hayes, S. A., M. H. Bond, C. V. Hanson, and R. B. MacFarlane. Interaction between endangered wild and hatchery salmonids: can the pitfalls of artificial propagation be avoided in small coastal streams? Journal of Fish Biology, 65(Supplement A):101-121.

Lewis, S. D. and M. W. Gibson 2010. Coastal steelhead and rainbow trout (*Oncorhynchus mykiss irideus*) spawning surveys and population estimates in the Ventura River Basin, California. Casitas Municipal Water District, Oak View, CA.

Lewis, S. D. and M. W. Gibson 2011. 2011 monitoring and evaluation study plan for the Robles Fish Passage Facility and related studies (draft). Casitas Municipal Water District, Oak View, CA.

National Marine Fisheries Service. 2003. Biological opinion for the Robles diversion fish passage facility, Ventura River, CA. Protected Resource Division, Southwest Region, March 31, 2003.

Pearse, D. E., S. A. Hayes, M. H. Bond, D. V. Hanson, E. D. Anderson, R. B. MacFarlane, and J. C. Garza. Over the falls? Rapid evolution of ecotypic differentiation in steelhead/rainbow trout (*Oncorhynchus mykiss*). Journal of Heredity, 100(5):515-525.

State Water Resources Control Board (SWRCB). 2008. Protectiveness of draft guideline alternatives. Appendix G, Approach for assessing effects of policy element alternatives on upstream passage and spawning habitat availability *in* North coast instream flow policy: scientific basin and development of alternatives protecting anadromous salmonids. California State Water Resources Control Board, Sacramento, California.

Stillwater Sciences, R. Dagit, and J. C. Garza. 2010. Lifecycle monitoring of *O. mykiss* in Topanga Creek, California. Prepared for California Department of Fish and Game Contract No. P0750021.

Tan, S. S., and T. A. Jones. 2006. Geologic map of the Matilija 7.5' quadrangle Ventura County, California: a digital database. Version 1.0, Los Angeles, CA.

Thompson, K. 1972. Determining stream flows for fish life. Pacific Northwest River Basins Commission, instream flow requirements workshop. Portland, Oregon. Proceedings: 31-50.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

2002/11871: RAB

September 29, 2011

Ned Gruenhagen
Bureau of Reclamation
1243 N Street
Fresno, CA 93721-1813

Dear Mr. Gruenhagen:

NOAA's National Marine Fisheries Service (NMFS) is contacting the Bureau of Reclamation (Reclamation) in regards to our letters of February 3, 2011, March 22, 2011, and June 22, 2011, and Biological Committee conference call on September 26, 2011. NMFS has reviewed Casitas Municipal Water District's (Casitas) monitoring and evaluation activities associated with the operation of the Robles Fish Passage Facility (Facility) targeted at improving endangered steelhead (*Oncorhynchus mykiss*) passage conditions in the Ventura River. NMFS has dedicated a significant amount of time providing recommendations to improve the efficacy of these monitoring and evaluation activities.

Based on the framework of the Cooperative Decision Making Process described in the Robles Biological Opinion, it is NMFS' role as a member of the Biological Committee to provide technical guidance to the Management Committee. Reclamation serves as Chair of the Management Committee, and is required to make final decisions regarding Robles Operation (including monitoring and evaluation activities) based on the information and recommendations provided from the Biological Committee. In this context, the goals of this letter are to reiterate NMFS' recommendations discussed during the call on September 26, 2011, to ensure the Facility monitoring is conducted in accordance with the Biological Opinion, and clear up any remaining Biological Committee misunderstandings that were not discussed during the conference call due to time limitations. NMFS requests that Reclamation review the recommendations provided in this current letter and previous correspondences and advise Casitas to 1) monitor the upstream steelhead impediment evaluation sites selected by the Biological Committee (including changes described in NMFS' letters), and 2) report all *O. mykiss* estimated length and migration direction and avoid speculation as to which *O. mykiss* should be classified as adults. NMFS would like to be copied on the letter from Reclamation that provides this guidance to Casitas.

1. Upstream Steelhead Impediment Evaluation

NMFS and CDFG have provided clear, consistent guidance on monitoring the same sites identified, and collectively agreed upon, by the Biological Committee in 2009 (excluding site 1). Because the sites were selected by the Biological Committee using the Cooperative Decision Making Process, any modifications to impediment evaluation sites must be conducted using the same process. Casitas made some in-season modifications to the 2011 impediment evaluation sites due to a March 2011 high-flow event without consulting with the Biological Committee. At its upcoming meeting, the Biological Committee will review these changes and the data collected and coordinate a site visit to make recommendations for the 2012 Monitoring Plan.

Rationale for Monitoring All Ventura River Impediments Downstream of Robles.— **NMFS recommends that impediment evaluations continue to occur at impediments identified throughout the Ventura River downstream of the Facility.** The rationale for NMFS' recommendation is provided in the Biological Opinion. Starting on page 2 of the Biological Opinion, NMFS defines the area affected by the proposed action as including the entire 26-km of mainstem Ventura River to the Pacific Ocean. On page 17 of the Biological Opinion, NMFS states that the proposed evaluation and monitoring activities have been developed to determine if the operations at the Robles Diversion are enhancing the opportunity for steelhead to migrate upstream to the Facility. Monitoring sites downstream of the Robles reach is necessary to determine if sufficient instream flows exist in the Ventura River from the river mouth upstream to the Facility during the fish passage augmentation season when Casitas is diverting streamflow.

Site 5 Primary Flow Channel Recommendation.— NMFS recommended conducting transect measurements at site 5 in the primary channel based on the assumption that steelhead would likely ascend the channel that carries the bulk of the flow. NMFS is not confused about our previous recommendation as was recently suggested, but rather NMFS is attempting to work cooperatively with Casitas at Site 5 to find an agreeable solution to continue monitoring at the selected site in light of the fact that the channel characteristics suggest it may create an impediment. Since one year of flow measurements have been collected at the site 5 primary channel, it is logical and appropriate to continue the duration of the monitoring effort at this site to capture the natural variation of water conditions that exist. To further the collaborative process of assessing the difficulty of monitoring at this site, NMFS visited site 5 on March 1, 2011, with Casitas and Reclamation and determined our recommendation to collect measurements in the primary flow channel was supported by the conditions observed (~50 cfs). **In the event one of the other impediment evaluation sites develops a braided channel, NMFS recommends Reclamation advise Casitas to take measurements in both channels as conducted in 2010 at site 5 and present all measurement data for both channels as Casitas did in the Draft 2010 Annual Report for Biological Committee review.**

Data Variability and Site Specific Discharge.—To improve the Biological Committee's ability to evaluate and interpret future impediment monitoring results, NMFS and CDFG recommended measuring Ventura River discharge at each impediment evaluation site in our February 3, 2011 letter. During our March 1, 2011, site visit, NMFS learned it is Casitas' standard procedure to

measure water velocity during all impediment transect measurements. **NMFS reiterates our recommendation that Reclamation advise Casitas to provide the site specific discharge measurements collected at impediment evaluation sites 2 – 8 in the 2010 and future Annual Reports.** NMFS believes excluding this information from Biological Committee review handicaps the Cooperative Decision Making Process in determining if the operations at the Robles Diversion are enhancing the opportunity for steelhead to migrate upstream to the Facility.

Impediment Site Evaluation Upstream of the Highway 150 Bridge.—The Biological Opinion states that all potential impediments to upstream fish migration shall be identified and monitored closely during the fish migration season to better understand fish passage limitations at these individual sites. **NMFS reiterates our recommendation that Reclamation advise Casitas to monitor an impediment site ~ 200-meter upstream of Highway 150 bridge** (see February 3, 2011, letter). Casitas reasoned that monitoring was occurring at seven sites and that an eighth site was not needed. Further review indicates that Casitas' impediment monitoring occurred only at six sites in 2011. NMFS does not support reducing the overall number of monitoring sites. Observations of intermittent streamflow were made by NMFS staff in 2011 on the Ventura River while conducting surveys about 200-meters upstream of Highway 150. These dry channel observations are significant because they were noted repeatedly during the steelhead migration and spawning season, and completely block all fish passage at this point in the river. Based on corresponding Robles discharge data (i.e., downstream releases) at the time of the observations, it appears that the mainstem Ventura River channel at this site can be dry when passage is deemed sufficient at other impediment monitoring sites. The functional effect of averaging the results of all the impediment sites lessens the severity of the true impediments that exist downstream of the Facility. Because the focus of the impediment evaluation is to identify a flow regime that allows for steelhead migration upstream to the Facility, evaluation of results for each individual site allow for identification of the necessary flows that afford unimpeded passage conditions throughout the entire 24-km reach of the Ventura River below the Facility.

ENTRIX 1999 Study Comparison.—ENTRIX (1999) completed a steelhead passage assessment of all low flow barriers observed in the 24-km reach of the Ventura River downstream of the Facility. The purpose of the assessment was to determine the most restrictive transects for fish passage and incorporate the corresponding minimum streamflow information for steelhead passage into the Robles Fish Passage Facility Biological Assessment. To determine the necessary streamflow, eleven transects at seven sites were evaluated using the Thompson (1972) method. The ENTRIX results indicate that the minimum flow allowing steelhead to migrate upstream lies in the range of 40 to 65 cfs. ENTRIX's recommendation is based on the minimum flow required for steelhead passage at the most restrictive sites, using the Thompson Criteria for the upper end of the flow recommendation (i.e., 65-cfs) and the 8-foot width criteria at 0.6-ft depth for the lower end of the range (i.e., 40-cfs). Applying the ENTRIX criteria to the Casitas data in the revised draft 2010 Report indicates that the minimum flow allowing steelhead to migrate upstream ranges from 68 to 138-cfs.

NMFS understands that river channel characteristics change over time (hence the reason to monitor numerous impediments over a period of years), but it is interesting to compare ENTRIX's most restrictive sites for steelhead passage to Casitas' 2010 results. ENTRIX determined their site located downstream of the Arroyo Mobile Home Park, and just upstream of Highway 150 bridge required the highest discharge for passage. Casitas' impediment site 3 is also located downstream of the Arroyo Mobile Home Park and was determined to be the second most restrictive passage site in 2010. A relatively short distance (~250-m) separates the second most restrictive impediment sites determined by both steelhead passage assessments on the Ventura River (Figure 1). NMFS recently learned that site 3 was replaced with a new impediment site due to site changes. ENTRIX's most restrictive site was located upstream of Highway 150 (Thompson method). Despite recommendations made by NMFS and CDFG, Casitas has ignored Biological Committee input and the Cooperative Decision Making Process by deciding not to monitor this location. In addition to monitoring at all sites selected by the Biological Committee, **NMFS recommends that Reclamation advise Casitas to evaluate the minimum discharge required for steelhead passage by focusing only on the site that creates the greatest passage difficulty as recommended by other studies (Reinfelds et al. 2010, Reiser et al 2006, ENTRIX 1999).**

2. Adult Steelhead Classification

Visual scale analysis of numerous cohorts across a wide age range can provide a foundation for differentiating age and attributing temporal growth periodicity between life stages. Using scale growth patterns to differentiate estuarine/marine growth from riverine growth can be achieved, but uncertainty exists without validation of the results. The fact that there is the potential for size range overlap between the co-occuring life forms further complicates correct classification. Chemical analysis of calcified structures can provide a reliable method to differentiate fish growth in fresh and saltwater (Campana and Thorrold 2001), but the method requires lethal sampling. Therefore, NMFS does not believe it is possible to distinguish adult steelhead from resident *O. mykiss* in anadromous stream reaches with any level of certainty using the methods described in Casitas' study plan, nor is it necessary to make such distinctions to fulfill the purpose of the Biological Opinion monitoring. **NMFS recommends that Reclamation advise Casitas to avoid speculation and eliminate the inconsistent classification of adult steelhead in the Annual Report and Monitoring Plan.** Instead of classifying individual *O. mykiss* as "adult steelhead" versus "*O. mykiss* non-adult steelhead" without the necessary data (i.e., otolith, scale analysis, DNA) to support the life history determination, simply document all *O. mykiss* estimated total lengths for upstream and downstream migrants.

Is *NMFS attempting to artificially inflate the steelhead population in the Ventura River by recommending an overly inclusive size limit for adult steelhead?*—NMFS reassures Reclamation that this claim is inaccurate. During the 2010 Biological Committee meeting on December 1, 2010, Reclamation asked for clarification on how other researchers differentiate adult steelhead based on size. In our March 22, 2011, letter summarizing the Biological Committee meeting, NMFS cited what we believe to be the best available science (see discussion below) based on published peer-reviewed studies. In response to Casitas' reference of NMFS using the Robles ladder counts to evaluate recovery of the Southern California steelhead Distinct Population

Segment (DPS), NMFS notes that the Robles Biological Opinion monitoring is defined as "effectiveness monitoring" (Boughton 2010). The effectiveness monitoring for the Robles Biological Opinion is designed to evaluate the Facility operation criteria, not evaluate the condition of the DPS population as a whole to judge its status toward recovery.

Is NMFS reference to the best available science limited in scope and outside the local DPS?— NMFS is required to rely on the best available scientific information to make well-informed decisions. Casitas' suggestion to utilize findings from scientific studies that are conducted within the Southern California steelhead DPS is agreeable with NMFS, but we are not limited to considering only studies conducted within the DPS. Unfortunately, very few published and peer-reviewed scientific studies documenting basic steelhead life history characteristics at the southern extent of the species range exist. In such cases, NMFS is required to then look to other best available information to inform its analyses and determinations. Casitas has questioned NMFS' reference to recent scientific studies conducted in central California coastal watersheds due to differences in geography and watershed size. NMFS notes numerous references in Casitas' 2010 Annual Report and 2011 Monitoring Plan demonstrate reliance on studies conducted in these same central California rivers, observations made in the Southern hemisphere and watersheds (Topanga Creek, 19-mi^2) that are about half the size of those cited by NMFS in central California (Scott Creek, 39- mi^2).

Casitas concluded that that there appears to have been many larger resident *O. mykiss* spawning in the Ventura River during 2010 (Lewis and Gibson 2010). Review of Lewis and Gibson (2010) indicates that a wide size range of redds were observed ranging in length from 0.35 to 2.03-m. Lewis and Gibson compared the Ventura River results to mean rainbow trout redd lengths and other characteristics measured on the Deshutes River in northern Oregon (Zimmerman and Reeves 2000), and concluded the vast majority of the Ventura River redds were constructed by resident fish. While NMFS does not disagree that resident *O. mykiss* may contribute to steelhead production in the Ventura River watershed, we find Casitas' comparison to a hydrologically different inland watershed in the Pacific Northwest to lack regional support for their conclusion. On the Santa Ynez River, Reclamation (2011) reported that the Cachuma Operation and Maintenance Board (COMB) uses a 0.91-m length criteria to differentiate anadromous steelhead redds from smaller resident *O. mykiss* spawning nests. While Lewis and Gibson (2010) did not report individual redd lengths, we see that their observed mean redd length of 0.97-m exceeds the COMB steelhead criteria. Unlike the Ventura, the Deschutes River is well known for its stability of flow, which is more uniform than any other river of its size (Zimmerman and Reeves 2000). Flows in the study area are regulated by dams and ranged from 4060 to 6320-cfs (Zimmerman and Reeves 2000), which contribute to a world-class tailrace fishery for native "redband" rainbow trout that range from 25 to 50-cm (ODFW website). NMFS agrees that physical redd characteristics are difficult to analyze with other comparative studies in southern California and warns that Casitas should exercise caution in drawing conclusions on these data.

In summary, NMFS recommends that Reclamation advise Casitas to 1) monitor the same impediment evaluation sites selected by the Biological Committee in 2009 (exchanging site near Highway 150 for Sandbar), and 2) report all *O. mykiss* length and migration direction in the Annual Reports and avoid speculation as to which *O. mykiss* should be classified as adults. The Monitoring and Evaluation component of the Incidental Take Statement (ITS) is mandatory for continued application of the section 7 (o)(2) exemption. If Reclamation fails to assume and implement the terms and conditions or fails to require Casitas to adhere to the terms and conditions of the ITS, the Robles Facility protective coverage of section 7 may lapse. Please contact Rick Bush at (562) 980-3562 to discuss the recommendations contained in this letter.

Sincerely,

Penny Ruvelas
Southern California Area Office Supervisor
for Protected Resources

cc: Scott Lewis, Casitas Municipal Water District
Mary Larson, California Department of Fish and Game
Roger Root, U.S. Fish and Wildlife Service
Administrative file#: 151422SWR2002PR6168

Literature Cited

Boughton, D. A. 2010. Some Research Questions On Recovery of Steelhead On the South-Central and Southern California Coast. NOAA Tech. Memo. NMFS-SWFSC 467.

Campana, S. E. and S. R. Thorrold. 2001. Otoliths, increments, and elements: keys to a comprehensive understanding of fish populations? Can. J. Fish. Aquat. Sci. 58: 30–38.

ENTRIX. 1999. Evaluation of Natural Passage Barriers on the Ventura River Downstream Of Robles Diversion. Prepared for Borcalli and Associates, December 2, 1999.

Reclamation. 2011. Cachuma Project 2008 Annual Monitoring Report and Trend Analysis for 2005-2008. Prepared for National Marine Fisheries Service, June 23, 2011.

Reinfelds, I., M. Lincoln-Smith, T. Haeusler, D. Ryan, and I. Growns. 2010. Hyraulic Assessment of Environmental Flow Regimes to Facilitate Fish Passage Through Natural Riffles: Shoalhaven River Below Tallowa Dam, NSW. River Res. Applic. 26: 589-604.

Reiser, D. W., C. Huang, S. Beck, M. Gagner and E. Jeanes. 2006. Defining Flow Windows for Upstream Passage of Adult Anadromous Salmonids at Cascades and Falls. TAFS, 135:668-679.

Zimmerman, C. E. and Reeves, G. H. 2000. Population structure of sympatric anadromous and nonanadromous *O. mykiss*: evidence from spawning surveys and otolith microchemistry. Canadian Journal of Fisheries and Aquatic Sciences 57:2152–2162.

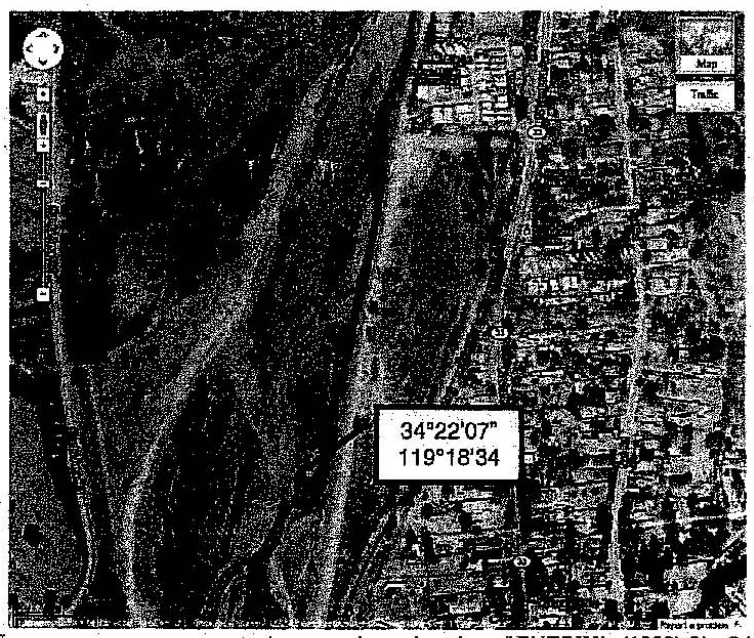


Figure 1. Upper green arrow represents the approximate location of ENTRIX's (1999) Site 7 located about 200-m downstream of Arroyo Mobile Home Park. Lower green arrow represents Casitas' Site 3. Both sites are bordered by Casitas Springs Levee on East bank, and located at similar channel features.