2011 Robles Fish Passage Facility

Progress Report

Steelhead smolt with gastric radio tag. Smolt was captured, tagged, and released downstream of the Robles Fish Facility in April 2011.

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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 affects of the Robles Fish Facility were analyzed in the Biological Opinion (BO) prepared by the National Marine Fisheries Service (NMFS 2003a). This 2011 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 2010 to 30 June 2011.

The monitoring and evaluation studies related to the Robles Fish Facility conducted during the 2010-2011 reporting period are included in two main sections of this progress report. The Fisheries Monitoring and Evaluation section includes: 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 includes: 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 43 water depth transects at six monitoring sites were completed and analyzed for the upstream fish migration impediment evaluation in 2011. The sandbar at the mouth of the Ventura River was closed only for short periods during mid October 2011 and was open for potential volitional steelhead passage during the remainder of the reporting period. A total of 640 *O. mykiss* juveniles were counted in the area upstream and downstream of the Robles Fish Facility during the fish attraction evaluations in 2011. This number likely represents multiple counts of some *O. mykiss* due to smolting rates and migration behavior. During the fish passage monitoring evaluations, 150 *O. mykiss* were detected migrating upstream through the Robles Fish Facility in 2011. Twenty-five *O. mykiss* migrating smolts were captured downstream of the Robles Fish

Facility; 16 were radio-tagged, 8 PIT-tagged, and one was not tagged. The mean migration rate through the Robles Reach was 2.2 km/day.

2.0 INTRODUCTION

NOAA Fisheries listed the southern California steelhead, *Oncorhynchus mykiss*, as endangered in 1997 (NMFS 1997) under the Endangered Species Act (ESA, 16 U.S.C. § 1531 et. seq.) 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 (*O. mykiss*) 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. An annual and ongoing reevaluation began after the 2010 fish passage season. Through the Cooperative Decision Making Process, the Robles Biological Committee will review each of the specific evaluations and determine if the original objectives have been addressed 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 during 2012. Due to 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. Each aspect of the monitoring and evaluation will be evaluated annually to determine if sufficient information exist to complete each objective. See Appendix 36 for correspondence among Biological Committee participants related to the 2011 progress report and 2012 study plan.

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. ENTRIX (1999) also evaluated the potential impediments 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 never validated. It has been observed that adult salmonids can successfully move through shallower riffles than the 0.6 ft criterion (Mosley 1982).

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 30-100 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 379 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.

ENTRIX Site Assessments

An effort was made to locate and determine the status of the ENTRIX (1999) sites during 2009. Because there had been numerous bed-mobilizing runoff events after the study was completed, the 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.

Of the seven sites originally identified by ENTRIX (1999), only four sites were located with any degree of certainty. Of those four sites, all were 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, based on photos from 2003, migrated laterally approximately 20 m towards the left bank (looking upstream, and all other examples) 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 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). 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 in 2009. The main low-flow river channel in 2009 was located on the right bank against the levee that protects Casitas Springs from high water runoff events. This represented 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 appeared 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 located, 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.

Results

During 2011, a total of 54 water depth transects were completed. Discharge from the Robles Fish Facility ranged from 30 to 100 cfs when transects were conducted. There was a high-flow event that peaked on 20 March 2011. The peak flow of approximately 20,000 cfs at the USGS Foster Park gage station represented a recurrence interval of about 6 years. Data from 11 transects collected prior to the high-flow event could not be used in the 2011 analyses because some impediments sites were altered significantly by the high flow event. It appeared that the lower in the Ventura River a site was, the more an impediment site and the channel were altered. Because of the high-flow event, only 43 transects were analyzed in this report. Data were analyzed by modeling discharge from the Robles Fish Facility and water depth at each site for several passage criteria that resulted in numerous adult steelhead passage criteria discharges.

Site 2, which was located near the Ojai Valley Sanitary District treatment plant at rkm 7.5, was surveyed only once prior to the March high-flow event. The high-flow event substantially changed Site 2 and it no longer appeared to be a potential impediment. Prior to the high flow event, Site 2 was characterized by having a long transverse riffle with dense vegetation that had progressively developed since the January 2005 high-flow event. In addition, approximately 80% of the discharge was flowing through the middle section of the riffle through a series of small channels in the vegetation. After the March 2011 high-flow event, two additional large channels were scoured through the riffle, one upstream and one downstream of the old primary channel (Appendix 15a). The upper most channel became the new primary channel and was visually estimated to pass approximately 85% of the total site discharge. The old primary channel had approximately 10% of the discharge and the lower new channel passed the remaining 5%. The area of the riffle in which the old primary channel was located received a substantial amount of gravel and cobble deposition from the March flow event. This likely contributed to the decrease of the percentage of total flow post flood in this area of the site. At the time of the visual estimates, numerous depth measurements were also recorded. The new primary channel, which passed 85% of the discharge, had maximum depths that ranged from 1.2 to 3.2 ft in the thalweg and a mean of 2.1 ft for five depths measured. At the time of the depth measurements and visual estimates, the discharge at Foster Park and the Robles Fish Facility was 46 cfs and 30 cfs, respectively. The scour of new channels by the March high-flow event substantially changed the channel at Site 2. Due to the large amount of total discharge and water depths in one of the new channels, during a time of lower flow from the Robles Fish Facility, this site was no longer considered a potential impediment and monitoring was not conducted after the March 2011 high-flow event.

Site 3 was also affected by the March 2011 high-flow event. The site was not altered enough to consider it substantially different. However, the March event did cause significant scour and depositional changes about 600 m upstream of the site where two channels split. These changes forced the vast majority of the river's flow to move to the left channel (looking upstream). Site 3 was originally located next to the Casitas Springs levee in the right channel. After the March 2011 high-flow event, there was approximately 80% of the flow in this new primary channel. The two channels split for 1 km before returning together. This switching between the two channels has occurred in the past. In fact, one of the original ENTRIX (1999) impediment sites was located in this new primary channel. After determining the primary channel had changed, a new impediment site was selected on 27 March and monitoring began on 28 March 2011. It was reasoned that a new site needed to be selected immediately to take advantage of post-storm flows rather than going through a lengthy Biological Committee selection process and lose a data collection opportunity. The committee was notified of the change in a letter dated 29 April 2011. The new impediment site was located at the upstream end of the new primary channel. After visually surveying the 1 km reach of the new primary channel, the new site (Site 3-2) appeared to be clearly the most significant potential impediment.

Site 3-2 was surveyed four times at discharges at Robles ranging from 30 to 69 cfs and Foster Park discharges ranging from 77 to 258 cfs. The Site 3-2 regression produced plausible results using the Thompson passage criteria (Appendix 3), which were 30 and 86 cfs. The resulting minimum discharges required to meet the three other criteria were negative and therefore not plausible. However, when the regression was forced through the origin, the resulting discharges ranged from 10 to 19 cfs. Minimum passage discharge to meet Thompson criteria were also calculated using the site discharge, which were 93 and 186 cfs (Appendix 4).

Site 4 was surveyed six times at Robles discharges ranging from 31 to 76 cfs. The March high-flow event did not appear to alter Site 4 substantially. To validate and quantify this observation, the percent length and continuous length regressions were tested to compare the 2010 and 2011 results. There was no significant difference between the 2010 and 2011 regressions for the percent length of Site 4 that was ≥ 0.6 ft (p-value = 0.07, one-way ANCOVA). In addition, there was no significant difference between the 2010 and 2011 regressions for the continuous length of Site 4 that was ≥ 0.6 ft (p-value = 0.9, one-way ANCOVA). Therefore, the transect data from 2010 and 2011 were combined into one regression model to increase the sample size that improved the regression statistics. The resulting minimum discharges required to meet the Thompson criteria were 62 and 50 cfs (Appendix 5). The resulting minimum discharges required to meet the three other criteria ranged from 40 to 69 cfs. The minimum discharge to meet the Thompson criteria when using the site discharge were 61 and 43 cfs (Appendix 6). Figures for sites 4, 7, and 8 include individual regression lines for each year as well as a line for the combined years. The resulting Robles discharges at those site for 2011 are in Appendix 19a.

The March high-flow event caused substantial changes at Site 5. The primary channel changed from the right (Site 5-1) to the left channel (Site 5-2) due primarily to sediment scour and some deposition. Previously, approximately 80% of the discharge was flowing through Site 5-1. After the high-flow event, approximately 60% of the discharge was flowing through Site 5-2. In fact, there was significantly more discharge flowing through Site 5-2 than 5-1 after the high-flow event (one-sided p-value < 0.001, t-test). Because Site 5-2 was the primary channel, it was used in all analyses. Site 5-2 was surveyed five times after the high-flow event. Robles discharge ranged from 30 to 74 cfs. The resulting minimum discharges required to meet the Thompson criteria were 55 and 14 cfs (Appendix 7). One of the resulting minimum discharges required to meet the three other criteria was negative and therefore not plausible. The regression was then forced through the origin and the resulting discharges ranged from 11 to 23 cfs. The minimum discharge to meet the Thompson criteria when using the site discharge were 48 and 3 cfs (Appendix 8)

Site 6, which was located about 1.3 km upstream from Santa Ana bridge, was substantially modified by the March high-flow event (Appendix 15h). A second channel was created that separated about 20 m upstream of the site. The two channels reconnected approximately 200 m downstream. Initial observations indicated that both channels appeared to have similar discharges; therefore, measurements were collected in both channels to determine the primary channel. The original channel had approximately 46% of the flow and the new channel had 54%. However, this small difference was not statistically significant (p-value = 0.12, t-test). After further analysis, the resulting minimum Thompson discharges for the new side channel were not plausible at -203 and -54 cfs. Furthermore, the regression for the percent total length was not statistically significant (p-value = 0.33). The original channel was chosen for final analysis because there was no significant difference in discharge between the two channels, the new channel regression produced non-plausible results, and original channel had improved regression statistics. The original channel (Site 6-2) was surveyed five times at Robles discharges ranging from 30 to 75 cfs (Appendix 9). The resulting minimum discharges required to meet the Thompson criteria were 64 and 65 cfs. The resulting minimum discharges required to meet the three other criteria ranged from 35 to 96 cfs (Appendix 9). Like the Robles discharge analysis, the site discharge analysis comparing the new channel with the original channel had similar results. The discharge for the Thompson criteria were not plausible at -68 to -440 cfs. Consequently, the original channel for site discharge analysis was deemed most appropriate for the same reasons. The minimum discharge to meet the Thompson criteria when using the site discharge were 31 and 32 cfs (Appendix 10).

Site 7 was not substantially modified by the March high-flow event. There were only two post-storm transects conducted and therefore a valid statistical comparison between the pre and post high-flow event results could not be done. However, the site visually appeared very similar before and after the high-flow event and the one directly comparable discharge produced similar results. As soon as additional data are collected, a comparison will be made. The data from 2010 and 2011 were combined for the final analysis. Site 7 was surveyed five times during 2011 at Robles discharges ranging from 31 to 76 cfs. The resulting minimum discharges required to meet the Thompson criteria were 23 and 53 cfs (Appendix 11). The resulting minimum discharges required to meet the three other criteria ranged from 13 to 26 cfs. The minimum discharge to meet the Thompson criteria when using the site discharge were 17 and 41 cfs (Appendix 12).

Site 8, like Site 7 and 4, was not substantially modified by the March high-flow event. There were only three post-storm transects conducted and therefore a statistical comparison between the pre and post high-flow event results was not suitable. However, the site visually appeared very similar before and after the high-flow event and the data recorded were similar. Like Site 7, when additional data are collected, a comparison will be made. The data from 2010 and 2011 were combined for the final analysis. Site 8 was surveyed five times during 2011 at Robles discharges ranging from

31 to 75 cfs. The resulting minimum discharges required to meet the Thompson criteria were -77 and 6 cfs (Appendix 13). The resulting minimum discharges required to meet the three other criteria ranged from 16 to 28 cfs. The minimum discharge to meet the Thompson criteria when using the site discharge were -74 and -2 cfs (Appendix 14). Photos of the potential impediment sites at a Robles discharge of about 30 cfs are in Appendix 15a-h for reference.

The regression equations and statistics for the four passage criteria using the Robles discharge are in Appendix 16. The calculated minimum discharges to meet the four passage criteria using the Robles discharge are in Appendix 17. The regression equations and statistics for the Thompson passage criteria using the site discharge are in Appendix 18. The calculated minimum discharges to meet the Thompson passage criteria using the site discharges are in Appendix 19.

Discussion

The survey and analytical methods used to evaluate the potential impediments in the Ventura River appeared to be able to produce plausible estimates of minimum discharge needed for adult steelhead passage in most cases. This is assuming that the criteria are valid in determining passage success. The intent of evaluating the impediments using the aforementioned criteria was simply to continue the validation process and determine if similar results could be obtained to that of ENTRIX (1999) on the Ventura River.

ENTRIX (1999) used the criteria developed by Thompson (1972) for adult steelhead at potential impediments, 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 potential impediments 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. Although it is not clear, it appears that NMFS averaged these two numbers and subtracted 10% of the difference [(65+40)/2)-(65-40)x0.1] to develop the initial minimum flow of 50 cfs for the Robles Fish Facility (NMFS 2003a). The discharge estimates by ENTRIX (1999) were generally lower than those produced by field measurements during 2010 and 2011. The mean discharge of all ENTRIX sites for the 25% criterion was about 28 cfs. The mean of the sites, excluding Site 8, reported here was about 53 cfs. 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 2011 included areas that developed secondary and even tertiary channels at higher flows. 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 and 2011 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 those collected during 2010 and 2011 could detect these types of differences. In contrast, the single transect modeling that ENTRIX conducted was incapable of determining such distinctions. The vegetation growth 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 20 March 2011 high-flow event caused substantial changes to the Ventura River channel. These channel changes altered some of the impediment monitoring sites, which necessitated modifications to the monitoring. Site 2 was altered to the point that it no longer appeared to be a potential impediment. This was at least partially because of its location in the Ventura River. The farther downstream a site was, the larger the peak discharge became simply due to the increased drainage area upstream. Other changes were related to new primary channel changes (i.e., switching between two existing channels) or creation of entirely new channels. However, three sites were not altered substantially and data from transects conducted in both years were combined into one regression model to increase the sample size that improved the regression statistics. Sites that changed little were likely able to dissipate more hydraulic energy as in the case of a wide channel or withstand the hydraulic energy without substantial change in the case of a channel with less mobile substrate (Leopold et al. 1964).

There was a clear difference between minimum discharge results based on Robles discharge as opposed to site discharge used in the analyses. At Site 3-2, the minimum discharge to meet Thompson criteria when using the Robles discharge was 30 and 86 cfs. When using the site discharge in the analysis, the minimum discharge was 93 and 186 cfs. This difference of 63 to 100 cfs was due to the tributary flow from San Antonio Creek, surface runoff, channel recharge, and other smaller drainages and tributaries. Site 3-2 was located downstream of the San Antonio Creek confluence with the Ventura River. The discharge from San Antonio Creek and the Ventura River upstream of their confluence share a similar pattern to their hydrographs. In comparing a 32-day period after the March high-flow event, the discharge between San Antonio Creek and the Ventura River upstream of the confluence was highly correlated ($R^2 = 0.99$, p-value <0.0001, linear regression). This should not be too surprising since the Ventura River basin is affected by storm precipitation in a similar pattern and produces a similar post-storm hydrograph among tributaries. Therefore, even though the minimum discharge to meet the Robles-based Thompson criteria was less, the additional water needed to meet the site-based Thompson criteria was intrinsically integrated into the Robles-based model given the similar post-storm hydrographs. Because 2011 was the first year data were collected at Site 3-2, only four transects were completed and additional data would be needed before conclusions could be made.

Upstream of the San Antonio Creek and the Ventura River confluence, the Robles-based minimum discharges were generally greater than the site-based discharges. This appeared to be due to the presence of side channels. Simply, the site-based minimum discharge did not include the secondary channel and the Robles-based minimum discharge did. This difference was generally proportional to the size of the secondary channel. The smallest difference was at Site 4, where there was only a 1 cfs difference for the 25% transect length criterion; 62 cfs for the Robles-based and 61 cfs for the site-based discharges.

Data must be collected at the new impediment sites or additional data collected at sites that changed substantially. Data collected at sites where the bed cross sections changed cannot be combined with previous data and analyzed. This situation applies to sites 3-2, 5-2, and 6-2. For sites where data could be combined for both years, some improvement to regression equations was gained. Site 4 showed significant model improvement for all criteria evaluated. In fact, Site 4 was the most consistent and robust site modeled to date because 1) the model results were similar for all criteria evaluated, 2) the criteria results were from model interpolation and not extrapolation, 3) all models were highly significant (0.001), 4) and the models all conformed to a general conceptual model that would necessitate a negative y-intercept (i.e., no locations on a transect would have a water depth ≥ 0.6 ft before the Robles discharge reached zero).

The limitations of the criteria, method, and/or channel applicability became evident at other sites. Site 7 began to deviate from the conceptual model of a negative y-intercept. Not to a degree that there were non-significant models that produce non-plausible results, only that a more horizontal model was evident for the percent length models; it also suffered from extrapolation issues. Site 8 produce essentially non-plausible results for the percent length models. At -77 and 6 cfs for the Thompson criteria, the limitations were apparent. It appears that for some channel shapes, modeling percent length may not be a valid approach to determine minimum discharge. Even though an absolute measurement will change (e.g., length in feet), a relative measurement (e.g., length as a percent of total) may not.

Additional data analysis may be conducted as more data from each site are collected. Different non-linear models can be explored that could fit the data better and data transformations can be conducted. For example, the Thompson method plots percent length; however, this is generally not an accepted statistical practice when using standard linear regression. 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 in many cases. Additional data collection and analysis will likely improve the results.

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, and discharge at the Robles Fish Facility and the USGS Foster Park gage station. Because the sandbar was open on 01 January 2011, 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 2010 through June 2011, the mouth of the Ventura River was inspected 20 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 2011) and seven were outside of the fish passage augmentation season. The sandbar was only closed during the October observation; however, this closure was brief in nature because it only occurred during low tides. During high tides, the surface water reached the Pacific Ocean (Appendix 20). In mid December of 2010, the sandbar was open and the Ventura River was flowing into the Pacific Ocean allowing fish to volitionally enter or exit the estuary. On 03 January 2011, 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 2011 fish passage augmentation season. On the days the sandbar was inspected during the reporting period, the discharge at the USGS Foster Park gage station ranged from approximately 5 to 1,200 cfs and 0 to 364 cfs at the Robles Fish Facility. The river was observed exiting almost exclusively from the west side of the estuary during the reporting period. During the 25 March 2011 observation, the river was exiting from two locations on each side of the sandbar due to the high river discharge. This observation occurred 5 days past the peak of a storm event.

Discussion

The sandbar at the mouth of the Ventura River tends to remain open during average and above average precipitation years and can close at times 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 21). 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 tendency for the sandbar to remain open in all but very dry years is likely due to a few factors. Although the mid reach of the Ventura River goes dry every year, subsurface water continues to flow and eventually begins to resurface just upstream of the confluence with San Antonio Creek and continues to increase slightly proceeding downstream. Additionally, treated effluent water from the Ojai Valley Sanitary District at rkm 7.5 increases the river discharge by approximately 3 cfs. Finally, tributary flow from San Antonio Creek also adds to the Ventura River through a surface or subsurface connection throughout the year. These factors contribute to the quantity at the mouth of the Ventura River to keep the sandbar from fully forming and closing the outlet during most years. The status of the sandbar indicates changes in the estuary/lagoon that may help determine potential entry and exit condition for adult and juvenile steelhead. It appears that passage conditions remain suitable during most seasons when steelhead are likely migrating. However, conditions optimal for juvenile rearing, which is when the sandbar is closed and a deeper freshwater lagoon is formed, appears limited most years.

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 downstream from the entrance pool 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 can 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 2011. 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 2011, which is when the vast majority of adults were 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 were 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 640 *O. mykiss* were counted from January through June of 2011 in the 340 m study reach (Appendix 22). A total of 7,140 m were surveyed by either bank or snorkel methodologies during the 6-month period. The water temperatures during the study period ranged from 11 °C in January to 22 °C in June and turbidity was less than 14 NTUs. *O. mykiss* were first observed in late January and peaked in late April and early May and remained between approximately 40 to 60 fish for the remainder of the season (Appendix 23). The discharge at the Robles Fish Facility ranged from about 20 to 50 cfs at the time of the surveys. However, during late March between scheduled surveys there was a high-flow event that peaked at Foster Park near 20,000 cfs, which represented a recurrence interval of about 6 years. During the period that *O. mykiss* counts began to increase, the discharge was very constant at about 30 cfs.

The 200 m reach downstream of the fish facility was surveyed on 21 separate occasions, 3 bank and 18 snorkel surveys. A cumulative total of 4,200 m were surveyed from January through June. A total of 205 *O. mykiss* were observed downstream of the Robles Fish Facility (Appendix 24). The peak count for the downstream reach was 24 *O. mykiss*. After the counts increased in late April, generally between 5 and 20 *O. mykiss* were counted each time for the remainder of the study period.

The 140 m reach upstream of the facility was surveyed on 21 separate occasions, 3 bank and 18 snorkel surveys. A cumulative total of 2,940 m were surveyed from January through June 2011. A total of 435 *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 late April and remained relatively consistent for the remainder of the season was similar for both upstream and downstream counts (Appendix 24).

An additional fish attraction survey method was conducted in 2011. This entailed surveying three times per day for five consecutive days following a BO-defined storm event and after a Secchi depth of 1 m was reached in the entrance pool. These surveys were conducted for three storm events and no adult steelhead were observed. Only bank surveys were conducted because the turbidity was too high to conduct snorkel surveys. The BO-defined storm events occurred on 18 February, 26 February, and 20 March. The two February events were relatively small and only yielded a mean daily discharge of 71 and 133 cfs downstream of the Robles Fish Facility. Because of this, the time for the visibility to reach 1 m was only 1 and 2 days, respectively. However, the March event was much larger and 8 days were needed before the visibility reached 1 m. Of the 45 total surveys planned for the post-storm fish attraction study, three were not completed. These were not completed because other aspects of the monitoring program were being conducted during this critical post-storm study period.

Discussion

The total count of 640 *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.

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 24). The increase of upstream and downstream counts simultaneously would indicate the downstream migrating *O. mykiss* were not delayed, at least within the one-week sampling interval, as they passed downstream through the Robles Fish Facility. Likely because of the better water conditions, the fish counts remained somewhat consistent in the reaches to the end of the study period. In previous years, as river flows decreased, *O. mykiss* numbers decreased also due to upstream and downstream movement (CMWD 2010). During 2011, the discharge from the Robles Fish Facility remained greater than 25 cfs through the end of the study period and provided *O. mykiss* with sufficient rearing habitat to remain in the study reaches. Cooler water temperatures also likely contributed to the *O. mykiss* remaining in the study reaches through the study period. It was not until the end of June that measured temperatures exceeded 20 °C.

There was a surface water connection to the lower Ventura River for 16 weeks during the study period, from mid February to the end of May. The surface water connection to the lower Ventura River was lost after smolt counts had reached peak numbers at the Robles Fish Facility. The majority of the steelhead smolts likely had an opportunity to migrate downstream and enter the ocean; however, given that the counts remained high, it is clear that a significant portion did not.

Based on qualitative observations during the snorkel surveys, it appeared that most of the *O. mykiss* were going through the smoltfication process. 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, 524 *O. mykiss* (82%) were observed and 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 method has been used successfully to classify smolting steelhead (Allen Scholz, Eastern Washington University, personal communication). A total of 80% of *O. mykiss* classified were in early to late smoltification stages (T-1 to full smolt). This would indicate that a downstream smolt migration behavior was likely the primary 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, maximum daily water temperatures began to reach 21 °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 and lack of emigration.

The total number of *O. mykiss* observed during 2011 was substantially more than in 2010. During the same period in 2010, 147 *O. mykiss* juveniles were counted as compared to the 640 during 2011 (CMWD 2010). The dramatic increase was likely due in part to the improved water condition that provided suitable habitat in the study reach for a greater period. There was at least one adult steelhead that passed upstream through the Robles Fish Facility during 2010; its spawning success was not known. The observed *O. mykiss* were likely a combination of 1+ and 2+ smolts from steelhead broods and resident rainbow trout produced progeny that had smolted and migrated downstream in attempt to reach the ocean.

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 the number 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 2010 through June 2011 during the reporting period. During this time, the crowder was removed from the fish bypass channel and cleaned or inspected 123 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 34 h during the operation period, which represented 0.9% of the time the Riverwatcher could have possibly been operated if there were no operational limitations. The Riverwatcher was operated a total of 193 days, which was 96.9% of the time the Riverwatcher could have possibly been operated.

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 25 for detection classification flow chart). At the request of NMFS, this classification system was modified during the review process of the 2010 progress report. 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 a useful video clip was recorded, measurements 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, silvery body, vertical edge to caudal fin, ≥ 38 cm TL (Shapovalov and Taft 1954), and had an eye diameter/SL ratio ≤ 0.045 (CMWD 2008). The new classification method could have 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 a fish 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 2011 fish migration season, the Riverwatcher recorded 1,124 total detections, of which 435 were upstream and 698 were downstream (Appendix 26). Of the total upstream detections, 29% (n = 127) were determined to be fish (excluding largemouth bass) and included: 101 *O. mykiss*, 20 probable fish, and 6 unknown fish. Of the total downstream detections, 10% (n = 67) were determined to be fish (excluding largemouth bass) and included 49 *O. mykiss* and 18 probable fish.

The mean date for the upstream migrating *O. mykiss* was 25 May and 05 May 2011 for the downstream migrating *O. mykiss* (Appendix 26). During the migration season, there was a general increase of fish detections for both upstream and downstream (Appendix 27).

Upstream detections occurred essentially at all times of the day, but the modal time was 1200 h (Appendix 28). The majority of downstream detections occurred between about 05:00 h to 13:00 h.

The mean total lengths for both upstream and downstream migrating *O. mykiss* was estimated to be 27 cm (Appendix 26). Overall lengths of upstream and downstream migrating *O. mykiss* ranged from 20 to 46 cm (Appendix 29). 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 5.1:1 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-value < 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 26). The mean water temperature recorded during the time *O. mykiss* were migrating upstream was approximately 18 °C and was 16.7 °C for downstream migrants. The mean turbidity levels at the time of passage for upstream and downstream *O. mykiss* was about 2-3 NTUs. The mean turbidity at the time of the false detections in both upstream and downstream directions was approximately 150-170 NTUs. The discharge from the Robles Fish Facility at the time of upstream passage for *O. mykiss* was a mean of 30 cfs and 31 cfs for downstream *O. mykiss*. Like turbidity, the periods of false detections coincided with higher discharge. For a list of all fish detections, see Appendix 30. The total time the Riverwatcher was not operational because of high turbidity was 4.7 days, which represented 2.6% of the time the Riverwatcher could have been operated if no operational limitations existed.

Discussion

Approximately 939 false detections occurred and were likely due to greater river discharges, associated turbidity and debris, and settings of the Riverwatcher to detect smaller fish. In addition, to increase the chance of detecting any adult steelhead, the Riverwatcher and crowder were left in the ladder for longer periods at high turbidity. Since the Riverwatcher is recommended to be set at a minimum of no less than 40 mm (Vaki 2003), an overestimation of fish passage was likely since all false detections could not be identified and eliminated. For the 2011 season, the minimum height was set at 28 mm so that a large number of false detections could be eliminated while still attempting to detect steelhead smolts. Based on available data from the Ventura Basin, the height of 28 mm was determined to be similar to some of the smallest steelhead smolts expected to emigrate downstream through the Robles Fish Facility. 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 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 indicates that the Riverwatcher is unable to sufficiently monitor steelhead smolt emigration and given the manufacture's operational recommendations, these results should not be surprising. Additional Riverwatcher validation/calibration tests were conducted during the summer of 2011 in an attempt to further identify the operation limitations of the Riverwatcher. These results will be reported on in the 2012 progress report.

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 uniform and rapid directional movement is also supported by observations during fish attraction monitoring where *O. mykiss* have been observed repeatedly swimming in and out of the fish ladder on both the upstream and downstream ends. Also, *O. mykiss* that appeared to be the same fish (based on video and length estimates) have been observed on video swimming back and forth through the fish crowder. *O. mykiss* juveniles were observed holding in 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 and all stages were observed. Because the smolt migration rate is positively correlated with the smoltification process (Quinn 2005), some holding and lack of rapid 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 reasons for the differences have not been determined at this time. The early morning movement of downstream migrating smolts is common among steelhead throughout its range (Dauble et al. 1989). 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 are 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 plausible 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.

3.4 Downstream Fish Passage Evaluations

Introduction

Passage evaluations of migrating salmonids 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 downstream migrants 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 for all three dimensions) with an internal fyke. The trap was situated in the center of the river channel and thalweg. The live-box internal frame was constructed 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 approximately 1 m so adult steelhead could pass upstream by the trap location (Appendix 31). 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 2011 or until water temperatures exceeded a daily mean of 22°C, which could negatively impact captured fish (SYRTAC 2000).

The trap was 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 in use, 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 scales and tissues 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). A concentration of 60-100 mg/L of MS-222 was used to achieve a short induction time (3-4 minutes) as recommended by Summerfelt and Smith (1990). This concentration allows for a recovery time of less than 5 minutes (Summerfelt and Smith 1990), but from previous experience, anesthetized steelhead smolts generally 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 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 was 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, a second trap would be installed and operated upstream of the Robles Fish Facility. To determine if any injuries were the result of passage through the facility, steelhead would be captured, marked, and released upstream the Robles Fish Facility and recaptured downstream of the facility to any differences.

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 14 March through 17 June 2011. During the 20 March high-flow event, the weir trap was swept downstream and lost. Just prior to its loss, an attempt was made to remove as much of the trap before the higher flows reached the Robles Fish Facility, but debris overloaded the fish screens and forced water to be spilled earlier than anticipated. A replacement trap was not installed until 04 April 2011, 15 days after the peak flows. Trapping was stopped when the mean daily water temperatures approached 22 °C and there was a forecasted increase of air temperatures.

A total of 25 smolts were captured between 13 March and 10 May 2011; 52% of the smolts were captured during the first two weeks of April (Appendix 32). The mean FL was 203 mm and mean weight was 85 g. The smolts all appeared to be undergoing smoltification; 28% were T-2, 24% were T-3, and 48% were full smolt and the mean condition factor was 1.0. The mean daily water temperature was 14.7 °C on days when smolts were captured. During days smolts were captured, the stream discharge into the Robles Fish Facility ranged from 40 to 177 cfs. All 25 smolts showed signs of descaling. Using the descaling assessment methods described, the descaling ranged from 0.8% to 9.3% with a mean of 3.4%. The most common physical injuries were small but noticeable areas of skin damage to the head region on 22 (88%) *O. mykiss* captured. Other injuries included skin contusions on 4 fish (16%), and 2 fish (8%) showing some fin damage.

Of the 25 smolts captured, 16 were radio tagged and released downstream into the first weir pool. One *O. mykiss* was too small to radio tag and was released into the pool. In order to help understand migration behavior of *O. mykiss* smolts near the Robles Fish Facility and determine condition and travel rate for any recaptured fish, all smolts captured in excess of radio tagging needs were implanted with a PIT tag. There were 8 smolts PIT tagged and released approximately 2 km upstream of the Robles Fish

Facility at the Camino Ciello bridge. No PIT-tagged *O. mykiss* were detected migrating downstream through the fish ladder or were recaptured in the weir trap.

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). Previous trapping efforts resulted in limited, but improving capture success. The 25 smolts captured in 2011 was a significant increase over previous years and allowed for a more thorough evaluation. *O. mykiss* juvenile are successfully navigating through the Robles Fish Facility during the expected steelhead smolt migration period considering the following: 1) smolts were captured migrating downstream through the Robles Fish Facility, 2) the fish attraction evaluation observed smolts downstream of the facility, 3) and the Riverwatcher and downstream video cameras detected downstream-migrating *O. mykiss*.

The second objective of downstream fish passage evaluation is to determine if there are any injuries to steelhead smolts or kelts that may be caused by passing downstream through the Robles Fish Facility (NMFS 2003a). The 25 *O. mykiss* smolts captured downstream of the Robles Fish Facility had a mean descaling of 3.4%. It could not be determined how much of this was due to passage downstream through the Robles Fish Facility or the trapping and handling procedures. Smolts are known to easily lose scales, and given that scales were commonly found in the anesthetizing and recovery buckets, much of this loss could likely be due to handling. A literature research will be conducted to determine what level of scale loss other researchers have estimated for steelhead smolts passing through fish facilities versus trapping and handling.

The skin damage on the heads of many of the smolts is thought to be from trapping. This was first noticed with some of the smolts captured prior to the 2011 season, but to a greater degree. After changing the mesh material to a smaller size two successive years, the severity of the injury has been reduced. The location of the skin damage on the top of the snout and head region suggests that it may result from “nosing” into the mesh to avoid capture while in the trap; this behavior was also observed during removal from the trap. Even though the percentage of smolts with this injury was high, the actual size of the injury was small. The injuries were approximately 2 mm x 10 mm and corresponded to the shape and dimensions of the plastic mesh. The injuries were not skin abrasions, but contusions and the epidermis was not broken. Given this detailed level of *O. mykiss* examinations, small injuries that would likely go unnoticed have been observed. Additional improvements will be made for the 2012 trapping season by adding smoother material to the inside of the trap to determine if the injuries can be reduced or eliminated.

The last smolt was captured on 10 May 2011 and was the only one captured in May. Given that the mean daily water temperature was consistently exceeding 16-17 °C (Appendix 33), the lack of continued downstream migration of *O. mykiss* was not unexpected. These temperatures are known to exceed the temperature limit of smolt regulating enzymes and hormones (Allen Scholz, Eastern Washington University, personal communication) and could explain much of this behavior as the *O. mykiss* residualized. The results of the data indicate that smolts actively migrating were doing so primarily from mid March to mid April. Since the trap was capturing smolts very soon after it was installed, an earlier start to trapping might be necessary to determine the initiation of emigration.

3.5 Downstream Fish Migration through the Robles Reach

Introduction

When the number of fish physically handled in a study is of concern, such as with an endangered species, 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 tagged fish until the batteries die, it is anticipated that downstream migration can be monitored all the way to the Ventura River estuary/lagoon and 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, a pilot study using radio telemetry was used for evaluations.

Methods

During the expected smolt migration period of mid-March through mid-June, 16 steelhead smolts captured in the weir trap downstream of the Robles Fish Facility were tagged with radio transmitters and released downstream of the weir trap. Only steelhead smolts that exhibited steelhead smolt characteristics and in good physical condition were tagged. 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 smolting characteristics have been used in southern California to identify steelhead smolts migrating downstream (Spina et al. 2005).

The radio transmitters 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 smolt weight in the air was less than 5%, which ensured that physiological stress will be minimized (Jepsen et al. 2001) and swimming performance was not 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 was expected to be closer to approximately 3%. The steelhead smolts 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 tags were 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 were behaving normally before they were released downstream for 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 smolts were released downstream of the weir trap. Each tagged smolt was located on a daily basis as it migrated downstream for the first week after release and then at least weekly until the battery died, 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 was 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

Of the 16 smolts tagged and released downstream of the Robles Fish Facility, 7 smolts were found to have migrated through the Robles Reach (Appendix 34). The number of days to migrate through the Robles Reach ranged from 1 to 8 days and the mean was 3 days. This was a mean migration rate of 2.2 km/day. The range of discharges from Robles during the period from release to initial detection downstream of the Robles Reach was from 30 to 33 cfs for all but one of the tagged smolts. One smolt was detected downstream of the Robles Reach one day after release; a migration rate of about 6 km/day. This occurred as flows were increasing during the March high-flow event. The remaining 9 smolts were found to have moved less than 4 km downstream of the Robles Fish Facility. It appears that a high rate of tag regurgitation occurred during the study. Of the 16 smolts tagged and released downstream of the Robles Fish Facility, 10 smolts appeared to regurgitate their tags. The range of days to regurgitation was estimated to be from 1 to 18 days and the mean was about 6 days. This did not include one *O. mykiss* that was found to move upstream of the Robles Fish Facility. Due to the length of time from release until it was found, an accurate time to tag loss could not be calculated.

Discussion

Even though the high rate of regurgitation limited the number of days that smolt migration behavior could be assessed, the time prior to tag loss did provided important information. It's not known the exact cause of the high tag loss. The size of the tag may have been too small, which could have allowed regurgitation to more easily occur. Before additional tags are used, a literature review will be conducted to determine if there is a correlation of tag and body size to tag loss. There was an attempt to locate all of the tags that were thought to be regurgitated. For fish that had not moved for a period of time, the tag location was determined and the surrounding area was snorkeled. While the snorkeling was occurring, the tag was continuously monitored to determine if any movement occurred that would indicate the fish still had the tag and was moving away from the snorkeler. Even with multiple searches, no tags were found using this method. Tags regurgitated prior to the high-flow event could have been buried by bed-load, but why tags regurgitated after the high flow could not be found is uncertain. The closest a tagged *O. mykiss* was found to the mouth of the Ventura River was at rkm 5, about 200 m downstream of Shell Road bridge. Other tagged smolts were lost and not found after a week or two and it is possible that they migrated down and out of the Ventura River before they could be detected in the lower river. The primary object of the study was to evaluate migration through the Robles Reach and therefore the same effort was not given to searching the lower river. In addition, it was much more difficult to find suitable sites to access and search the lower river and fish could have more easily moved through the lower river undetected. In general, the method of radio telemetry to evaluate movement through the Robles Reach appears useful at addressing this objective. Additional data is still needed to better understand the smolt migration through this reach.

4.0 ROBLES FACILITY OPERATIONS

4.1 Facility Status

The Robles Fish Passage Facility started the 2010-2011 season in a fully functional mode with the exception of the Fish Ladder flow meter. The 2010-2011 season was characterized by an above average rainfall year, 35.99 inches as measured at Casitas Dam. The average annual rainfall at the dam is 24.06 inches. The area experienced an unusually wet December in 2010 with 15.79 inches reported for the month at Casitas Dam and good rainfalls in February and March 2011. Two peak flow events, one with an overlapping peak, as defined by the BA/BO occurred during the Fish Flow Operations Season. Water diversions began on December 19, 2010 and continued through June 14, 2011 with the exception of two days in February. The diversion periods included water that was downloaded from Lake Matilija. Some surface flow continued over the measurement weir through the date this section of the report was prepared in late August 2011.

The 2010 Report identified several projects to be completed during the summer and fall. The principal projects were:

- 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.

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

Adjust interim weir two and three to improve fish passage-This work was accomplished. Additional adjustments may be made to weir three during fall 2011.

Replace the mechanical limit switches with optical switches on the brush system- This work was accomplished. The new optical limit switches so far have been more reliable then the original mechanical switches.

Repair or replace the auxiliary water flow meter-The meter was found to be intact and functioning. The erroneous readings appear to be from "sloshing".

Relocate the fish passage flow meter to minimize turbulence from the Vaki shroud-Work on this item was begun but the early heavy rains prevented completion. The work will be completed during the summer and fall of 2011.

Update and improve the automated controls for the facility-This work was completed and will continue as Casitas gains additional experience with the system.

4.2 Flow Observations and Control

Flow and level measurement devices are 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 headworks – 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). **Note: This is the most reliable flow measurement for the fish passage and downstream releases.**
- 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. **Note: This flow measurement device was not functional during the 2010-11 season.**
- Auxiliary Water Supply-An American Sigma flow meter. This meter did not function properly. The problem is now believed to be "sloshing" in the pipe. Casitas has proposed a solution.

All of the instruments can suffer from inaccuracies from time to time. The inaccuracies can be caused by clogged bubbler lines, electronic creep, debris accumulating on sensors, changes to the measured cross sections, and equipment problems. For this reason, the data were 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. Note: *The spreadsheets are in Appendix 35, entitled "Ventura River Flow Assessment for the Robles Fish Passage Facility – FY 10-11".*

The fish screens remained in place for the entire year.

Two storm peaks occurred this year that triggered BA/BO required supplemental flow releases. The peaks occurred on February 18 and on March 20, 2011. An overlapping peak, as defined by the BO occurred on February 26, 2011. The February peak was relatively small at about 215 cfs. The overlapping peak was the larger peak at 270 cfs. The March peak was the largest peak the system has seen since 2005 at over 6000 cfs. Some flow did go over the cut-off wall during the March peak.

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 2010-11 fiscal years:

- **Fisheries Monitoring**:

Salaries & Benefits	$331,623
Equipment/Material	$ 42,356
	$373,979

- **Facility Operations**:

Salaries & Benefits	$ 93,007
Equipment/Materials	$ 14,158
Outside Contracts	$ 15,841
Utilities	$ 5,286
Permit	$ 535
	$128,827

- **Capital Improvements**:

  No capital improvements were made during this fiscal year.

4.4 Assessment of the Effectiveness to Provide Fish Passage

Casitas has entered into an agreement with HydroScientific West to complete the first phase of the performance (hydraulic) testing. Performance testing of the fish screen was completed March 24 and 25. The report for the fish screen portion of the testing is scheduled to be delivered shortly.

Some initial velocity data were collected during 2008 to provide general fish ladder operation parameters. During a downstream release of 50 cfs, velocity measurements were collected at the top, middle, and bottom of the entrance gate #5. Each slide gate is 18 in wide and 8 ft tall. At each location, four measurements were taken that spanned the width of the gate. This resulted in a total of 12 velocity measurements per gate measurement. Gate #5 was first measured with the total 50 cfs flowing only through it. The mean velocity was 2.0 ft/sec for all 12 measurements. However, the velocity increased with depth. The surface mean velocity was 0.2 ft/sec, the middle of the gate was 2.8 ft/sec, and the bottom was 3.2 ft/sec. With gates #4 and #5 open at 50 cfs, the mean velocity in gate 5 dropped to 1.1 ft/sec. The surface mean velocity was 0.2 ft/sec, the middle of the gate was 2.2 ft/sec, and the bottom was 1.0 ft/sec.

4.5 Recommendations Regarding the Prioritization of Future Activities

The District has completed its sixth 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:

- Modify the diffuser panel in the auxiliary water system.
- Complete the relocation of the fish passage flow meter to minimize turbulence from the Vaki shroud.
- Adjust interim weir three if flow stops in the weir section of the river.
- Modify the differential level sensors at the fish ladder entrance to individually read water levels.

4.6 Recommendations on any Revisions Deemed Necessary to the Operations

Casitas is recommending that the fish screen diffuser panels be replaced. The current diffuser panels are two super-imposed perforated plates with ¼” holes at 3/8” staggered centers. Casitas is proposing to replace the perforated plates with ½” diameter holes on 11/16” staggered centers perforated plates. This year, the brush system worked much better at keeping the screens clean. However, the diffuser panels behind the screens became clogged. The fewer but larger openings of the proposed panels should reduce the clogging.

Casitas has proposed modifying the diffuser panel on the auxiliary water in an email to all BC members. This diffuser appears to be restricting the flow in the auxiliary water system.

Casitas continues to recommend 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*.

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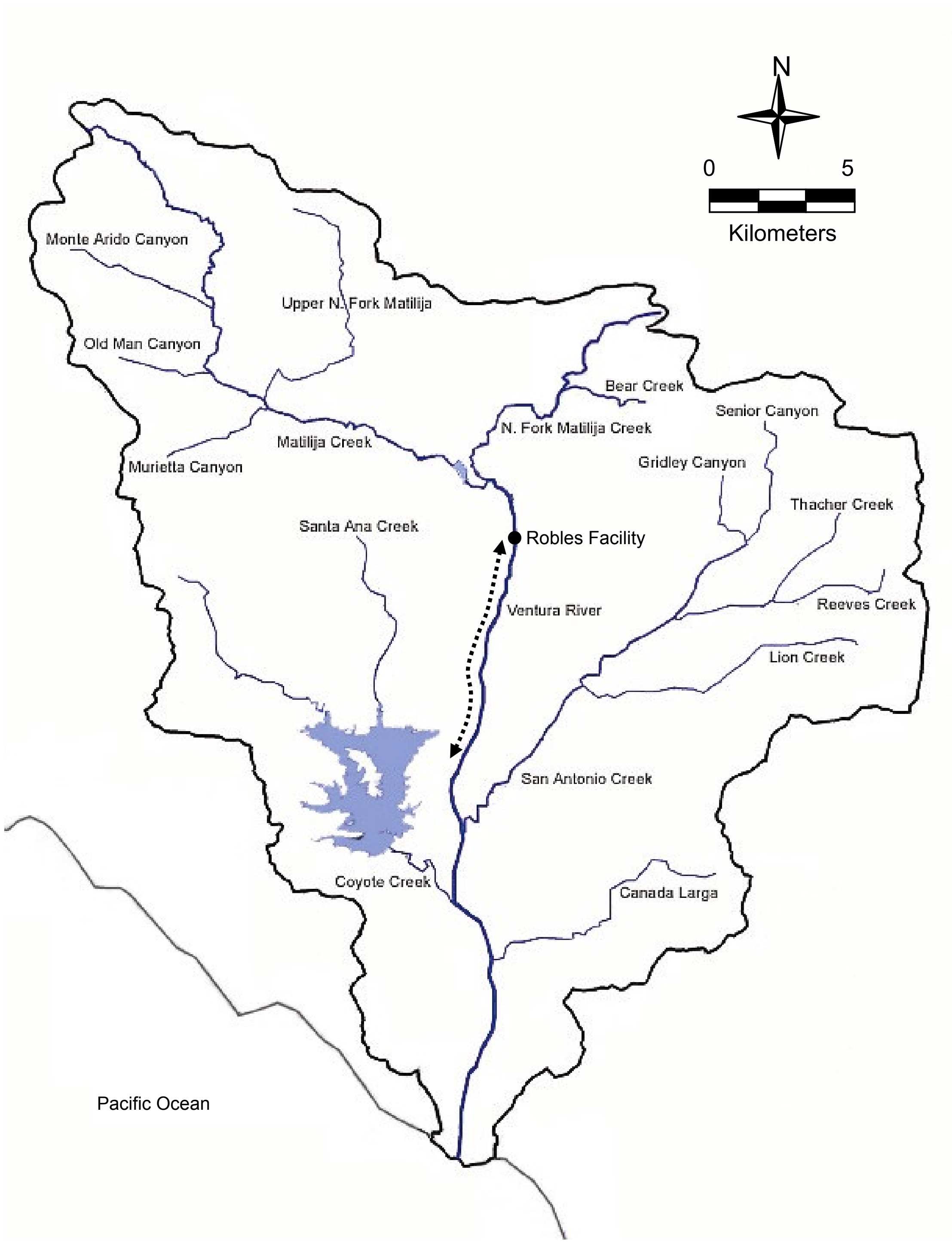
6.0 APPENDIXES



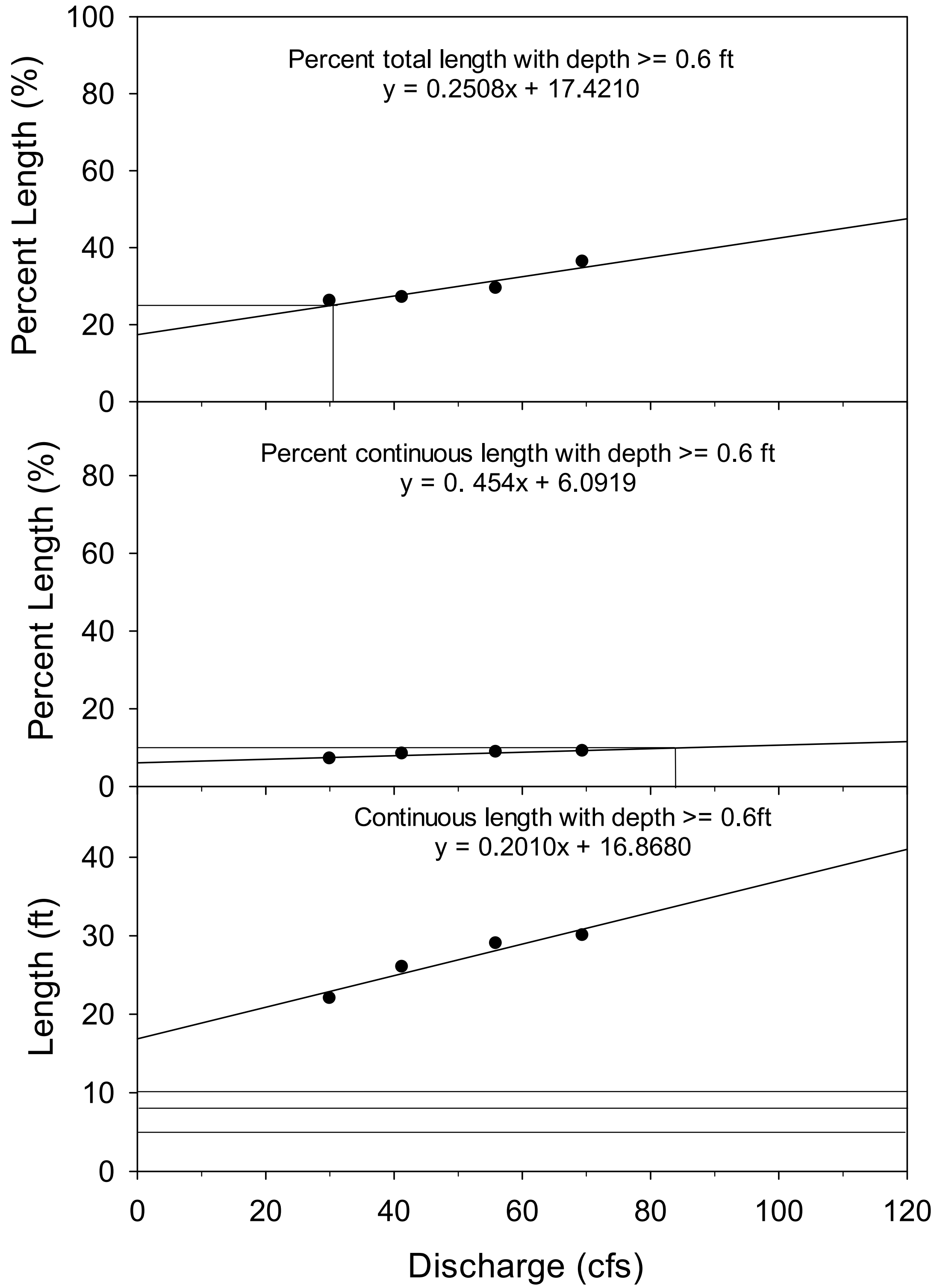
Appendix 1. Basin map of the Ventura River. The Robles Fish Passage Facility is identified by the black dot and the Robles Reach is identified by the dashed line downstream of the Robles Facility.

Appendix 2. Summary data of impediment sites originally selected during 2009 for upstream fish migration impediment evaluations. Several sites were altered by high flows that peaked 20 March 2011 (see text for description).

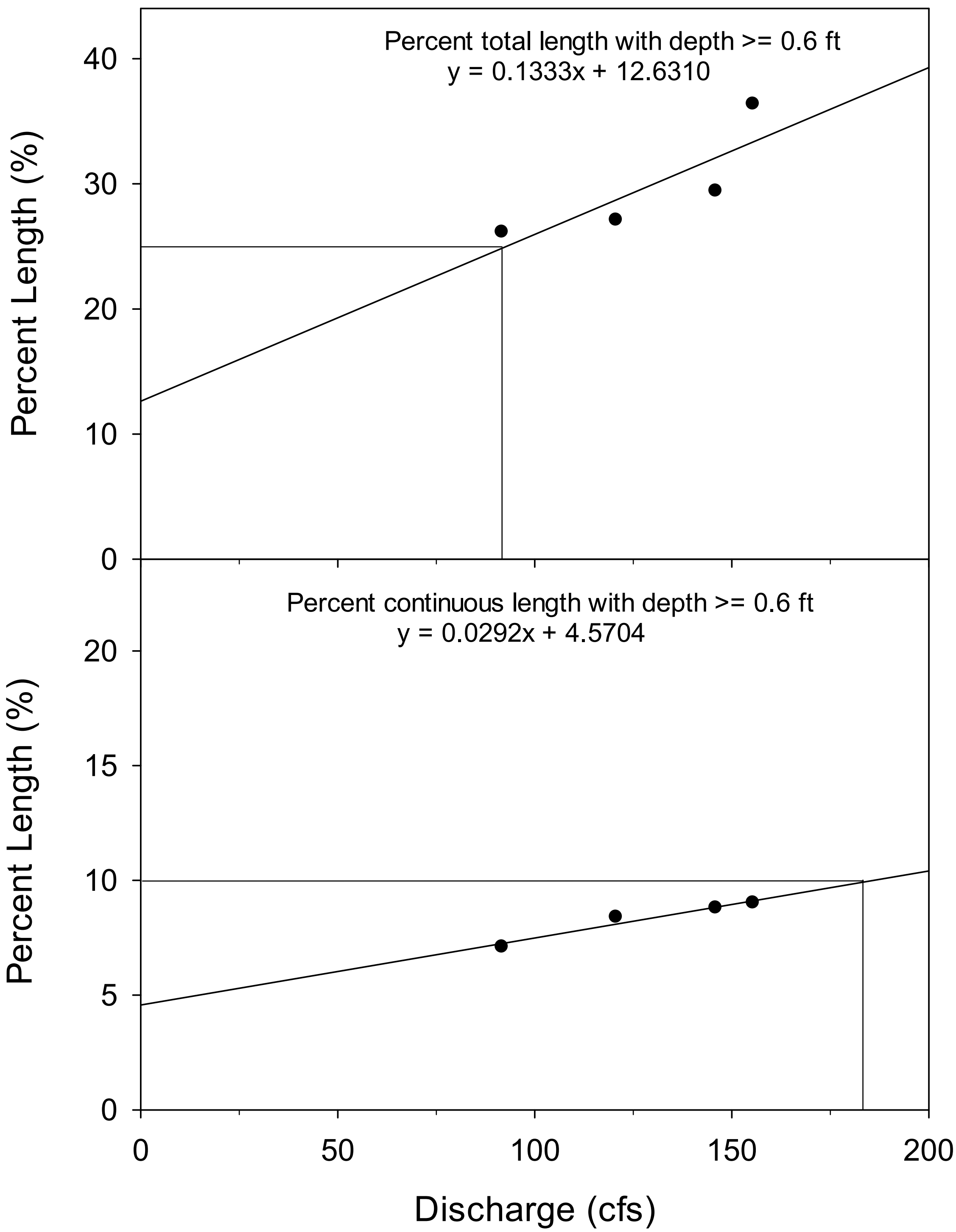
Site	Latitude (N)	Longitude (W)	km	Habitat Type[a]	Site Description	Length (m)	Slope (%)	Percent Substrate[b] SO	SD	GR	CB	BD	BR	Active Channel Width (m)
1			0		River mouth				100					
2	34°20'27"	119°17'53"	7.5	RI	Near treatment plant	16.4	2.8	10	10	15	45	20	0	31.3
3	34°22'07"	119°18'34"	11	RB	Near Casitas 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.

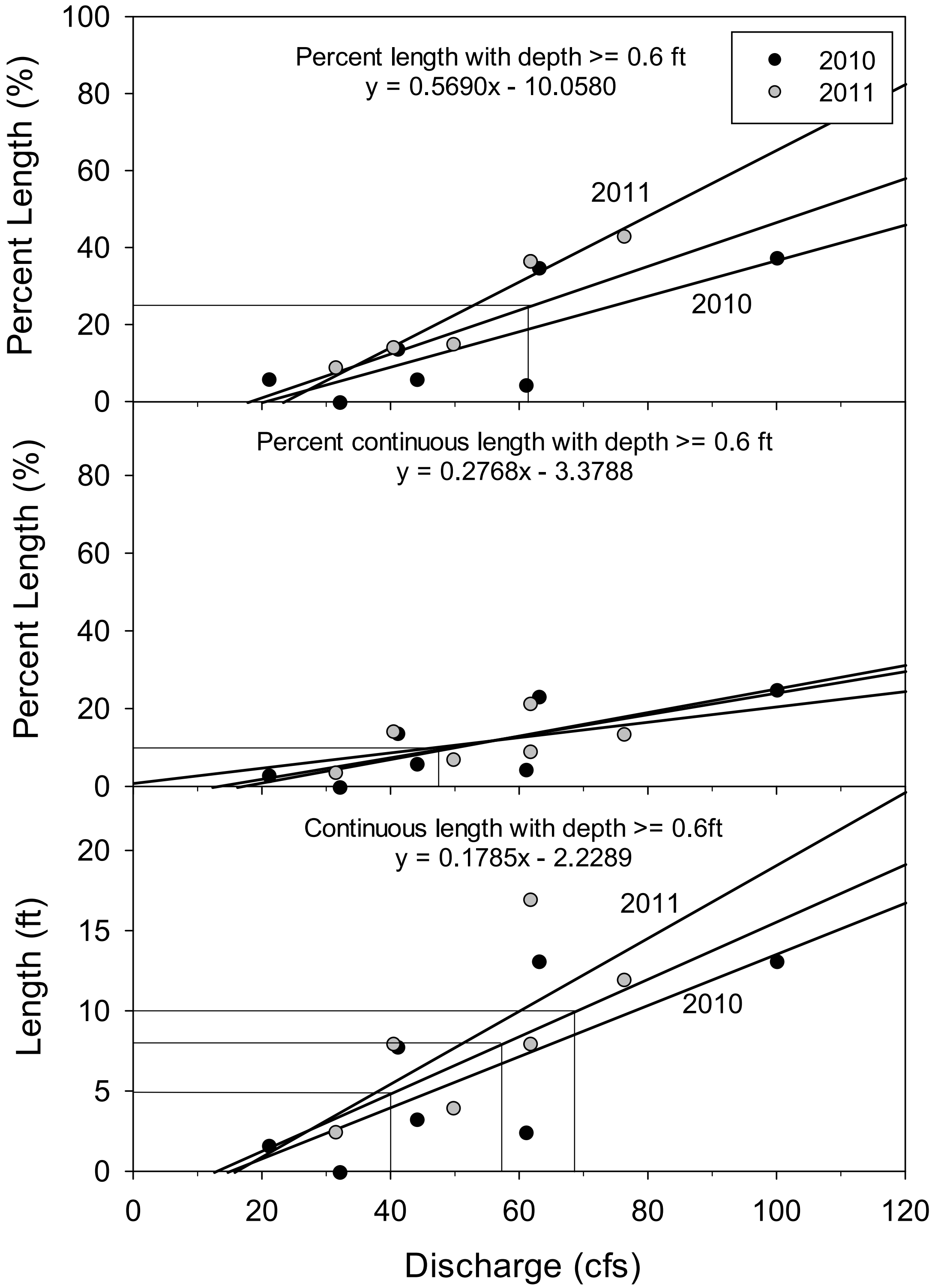
[b]The substrate types are: SO = silt and organics, SD = sand, GR = gravel, CB = cobble, BD = boulders, and BR = bedrock.



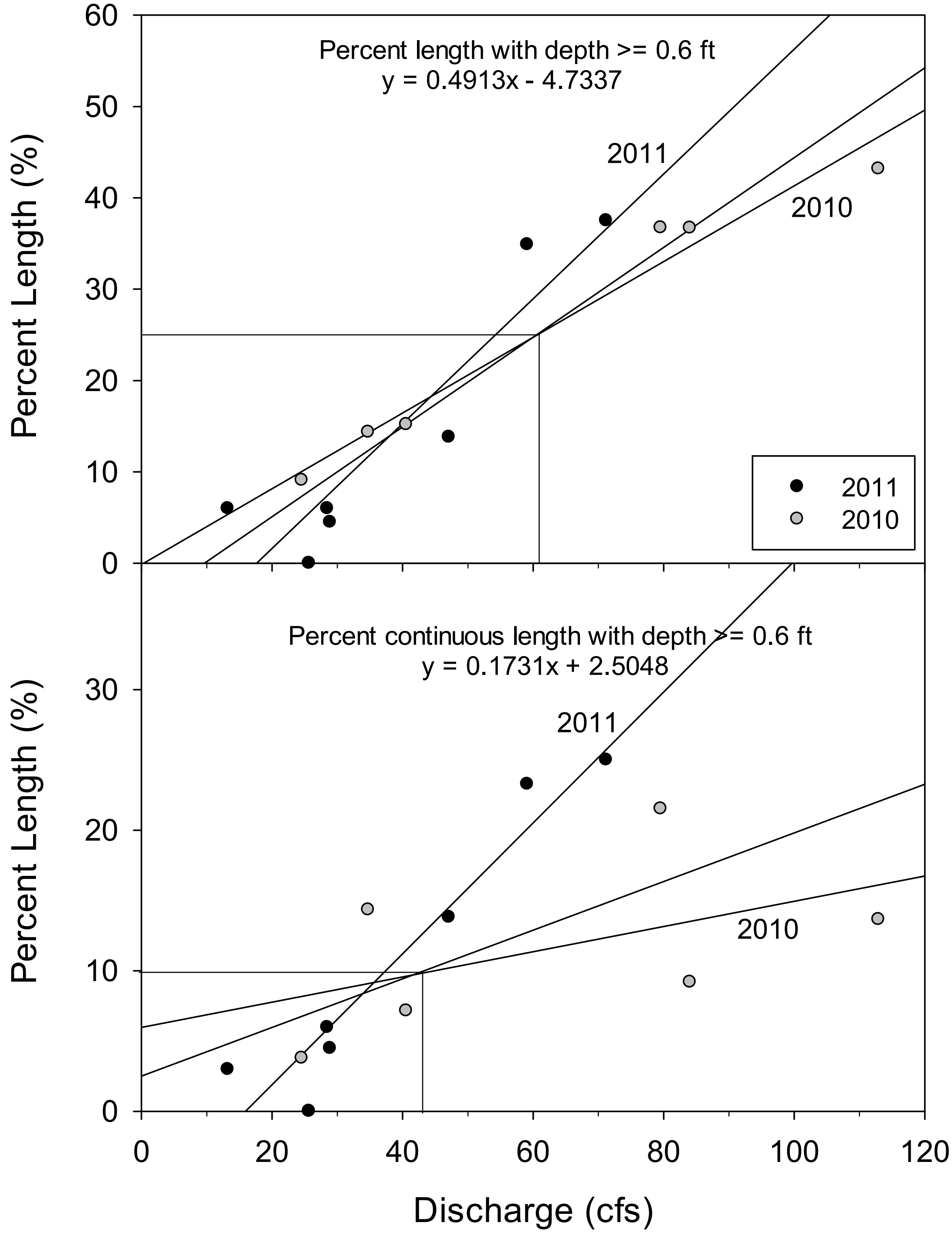
Appendix 3. Relation between Robles discharge and water depth at Site 3-2 near Casitas Springs and resulting discharge for various passage criteria.



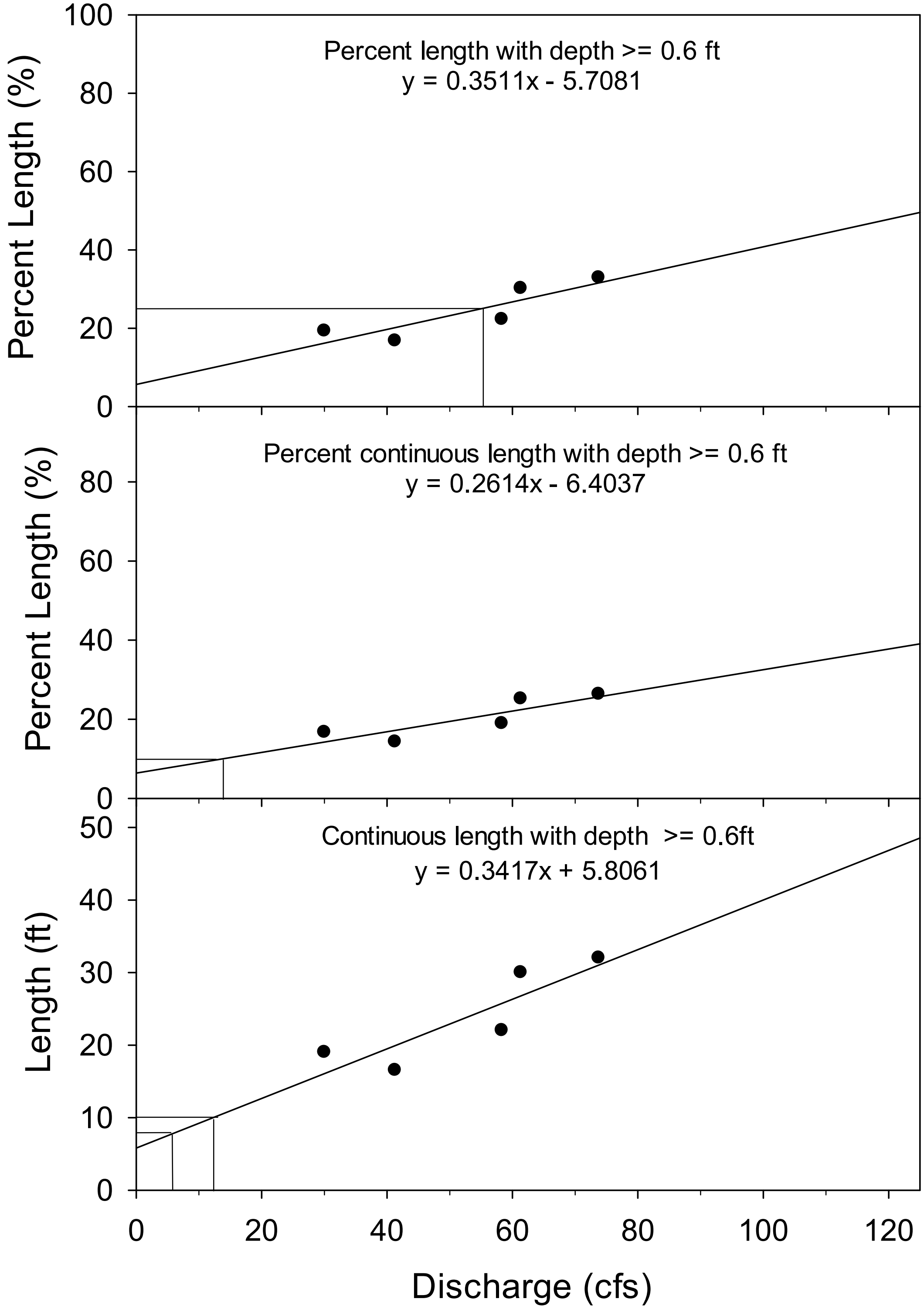
Appendix 4. Relation between site discharge and water depth at Site 3-2 near Casitas Springs and resulting discharge for the Thompson passage criteria.



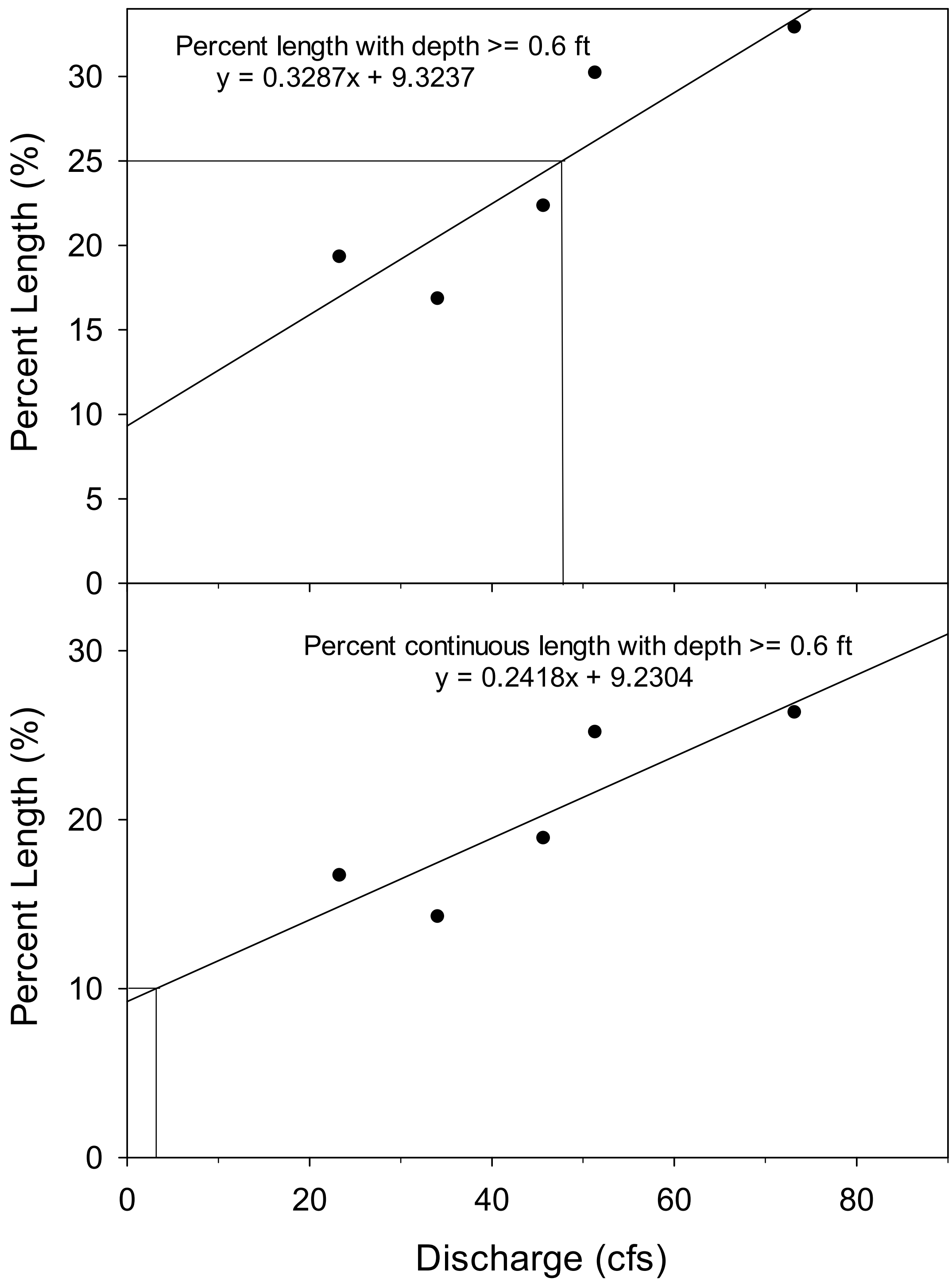
Appendix 5. Relation between Robles discharge and water depth at Site 4 upstream of San Antonio Creek and resulting discharge for various passage criteria.



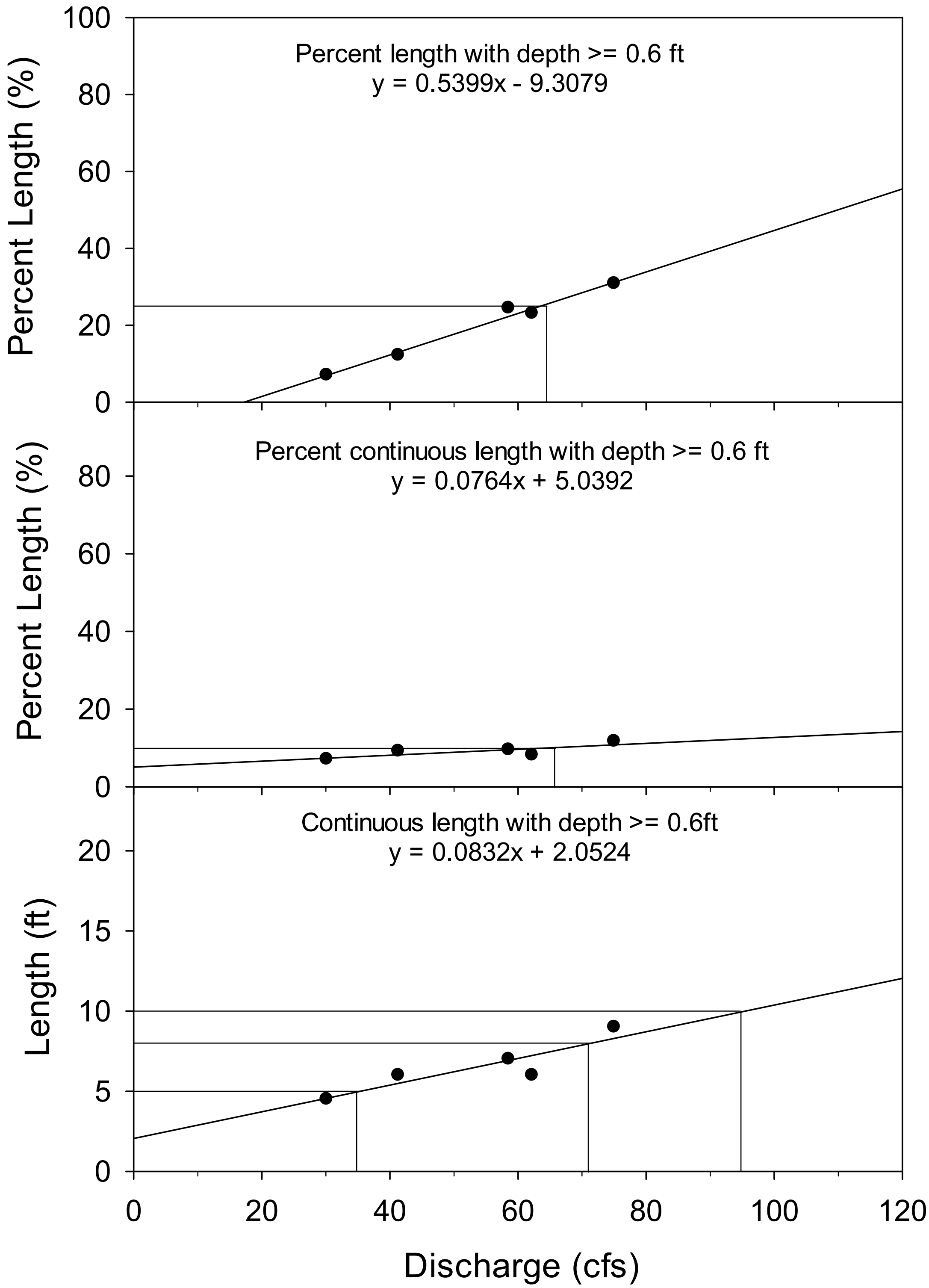
Appendix 6. Relation between site discharge and water depth at Site 4 upstream of San Antonio Creek and resulting discharge for the Thompson passage criteria.



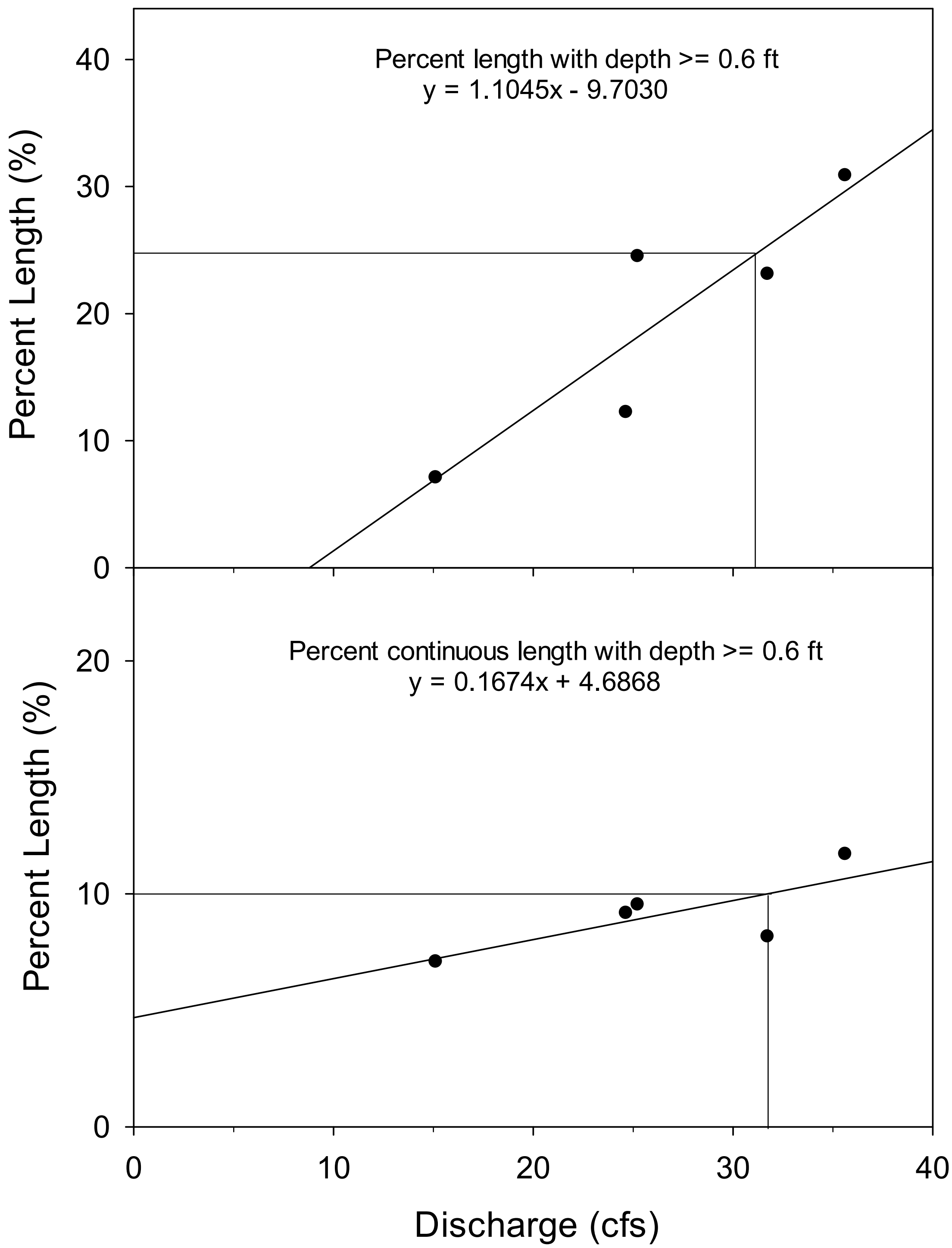
Appendix 7. Relation between Robles discharge and water depth at Site 5-2 downstream of Santa Ana bridge and resulting discharge for various passage criteria.



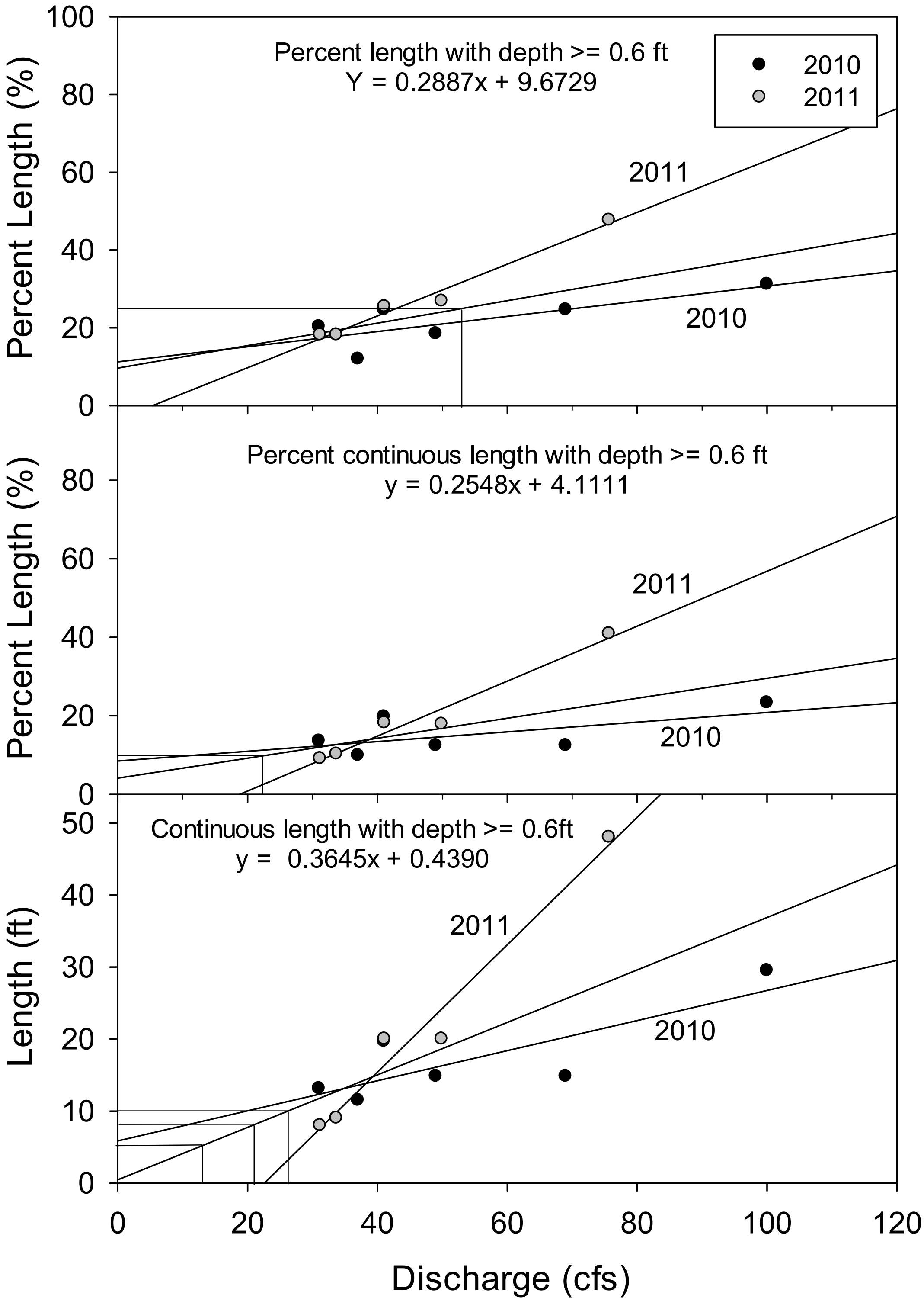
Appendix 8. Relation between site discharge and water depth at Site 5-2 downstream of Santa Ana bridge and resulting discharge for Thompson passage criteria.



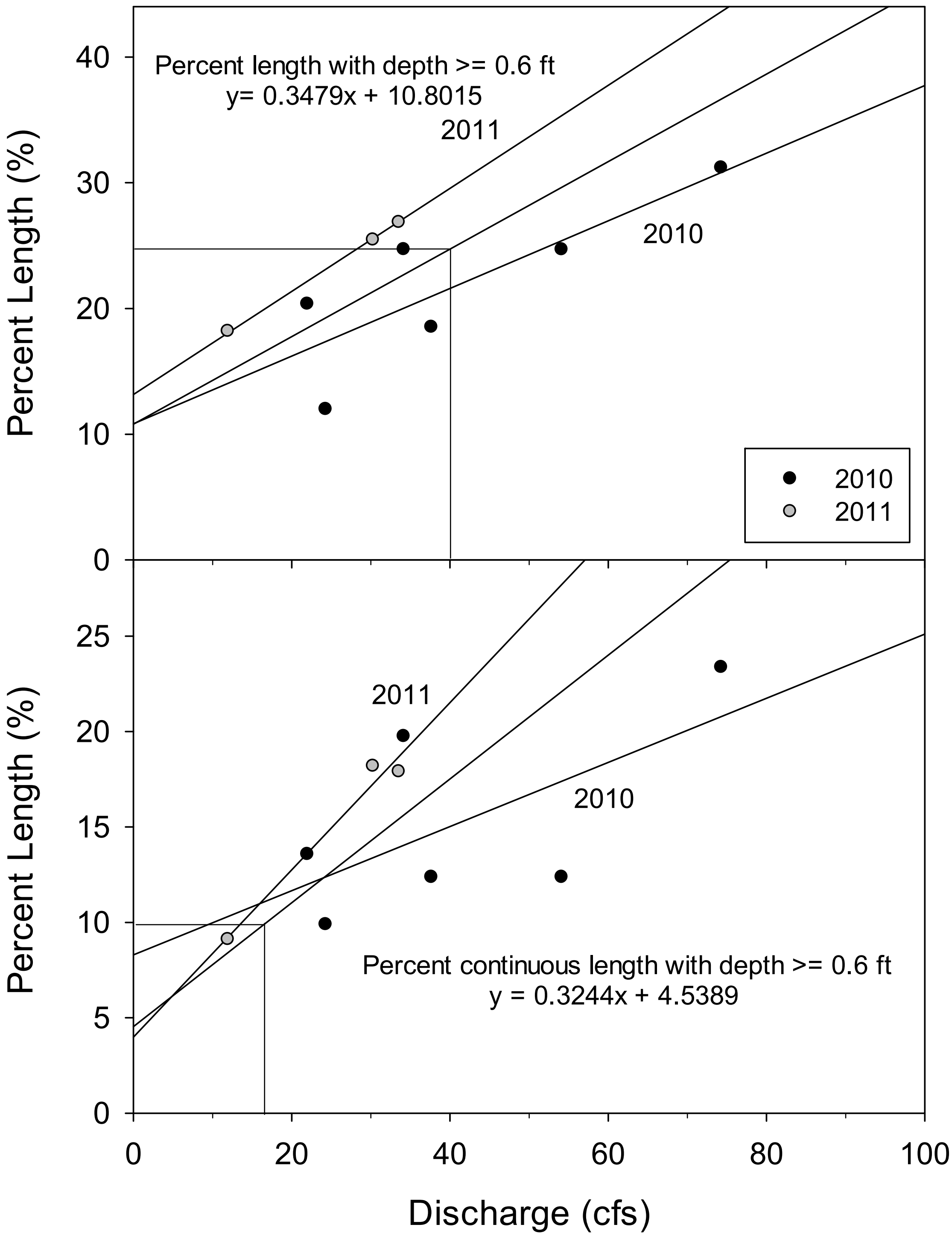
Appendix 9. Relation between Robles discharge and water depth at Site 6-2 upstream of Santa Ana bridge and resulting discharge for various passage criteria.



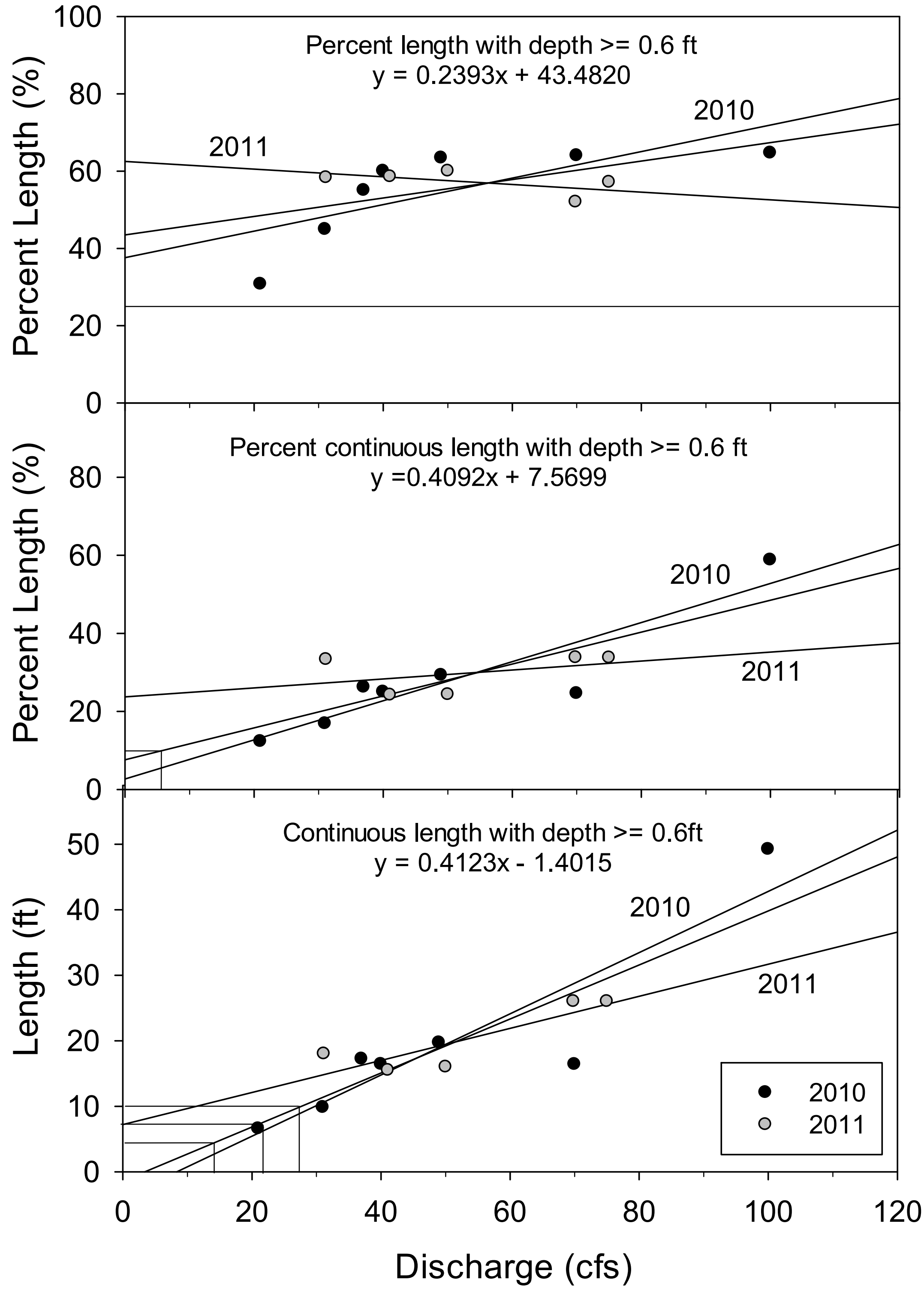
Appendix 10. Relation between site discharge and water depth at Site 6-2 upstream of Santa Ana bridge and resulting discharge for Thompson passage criteria.



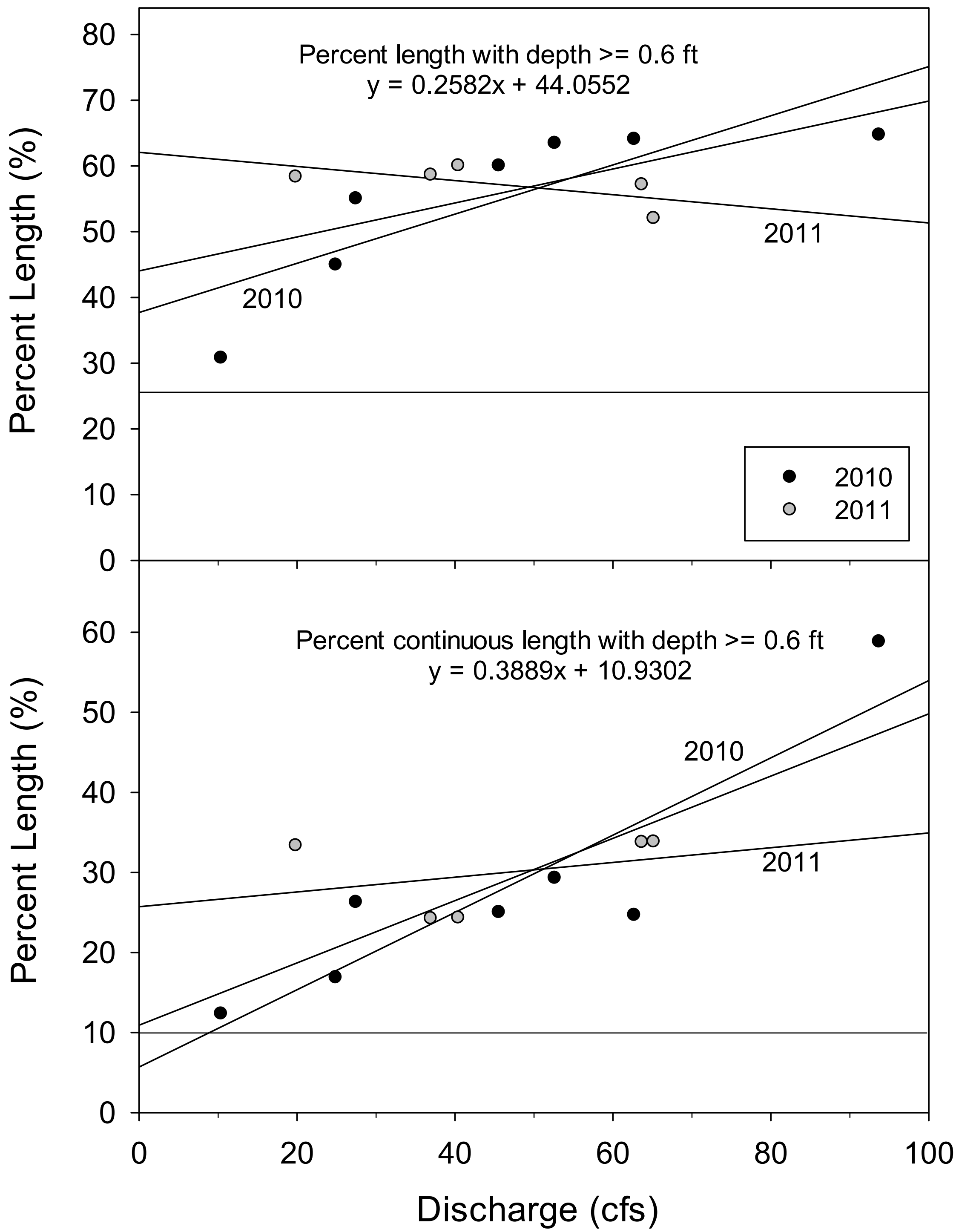
Appendix 11. Relation between Robles discharge and water depth at Site 7 upstream of Hwy 150 bridge and resulting discharge for various passage criteria.



Appendix 12. Relation between site discharge and water depth at Site 7 upstream of Hwy 150 bridge and resulting discharge for Thompson passage criteria.



Appendix 13. Relation between Robles discharge and water depth at Site 8 downstream of the Robles Fish Facility and resulting discharge for various passage criteria.



Appendix 14. Relation between site discharge and water depth at Site 8 downstream of Robles Fish Facility and resulting discharge for Thompson passage criteria.


A.


B.


C.

Appendix 15a. Photos of Site 2 impediment on 13 April 2011 during 64 cfs, as measured at Foster Park USGS gage, looking from: (A) upstream, (B) upstream from upstream edge of impediment, and (C) downstream from upstream edge of impediment.

A.

B.

C.

D.

Appendix 15b. Photos of Site 3-2 impediment on 05 April 2011 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 15c. Photos of Site 4 impediment on 26 April 2011 during 31 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 15d. Photos of Site 5-2 impediment on 05 April 2011 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 15e. Photos of Site 6-2 impediment on 05 April 2011 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.

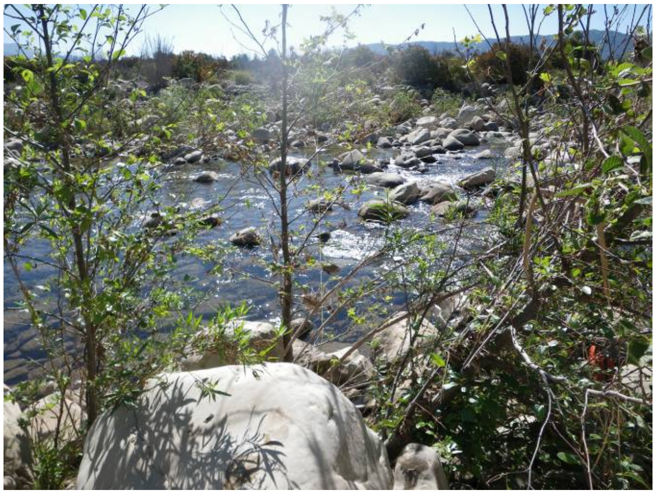

D.

Appendix 15f. Photos of Site 7 impediment on 26 April 2011 during 31 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 15g. Photos of Site 8 impediment on 26 April 2011 during 31 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.

Appendix 15h. Photos of Site 6 impediment Site 6 looking downstream on 09 March 2011 (A) during 36 cfs discharge release from Robles Fish Facility and looking downstream from similar location on 01 April 2011 (B) during 39 cfs.

Appendix 16. Regression equations and statistics of the four passage criteria using the Robles discharge evaluated at potential impediment sites.

	% Total Length with Depth ≥ 0.6 ft			% Continuous Length 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
3-2	y = 0.2508x + 17.4210	0.87	0.07	y = 0.0454x + 6.0919	0.83	0.09	y = 0.2010x + 16.8680	0.92	0.04
4	y = 0.5690x - 10.0580	0.61	< 0.01	y = 0.2768x - 3.3788	0.51	0.01	y = 0.1785x - 2.2289	0.50	0.01
5-2	y = 0.3511x + 5.7081	0.76	0.05	y = 0.2614x + 6.4037	0.73	0.06	y = 0.3417x + 5.8061	0.75	0.06
6-2	y = 0.5399x - 9.3079	0.98	< 0.01	y = 0.0764x + 5.0392	0.62	0.11	y = 0.0832x + 2.0524	0.79	0.04
7	y = 0.2887x + 9.6729	0.46	0.02	y = 0.2548x + 4.1111	0.38	0.05	y = 0.3645x + 0.4390	0.49	0.02
8	y = 0.2393x + 43.4820	0.33	0.05	y = 0.4092x + 7.5699	0.66	< 0.01	y = 0.4123x - 1.4015	0.77	< 0.01

Appendix 17. Calculated discharge (cfs) required from the Robles Fish 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]
3-2	30	86	86	-34	-44	-59
4	62	50	62	69	57	40
5-2	55	14	55	12	6	-2
6-2	64	65	65	96	71	35
7	53	23	53	26	21	13
8	-77	6	6	28	23	16

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

Appendix 18. Regression equations and statistics for the Thompson passage criteria using the site discharge.

	% 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
3-2	y = 0.1333x + 12.6310	0.68	0.18	y = 0.0292x + 4.5704	0.95	0.03
4	y = 0.4913x - 4.7332	0.87	< 0.01	y = 0.1731x + 2.5049	0.38	0.02
5-2	y = 0.3287x + 9.3237	0.80	0.04	y = 0.2418x + 9.2304	0.75	0.06
6-2	y = 1.1045x - 9.7030	0.80	0.04	y = 0.1674x + 4.6868	0.58	0.14
7	y = 0.3479x + 10.8020	0.70	< 0.01	y = 0.3244x + 4.5389	0.65	< 0.01
8	y = 0.2582x + 44.0550	0.40	0.03	y = 0.3889x + 10.9300	0.63	< 0.01

Appendix 19. Calculated discharge (cfs) required at each 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
3-2	93	186	186
4	61	43	61
5-2	48	3	48
6-2	31	32	32
7	41	17	41
8	-74	-2	-2

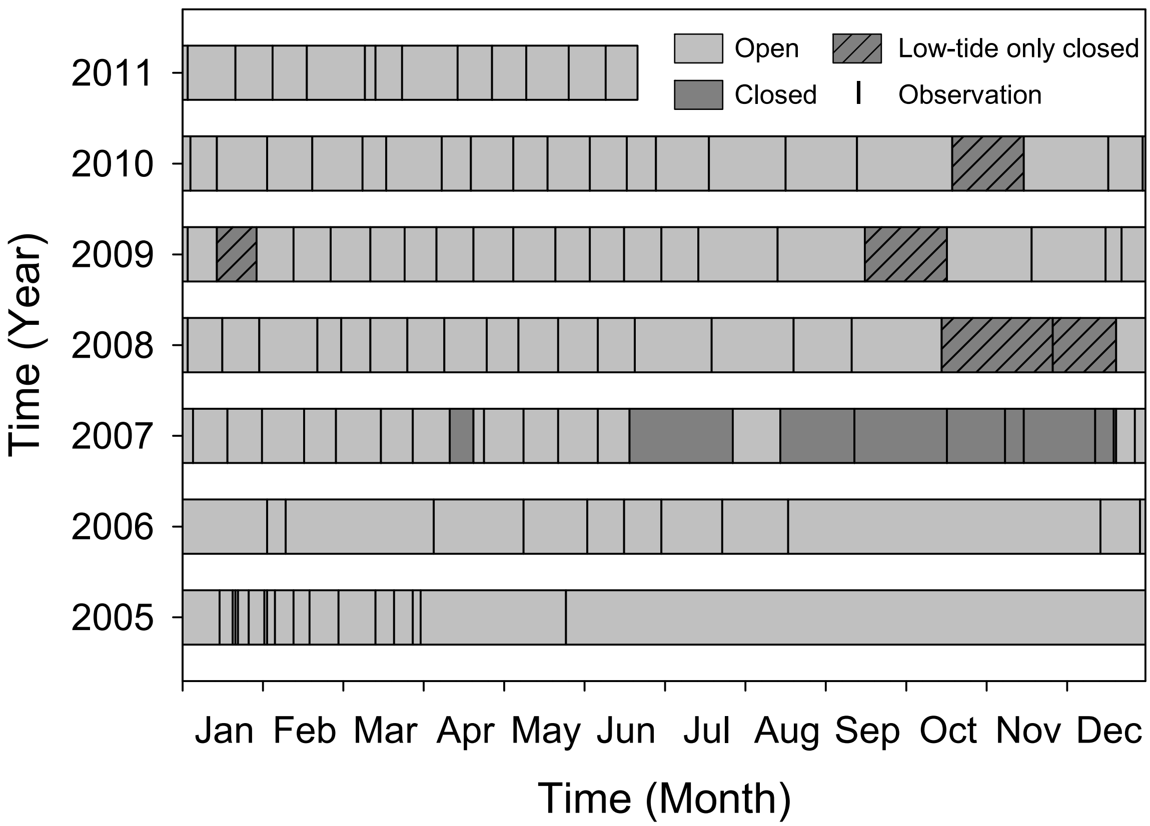
Appendix 19a. Calculated discharge (cfs) required at Robles for 2011 data to meet Thompson (1972) passage criteria.

Site	25% Total length with depth ≥ 0.6 ft	10% Continuous length with depth ≥ 0.6 ft
4	52	45
7	43	33
8	378	-120

Appendix 20. Ventura River sandbar monitoring data from July 2010 through June 2011.

Date	Sandbar Breeched (Y/N)	Time (24h)	Tide Height (ft)	Tidal State	High Tide Time (24h)	High Tide Height (ft)	Low Tide Time (24h)	Low Tide Height (ft)	Mean Daily Discharge at Foster[a] (cfs)	Mean Daily Discharge at Robles (cfs)	Notes
07/19/2010	Y	12:15	2.7	flood	17:05	5.5	10:08	2.1	11.0	1	Open on west bank
08/17/2010	Y	13:00	3.8	flood	16:35	5.3	09:40	2.8	6.4	0	Open on west bank
09/13/2010	Y	14:00	5.4	ebb	13:22	5.5	21:11	0.6	6.1	0	Open on west bank
10/19/2010	N[b]	10:45	3.6	ebb	08:06	5.1	14:28	1.2	7.7	0	If open, on west bank
11/15/2010	Y	15:30	3.2	flood	17:22	3.7	11:58	2.0	4.8	1	Open on west bank
12/17/2010	Y	14:30	0.3	flood	12:14	3.3	13:31	0.1	4.7	1	Open on west bank
12/30/2010	Y	12:40	-0.1	slack	18:46	3.2	12:31	-0.1	35.0	20	Open on west bank
01/03/2011	Y	16:00	-1.1	flood	21:45	3.9	15:22	-1.2	39.0	20	Open on west bank
01/21/2011	Y	15:30	-0.6	ebb	09:45	6.2	16:43	-1.1	26.0	20	Open on west bank
02/04/2011	Y	14:00	1.3	ebb	09:35	5.3	16:23	-0.3	25.0	20	Open on west bank
02/17/2011	Y	13:40	-0.6	ebb	08:08	6.3	15:03	-1.3	31.0	20	Open on west bank
03/11/2011	Y	14:25	2.3	flood	15:38	2.3	08:18	1.0	76.0	32	Open on west bank
03/15/2011	Y	09:15	3.1	ebb	06:25	5.0	13:48	-0.4	72.0	33	Open on west bank
03/25/2011	Y	10:15	0.1	flood	16:59	3.0	09:52	0.1	1180.0	364	Open west and east
04/15/2011	Y	09:00	4.5	ebb	07:58	4.9	14:12	0.0	59.0	31	Open on west bank
04/28/2011	Y	12:15	1.2	ebb	07:31	3.8	13:36	0.9	45.0	30	Open on west bank
05/11/2011	Y	09:30	0.9	ebb	04:09	4.0	11:10	0.4	41.0	31	Open on west bank
05/27/2011	Y	12:30	1.6	slack	07:08	3.2	12:33	1.6	41.0	32	Open on west bank
06/10/2011	Y	12:58	1.8	flood	17:52	5.5	11:08	1.1	45.0	32	Open on west bank
06/22/2011	Y	14:17	3.8	flood	15:59	4.3	09:00	1.0	34.0	27	Open on west bank

[a]USGS gauging station number 11118500, downstream of Foster Park.
[b]Sandbar was closed at low tide and open during some high tides.

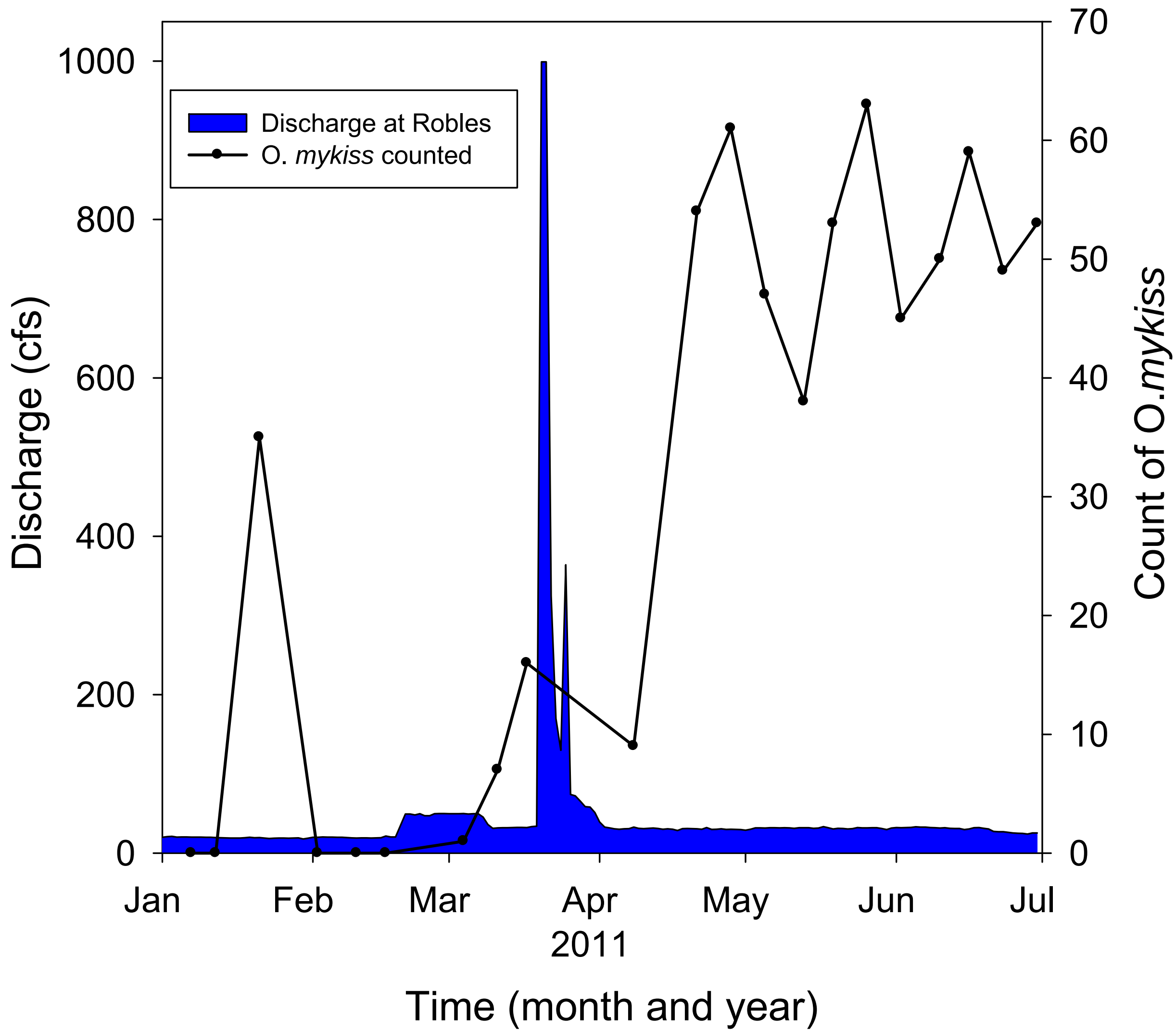


Appendix 21. Sandbar status at the mouth of the Ventura River from 2005 through June of 2011. Each observation is indicated by vertical lines and the sandbar status was assumed to remain the same until the next observation (Lewis et al. 2010).

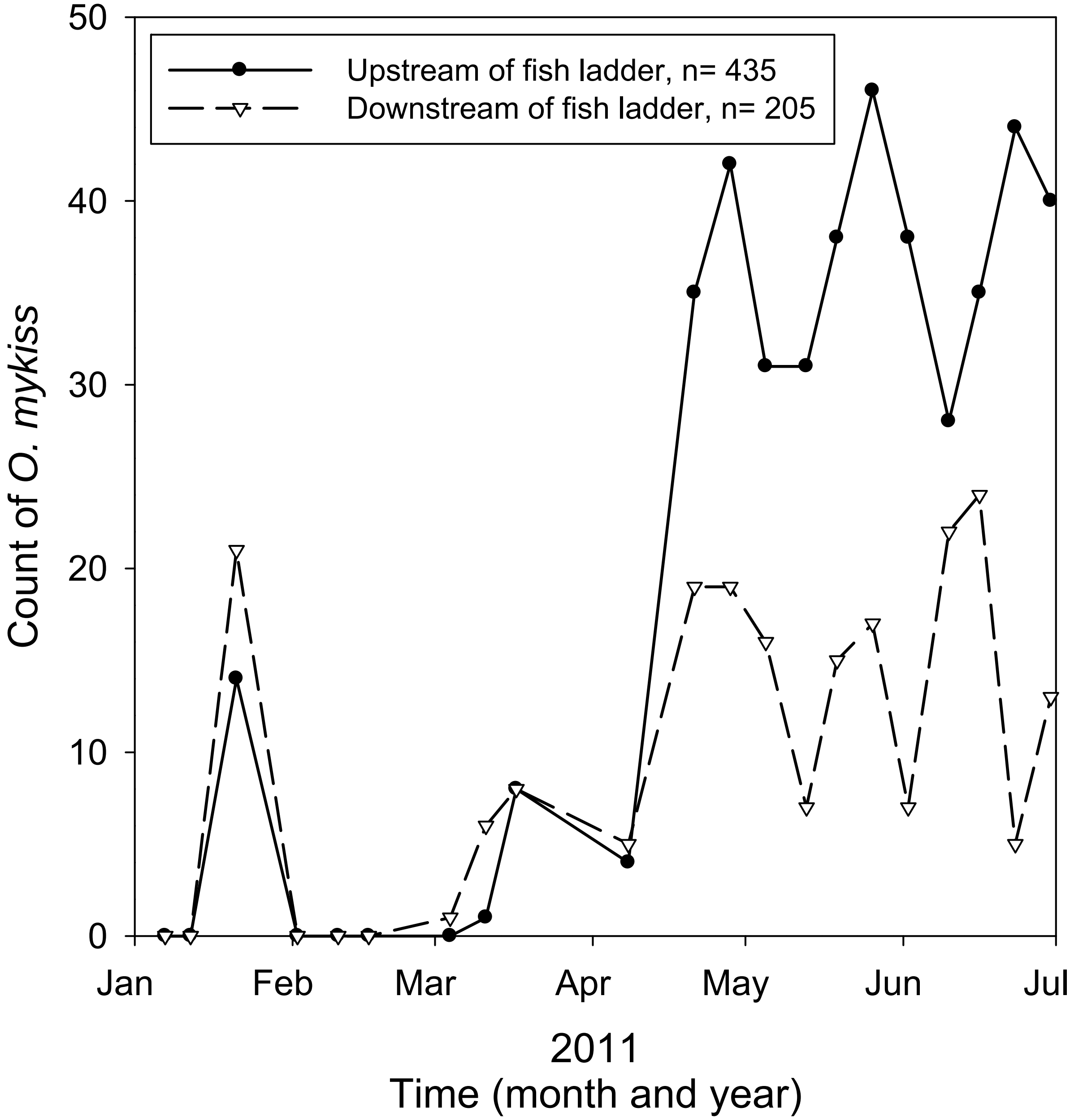
Appendix 22. Fish attraction counts of *O. mykiss* in close proximity to the Robles Fish Facility from January through June of 2011.

Date	Method	Direction	Length (m)	Temp (°C)	Turbidity (NTU)	Robles Discharge (CFS)	Species[a]	Count
7-Jan-2011	BANK	Upstream	140	11	7	20	NFO	0
7-Jan-2011	BANK	Downstream	200	11	7	20	NFO	0
12-Jan-2011	BANK	Upstream	140	11	3	20	NFO	0
12-Jan-2011	BANK	Downstream	200	11	3	20	NFO	0
21-Jan-2011	SNORKEL	Upstream	140	12	4	20	OMY	14
21-Jan-2011	SNORKEL	Downstream	200	12	1	20	OMY	21
2-Feb-2011	SNORKEL	Upstream	140	11	2	20	NFO	0
2-Feb-2011	SNORKEL	Downstream	200	11	1	20	NFO	0
10-Feb-2011	SNORKEL	Upstream	140	11	1	19	NFO	0
10-Feb-2011	SNORKEL	Downstream	200	11	1	19	NFO	0
16-Feb-2011	BANK	Upstream	140	13	6	21	NFO	0
16-Feb-2011	BANK	Downstream	200	13	2	21	NFO	0
4-Mar-2011	SNORKEL	Upstream	140	13	3	50	NFO	0
4-Mar-2011	SNORKEL	Downstream	200	13	3	50	OMY	1
11-Mar-2011	SNORKEL	Upstream	140	14	2	32	OMY	1
11-Mar-2011	SNORKEL	Downstream	200	14	2	32	OMY	6
17-Mar-2011	SNORKEL	Upstream	140	15	7	32	OMY	8
17-Mar-2011	SNORKEL	Downstream	200	15	4	32	OMY	8
8-Apr-2011	SNORKEL	Upstream	140	13	11	33	OMY	4
8-Apr-2011	SNORKEL	Downstream	200	13	9	33	OMY	5
21-Apr-2011	SNORKEL	Upstream	140	15	13	31	OMY	35
21-Apr-2011	SNORKEL	Downstream	200	15	10	31	OMY	19
28-Apr-2011	SNORKEL	Upstream	140	17	6	30	OMY	42
28-Apr-2011	SNORKEL	Downstream	200	17	3	30	OMY	19
5-May-2011	SNORKEL	Upstream	140	18	4	32	OMY	31
5-May-2011	SNORKEL	Downstream	200	18	6	32	OMY	16
13-May-2011	SNORKEL	Upstream	140	18	11	32	OMY	31
13-May-2011	SNORKEL	Downstream	200	18	2	32	OMY	7
19-May-2011	SNORKEL	Upstream	140	17	10	30	OMY	38
19-May-2011	SNORKEL	Downstream	200	17	4	30	OMY	15
26-May-2011	SNORKEL	Upstream	140	18	14	32	OMY	46
26-May-2011	SNORKEL	Downstream	200	18	14	32	OMY	17
2-Jun-2011	SNORKEL	Upstream	140	18	6	32	OMY	38
2-Jun-2011	SNORKEL	Downstream	200	18	2	32	OMY	7
10-Jun-2011	SNORKEL	Upstream	140	18	1	32	OMY	28
10-Jun-2011	SNORKEL	Downstream	200	18	1	32	OMY	22
16-Jun-2011	SNORKEL	Upstream	140	18	1	30	OMY	35
16-Jun-2011	SNORKEL	Downstream	200	18	1	30	OMY	24
23-Jun-2011	SNORKEL	Upstream	140	22	2	27	OMY	44
23-Jun-2011	SNORKEL	Downstream	200	22	2	27	OMY	5
30-Jun-2011	SNORKEL	Upstream	140	21	1	26	OMY	40
30-Jun-2011	SNORKEL	Downstream	200	21	1	26	OMY	13
		Upstream	2,940				Upstream	435
		Downstream	4,200				Downstream	205
		Total	7,140				Total	640

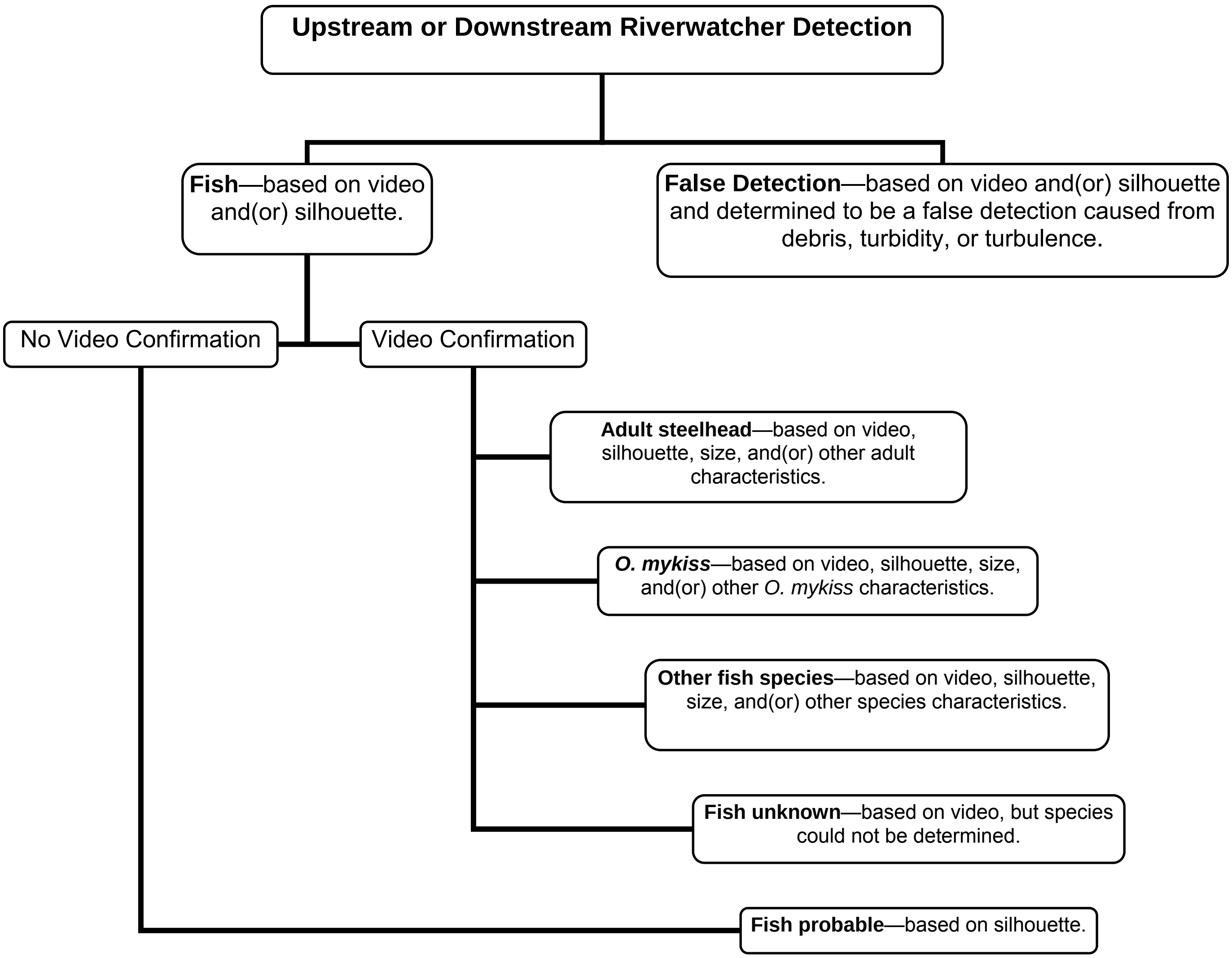
[a]OMY = *O. mykiss* and NFO = no fish observed.



Appendix 23. Total count of *O. mykiss* observed during fish attraction surveys during the fish passage season from January through June 2011 and discharge from the Robles Facility.



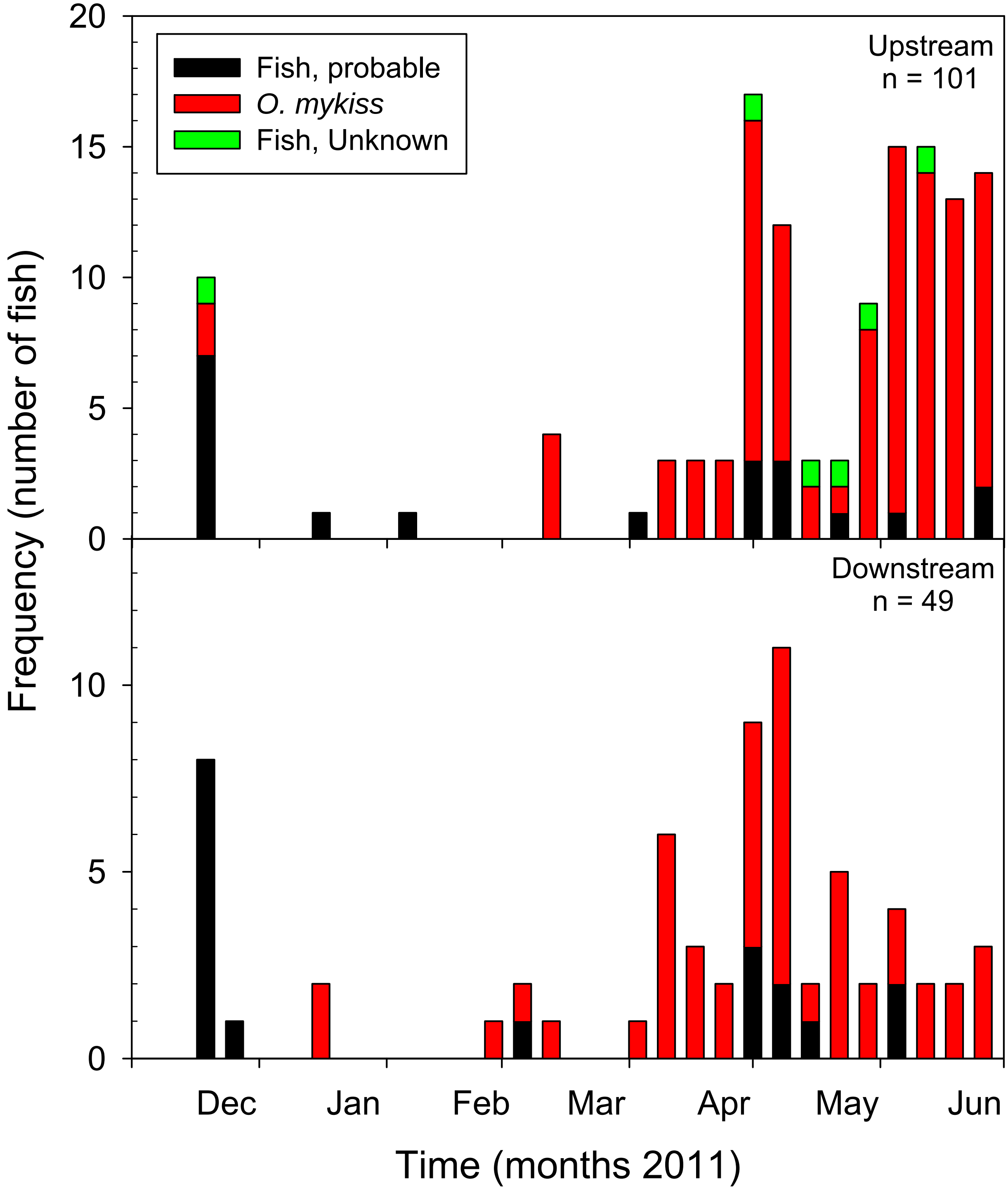
Appendix 24. Count of *O. mykiss* observed during fish attraction surveys upstream and downstream of the Robles Fish Facility during the fish passage season from January through June 2011.



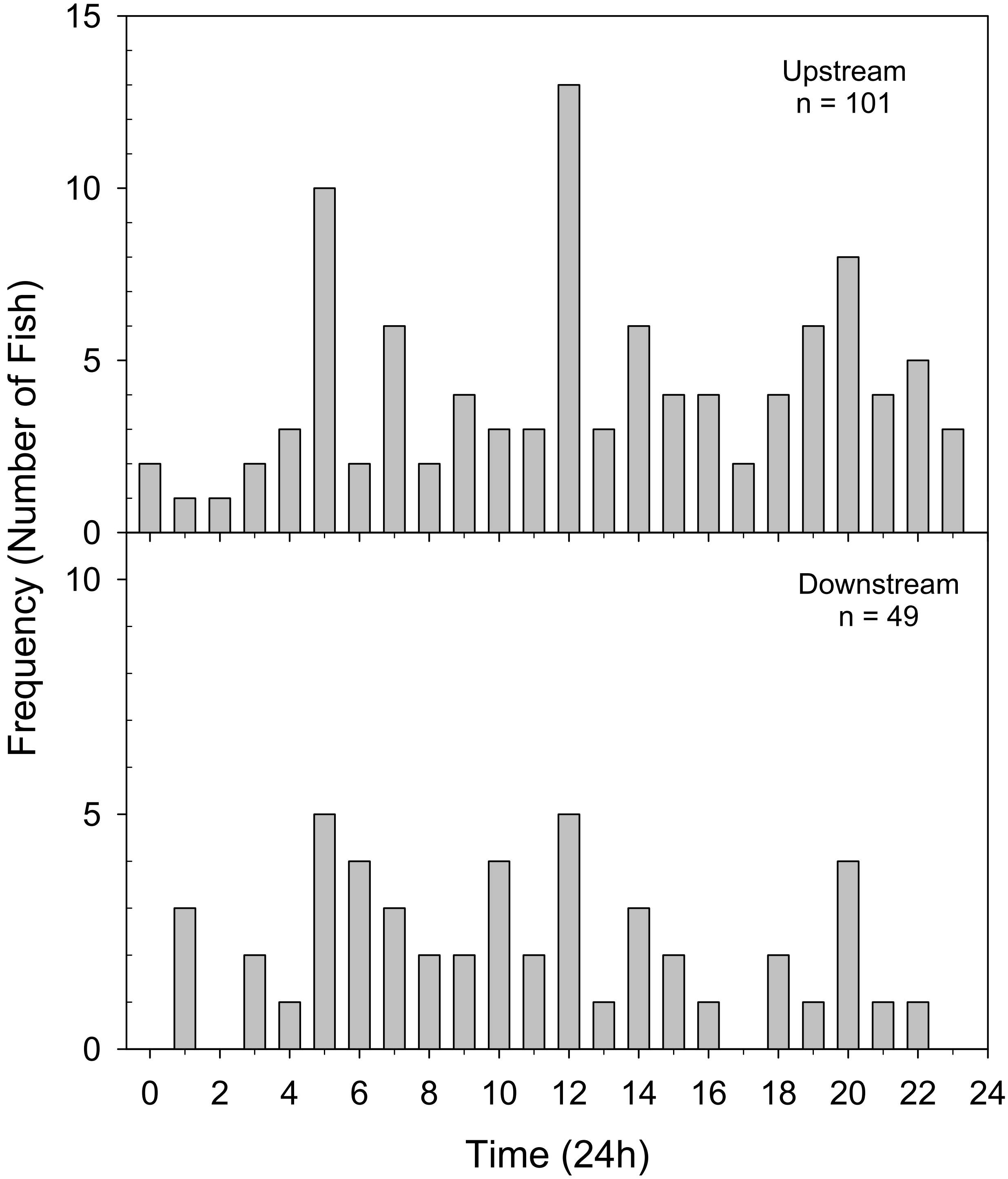
Appendix 25. Riverwatcher detection classification flow chart that outlines the pathways for upstream and downstream detections.

Appendix 26. Summary of Riverwatcher detections classified as fish probable and *O. mykiss* from January through June of 2011.

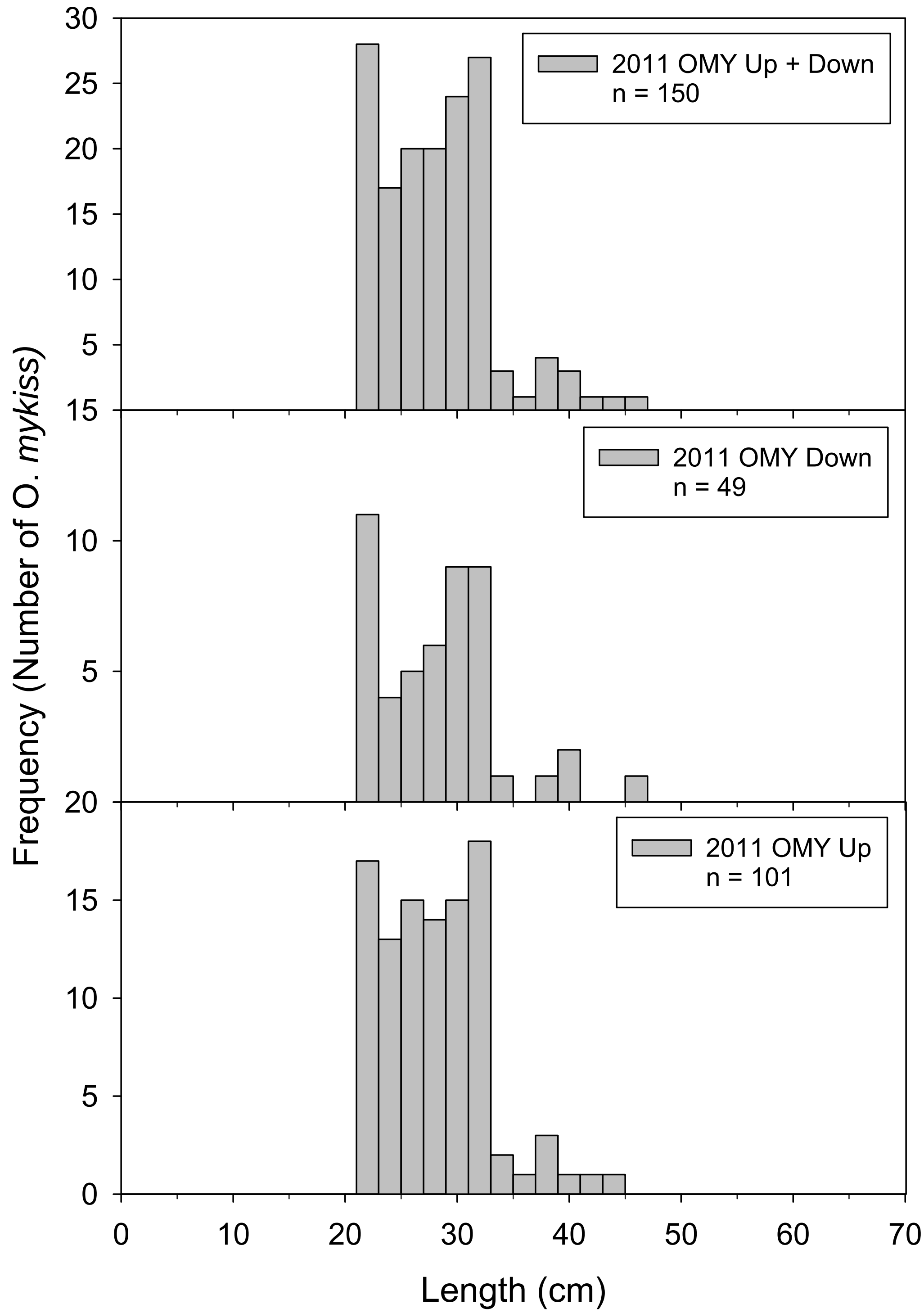
	Upstream	Downstream
O. *mykiss*	101	49
Fish, probable	20	18
False detections	308	631
Fish, unknown	6	
Total	435	698
Mean date-O. *mykiss*	25-May-11	5-May-11
Mean date-fish, unknown	30-Apr-11	
Mean date-fish, probable	18-Mar-11	2-Mar-11
Mean time-O. *mykiss* (24h)	13:14	10:58
Mean time-fish, unknown (24h)	9:03	
Mean time-fish, probable (24h)	12:23	13:54
Mean length-O. *mykiss* (cm)	27	27
Mean length- fish, unknown (cm)	26	
Mean length-fish, probable (cm)	32	30
Mean daily temperature-O. *mykiss* (°C)	18.0	16.7
Mean daily temperature-fish, unknown (°C)	16.9	
Mean daily temperature-fish, probable (°C)	15.2	14.6
Mean daily turbidity-O. *mykiss* (NTU)	3	2
Mean daily turbidity-fish, probable (NTU)	16	21
Mean daily turbidity-fish, unknown (NTU)		7
Mean daily turbidity-false detections (NTU)	171	150
Mean daily discharge-O. *mykiss* (cfs)	30	31
Mean daily discharge-fish, probable (cfs)	29	32
Mean daily discharge-fish, unknown (cfs)	32	
Mean daily discharge-false detections (cfs)	254	240



Appendix 27. Weekly Riverwatcher upstream and downstream detections classified as *O. mykiss*, fish probable, and fish unknown from January through June of 2011.



Appendix 28. Time (24h) of *O. mykiss,* fish probable, and fish unknown passage through the Riverwatcher in upstream and downstream directions from January through June of 2011.



Appendix 29. Length frequency distribution of *O. mykiss* detected passing through the Riverwatcher from January through June of 2011.

Appendix 30. Date, time, TL, direction, discharge, turbidity, and temperature at time of all upstream and downstream Riverwatcher detections that were determined to be fish.

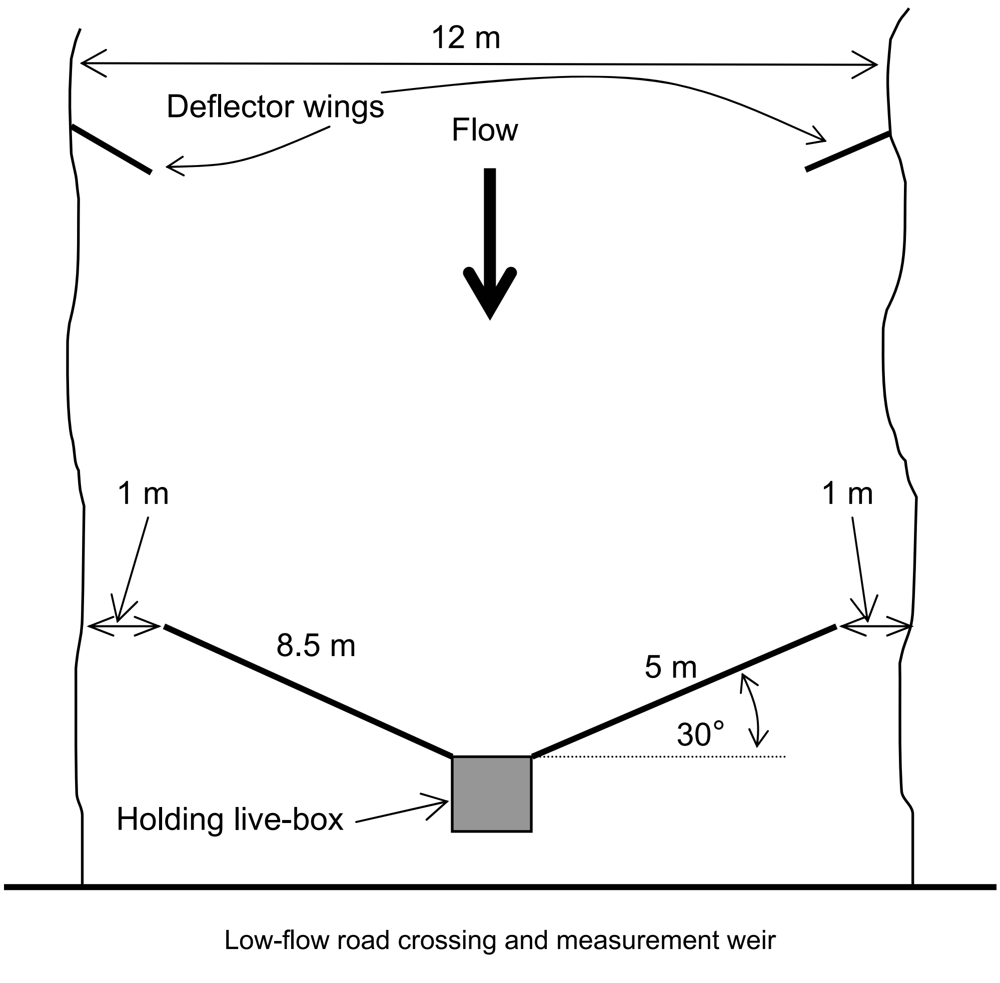
Date	Time (24h)	Fish Category	Total Length (cm)	Direction	Mean Daily Discharge (cfs)	Daily Turbidity (NTU)	Mean Daily Temperature (°C)
24-Dec-2010	11:44	Fish Probable	35	Down	22	48	12.1
24-Dec-2010	11:50	Fish Probable	35	Up	22	48	12.1
24-Dec-2010	12:29	O. mykiss	39	Up	22	48	12.1
24-Dec-2010	12:47	Fish Probable	46	Down	22	48	12.1
24-Dec-2010	13:10	Fish Probable	44	Up	22	48	12.1
24-Dec-2010	14:51	Fish Probable	35	Up	22	48	12.1
24-Dec-2010	15:09	Fish Probable	42	Down	22	48	12.1
24-Dec-2010	15:10	Fish Probable	41	Up	22	48	12.1
24-Dec-2010	15:20	Fish Probable	37	Down	22	48	12.1
24-Dec-2010	16:31	Fish Probable	37	Down	22	48	12.1
25-Dec-2010	8:55	Fish Probable	32	Up	22	29	12
25-Dec-2010	9:16	Fish Probable	42	Down	22	29	12
25-Dec-2010	9:20	O. mykiss	34	Up	22	29	12
25-Dec-2010	9:22	Fish Probable	34	Down	22	29	12
25-Dec-2010	9:23	Fish Probable	34	Up	22	29	12
25-Dec-2010	9:36	Fish Probable	30	Down	22	29	12
25-Dec-2010	9:38	Fish Probable	41	Up	22	29	12
25-Dec-2010	10:06	Fish Unknown	30	Up	22	29	12
26-Dec-2010	1:46	Fish Probable	28	Down	21	18	11.7
22-Jan-2011	9:33	Fish Probable	37	Up	19	2	11.9
22-Jan-2011	10:02	O. mykiss	23	Down	19	2	11.9
22-Jan-2011	13:59	O. mykiss	32	Down	19	2	11.9
6-Feb-2011	15:20	Fish Probable	35	Up	20	2	12.5
4-Mar-2011	21:02	O. mykiss	27	Down	50	2	12.5
11-Mar-2011	3:39	O. mykiss	20	Down	32	1	14.4
11-Mar-2011	14:29	Fish Probable	20	Down	32	1	14.4
14-Mar-2011	19:32	O. mykiss	35	Up	32	1	14.6
16-Mar-2011	5:57	O. mykiss	22	Up	33	1	15.6
16-Mar-2011	20:33	O. mykiss	42	Up	33	1	15.6
17-Mar-2011	1:27	O. mykiss	39	Down	32	3	14.6
18-Mar-2011	21:26	O. mykiss	32	Up	33	2	13.4
9-Apr-2011	8:51	Fish Probable	32	Up	31	4	12.1
9-Apr-2011	20:23	O. mykiss	25	Down	31	4	12.1
12-Apr-2011	2:05	O. mykiss	25	Up	32	2	14.3
12-Apr-2011	15:55	O. mykiss	22	Down	32	2	14.3
13-Apr-2011	20:40	O. mykiss	30	Down	31	2	14.3
14-Apr-2011	1:09	O. mykiss	25	Down	30	2	14
14-Apr-2011	1:34	O. mykiss	27	Up	30	2	14
14-Apr-2011	6:35	O. mykiss	30	Down	30	2	14
15-Apr-2011	8:23	O. mykiss	20	Down	31	2	14.7
15-Apr-2011	10:09	O. mykiss	23	Down	31	2	14.7

Date	Time (24h)	Fish Category	Total Length (cm)	Direction	Mean Daily Discharge (cfs)	Daily Turbidity (NTU)	Mean Daily Temperature (°C)
15-Apr-2011	19:40	O. mykiss	22	Up	31	2	14.7
19-Apr-2011	3:25	O. mykiss	23	Down	31	2	16.1
22-Apr-2011	10:56	O. mykiss	20	Up	30	4	15.4
22-Apr-2011	11:02	O. mykiss	30	Down	30	4	15.4
22-Apr-2011	11:08	O. mykiss	25	Up	30	4	15.4
23-Apr-2011	5:56	O. mykiss	30	Up	32	4	15.9
23-Apr-2011	9:54	O. mykiss	28	Down	32	4	15.9
24-Apr-2011	4:50	O. mykiss	28	Up	30	2	15.3
24-Apr-2011	12:18	O. mykiss	20	Down	30	2	15.3
27-Apr-2011	16:12	O. mykiss	37	Up	30	2	16.2
27-Apr-2011	16:15	O. mykiss	30	Down	30	2	16.2
28-Apr-2011	20:22	O. mykiss	23	Up	30	2	17.2
3-May-2011	6:04	O. mykiss	22	Down	32	3	17.2
4-May-2011	0:57	O. mykiss	32	Up	32	3	18
5-May-2011	5:46	O. mykiss	28	Up	32	3	18.3
5-May-2011	21:22	Fish Probable	22	Up	32	3	18.3
5-May-2011	21:24	Fish Probable	27	Up	32	3	18.3
5-May-2011	21:25	Fish Probable	23	Down	32	3	18.3
6-May-2011	4:36	O. mykiss	27	Down	32	3	18.4
6-May-2011	4:41	O. mykiss	30	Up	32	3	18.4
6-May-2011	6:41	Fish Unknown	30	Up	32	3	18.4
6-May-2011	7:29	O. mykiss	27	Up	32	3	18.4
6-May-2011	8:03	Fish Probable	28	Up	32	3	18.4
6-May-2011	8:43	O. mykiss	32	Up	32	3	18.4
6-May-2011	10:23	O. mykiss	37	Down	32	3	18.4
6-May-2011	11:57	O. mykiss	32	Up	32	3	18.4
6-May-2011	12:27	O. mykiss	25	Up	32	3	18.4
6-May-2011	19:17	O. mykiss	28	Up	32	3	18.4
6-May-2011	23:08	O. mykiss	22	Up	32	3	18.4
6-May-2011	23:08	Fish Probable	22	Down	32	3	18.4
7-May-2011	1:09	O. mykiss	25	Down	32	3	17
7-May-2011	5:18	Fish Probable	25	Down	32	3	17
7-May-2011	5:27	O. mykiss	28	Down	32	3	17
7-May-2011	5:34	O. mykiss	22	Up	32	3	17
7-May-2011	6:39	O. mykiss	41	Up	32	3	17
7-May-2011	10:39	O. mykiss	32	Up	32	3	17
7-May-2011	20:18	O. mykiss	39	Down	32	3	17
7-May-2011	20:45	O. mykiss	25	Up	32	3	17
8-May-2011	7:35	O. mykiss	34	Down	32	2	16.6
8-May-2011	7:53	O. mykiss	27	Down	32	2	16.6
8-May-2011	12:12	O. mykiss	32	Up	32	2	16.6
8-May-2011	12:26	O. mykiss	27	Up	32	2	16.6
8-May-2011	12:26	O. mykiss	20	Down	32	2	16.6
8-May-2011	12:33	O. mykiss	28	Down	32	2	16.6

Date	Time (24h)	Fish Category	Total Length (cm)	Direction	Mean Daily Discharge (cfs)	Daily Turbidity (NTU)	Mean Daily Temperature (°C)
8-May-2011	23:53	O. mykiss	32	Up	32	2	16.6
10-May-2011	6:02	Fish Probable	28	Up	32	2	16.5
10-May-2011	6:21	Fish Probable	27	Down	32	2	16.5
10-May-2011	17:23	O. mykiss	25	Up	32	2	16.5
10-May-2011	20:37	O. mykiss	22	Up	32	2	16.5
11-May-2011	5:12	O. mykiss	27	Down	31	2	16.9
11-May-2011	5:39	O. mykiss	30	Up	31	2	16.9
11-May-2011	6:22	O. mykiss	30	Down	31	2	16.9
11-May-2011	18:53	Fish Probable	30	Up	31	2	16.9
11-May-2011	20:01	O. mykiss	30	Down	31	2	16.9
12-May-2011	5:25	O. mykiss	23	Up	32	3	17.8
12-May-2011	5:36	Fish Probable	27	Up	32	3	17.8
12-May-2011	18:34	O. mykiss	28	Up	32	3	17.8
13-May-2011	18:47	O. mykiss	25	Up	32	3	18
13-May-2011	19:11	O. mykiss	22	Down	32	3	18
13-May-2011	19:54	Fish Probable	23	Down	32	3	18
13-May-2011	22:58	O. mykiss	20	Down	32	3	18
15-May-2011	12:34	O. mykiss	27	Up	31	3	16.7
20-May-2011	12:58	O. mykiss	44	Down	31	3	17.3
20-May-2011	21:32	Fish Unknown	24	Up	31	3	17.3
21-May-2011	18:48	Fish Probable	25	Down	31	3	18
21-May-2011	20:11	O. mykiss	28	Up	31	3	18
23-May-2011	11:48	O. mykiss	30	Down	31	2	17.4
23-May-2011	19:09	Fish Probable	30	Up	31	2	17.4
23-May-2011	21:58	O. mykiss	34	Up	31	2	17.4
24-May-2011	1:57	Fish Unknown	25	Up	32	2	17.5
24-May-2011	5:01	O. mykiss	23	Down	32	2	17.5
25-May-2011	7:00	O. mykiss	25	Down	32	2	18
25-May-2011	18:40	O. mykiss	20	Down	32	2	18
26-May-2011	5:12	O. mykiss	28	Down	32	2	18.3
31-May-2011	12:17	O. mykiss	30	Up	31	2	17.6
31-May-2011	12:38	O. mykiss	20	Up	31	2	17.6
1-Jun-2011	5:47	O. mykiss	25	Up	32	2	17.5
1-Jun-2011	19:32	O. mykiss	20	Up	32	2	17.5
2-Jun-2011	9:10	O. mykiss	27	Up	32	2	17.7
2-Jun-2011	10:02	O. mykiss	27	Down	32	2	17.7
2-Jun-2011	15:37	O. mykiss	25	Down	32	2	17.7
3-Jun-2011	3:43	Fish Unknown	20	Up	32	2	17.5
3-Jun-2011	22:43	O. mykiss	22	Up	32	2	17.5
4-Jun-2011	7:48	O. mykiss	23	Up	33	3	16.7
4-Jun-2011	21:04	O. mykiss	30	Up	33	3	16.7
5-Jun-2011	21:45	O. mykiss	25	Up	33	2	16.4
6-Jun-2011	14:36	O. mykiss	27	Up	33	2	16.9
7-Jun-2011	3:17	O. mykiss	23	Up	33	3	17.9

Date	Time (24h)	Fish Category	Total Length (cm)	Direction	Mean Daily Discharge (cfs)	Daily Turbidity (NTU)	Mean Daily Temperature (°C)
7-Jun-2011	7:40	Fish Probable	22	Up	33	3	17.9
7-Jun-2011	15:13	O. mykiss	25	Up	33	3	17.9
7-Jun-2011	20:01	O. mykiss	23	Up	33	3	17.9
7-Jun-2011	20:35	Fish Probable	20	Down	33	3	17.9
8-Jun-2011	6:22	O. mykiss	28	Down	32	2	17.2
8-Jun-2011	18:17	O. mykiss	28	Down	32	2	17.2
8-Jun-2011	22:44	O. mykiss	37	Up	32	2	17.2
9-Jun-2011	8:06	O. mykiss	25	Up	32	2	18.3
9-Jun-2011	12:29	O. mykiss	25	Up	32	2	18.3
9-Jun-2011	20:29	O. mykiss	22	Up	32	2	18.3
10-Jun-2011	0:07	O. mykiss	25	Up	32	3	17.6
10-Jun-2011	10:41	O. mykiss	22	Up	32	3	17.6
10-Jun-2011	17:07	O. mykiss	25	Up	32	3	17.6
11-Jun-2011	7:59	O. mykiss	28	Up	32	2	16.9
11-Jun-2011	13:58	O. mykiss	28	Up	32	2	16.9
11-Jun-2011	18:46	Fish Probable	23	Down	32	2	16.9
12-Jun-2011	12:48	O. mykiss	20	Up	31	2	16.9
12-Jun-2011	15:55	O. mykiss	25	Up	31	2	16.9
13-Jun-2011	10:21	Fish Unknown	23	Up	31	2	18.5
13-Jun-2011	12:25	O. mykiss	23	Up	31	2	18.5
13-Jun-2011	12:47	O. mykiss	28	Up	31	2	18.5
13-Jun-2011	14:12	O. mykiss	28	Down	31	2	18.5
13-Jun-2011	14:23	O. mykiss	28	Up	31	2	18.5
13-Jun-2011	18:34	O. mykiss	28	Up	31	2	18.5
14-Jun-2011	5:26	O. mykiss	22	Up	31	2	19.7
14-Jun-2011	16:29	O. mykiss	28	Up	31	2	19.7
15-Jun-2011	18:00	O. mykiss	23	Up	30	3	20.3
16-Jun-2011	5:14	O. mykiss	27	Up	30	2	18.4
16-Jun-2011	6:50	O. mykiss	20	Up	30	2	18.4
17-Jun-2011	3:15	O. mykiss	25	Up	32	2	17.9
18-Jun-2011	12:14	O. mykiss	20	Down	32	2	18
18-Jun-2011	12:33	O. mykiss	30	Up	32	2	18
18-Jun-2011	22:40	O. mykiss	23	Up	32	2	18
19-Jun-2011	9:16	O. mykiss	20	Up	31	2	18
19-Jun-2011	22:11	O. mykiss	27	Up	31	2	18
20-Jun-2011	16:07	O. mykiss	27	Up	30	2	19.6
20-Jun-2011	19:05	O. mykiss	27	Up	30	2	19.6
20-Jun-2011	20:30	O. mykiss	28	Up	30	2	19.6
21-Jun-2011	9:20	O. mykiss	28	Up	27	4	21.1
21-Jun-2011	9:34	O. mykiss	28	Down	27	4	21.1
21-Jun-2011	19:13	O. mykiss	23	Up	27	4	21.1
22-Jun-2011	14:20	O. mykiss	30	Down	27	3	21.4
22-Jun-2011	15:12	O. mykiss	28	Up	27	3	21.4
23-Jun-2011	12:51	O. mykiss	22	Up	27	3	21.5

Date	Time (24h)	Fish Category	Total Length (cm)	Direction	Mean Daily Discharge (cfs)	Daily Turbidity (NTU)	Mean Daily Temperature (°C)
23-Jun-2011	23:54	O. mykiss	37	Up	27	3	21.5
25-Jun-2011	7:56	O. mykiss	23	Up	26	4	21.2
25-Jun-2011	11:13	O. mykiss	27	Up	26	4	21.2
25-Jun-2011	14:34	O. mykiss	32	Up	26	4	21.2
26-Jun-2011	4:11	O. mykiss	32	Up	25	4	21.3
26-Jun-2011	5:29	O. mykiss	32	Up	25	4	21.3
26-Jun-2011	7:10	O. mykiss	27	Up	25	4	21.3
26-Jun-2011	14:35	O. mykiss	23	Up	25	4	21.3
26-Jun-2011	16:08	O. mykiss	27	Up	25	4	21.3
27-Jun-2011	13:31	O. mykiss	28	Up	25	4	21.7
28-Jun-2011	5:37	O. mykiss	27	Down	24	4	21.6
28-Jun-2011	13:22	O. mykiss	32	Up	24	4	21.6
29-Jun-2011	7:40	O. mykiss	22	Up	25	3	21.2
29-Jun-2011	8:06	O. mykiss	20	Down	25	3	21.2
29-Jun-2011	8:08	Fish Probable	25	Up	25	3	21.2
29-Jun-2011	14:06	O. mykiss	28	Down	25	3	21.2
29-Jun-2011	14:22	O. mykiss	23	Up	25	3	21.2
29-Jun-2011	14:43	Fish Probable	27	Up	25	3	21.2
29-Jun-2011	22:10	O. mykiss	23	Up	25	3	21.2
30-Jun-2011	14:49	O. mykiss	27	Up	26	3	20.1
30-Jun-2011	15:47	O. mykiss	30	Up	26	3	20.1

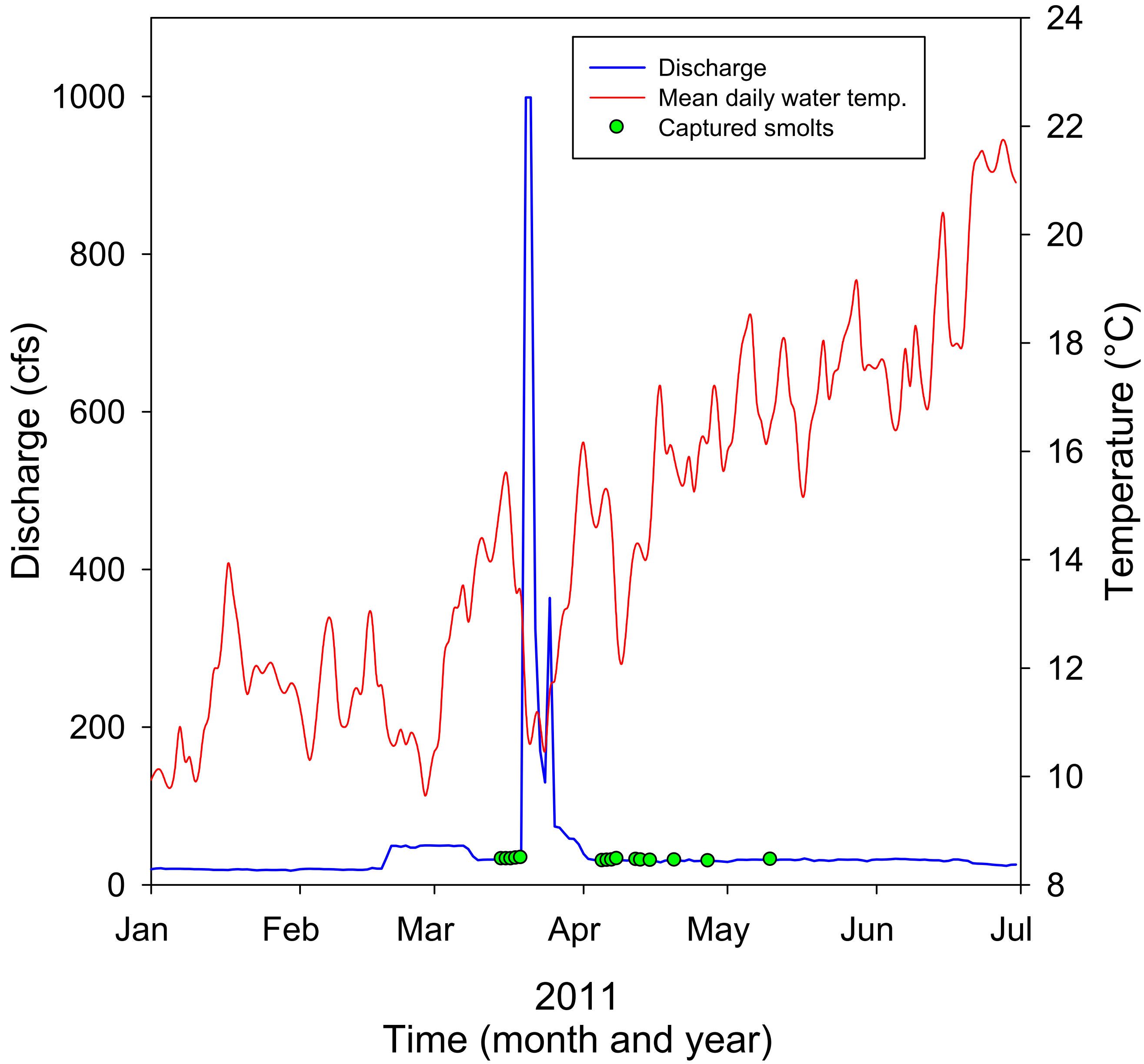


Appendix 31. Top view of downstream migrant smolt trap layout in the Ventura River below the Robles Fish Facility.

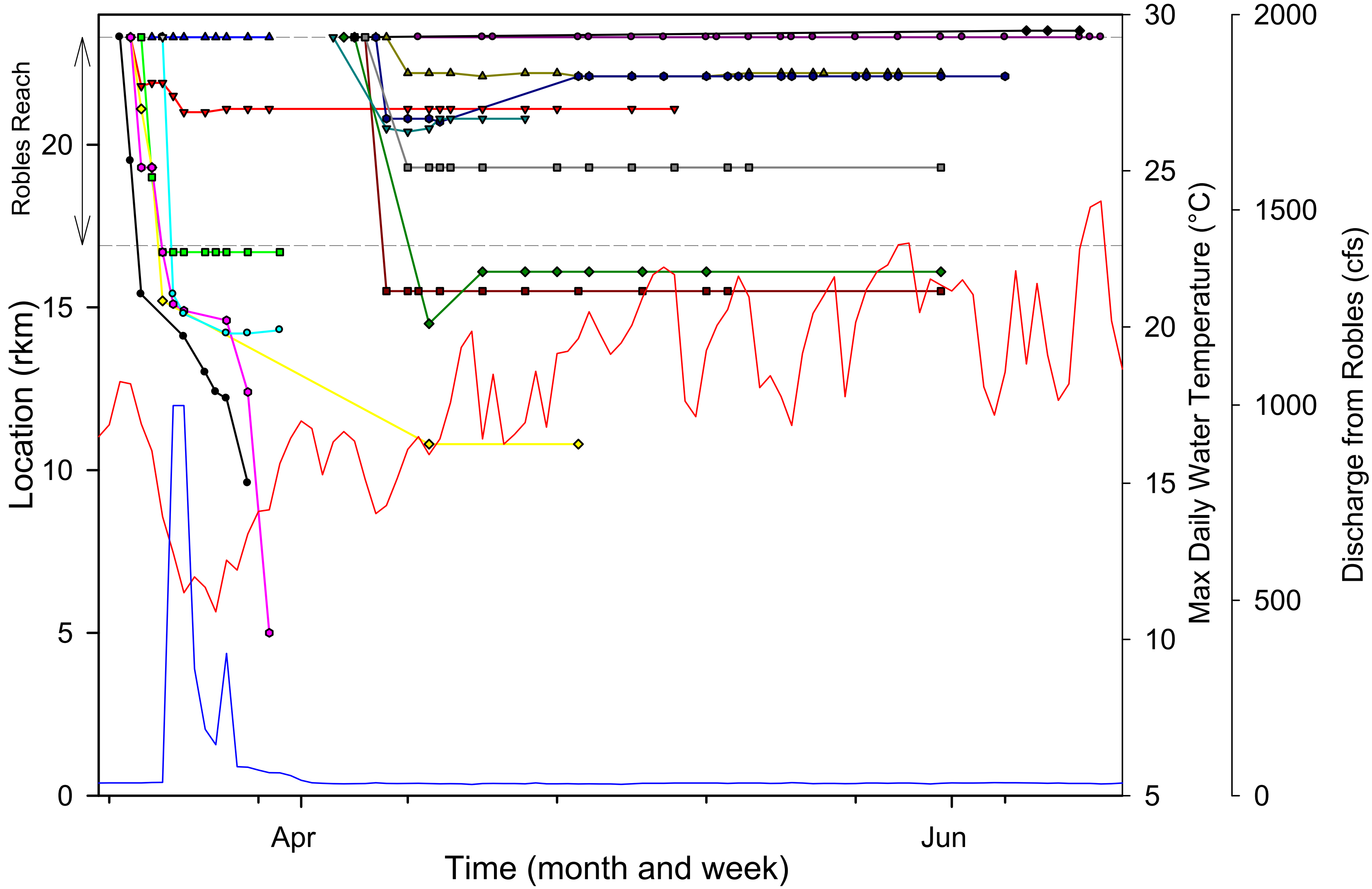
Appendix 32. Data for 25 smolts captured in the downstream weir trap during the spring of 2010.

Date	Time	Fork length (mm)	Weight (g)	Condition factor (K_{FL})[a]	Smolt stage[b]	Scale loss (%)	Mean daily water temp. (°C)	Mean daily facility inflow (cfs)	Mean daily weir discharge (cfs)	Cloud cover (%)	Moon phase (% full)	Tag type	Release site
03/15/2011	11:02	172	50	0.98	T2	1.5	15.3	42	33	60	71	Radio	Weir Pool 1
03/16/2011	9:25	225	114[b]	1.00	T3	3.2	15.6	41	33	40	81	Radio	Weir Pool 1
03/16/2011	9:47	209	94[b]	1.03	T3	3.9	15.6	41	33	40	81	Radio	Weir Pool 1
03/16/2011	15:29	188	60	0.90	T3	3.7	15.6	41	33	60	81	Radio	Weir Pool 1
03/17/2011	9:42	184	66	1.06	T3	2.8	14.6	40	32	100	89	Radio	Weir Pool 1
03/18/2011	9:23	162	41	0.97	T2	4.7	13.4	40	33	10	95	Radio	Weir Pool 1
03/19/2011	9:31	196	72	0.96	T2	2.0	13.3	44	34	100	100	Radio	Weir Pool 1
03/19/2011	9:31	199	81	1.03	T2	0.8	13.3	44	34	100	100	Radio	Weir Pool 1
04/05/2011	9:45	206	90[c]	1.03	FS	1.6	15.2	177	30	0	2	Radio	Weir Pool 1
04/06/2011	10:11	214	101	1.03	FS	3.5	15.3	166	31	75	5	Radio	Weir Pool 1
04/06/2011	10:22	224	115	1.02	FS	4.3	15.3	166	31	75	5	Radio	Weir Pool 1
04/07/2011	9:15	204	85	1.00	T3	3.2	14.4	157	31	100	10	Radio	Weir Pool 1
04/07/2011	16:09	208	84	0.93	FS	2.3	14.4	157	31	50	10	Radio	Weir Pool 1
04/07/2011	16:18	156	42	1.11	T2	2.3	14.4	157	31	50	10	None	Weir Pool 1
04/08/2011	9:51	248	156	1.02	FS	4.9	12.6	151	33	10	17	Radio	Weir Pool 1
04/08/2011	10:00	224	111	0.99	FS	2.8	12.6	151	33	10	17	Radio	Weir Pool 1
04/12/2011	10:00	190	66	0.96	T3	3.3	14.3	120	32	0	56	Radio	Weir Pool 1
04/13/2011	10:40	183	62	1.01	T3	4.2	14.2	116	31	100	66	PIT	Camino Ciello
04/13/2011	10:49	182	67	1.11	FS	2.3	14.2	116	31	100	66	PIT	Camino Ciello
04/13/2011	10:57	210	87	0.94	FS	3.0	14.2	116	31	100	66	PIT	Camino Ciello
04/15/2011	9:45	217	99	0.97	FS	3.8	14.7	107	31	NA	86	PIT	Camino Ciello
04/20/2011	10:26	213	108	1.12	T2	9.3	15.8	98	31	100	95	PIT	Camino Ciello
04/20/2011	10:33	244	142	0.98	FS	4.3	15.8	98	31	100	95	PIT	Camino Ciello
04/27/2011	9:18	211	100	1.06	FS	2.7	16.2	77	30	0	32	PIT	Camino Ciello
05/10/2011	9:34	202	68	0.83	FS	4.7	16.5	63	32	0	50	PIT	Camino Ciello
Means		203	85	1.0		3.4	14.7	101	32	58	55		

[a] K_{FL} = [weight (g) x fork length (mm)^3] x 100,000
[b] Smolt stage includes: parr, T1, T2, T3, and full smolt (FS).
[c] Scale error so weight was determined from a weight to length regression.



Appendix 33. Mean daily water temperature, mean daily discharge, and time of capture for smolts in the weir trap downstream of the Robles Fish Facility in 2011.



Appendix 34. Location and date of radio-tagged *O. mykiss* smolts released downstream of the Robles Fish Facility in March and April of 2011. Red line is maximum daily water temperature downstream of the Robles Fish Facility and the blue line is discharge from Robles. The Robles Reach is indicated by the two horizontal dashed lines.

Appendix 35. Annual flow summary at the Robles Fish Facility for water year 2010-2011.

Annual Flow Summary - Robles Fish Passage Facility
Water Year 2010 - 2011

	* (1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	* (2) North Fork Matilija Ck.* (cfsd)	(1)+(2) Sum of Creek Flows (cfsd)		** (3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) VRNMO Weir (cfsd)	(5) Diversion Canal (cfsd)	*** (4)+(5) Total Inflow (cfsd)
Jul-10	0	0	0		46	46	0	46
Aug-10	0	0	0		3	3	0	3
Sep-10	0	0	0		0	0	0	0
Oct-10	0	0	0		0	0	0	0
Nov-10	0	0	0		0	0	0	0
Dec-10	0	0	0		296	1014	2252	3265
Jan-11	0	0	0		605	605	878	1484
Feb-11	0	0	0		832	832	360	1193
Mar-11	0	0	0		1354	4121	4116.48	8237
Apr-11	0	0	0		931	931	2802	3733
May-11	0	0	0		976.33	976.32	781	1757
Jun-11	0	0	0		893.47	893.47	75	969
Total	0	0	0		5936	9421	11265	20687

* 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

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Jul-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			0	1.4	3	3	0	3	0		
2			0	1.3	2	2	0	2	0		
3			0	1.4	3	3	0	3	0		
4			0	1.4	3	3	0	3	0		
5			0	1.4	3	3	0	3	0		
6			0	1.5	3	3	0	3	0		
7			0	1.5	3	3	0	3	0		
8			0	1.4	3	3	0	3	0		
9			0	1.4	3	3	0	3	0		
10			0	1.4	3	3	0	3	0		
11			0	1.4	3	3	0	3	0		
12			0	1.4	3	3	0	3	0		
13			0	1.3	2	2	0	2	0		
14			0	1.3	2	2	0	2	0		
15			0	1.2	1	1	0	1	0		
16			0	1.1	1	1	0	1	0		
17			0	1.1	1	1	0	1	0		
18			0	1.1	1	1	0	1	0		
19			0	1.1	1	1	0	1	0		
20			0	1.1	1	1	0	1	0		
21			0	1.1	1	1	0	1	0		
22			0	1.1	1	1	0	1	0		
23			0	1.1	1	1	0	1	0		
24			0	1.0	0	0	0	0	0		
25			0	1.1	0	0	0	0	0		
26			0	1.0	0	0	0	0	0		
27			0	0.9	0	0	0	0	0		
28			0	0.9	0	0	0	0	0		
29			0	0.9	0	0	0	0	0		
30			0	1.0	1	1	0	1	0		
31			0	1.0	1	1	0	1	0		
Totals	0	0	0		46	46	0	46	0		

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Aug-10	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) North Fork Matilija Ck. (cfsd)	(1)+(2) Sum of Creek Flows (cfsd)		Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) VRNMO Weir (cfsd)	(5) Diversion Canal (cfsd)	(4)+(5) Total Inflow (cfsd)		(5) X 1.98 Robles Diversion (AF)		- Field Measurement: Matilija Creek (cfsd)	VRNMO (cfsd)
1			0		1.1	1	1	0	1		0			
2			0		1.0	0	0	0	0		0			
3			0		0.8	0	0	0	0		0			
4			0		0.6	0	0	0	0		0			
5			0		0.8	0	0	0	0		0			
6			0		0.8	0	0	0	0		0			
7			0		0.7	0	0	0	0		0			
8			0		0.8	0	0	0	0		0			
9			0		0.7	0	0	0	0		0			
10			0		0.6	0	0	0	0		0			
11			0		0.6	0	0	0	0		0			
12			0		0.6	0	0	0	0		0			
13			0		0.6	0	0	0	0		0			
14			0		0.6	0	0	0	0		0			
15			0		0.7	0	0	0	0		0			
16			0		0.6	0	0	0	0		0			
17			0		0.5	0	0	0	0		0			
18			0		0.5	0	0	0	0		0			
19			0		0.6	0	0	0	0		0			
20			0		0.6	0	0	0	0		0			
21			0		0.5	0	0	0	0		0			
22			0		0.6	0	0	0	0		0			
23			0		0.5	0	0	0	0		0			
24			0		0.4	0	0	0	0		0			
25			0		0.3	0	0	0	0		0			
26			0		0.2	0	0	0	0		0			
27			0		0.2	0	0	0	0		0			
28			0		0.0	0	0	0	0		0			
29			0		0.0	0	0	0	0		0			
30			0		0.0	0	0	0	0		0			
31			0		0.0	0	0	0	0		0			
Totals	0	0	0			3	3	0	3		0			

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

* Headworks computer down. Bubbler data indicated no flow from late Aug to early Oct

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

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Nov-10	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) North Fork Matilija Ck. (cfsd)	(1)+(2) Sum of Creek Flows (cfsd)		Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) VRNMO Weir (cfsd)	(5) Diversion Canal (cfsd)	(4)+(5) Total Inflow (cfsd)		(5) X 1.98 Robles Diversion (AF)		- Field Measurement: Matilija Creek (cfsd)	VRNMO (cfsd)
1			0		0.1	0	0	0	0		0			
2			0		0.1	0	0	0	0		0			
3			0		0.1	0	0	0	0		0			
4			0		0.0	0	0	0	0		0			
5			0		0.0	0	0	0	0		0			
6			0		0.0	0	0	0	0		0			
7			0		0.0	0	0	0	0		0			
8			0		0.1	0	0	0	0		0			
9			0		0.0	0	0	0	0		0			
10			0		0.0	0	0	0	0		0			
11			0		0.0	0	0	0	0		0			
12			0		0.0	0	0	0	0		0			
13			0		0.0	0	0	0	0		0			
14			0		0.0	0	0	0	0		0			
15			0		0.0	0	0	0	0		0			
16			0		0.0	0	0	0	0		0			
17			0		0.0	0	0	0	0		0			
18			0		0.0	0	0	0	0		0			
19			0		0.3	0	0	0	0		0			
20			0		1.2	0	0	0	0		0			
21			0		1.2	0	0	0	0		0			
22			0		1.0	0	0	0	0		0			
23			0		0.9	0	0	0	0		0			
24			0		0.9	0	0	0	0		0			
25			0		0.9	0	0	0	0		0			
26			0		0.9	0	0	0	0		0			
27			0		0.9	0	0	0	0		0			
28			0		0.9	0	0	0	0		0			
29			0		0.8	0	0	0	0		0			
30			0		0.8	0	0	0	0		0			
Totals	0	0	0			0	0	0	0		0			

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Dec-10	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) North Fork Matilija Ck. (cfsd)	(1)+(2) Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) VRNMO Weir (cfsd)	(5) Diversion Canal (cfsd)	(4)+(5) Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	Field Measurement: Matilija Creek (cfsd)	VRNMO (cfsd)
1			0	0.9	0	0	0	0	0		
2			0	0.9	0	0	0	0	0		
3			0	0.9	0	0	0	0	0		
4			0	0.9	0	0	0	0	0		
5			0	0.9	0	0	0	0	0		
6			0	1.0	0	0	0	0	0		
7			0	0.9	0	0	0	0	0		
8			0	0.9	0	0	0	0	0		
9			0	0.9	0	0	0	0	0		
10			0	0.9	0	0	0	0	0		
11			0	0.9	0	0	0	0	0		
12			0	0.9	0	0	0	0	0		
13			0	0.9	0	0	0	0	0		
14			0	0.9	0	0	0	0	0		
15			0	0.9	0	0	0	0	0		
16			0	0.9	0	0	0	0	0		
17			0	1.5	0	0	0	0	0		
18			0	2.5	13	13	7	20	14		
19			0	6.4	35	35	311	346	616		
20			0	7.1	20	20	313	333	620		
21			0	5.1	19	19	172	191	341		
22			0	7.0	20	655	326	982	646		
23			0	7.4	21	104	335	439	664		
24			0	5.7	22	22	189	212	375		
25			0	5.1	22	22	132	154	261		
26			0	5.0	21	21	117	138	231		
27			0	4.7	20	20	87	107	171		
28			0	4.5	20	20	73	93	144		
29			0	4.7	21	21	73	94	144		
30			0	4.7	20	20	62	82	122		
31			0	4.6	20	20	55	75	109		
Totals	0	0	0		296	1014	2252	3265	4459		

Flows picked up early evening

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	(1)	(2)	(1)+(2)		(3)	(4)	(5)	(4)+(5)	(5) X 1.98	-	
	Source Stream Daily Flows				Robles Facility Daily Flows					Field Measurement	
Jan-11	Matilija Ck D/S Dam (cfsd)	North Fork Matilija Ck. (cfsd)	Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	Fishway Ladder (cfsd)	VRNMO Weir (cfsd)	Diversion Canal (cfsd)	Total Inflow (cfsd)	Robles Diversion (AF)	Matilija Creek (cfsd)	VRNMO (cfsd)
1			0	4.6	20	20	49	69	96		
2			0	4.8	21	21	48	69	95		
3			0	5.0	21	21	74	95	147		
4			0	4.9	20	20	63	83	125		
5			0	4.8	20	20	56	76	111		
6			0	4.7	20	20	52	72	102		
7			0	4.7	20	20	47	67	93		
8			0	4.6	20	20	45	66	90		
9			0	4.6	20	20	42	62	84		
10			0	4.6	20	20	39	59	77		
11			0	4.5	20	20	36	56	71		
12			0	4.4	20	20	30	50	60		
13			0	4.3	19	19	26	45	51		
14			0	4.4	19	19	25	45	50		
15			0	4.3	19	19	23	42	46		
16			0	4.4	19	19	22	41	44		
17			0	4.4	19	19	20	39	41		
18			0	4.5	20	20	18	38	36		
19			0	4.5	20	20	17	37	34		
20			0	4.4	20	20	16	35	32		
21			0	4.4	20	20	15	35	30		
22			0	4.4	19	19	15	34	29		
23			0	4.3	18	18	14	33	28		
24			0	4.2	19	19	13	32	25		
25			0	4.1	19	19	12	31	24		
26			0	4.0	19	19	11	30	22		
27			0	4.0	19	19	10	29	21		
28			0	3.9	19	19	10	29	19		
29			0	3.9	19	19	9	28	18		
30			0	4.0	18	18	10	28	21		
31			0	4.2	19	19	9	28	17		
Totals	0	0	0		605	605	878	1484	1739		

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Feb-11	Matilija Ck D/S Dam (cfsd) (1)	North Fork Matilija Ck. (cfsd) (2)	Sum of Creek Flows (cfsd) (1)+(2)		Forebay Avg. Depth (ft)	Fishway Ladder (cfsd) (3)	VRNMO Weir (cfsd) (4)	Diversion Canal (cfsd) (5)	Total Inflow (cfsd) (4)+(5)		Robles Diversion (AF) (5) X 1.98		Matilija Creek (cfsd)	VRNMO (cfsd)
	Source Stream Daily Flows					Robles Facility Daily Flows							Field Measurement	
1			0		4.3	20	20	8	27		15			
2			0		4.2	20	20	6	26		13			
3			0		4.2	20	20	6	26		12			
4			0		4.2	20	20	6	26		11			
5			0		4.1	20	20	6	26		11			
6			0		4.1	20	20	5	25		10			
7			0		4.0	20	20	4	24		9			
8			0		4.0	20	20	5	24		9			
9			0		4.0	19	19	4	23		8			
10			0		4.0	19	19	4	23		8			
11			0		4.0	19	19	4	23		8			
12			0		3.9	19	19	3	22		6			
13			0		3.9	19	19	3	22		6			
14			0		3.9	19	19	3	22		6			
15			0		4.0	19	19	3	22		6			
16			0		4.2	21	21	16	38		32			
17			0		4.4	20	20	28	48		55			
18			0		4.5	21	21	30	51		60			
19			0		6.1	34	34	23	57		45			
20			0		8.0	49	49	22	71		44			
21			0		8.0	49	49	11	60		22			
22			0		7.9	48	48	3	51		6			
23			0		8.1	50	50	0	50		0			
24			0		7.6	47	47	0	47		0			
25			0		7.7	47	47	12	59		23			
26			0		7.9	50	50	84	133		166			
27			0		8.0	50	50	38	88		74			
28			0		8.0	50	50	25	75		49			
Totals	0	0	0			832	832	360	1193		714			

Ventura River Flow Assessment
Water Year 2010 - 2011

	(1)	(2)	(1)+(2)		(3)	(4)	(5)	(4)+(5)	(5) X 1.98		
	Source Stream Daily Flows				Robles Facility Daily Flows					Field Measurement	
Mar-11	Matilija Ck D/S Dam (cfsd)	North Fork Matilija Ck. (cfsd)	Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	Fishway Ladder (cfsd)	VRNMO Weir (cfsd)	Diversion Canal (cfsd)	Total Inflow (cfsd)	Robles Diversion (AF)	Matilija Creek (cfsd)	VRNMO (cfsd)
1			0	8.0	50	50	19	69	39		
2			0	8.0	50	50	18	68	36		
3			0	8.0	50	50	22	72	43		
4			0	8.0	50	50	18	68	35		
5			0	8.0	49	49	13	62	26		
6			0	8.1	50	50	9	59	18		
7			0	8.1	50	50	8	58	16		
8			0	7.5	45	45	12	57	23		
9			0	6.0	36	36	17	54	34		
10			0	5.0	31	31	18	49	35		
11			0	5.0	32	32	16	48	32		
12			0	5.0	32	32	15	47	29		
13			0	5.0	32	32	13	45	26		
14			0	5.0	32	32	11	44	22		
15			0	5.0	33	33	10	42	19		
16			0	5.0	33	33	9	41	18		
17			0	5.0	32	32	7	40	14		
18			0	5.1	33	33	7	40	13		
19			0	5.2	34	34	10	44	20		
20			0	5.2	50	999	108	1107	214		
21			0	8.6	50	999	382	1381	757		
22			0	8.3	50	325	399	724	789		
23			0	7.5	50	170	314	484	622		
24			0	7.6	50	130	286	416	566		
25			0	7.2	50	364	419	783	829		
26			0	7.7	50	74	444	518	879		
27			0	7.3	50	72	363	436	720		
28			0	6.9	50	65	345	410	683		
29			0	6.5	50	59	298	357	591		
30			0	6.1	50	58	262	320	518		
31			0	6.6	50	51	244	295	483		
Totals	0	0	0		1354	4121	4116	8237	8151		

Flow Exceeds 999 cfs

Ventura River Flow Assessment
Water Year 2010 - 2011

Apr-11	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) North Fork Matilija Ck. (cfsd)	(1)+(2) Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) VRNMO Weir (cfsd)	(5) Diversion Canal (cfsd)	(4)+(5) Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	- Field Measurement: Matilija Creek (cfsd)	VRNMO (cfsd)
1			0	6.5	39	39	224	263	444		
2			0	5.5	33	33	208	241	412		
3			0	5.3	32	32	184	216	364		
4			0	5.1	31	31	162	193	321		
5			0	5.0	30	30	147	177	291		
6			0	5.0	31	31	136	166	269		
7			0	5.0	31	31	127	157	251		
8			0	5.0	33	33	118	151	234		
9			0	5.0	31	31	110	142	218		
10			0	5.0	31	31	102	133	201		
11			0	5.0	31	31	95	126	187		
12			0	4.9	32	32	89	120	176		
13			0	4.6	31	31	85	116	169		
14			0	4.5	30	30	80	111	159		
15			0	4.7	31	31	76	107	151		
16			0	4.9	30	30	72	102	142		
17			0	4.9	28	28	71	99	140		
18			0	4.8	31	31	70	101	139		
19			0	4.6	31	31	66	98	131		
20			0	4.6	31	31	67	98	132		
21			0	4.6	31	31	62	93	124		
22			0	4.5	30	30	61	91	120		
23			0	4.5	32	32	58	90	115		
24			0	4.6	30	30	57	88	114		
25			0	4.5	30	30	53	83	106		
26			0	4.6	31	31	48	79	96		
27			0	4.6	30	30	47	77	92		
28			0	4.6	30	30	44	74	86		
29			0	4.6	30	30	41	71	81		
30			0	4.6	30	30	41	71	81		
Totals	0	0	0		931	931	2802	3733	5548		

Ventura River Flow Assessment
Water Year 2010 - 2011

May-11	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) North Fork Matilija Ck. (cfsd)	(1)+(2) Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) VRNMO Weir (cfsd)	(5) Diversion Canal (cfsd)	(4)+(5) Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	- Field Measurement: Matilija Creek (cfsd)	VRNMO (cfsd)
1			0	4.6	29	29	42	71	83		
2			0	4.5	30	30	37	67	73		
3			0	4.6	32	32	32	64	64		
4			0	4.6	32	32	30	62	60		
5			0	4.6	32	32	30	61	59		
6			0	4.5	32	32	29	61	58		
7			0	4.5	32	32	32	64	63		
8			0	4.6	32	32	35	67	70		
9			0	4.6	32	32	33	65	66		
10			0	4.6	32	32	31	63	62		
11			0	4.5	31	31	30	61	59		
12			0	4.5	32	32	27	59	53		
13			0	4.4	32	32	24	56	48		
14			0	4.5	32	32	27	59	53		
15			0	4.2	31	31	29	61	58		
16			0	4.5	32	32	27	59	54		
17			0	4.5	33	33	35	68	69		
18			0	4.5	32	32	40	72	79		
19			0	4.3	30	30	30	60	60		
20			0	4.3	31	31	24	55	47		
21			0	4.3	31	31	23	54	45		
22			0	4.3	30	30	23	54	46		
23			0	4.2	31	31	20	51	40		
24			0	4.3	32	32	18	50	35		
25			0	4.3	32	32	16	48	31		
26			0	4.3	32	32	14	45	27		
27			0	4.3	32	32	9	41	17		
28			0	4.3	32	32	6	39	13		
29			0	4.3	31	31	8	40	17		
30			0	4.4	30	30	11	41	22		
31			0	4.3	31	31	8	40	17		
Totals	0	0	0		976	976	781	1757	1546		

Ventura River Flow Assessment
Water Year 2010 - 2011

Jun-11	(1) Source Stream Daily Flows: Matilija Ck D/S Dam (cfsd)	(2) North Fork Matilija Ck. (cfsd)	(1)+(2) Sum of Creek Flows (cfsd)	Forebay Avg. Depth (ft)	(3) Robles Facility Daily Flows: Fishway Ladder (cfsd)	(4) VRNMO Weir (cfsd)	(5) Diversion Canal (cfsd)	(4)+(5) Total Inflow (cfsd)	(5) X 1.98 Robles Diversion (AF)	- Field Measurement: Matilija Creek (cfsd)	VRNMO (cfsd)
1			0	4.3	32	32	6	38	12		
2			0	4.3	32	32	5	37	11		
3			0	4.3	32	32	3	35	6		
4			0	4.3	33	33	0	33	0		
5			0	4.5	33	33	5	38	10		
6			0	4.4	33	33	18	51	36		
7			0	4.3	33	33	9	41	17		
8			0	4.3	32	32	7	39	13		
9			0	4.2	32	32	5	37	10		
10			0	4.1	32	32	1	33	2		
11			0	4.2	32	32	4	36	7		
12			0	4.3	31	31	7	38	13		
13			0	4.2	31	31	5	36	9		
14			0	4.0	31	31	1	32	2		
15			0	3.8	30	30	0	30	0		
16			0	4.0	30	30	0	30	0		
17			0	4.2	32	32	0	32	0		
18			0	4.1	32	32	0	32	0		
19			0	4.1	31	31	0	31	0		
20			0	4.0	30	30	0	30	0		
21			0	3.5	27	27	0	27	0		
22			0	3.5	27	27	0	27	0		
23			0	3.6	27	27	0	27	0		
24			0	3.3	26	26	0	26	0		
25			0	3.2	26	26	0	26	0		
26			0	3.1	25	25	0	25	0		
27			0	3.0	25	25	0	25	0		
28			0	2.9	24	24	0	24	0		
29			0	3.1	25	25	0	25	0		
30			0	3.1	26	26	0	26	0		
Totals	0	0	0		893	893	75	969	149		

Appendix 36. Correspondences among Biological Committee participants regarding the 2011 progress report and 2012 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

DEC 19 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) to provide recommendations for the 2012 Robles Facility monitoring and evaluation activities defined in the Robles Biological Opinion. On November 22, 2011, NMFS received Casitas Municipal Water District's (Casitas) *2012 Monitoring and Evaluation Study Plan for the Robles Fish Passage Facility and Related Studies* (Study Plan). Having reviewed the Study Plan, NMFS understands the monitoring and evaluation activities Casitas proposes for 2012 in the Ventura River. The Biological Committee met on December 1, 2011, to discuss the 2011 Annual Report and the 2012 Study Plan. Due to the compressed timeframe to review and provide input on the 2012 Study Plan before monitoring activities begin (i.e., less than 30-days), this letter focuses on providing NMFS' comments on the monitoring and evaluation of the operation of the Robles Fish Passage Facility (Facility) that are specifically targeted at improving endangered steelhead (*Oncorhynchus mykiss*) passage conditions in the Ventura River. NMFS' comments on the 2011 Progress Report will be provided under a separate cover.

To ensure the Facility monitoring and data reporting are conducted in accordance with the Biological Opinion, NMFS requests Reclamation review the recommendations provided in this letter and advise Casitas to modify the 2012 Study Plan such that the monitoring activities are mutually agreeable to all Biological Committee members. NMFS recommendations for the 2012 monitoring address the upstream steelhead migration impediment evaluation, fish attraction evaluation, downstream fish migration through the Robles reach, and the Facility performance testing. NMFS requests that Reclamation distribute the Final Draft of the 2012 Study Plan, incorporating NMFS' recommendations, before the 2012 monitoring activities commence.

Upstream steelhead impediment evaluation

Section 2.0 of the draft Study Plan does not provide a sufficient amount of information about the impediment sites proposed for monitoring in 2012. Table 2 provides the summary data of the impediment sites that were originally selected during the 2009 Biological Committee selection process. The text on page 7 indicates that the sites presented in Table 2 are the sites that will be surveyed in 2012. This is not consistent with the results presented in the 2011 Progress Report, which indicate that monitoring at some sites (e.g., Site 2) has been discontinued and new replacement sites (e.g., Site 3-2) have been selected by Casitas during the 2011 monitoring season. Additionally, the group discussion at the December 1, 2011, Biological Committee meeting included plans of continuing to monitor at the new Site 3-2, assessment and likely replacement of Site 2, adding a new site just upstream from Highway 150, and assessment of Site 8 to determine whether this site has the site characteristics of a critical riffle or not (see Figures 1 and 2). NMFS recommends for the second year in a row that Reclamation advise Casitas to conduct impediment evaluation monitoring at the riffle complex approximately 200-meters upstream of Highway 150. All available Biological Committee members should accompany Casitas in the field for identification of this site, and delineation of the transect. A Biological Committee site visit is scheduled for January 11, 2012, to review the proposed monitoring sites (including the site upstream of Highway 150). NMFS understands that if the Biological Committee agrees that the site appears to be an impediment, monitoring will occur at this site during the 2012 flow augmentation season.

The methods outlined for the steelhead impediment monitoring involves surveying all selected sites over a range of discharges from approximately 20 – 100 cfs. Based on discussions at the 2011 Biological Committee meeting, NMFS understands that Casitas is limited to two survey crews to conduct the transect measurements and each crew is capable of surveying 4 – 5 sites each day. Casitas declined CDFG grant funding assistance for hiring extra technicians to conduct 2012 impediment survey transects. Results from the last two years of data collection at the seven monitoring sites indicate only 5 of 102 survey transects were completed at the upper proposed discharge (i.e., 80 – 100 cfs), though streamflows greater than 80-cfs were available for sampling. NMFS recommended that an effort be made in 2012 to collect multiple survey transects at each site when flows are greater than 80-cfs. Casitas agreed to conduct transect measurements at the upper flow range, and will attempt to survey transects at discharges greater than 100-cfs if sufficient supplemental flows exist. Casitas indicated that they use a systematic sampling matrix to ensure sites that are missing a transect measurement at a specific Robles release are sampled first when those stormflow-supplementation releases occur. This sampling method should promote surveying each site at the widest range of flows possible, and provide the rationale to conduct extra survey transects at new replacement sites to develop a better depth-discharge relationship.

Fish Attraction Evaluation

The primary purpose of the Robles fish-attraction surveys is to evaluate if migrating adult steelhead are holding in the area immediately downstream of the fish-ladder entrance during stormflow supplementation operations. The stormflow-supplementation period is defined as the period of time that downstream flow-augmentation releases are provided to enhance steelhead migration through the fish ladder. The goal of the stormflow-supplementation operations is to provide adult steelhead with at least 10 passage days, defined as days where flow released downstream of Robles is ≥ 50-cfs, following the peak of a storm event. Stormflow-supplementation releases that exceed the fish-ladder capacity (50-cfs) are first routed through the auxiliary water supply pipeline up to a total release of 121-cfs. The combination of the fish ladder and the auxiliary pipeline will provide the necessary downstream bypass design flow of 171-cfs as specified in the biological opinion to meet the stormflow-supplementation operations criteria when Robles inflow exceeds 671-cfs. Therefore, NMFS recommends that the fish-attraction surveys be conducted during the 10-12 day managed release on the receding limb of naturally generated storm hydrographs.

Modifications are needed to improve the current fish-attraction evaluation surveys. NMFS agrees with Casitas that the interpretation of weekly observational counts are extremely limited for interpreting the effects of the attraction flows on the behavior of steelhead holding downstream of the fish-ladder entrance. The most restrictive element of the current survey protocol is water visibility at the time of day that the survey occurs. Another concern with the bank or snorkel survey method is the disturbance caused by the presence of the surveyor. For this reason, NMFS recommended the installation of an underwater video camera mounted above the fish-ladder entrance to monitor fish entering and exiting the fish-ladder for the duration of the stormflow supplementation period. A camera is unable to ameliorate the effects of high water turbidity, but installing the camera at the start of the stormflow supplementation period (i.e., 24-hrs post storm peak) and leaving it installed for the entire 10-day supplementation period will allow for continuous monitoring once the river conditions permit. NMFS recommends that the camera be installed prior to obtaining the 1-meter secchi-disk measurement to prevent loss of data if conditions improve prior to the next secchi measurement. This protocol frees staff to conduct other concurrent flow-dependent aspects of the monitoring program.

NMFS recommends that the fish-attraction evaluation results be presented in the Annual Report in a manner that allows for comparison to detailed Robles fish-ladder discharge. The underwater video results should be presented in tabular format similar to the Vaki Riverwatcher detections, and graphed on a fish-ladder hydrograph corresponding to flow augmentation for each storm event evaluated. The following data should be recorded for each steelhead observed entering/exiting the fish ladder entrance: orifice number, date, time, length estimate, direction, instantaneous turbidity, instantaneous fish-ladder discharge, auxiliary pipeline discharge and spillway gate operation (i.e., estimated discharge through gates). Because streamflow augmentation is ramped down each day (reportedly around midday), recording the discharge at the time of observation, rather than the mean daily discharge, is important. Report fish-ladder turbidity measured closest to the time of steelhead observation to better understand the operational limits of the underwater video to assess fish attraction. To account for the potential that no steelhead will be detected entering the fish ladder using the underwater video monitoring due to technical limitations (e.g., high turbulence, poor camera angle, high turbidity during supplementation period, etc.), all Vaki Riverwatcher detections including fish probable, fish unknown and *O. mykiss* should be included in the fish attraction evaluation results (table and graphs) for all 10-day storm-supplementation periods and overlapping storm events. The results of the underwater video and Vaki Riverwatcher detections should be clearly distinguishable in the tables and graphs.

The secondary purpose of the fish-attraction surveys is to evaluate if downstream migrants (i.e., smolts) are congregating in the entrance pool towards the end of the out-migration season when mainstem riverflows are declining. Because Ventura River turbidity is normally not a problem in late spring and summer when juvenile fish-attraction surveys are conducted, snorkel and bank surveys of the entrance pool are a sufficient method to evaluate if a fish-stranding problem exists at the Facility. NMFS does not see value in continuing the snorkel surveys upstream of the Facility because the purpose of the fish-attraction surveys is to evaluate if migrants are holding downstream of the Facility. The reporting of the upstream fish observations and discussion of this monitoring activity should be relocated to Section 6.0 of the Study Plan titled "Additional Monitoring Studies – *O. mykiss* Presence/Absence Surveys."

Downstream fish passage evaluation

NMFS is concerned about the high level of physical injuries to steelhead observed during the 2011 Robles Facility smolt-trapping season. The reported body damage included skin damage in the head region (88%), skin contusions (16%) and fin damage (8%). With regard to the 2011 results presented in Appendix 32, whether all 25 smolts removed from the trap had sustained injuries, or if individual fish sustained multiple types of body damage, is not clear. The cause of fish injury observed in the trap, whether sustained during passage through the Robles Facility or the result of trapping, are not known to NMFS because the current smot-trapping design does not allow for resolution of this important distinction. Regardless of the cause of injury, the high level of fish injury reported after completion of the 2011 trapping season is unacceptable. Observation of steelhead injury or mortality should be reported to NMFS at the time injury or mortality is discovered. The observation of fish injury is not a new occurrence at the Robles Facility smolt trap. In 2010, 80-percent of the smolts captured had skin damage to the head region. As a result, Casitas proposed to 1) conduct a pilot test with hatchery fish in 2011 to assess what level of fish injury may be the result of their trap design, and 2) conduct literature research on the topic. Neither product has been provided for NMFS review. In 2009, the only steelhead captured in the smolt trap sustained 64% descaling due to becoming impinged in the plastic mesh covering the trap-holding box. In-season changes were made during 2009 to the trap design that were thought to eliminate future fish injury. However, uncertainty exists as to whether the injuries observed in 2011 are the result of trapping or from passage through the Facility. The available data suggest that because the trap is located downstream of the facility, the cause of fish injury will not be resolved during the 2012 trapping season. Because greater than 80-percent of smolts captured in the last two years sustained physical injuries, NMFS recommends Reclamation evaluate the need for installing an upstream and downstream trap as outlined in the 2012 Study Plan to gain a better understanding of whether passage through the Facility is causing the high level of observed fish injury.

The results of the 2011 smolt-tagging was discussed at the December 1, 2011 Biological Committee meeting. Because none of the eight PIT-tagged fish that were released upstream of the Facility were detected by the fish ladder tag reader or manually interrogated at the smolt trap, the Biological Committee agreed that a tagging protocol should be developed for tagging fish with either PIT-tags or radio tags. NMFS cautioned that the 2011 practice of tagging the earliest arriving smolts with radio tags and tagging the latest arriving smolts with PIT-tags should be discontinued. Criteria for selecting fish for tagging and the specific tag type should be independent of fish size and condition. An effort should be made to distribute fish upstream of the Facility with PIT-tags and downstream with radio tags on the same days when sufficient numbers of smolts are captured. Since the 2011 Biological Committee meeting, Casitas has agreed to PIT-tag every fourth steelhead smolt captured in the trap downstream of the Facility and release the PIT-tagged fish upstream at Camino Cielo Road. With regard to the 63-percent radio tag loss reported during 2011, NMFS would like to know Casitas' proposal to prevent future high levels of tag loss and potential tag loss due to fish mortality.

Facility operations and performance testing

The 2011 Progress Report includes Section 4.5 titled "Recommendations Regarding the Prioritization of Future Activities." Because all of the items listed in Section 4.5 affect the operation and biological monitoring of steelhead passage of the Robles Facility, NMFS recommends these action items be included in the 2012 Study Plan. In addition to the list in Section 4.5, the following evaluations are expected to be conducted per the guidelines in the Robles Performance Evaluation Program as soon as the necessary stormflows exist:

1. Fish Ladder Testing;
2. Auxiliary Water Supply System Testing;
3. Entrance Pool Testing; and,
4. Temporary Rock Weirs Testing.

Review of the Ventura River flow assessment in the 2010 and 2011 Progress Reports indicate that no field measurements have been reported at the Robles low-flow crossing measurement weir (VRNMO) for the last two water years. This concerns NMFS because Casitas reports that this device is the most reliable flow measurement at the Facility for the fish passage and downstream stormflow-supplementation. Because the flow meters in both the fish-ladder and the auxiliary water pipeline are reported to be not functioning properly (turbulence and sloshing problems), NMFS recommends that routine field measurements be conducted at the VRNMO weir to calibrate the measurement device to correct inaccuracies caused by clogging of bubbler lines, electronic creep, sensor fouling, changes to the measured cross section and equipment problems. At a minimum, field measurements should be collected prior to the first qualifying storm event of the stormflow-supplementation season (i.e., December), once during each stormflow-supplementation period, and after any larger storm events (≥ 671-cfs). Comparison of February 2009 measurements reported at the VRNMO weir indicate that the weir measurement device (27-cfs) can differ from field measurement (19.8) by as much as 27-percent. NMFS recommends that VRNMO field measurements at flows greater than the fish ladder capacity (50-cfs) be conducted in 2012 to develop a better rating curve at supplementation flows in order to adequately evaluate the performance of the proposed modification to the auxiliary diffuser panel.

In conclusion, NMFS recommends that Reclamation advise Casitas to distribute the draft 2013 Study Plan well in advance of the 2012 Biological Committee meeting to facilitate timely discussion prior to distribution of the final Study Plan. 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 Study Plan recommendations contained in this letter.

Sincerely,

for 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

Figure 1. Approximate location of Casitas' Site 8 transect near OVLC pools in boulder run habitat. Person on West bank positioned at GPS coordinate from Casitas' Table 2 (34°12'15", 119°17'36").

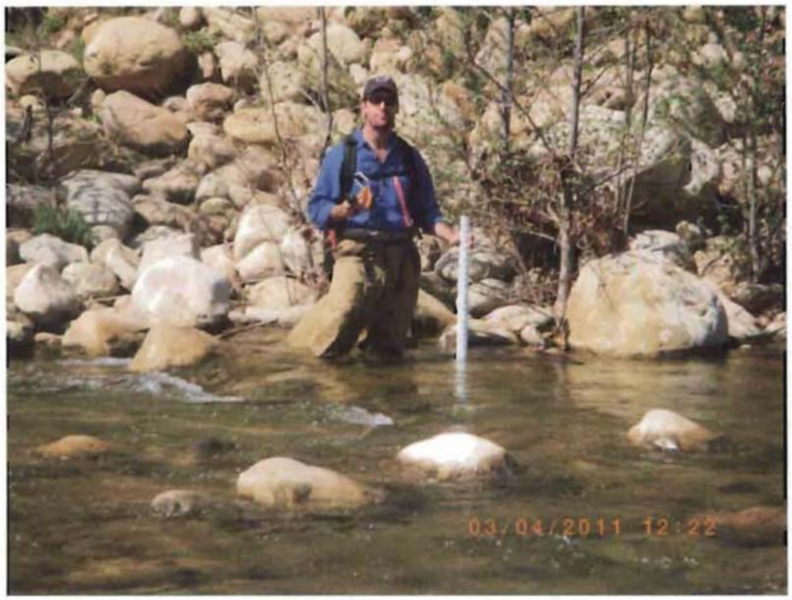


Figure 2. Depth measured 2.0-ft deep at this location (1.2-km downstream Robles) and Robles discharge was 50-cfs. All transect stream depths perpendicular to streamflow measured greater than 0.6-ft deep.

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

08 March 2012

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 dated December 19th of 2011, which was pertaining to the Robles Fish Facility and the 2012 study plan. 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. The headings from the NMFS letter were followed below.

Upstream Steelhead Impediment Evaluation

The impediment site table provided in the draft 2012 study plan was not updated to include the changes made mid-season due to the March 2011 high-flow event because additional modification were anticipated after BC review process. Consequently, Casitas planned to update the table for the final study plan once the review process was completed.

Casitas decline the CDFG funding assistance at the 2011 BC meeting. However, NMFS failed to mention that at the meeting Casitas stated its plans of hiring two short-term fisheries technicians to assist with data collection efforts during the busiest time of the season. Casitas will try to collect transect data at higher flows as stated in the study plans. However, NMFS must realize and acknowledge there will always be logistical constraints with any field study.

Fish Attraction Evaluation

Casitas is willing to make the recommended changes to the Fish Attraction Evaluation, and has done so in the 2012 study plan. However, it should be noted that the current evaluation method of post-storm surveys was originally recommended by NMFS.

Casitas will conduct video monitoring at the entrance gate during 2012, but the operational and analysis limits are unknown at this point.

Contrary to NMFS, Casitas sees the value in continuing the fish attraction surveys upstream of the Robles Fish Facility. Not only do these surveys provide information about general *O. mykiss* behavior near the facility, but also they are valuable in evaluating other aspects of the monitoring and evaluations at the facility (e.g., Downstream Fish Passage Evaluation). Casitas believes these surveys can help determine whether successful passage at the Robles Fish Facility by comparing downstream to upstream counts. Therefore, Casitas believes these data should continue to be collected, analyzed, and displayed in the same manner.

Downstream Fish Passage Evaluation

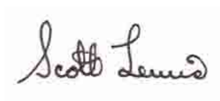
The skin damage on the heads of many of the smolts was believed to have occurred from trapping. This was first noticed with some of the smolts captured prior to 2011, but to a greater degree. Even though the percentage of smolts with this injury was high, the actual size of the injury was small. The injury was approximately 2 mm x 10 mm and corresponded to the shape and dimensions of the plastic mesh. The injuries were not skin abrasions, but contusions and the epidermis was not broken. After changing the mesh material to a smaller size, this injury was reduced. The location of the skin damage on the top of the snout and head region suggests that it was caused from "nosing" into the mesh to avoid capture; this behavior was also observed during removal from the trap. Additional improvements will be made for the 2012 trapping season by adding smoother material to the inside of the trap to determine if the injuries can be reduced or eliminated. Unfortunately, the fish trap handling experiment was not conducted during 2011 as anticipated. The experiment will be conducted this year and will be reported in the 2012 progress report. Additionally, the results of a literature review on smolt injuries will be included at that time.

Facility Operations and Performance Testing

Casitas will make all attempts to collect data as outlined in the performance evaluation study plan if flows occur during 2012. Casitas has, and will continue, to make improvements to the accuracy of measurement weir and all other Robles Fish Facility flow monitoring devices.

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,



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