2009 Robles Fish Passage Facility

Progress Report

Casitas Municipal Water District
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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 BA was later analyzed in the Biological Opinion (BO) prepared by the National Marine Fisheries Service (NMFS 2003a). This 2009 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 2008 to 30 June 2009.

The monitoring and evaluation studies related to the Robles Fish Facility conducted during the 2008-2009 reporting period are included in two main sections of this progress report. The Fisheries Monitoring and Evaluation section contains: upstream fish migration impediment evaluation, sandbar monitoring at the mouth of the Ventura River, fish attraction evaluation, fish passage monitoring, downstream fish passage evaluations, and downstream fish migration through the Robles Reach. The Facility Operation section contains: information and data on the facility status, flow observations and control, costs associated with operation and monitoring, assessment of the effectiveness to provide fish passage, recommendations of priorities for future activities, and revisions deemed necessary to the operations.

A total of eight monitoring sites were selected for the upstream fish migration impediment evaluation and a baseline set of measurements and photos were collected in 2009. Initial flow measurements will begin, if sufficient river discharge exists, in the next migration season. The sandbar at the mouth of the Ventura River was only closed for short periods during October and November of 2008 and was open for potential volitional steelhead passage during the remainder of the reporting period. A total of 807 *O. mykiss* juveniles were counted in the area upstream and downstream of the Robles Fish Facility during the fish attraction evaluations in 2009. This number represents multiple counts of some *O. mykiss* due to smolting rates and migration behavior; however, this was the largest count recorded since monitoring began in 2005. The number of *O. mykiss* juveniles were likely the primary result of adult steelhead that successfully migrated upstream of the Robles Fish Facility and spawned in the spring of 2008 that subsequently produced migrant offspring in 2009. During the fish passage monitoring evaluations, no adult steelhead were detected migrating upstream through the Robles Fish Facility in 2009. However, this was not unexpected due to the dry river conditions during the expected migration period. Only one *O. mykiss* juvenile was captured migrating downstream below the Robles Fish Facility before the trap was removed due to low-flow conditions.

2.0 INTRODUCTION

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

Rainbow trout can be generally organized into four large groupings (Behnke 1992; Scott and Crossman 1973): 1) coastal rainbow trout that extend from northern Baja California to northern Alaska near the Kuskokwim River and also the Kamchatkan Peninsula of northeastern Asia, 2) redband trout of the inland Columbia and Frazer River basins, 3) redband trout of the central valley of California, and 4) trout of the Gulf of California drainages. The taxonomic group of coastal rainbow trout, *O. m. irideus*, exhibit two life history forms; anadromous and resident. The common name for the anadromous life history form is termed steelhead trout and the resident form is generally termed rainbow trout. Throughout the range of coastal rainbow trout, there is a widespread occurrence of the anadromous life history form (Behnke 1992). There are two general life history patterns exhibited by adult anadromous steelhead when they return from the ocean to spawn in fresh water. The patterns are grouped by either summer or winter spawning runs. There are many exceptions to this pattern, but this general characterization has been used to group steelhead spawning runs by the season in which the peak occurs as they return from the ocean (Busby et al. 1996). Summer steelhead are generally found in river systems that drain from farther inland, such as the Columbia River basin. Winter steelhead runs are typically found in the coastal systems where the rivers 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 Fish Flow Operations

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 since that was the first year the Robles Fish Facility was fully operational. This would necessitate a reevaluation after the 2010 fish passage season. Through the Cooperative Decision Making Process, the Robles Biological Committee would review each of the specific monitoring and evaluations and determine if they have address the original objectives and could be discontinued or if additional study would be needed.

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 10 km to the confluence with San Antonio Creek (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); seven sites were identified in the Robles Reach. The physical characteristics of the 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 width. The potential impediments were also evaluated using a criteria of 0.5 ft and 0.6 ft depth for 25% 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 was based on fish body measurements and not on actual migration observations or data, and it has been observed that adult salmonids can successfully move through shallower riffles (Mosley 1982). The final evaluation of potential impediments will use one of the aforementioned criteria or a yet to be determined criteria that will be developed by the Biological Committee through the Cooperative Decision Making Process as described in the BO.

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

Methods

Selected channel features that may pose an impediment to upstream passage will be 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 will be surveyed over a range of discharges from approximately 10-100 cfs (the upper limit will be dependent on the ability to safely conduct the surveys), which could be correlated with discharge at the Robles Fish Facility. The number of repeated surveys will be dependent on the number and duration of significant rain events in a given year, 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 that will be used to evaluate fish passage.
During the initial phase, the Ventura River was surveyed from the mouth to the Robles Fish Facility (23 km) using standard stream survey techniques and was completed in 2008 (CMWD 2008). This provided physical measurements of all habitat units for the selection process. The survey methodology followed Moore et al. (2002) and was equivalent to a level IV survey as described in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 2002).

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

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

Results

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

A baseline set of photos was taken of each site after the final selection was completed to provide a method for determining qualitative changes over time (Appendix 3a-g). However, this first set of photos was not able to fully reveal site characteristics due to the heavy vegetation growth that has occurred since the last significant discharge event in January 2008 (CMWD 2008). The vegetation growth has occurred primarily in areas that tend to have longer periods of flowing surface water, which is primarily in the mainstem Ventura River below the Robles Reach. After the next significant discharge event removes this vegetation, and subsequent impediment surveys are completed, it will be easier to view and document the impediment sites.

Of the seven sites originally identified by ENTRIX (1999), only four sites were able to be relocated with any degree of certainty. Of those four sites, all are no longer in the primary low-flow channel. Sites 1-3 were originally located between the Robles Fish Facility and the Hwy 150 bridge. The river channel in the general area where these site 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 presently within the river channel due to a lack of lateral channel migration, there could have been longitudinal migration of the channel features over the last 10 years. Site 4 was originally located just upstream of the Hwy 150 bridge. The channel since then, based on photos from 2003, has migrated laterally approximately 20 m towards the left bank (looking upstream) caused from natural channel meandering. Site 5 was originally located just downstream of Santa Ana Blvd bridge. Based on photos from 2003, the channel has moved latterly approximately 30 m from the right bank towards left bank. This could be partly due to channel modifications that were made by CalTrans near the bridge in recent years (Mary Larson, CDFG, personal communication). Sites 6 and 7 were both originally located near the community of Casitas Springs. Site 6 was located behind the Arroyo Trailer Park and site 7 was located approximately 200 yards downstream (ENTRIX 1999). Again based on aerial photos of this area prior to the

2005 flood event, the river channel was located considerably closer to the left bank than it is presently. The main low-flow river channel is now located on the right bank against the levee that protects Casitas Springs from high water runoff events. This represents approximately a 30 m shift to the right bank for site 6 and a 50 m shift for site 7. The main low-flow channel at sites 6 and 7 appears to have switched between preexisting channels and was not the result of natural meandering over the last 10 years. Of the four original sites that could be relocated, all would be inundated at higher flows; however, since low-flow river conditions are the focus of the upstream fish impediment evaluation (NMFS 2003a), new sites were needed for future evaluations.

3.1.1 Sandbar Monitoring

<u>Introduction</u>

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 also enhance marine survival (Bond et al. 2008).

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

Methods

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

Results

During the reporting period, July 2008 through June 2009, the mouth of the Ventura River was inspected 21 times to determine if the sandbar was open or closed. Fourteen of the observations occurred during the fish passage augmentation season (01 January to 30 June) and seven were outside of the fish passage augmentation season. The sandbar was closed during observations that occurred in October and November of 2008; however, these closures were brief in nature because they only occurred during low tides.

During high tides, the surface water was reaching the Pacific Ocean (Appendix 4). In mid December of 2008, the sandbar was open and the Ventura River was able to flow into the Pacific Ocean allowing fish to volitionally enter or exit the estuary. On 02 January 2009, the sandbar was also open, which officially initiated the beginning of the fish passage augmentation season. The low tide only closures occurred again during mid January of 2009. The sandbar was open for the remaindered of the 2009 fish passage augmentation season. On the days the sandbar was inspected, the river discharge at the USGS Foster Park gauge station ranged from approximately 5 to 20 cfs and 0 to 30 cfs at the Robles Fish Facility. The river was observed exiting from the eastside of the estuary every time the sandbar was found to be open during the reporting period.

A total of 4,856 piscivorous birds were counted during 19 index surveys of the Ventura River estuary (Appendix 5). Gulls represented approximately 80% of the bird observations at 3,850, followed by cormorants at 471, terns at 264, and pelicans at 235. Egrets, grebes, herons, and mergansers were each counted in total less than 23 times during the same period and no kingfishers were observed.

Discussion

The sandbar at the mouth of the Ventura River tends to remain open during wet years and is closed more often during years with few significant rain events (Lewis and Gibson 2009, in prep). During 2005 and 2006, the sandbar remained open and did not close until April of 2007 after an extended period of low precipitation (Appendix 6). 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 and Gibson 2009, in prep). The status of the sandbar indicates changes in the estuary/lagoon that may help determine potential juvenile steelhead rearing conditions.

3.2 Fish Attraction Evaluation

Introduction

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

The entrance of the fish ladder at the Robles Fish Facility is located approximately 20 m downstream of the spillway gates and is where fish migrating upstream enter and where fish migrating downstream exit. The downstream end of the ladder is adjacent to a large pool (entrance pool) that was scoured out and maintained by high discharges through the spillway gates. Maximum discharge at the exit of the ladder is 170 cfs (50 cfs through the entire ladder and an additional 120 cfs can be supplemented at the lower end of the ladder). The distance from the entrance pool downstream to the lower most interim rock weir is approximately 200 m. This reach includes all four rock weirs and the facility's low flow road crossing, which is also the discharge measurement weir 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 2009. The particular survey methodology used was determined based on water visibility, river discharge, and expected steelhead life history stage present at the time of the survey. From January through March, which is when the vast majority of adults are expected to be migrating upstream (Shapovalov and Taft 1954), bank surveys were the predominant method used. Beginning in March through the remainder of the fish passage season, snorkel surveys were the predominant method used, which is when steelhead smolts are expected to migrate downstream (Shapovalov and Taft 1954; Spina et al. 2005). Bank surveys were conducted by one or two surveyors in an upstream direction. The surveyors wore polarized sunglasses to reduce water surface reflection. Snorkel surveys were conducted by one or two surveyors in an upstream direction. All fish species were identified and enumerated to the greatest extent possible that the river conditions and fish densities allowed at the time of the surveys. Lengths of each *O. mykiss* were estimated to the nearest cm if only a few individuals were present. At times of greater abundance, *O. mykiss* were grouped and assigned to the nearest 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 807 *O. mykiss* were counted from January through June of 2009 in the 340 m study reach (Appendix 7). No adult steelhead were observed during the fish attraction surveys. A total of 8,700 m were surveyed by either bank or snorkel methodologies during the 6-month period. The water temperatures during the study period ranged from 10 °C in January to 27 °C in June and turbidity was less than 5 NTUs. *O. mykiss* were first observed in considerable numbers toward the end of March (Appendix 8). Counts then peaked in mid April at 131 *O. mykiss* and declined to less than 40 beginning in May. Survey counts ranged from 10 to 40 *O. mykiss* through the end of June 2009. Due to dry conditions, there was no discharge below the Robles Fish Facility until the end of November 2008. From that time until February, discharge ranged from about 2 to 15 cfs. Then during February and March, discharge increased modestly to about 30 cfs. During the period that *O. mykiss* counts began to increase, the discharge began to decrease.

The 200 m reach downstream of the fish facility was surveyed on 26 separate occasions, 8 bank and 18 snorkel surveys. A cumulative total of 5,200 m were surveyed from January through June. A total of 546 *O. mykiss* were observed downstream of the Robles Fish Facility (Appendix 9). The peak count for the downstream reach was 75 *O. mykiss*, which declined to about 20 *O. mykiss* for the remainder of the study period.

The 140 m reach upstream was surveyed on 25 separate occasions, 11 bank and 14 snorkel surveys. A cumulative total of 3,500 m were surveyed from January through June. A total of 261 *O. mykiss* were observed in the upstream reach. Observations of *O. mykiss* upstream of the Robles Fish Facility were similar to downstream counts. The general pattern of increasing counts in late March, peaking in mid April, and receding to lower levels in early May was similar for both upstream and downstream counts (Appendix 9). The peak count for the upstream reach was 53 *O. mykiss*, which declined to about 3 *O. mykiss* for the remainder of the season.

Discussion

The total count of 807 *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. Since 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. However, the *O. mykiss* were certainly migrating downstream. This was evident by the fact that snorkel survey counts peaked at 80 *O. mykiss* on 31 March in the two large pools on the Ojai Valley Land Conservancy (OVLC) property, approximately 1 km downstream of the Robles Fish Facility (Lewis and Gibson 2009, in prep). Moreover, this relative abundance pattern was very similar to that at the Robles Fish Facility with regard to the timing of initial increase in late March, peaking in April, and then declining in late April and into May. Without tracking individual *O. mykiss* (e.g., mark/recapture, telemetry, or other tagging studies), the time spent by *O. mykiss* in close proximity to the Robles Fish Facility cannot be determined by observations alone. It is clear, however, that *O. mykiss* are migrating from the upper Ventura Basin and passing through the Robles Fish Facility successfully and continuing downstream.

From observational counts alone, the ability to interpret the fine-scale migration behavior of the *O. mykiss* near the Robles Fish Facility is limited. The abundance trends were indeed similar for upstream and downstream observations (Appendix 9). Since *O. mykiss* counts increased in both the upstream and downstream reaches simultaneously, it indicated that fish were moving volitionally downstream through the Robles Fish Facility. The decreased counts for both the upstream and downstream reaches in early May indicates that they were obviously moving out of the study reaches. As stated before, some *O. mykiss* were continuing to migrate downstream as indicated by observations in the two large pools on OVLC property. However, these downstream observations could not solely account for decreased counts at the Robles Fish Facility. Some of the *O. mykiss* in the upstream reach most likely migrated back upstream as water temperature increased above 22 °C. *O. mykiss* counts downstream did not decrease proportional as they did upstream. This could have been due to several reasons, acting alone or together, that resulted in an accumulation of *O. mykiss* in the entrance pool below the Robles Fish Facility. As discharge decreased in May, *O. mykiss* could have had difficultly moving back upstream through the ladder. During this period, discharge was only about 2-3 cfs and the facility operational design criterion for functional fish passage was estimated to be a minimum of 10 cfs (CMWD et al. 2002). Additionally, water temperature related effects could have played a role. As the discharged receded in May, the surface water temperature was increasing. When given a choice between the cooler water of the thermally stratified entrance pool (3.5 m deep) and the warmer water discharged from the ladder, *O. mykiss* most likely preferred to stay in the entrance pool. During late May, surface water in the entrance pool was approximately 25 °C and 19 °C near the bottom (Lewis and Gibson 2009, in prep). At that same time, the dissolved oxygen remained about 9 mg/L from the surface to the bottom. *O. mykiss* are known to use thermally stratified pools as a means to escape warmer surface water temperatures (Matthews et al. 1994). However, deep pools can develop low concentrations of DO at times of the year, and depending on their hydraulic connection to subsurface flows, *O. mykiss* may face a tradeoff between warmer surface water and low DO in the cooler water of deep pools (Matthews and Berg 1997). Given that the DO throughout the water column in late May was within the range acceptable to

O. mykiss, they did not face this tradeoff between low DO and high temperatures. Thus, in effect, the fish could have been restricted to the deeper water of the entrance pool by a thermal blockage and unable or unwilling to move through it.

Due to the dry water year, there was only a surface water connection to the lower Ventura River for 3 weeks, from March 6th to March 26th (Lewis and Gibson 2009, in prep). The surface water connection to the lower Ventura River was actually lost before the peak counts of *O. mykiss* near the Robles Fish Facility occurred. Unfortunately, this did not provide the vast majority of steelhead smolts from the upper Ventura Basin an opportunity to migrate downstream and enter the ocean.

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 March through June, approximately 25% of the *O. mykiss* observed were categorized into five classifications that included parr, three transitional phases (T-1, T-2, and T-3), and full smolts following the methods of Hasler and Scholz (1983). This classification method has been used successfully for smolting steelhead (Allen Scholz, Eastern Washington University, personal communication). Of the classified *O. mykiss*, 41% were considered to be in T-2 stage, 27% were stage T-3, and 6% full smolts (Lewis and Gibson 2009, in prep). Almost 75% of classified *O. mykiss* were in mid to late smoltification stages, which would clearly indicate the reason for their downstream migration behavior. Based on snorkel observations during June, it appeared the remaining *O. mykiss* were beginning to revert to a resident form (i.e., lightening of the margin of the fins, coloring across lateral line, and reappearance of parr marks). During this period of smolt reversal, the mean water temperature during snorkel observations was measured at 22 °C, which exceeded the temperature limit of smolt regulating enzymes and hormones (Allen Scholz, Eastern Washington University, personal communication) and could explain the residualization observations.

The total number of *O. mykiss* observed during 2009 was substantially greater than in 2008. During same period in 2008, only 47 *O. mykiss* juveniles were counted as compared to the 807 during 2009 (CMWD 2008). In fact, the 807 *O. mykiss* counted during the fish attraction surveys was by far the greatest counted since the surveys began in 2005 (CMWD 2005, 2006, and 2007). The dramatic increase was most likely do the migration and successful spawning of adult steelhead in 2008. There were 6 adult steelhead detected migrating upstream through the Robles Fish Facility during the 2008 migration season (CMWD 2008). These adults most likely spawned with each other or resident rainbow trout and produced progeny that reared until 2009 and began to smolt and migrate downstream as one-year-olds in an 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 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 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). Presently, 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 camera was installed in 2008 so that video of downstream fish could be captured on a digital video recorder (DVR). The first camera was started on 10 February 2009. On 02 April 2009, a second downstream camera was installed to capture a larger viewing area. Both downstream cameras are located upstream of the Riverwatcher scanners in an aluminum tunnel along with the original upstream Riverwatcher camera. The downstream digital cameras records continuously at 12 frames/sec and capture 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 during the July 2008 through June 2009 reporting period. During this time, the crowder and Riverwatcher were removed from the fish bypass channel and cleaned or inspected 105 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.

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 10 for detection classification flow chart). 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, a measurement of eye diameter and standard length (SL) were estimated from the video clip to calculate morphometric ratios that were compared to known steelhead and rainbow trout. A commonly used method is to develop ratios of body measurements for comparison to remove the effects of body size so actual differences can be determined (Strauss and Bond 1990). This was done by comparing SL to the ratio of eye diameter to SL in linear regression. Standard length is the length from the snout to the end of the hypural plate near the end of the fleshy caudal peduncle, which is unaffected by caudal fin deformities (Anderson and Neumann 1996). The adult steelhead classification was used if the fish observed was an *O. mykiss* and displayed the typical characteristics of an adult steelhead, such as black spotting on dorsal, adipose, and caudal fins, black spotting on dorsal side of body, slivery body, vertical edge to caudal fin, ≥ 38 cm TL (Shapovalov and Taft 1954), and had an eye diameter/SL ratio ≤ 0.045 (CMWD 2008). *O. mykiss* non-adult steelhead classification was used if the fish observed was an *O. mykiss* but did not display the characteristics of an adult *O. mykiss*; lobed caudal fins and darker color. Because of the difficulty in distinguishing between resident and anadromous *O. mykiss* of smaller sizes, no further classifications were used for *O. mykiss*. Even though many, if not most, of the *O. mykiss* documented were likely smolting, the uncertainty remains. Conceivably, after more data have been collected from the downstream trapping component of the monitoring and evaluation, a more detailed classification of Riverwatcher detections can be made. The fish unknown classification was used if the detection was identified to be a fish based on video evidence, but the species identity could not be determined due to high turbidity or the fish not swimming through the camera field of view. The fish probable classification was used if no fish was observed in the video, but the silhouette was similar to that of a typical fish silhouette based on previous experience. Even with reasonably good video coverage, smaller fish were still able to pass through the Riverwatcher undetected by the video cameras. This can occur if the fish swim very close, high, or low to the cameras. In addition, this can happen if an upstream fish swims through the scanners then stops before entering the video field of view. High turbidity can also obscure the video detection and identification of fish. The false detection classification was used when no fish was observed in the video and the silhouette was not similar to that of a typical fish silhouette based on previous experience. Since false detections tended to frequently occur 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, there are hundreds of false detections per hour and it is not until turbidity falls below 30 NTUs that the Riverwatcher is 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

To validate measurement estimates for smaller fish by the Riverwatcher, a pilot study was conducted on August 27-28th of 2009 to determine the difference between test fish that were first measured by hand and then allowed to swim through the Riverwatcher. Some detection rates by the Riverwatcher were also calculated. The crowder and Riverwatcher were placed in an aboveground pool (3.5 x 2.5 x 1 m) outside of the fishway and filled with water until the Riverwatcher scanners were submersed. To provide water currents, a 700 L/min trash pump was used to mimic normal operation. The suction end was placed near the downstream end of the crowder and the water exhaust end at the upstream end of the crowded and fitted with a PVC section so that water was directed through the Riverwatcher. This closed-circuit water system was able to develop water velocities at the Riverwatcher scanner of about 0.25 m/sec, which was similar to what was measured in the fish bypass at 0.21 m/sec during low-flow conditions near the Riverwatcher. Groups of hatchery rainbow trout were measured, weighed, and released into the pool. The rainbow trout were acquired from Jess Ranch Lakes in Apple Valley, CA. The fish were directed and guided to swim through the Riverwatcher in both upstream and downstream directions so that the detection rates and estimated fish body depths could be determined.

<u>Results</u>

During the 2009 fish migration season, the Riverwatcher recorded 754 total detections, of which 300 were upstream and 454 were downstream (Appendix 11). Of the total upstream detections, 38% (n = 113) were determined to be fish (excluding largemouth bass) and included: 55 *O. mykiss* non-adult steelhead, 31 fish of unknown species, and 27 probable fish. Of the total downstream detections, 28% (n = 126) were determined to be fish (excluding largemouth bass) and included 42 *O. mykiss* non-adult steelhead, 25 fish of unknown species, and 59 probable fish.

The mean date for the upstream migrating *O. mykiss* non-adult steelhead was 02 April and 06 May 2009 for the downstream migrating *O. mykiss* (Appendix 11). However, this difference was due to the second downstream camera being installed in early April allowing for better identification of downstream detections. Downstream detections during the January modal peak could not be identified and therefore shifted the mean date of downstream *O. mykiss* detections. The mean date for upstream and downstream migrating unknown fish was 06 April and 18 April 2009, respectively. For the fish probable detections, the mean date for upstream detections was 18 March 2009 and 21 February 2009 for downstream detections. During the migration season, there were bimodal distributions of fish detections for both upstream and downstream (Appendix 12). The first modal peak of detections occurred during mid to late January and the second during early April. Both of these modal peaks occurred 3-4 weeks after a peak in river discharge relative to low-flow periods (Appendix 8).

The mean time of upstream detections for all categories ranged from about 15:30 h to 17:00 h (Appendix 11). The mean time of downstream categories ranged from about 05:40 h to 09:00 h. However, because of the skewed distribution of times due to morning and evening migration events, the mean statistic does not fully describe the migration behavior. In general, *O. mykiss* migrated upstream primarily in evening from 17:00 h to 20:00 h and downstream in the early morning from 04:00 h to 05:00 h (Appendix 13). As the migration season progressed, the diel migration pattern appeared to shift slightly to earlier times of the day for the downstream migrants and later in the day for the upstream migrants. This was likely caused by the lengthening daylight period as the season progressed and would indicate that dawn and dusk were the primary environmental cues used by *O. mykiss* in determining their migration behavior.

The mean total lengths for upstream and downstream *O. mykiss* were estimated to be 27 and 23 cm, respectively (Appendix 11). For unknown fish species and fish probable, upstream and downstream lengths ranged from 22 to 27 cm. Upstream and downstream *O. mykiss* lengths overall ranged from 16 to 33 cm (Appendix 14). The mean for all *O. mykiss* was 25 cm and the mode was 29 cm. The software program that operates the Riverwatcher estimates the TL of a fish detection based on a ratio of height to length (Vaki 2003). This ratio can be changed depending on available data for the target species. Based on morphometric measurements of *O. mykiss* mortalities over the last several years, an *O. mykiss* height to TL ratio was estimated to be 5.1 for fish ranging from about 10 to 28 cm. During the aforementioned 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 2009. However, after completing this process, the resulting TL estimates appeared to be over estimates when compared to known *O. mykiss* lengths that were measured in 2009. It was decided instead that a better method would be to use a regression model to convert Riverwatcher estimated fish heights to lengths. Again, from the morphometric measurements, a linear regression was conducted to develop a model for converting the Riverwatcher fish heights to total lengths ($y = 4.9293x + 8.0507$, $p < 0.001$, $r^2 = 0.92$, $n = 19$). This regression model will continued be improved as more data becomes available.

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 11). The mean water temperature for upstream migrating *O. mykiss* was approximately 17 °C and was 20 °C for downstream *O. mykiss*. The mean turbidity levels at the time of passage for upstream and downstream *O. mykiss* non-adult steelhead was about 2 NTU. The mean turbidity at the time of the false detections in both upstream and downstream directions was approximately 60 NTU. The discharge at the Robles Fish Facility at the time of upstream passage for *O. mykiss* non-adult steelhead was a mean of 5 cfs and 3 cfs for downstream migrating *O. mykiss*. The discharge for unknown fish and fish probable in both directions was a mean of approximately 6 cfs. Like turbidity, the periods of false detections coincided with times of higher discharge. For a list of all fish detections, see Appendix 15.

The results of the Riverwatcher validation tests indicated that the Riverwatcher was inefficient at detecting smolt-sized fish passing upstream or downstream and underestimates the size of fish that it does detect. For the smaller sized test fish (median height = 50 mm, equivalent to a TL min, mean, and max of 215, 255, and 274 mm, respectively), the mean detection rate was only 31% (downstream = 50% and upstream = 12%, n = 88). For these same smaller test fish, the median estimated height by the Riverwatcher was 40.5 mm, a difference of 9.5 mm. For larger sized test fish (median height = 67 mm, equivalent to a TL min, mean, and max of 312, 338, and 348 mm, respectively), the detection rate was estimated to be 100% (n = 46). For the tests of the larger fish, the number of detections actually exceeded the number of fish that should have been detected. This was partly because the test fish would sometimes make multiple passes through the Riverwatcher scanner before exiting. It was believed that virtually all the fish were detected since they were counted easily enough to cause the total counts to be 53% greater than what should have been possible. The estimated median height of the larger test fish was 47 mm, a difference of 20 mm.

Discussion

Due to the dry water year, there was only a surface water connection through the Robles Reach to the lower river for 3 weeks, from March 6 to March 26 (Lewis and Gibson 2009, in prep). During this brief time, and relatively low discharge, it was reasonable to expect no adult steelhead passing upstream through the Riverwatcher.

The *O. mykiss* non-adult detections were less than what would have been expected given the number observed throughout the fish attraction monitoring. During the 31 March fish attraction snorkel survey, 194 *O. mykiss* were counted downstream of Robles Fish Facility in the fish attraction study reach and in the two large pools on the OVLC property. This was the largest one-time count of *O. mykiss* near the Robles Fish Facility and would indicate that at a minimum, 194 *O. mykiss* passed through the Riverwatcher. The net total of *O. mykiss* passing through the Riverwatcher (downstream minus upstream detections) for the entire migration season was only 13 fish in the upstream direction. This indicates that smolt detection efficiency of the Riverwatcher is very low. As indicated by the validation pilot study, the detection rate for test fish was only 31% for smaller fish (median height = 50 mm or 255 mm TL). During the 2008 migration season, approximately 5,000 false detections occurred (CMWD 2008). This was partly due to the greater river discharges, and associated turbidity and debris, but was also due to Riverwatcher settings to detect small fish. For most of the 2008 season, the minimum detection height was set at 10 or 20 mm. The time needed to analyze and categorize these detections was too time consuming. Given that the Riverwatcher is recommended to be set at a minimum of no less than 40 mm (Vaki 2003), it appears that overestimation of fish passage was likely given that all false detections could not be identified and eliminated. For the 2009 season, the minimum height was set at 28 mm so that large numbers of false detections could be eliminated while still attempting to detect steelhead smolts. The height was determined to be similar to some of the smallest steelhead smolts that might be expected migrating downstream through the Robles Fish Facility based on available data from the Ventura Basin. The height of 28 mm corresponds to 146 mm TL and 139 mm FL. *O. mykiss* mortalities found and measured during the course of ongoing field monitoring efforts, and subsequently turned over to NMFS, were all larger than 146 mm TL. It is clear that the Riverwatcher was not designed to monitor movement of smaller-sized fish. The estimated fish detection rate from the validation pilot study and the comparison of snorkel counts to Riverwatcher detections both indicate that as much as 78-88% of smolt sized *O. mykiss* are not able to be detected by the Riverwatcher. During the 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. Additional Riverwatcher validation tests focused on efficiency will be conducted during 2010. Like the detection efficiency, the Riverwatcher estimated fish heights were also highly variable and the true error could not be determined. The 2009 pilot study indicated an underestimation was occurring. However, when a correction was applied to the Riverwatcher data for 2009, the result appeared to overestimate the size of the detected fish. The data collected to date would indicate that the Riverwatcher is not able to sufficiently monitor steelhead smolt emigration, and given the manufacture's operational recommendations, these results should not be surprising. However, additional Riverwatcher validation/calibration tests will be conducted during 2010 in an attempt to further identify the operation limitations of the Riverwatcher.

Even though the 2009 migration season was a dry period, the timing of *O. mykiss* downstream migration was similar to other populations during normal wet years. The bimodal distribution of *O. mykiss* migration was similar to what others have found in California. The smaller modal peak in late winter and the larger modal peak in April and part of May was very similar to what Shapovalov and Taft (1954) documented over a nine-year study on Waddell Creek. Shapovalov and Taft (1954) determined the late winter peak of downstream migrants was composed primarily of age 1+ fish and the April and May period by 1+ and 2+ fish. The similarity with this long-term study might indicate the bimodal distribution was more the result of life history patterns than river discharge or other factors. This migration pattern similarity indicates that it may be relatively hard-wired into the steelhead populations (Quinn 2005) but plasticity would most likely be needed given the environmental conditions at the southern range of the species. Spina et al. (2005) also documented a similar April modal peak of smolt migration in San Luis Obispo Creek over a three-year study period. Even as far north as Oregon, coastal steelhead smolts can have a similar April/May modal peak of downstream smolt migration (Wagner et al. 1963). From general observations over the last several years, and supported by observations during the validation pilot study, *O. mykiss* juvenile do not move through the fish crowder and Riverwatcher quickly. *O. mykiss* tend to swim downstream and back upstream repeatedly before ultimately moving completely in one direction. Additionally, this lack of aggressive and rapid directional movement is supported by observations during the fish attraction monitoring. *O. mykiss* juveniles were observed holding in general areas for extended periods of time before either moving downstream or back upstream, which is commonly found in all salmonid smolts (Quinn 2005). Furthermore, smolt migration rate is positively correlated with the smoltification process (Quinn 2005). During the fish attraction surveys, of the *O. mykiss* that were categorized into smolt transformation stages, 27% were in stage T-3, and only 6% were full smolts (Lewis and Gibson 2009, in prep). Therefore, some holding and lack of aggressive downstream migration would be expected.

The detection of *O. mykiss* by the Riverwatcher revealed a diel migration pattern through the Robles Fish Facility, in which *O. mykiss* primarily passed downstream just before dawn then passed back upstream just before and after dusk. This general migration pattern was the same in 2008 as well (CMWD 2008). The early morning movement of downstream migrating smolts is common among steelhead throughout its range (Dauble et al. 1989). However, monitoring of upstream movements of smolts has not been studied specifically, therefore little available comparison information exists. Most smolt monitoring studies do not have volitional passage with passive monitoring like what is used at the Robles Fish Facility. Therefore, the opportunity to examine upstream movements is not usually available. The distance of the individual daily travel was unknown; however, it is likely the fish remained within, or near, the Robles Fish Facility before continuing their downstream migration.

As previously discussed, the Riverwatcher's ability to accurately estimate fish lengths is an area that will need more work to fully determine its usefulness in monitoring smolt-sized *O. mykiss*. However, the use of the regression model to estimate TL from the Riverwatcher's estimate of height produced reasonable results. The mean TL of *O. mykiss* detections was 25 cm (equal to 24 cm FL). This 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. This, however, seemed unlikely since the mean TL of the measured *O. mykiss* mortalities from 2009 was approximately 22 cm and was relatively similar to the estimated Riverwatcher *O. mykiss* detections of 25 cm. The larger *O. mykiss* migrants are probably due to faster growth rates in the warmer water of the Ventura Basin as compared to the more northern aforementioned 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 salmonid through fish passage facilities have been conducted throughout the western United States for many years. Determining if a facility is operating as designed and not causing harm to the intended fish species has been done using a variety of different methods. Early work typically entailed trapping and tagging fish before entering a facility and recapturing them after exiting. Trapping and visual inspections for injuries, PIT tagging, radio telemetry, and acoustical telemetry has been conducted extensively as well.

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

Methods

A weir trap was placed and operated approximately 100 m downstream of the Robles Fish Facility. The weir trap consisted of a live-box (120 cm on all three sides) with an internal fyke situated in the center of the river channel and thalweg. The holding live-box was constructed out of PVC pipe for the internal frame and covered with plastic fencing with 3-cm diagonal openings. A plastic fence (3-cm openings) supported by T-bar fence posts were extended upstream on both sides of the live-box at 30° angles into the river channel and ended near each bank leaving an approximate gap of 2 m so adult steelhead could pass upstream by the trap location (Appendix 16). Since the vast majority of downstream steelhead migrants are expected to be captured from mid-March through mid-June (Shapovalov and Taft 1954; Dettman and Kelley 1986), the trap was planned to be operated from mid-March through June or until water temperatures exceeded a daily mean of 22°C, which could negatively impact captured fish (SYRTAC 2000). The trap was installed and operation began on 16 March 2009 as planned; however, trap operations ended on 09 April 2009 at the insistence of NMFS because they believed trapping should only occur if there is a surface water connection through the Robles Reach (NMFS 2009).

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

When the trap was operational, it was checked twice per day (in the morning and late afternoon). Data to be collected included: fork length (mm), weight (g), and a subsample of scale and tissue samples for aging and genetic analysis. Fish that were to be handled were put into an aerated container with a solution of tricaine methanesulfonate (MS-222) and Stress Coat®. The anesthesia MS-222 is registered by the US Food and Drug Administration for use with food fish (Summerfelt and Smith 1990). The level of anesthesia needed is generally stage 2-4, which is a deep sedation to a total loss of equilibrium (Summerfelt and Smith 1990). To achieve a short induction time of 3-4 minutes, as recommended by Summerfelt and Smith (1990), a concentration of 60-100 mg/L of MS-222 was used. This concentration allows for a recovery time of less than 5 minutes (Summerfelt and Smith 1990), but from previous experience, anesthetized steelhead smolts will most likely recover in less than 3 minutes. Stress Coat® is a synthetic slime coating that replaces the naturally secreted 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 are: 1) the caudal zone 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 included the area anterior of the caudal zone to the operculum and above the lateral line, and 3) the ventral zone that included the area anterior of the caudal zone to the operculum and below the lateral line (Marine and Gorman 2005). The percentage of scale loss in each zone was estimated and then weighted by each zone's area proportional to the total area of all six zones. Summing of the resulting weighted scale loss yielded the total area of each fish with scale loss. Any physical injury was noted and categorized among the fins, skin, eyes, and head. Within each anatomical category, there are from four to six types of injuries that could be documented. In general, the scale loss and physical injury methods followed those of Marine and Gorman (2005) and McNabb et al. (1998). Only one weir trap will be used initially to determine if there are any significant physical injuries or scale loss occurring. If significant scale loss or physical injuries are occurring, and the Robles Biological Committee deems it necessary, then a second trap will be installed and operated upstream of the Robles Fish Facility. If an upstream trap is operated in the future, steelhead will be captured, marked, and released before they enter the Robles Fish Facility and then recaptured in a trap downstream of the facility to determine if the injuries were the result of passage through the facility.

Prior to the operation of the downstream weir trap, an annual fish handling training class is conducted with the seasonal fisheries technicians and full time biologists. This training class is conducted with hatchery rainbow trout and all techniques and procedures are practiced until the fisheries personnel are fully proficient with each.

Additional, annual training and review occurs with all other aspects of the monitoring and evaluation program so all personnel are proficient as each task that they may be assigned to conduct.

Results

The weir trap was operated from 13 March through 09 April 2009. The trap generally operated from Sunday afternoon through Saturday morning. On 22 March 2009, the first *O. mykiss* juvenile was captured. It measured 163 mm FL and weighed 50 g. It appeared to be undergoing smoltification and was estimated to be in a T-2 transitional smolting phase. The mean daily water temperature was 16 °C during the 25-day trapping period and was 15 °C at the time the only *O. mykiss* was captured. The stream discharge ranged from 5 to 26 cfs during the trapping period and was 14 cfs at the time the one *O. mykiss* was captured. The *O. mykiss* juvenile was tagged with a radio transmitter and released downstream of the trap (see section 3.5). At the time the *O. mykiss* was being removed for the holding box, it became impinged in the plastic mesh covering the holding box and sustained substantial descaling. Using the descaling assessment methods, the *O. mykiss* was estimated to have a 64% loss. Given the size of the *O. mykiss*, smaller than expected at 163 mm FL, it was thought that future incidents were unlikely. However, to ensure that this would not occur again, the holding box was recovered with smaller plastic mesh (1.9 cm) the next day on 23 March 2009.

Discussion

The first objective of the downstream fish passage evaluation is to determine if steelhead are successfully passing downstream through the Robles Fish Facility (NMFS 2003a). If determined using downstream trapping data alone, this objective cannot be fully evaluated with the limited data collected to date. The date of the first captured *O. mykiss* juvenile was just prior to large numbers of *O. mykiss* beginning to move downstream into the reach below the Robles Fish Facility. Even though no additional *O. mykiss* were captured in the trap after the one on 22 March and before the trapping was stopped on 09 April, some *O. mykiss* were able to make it downstream past the trap. On 10 April, the day after trapping was stopped, 29 *O. mykiss* juveniles were counted downstream of the trap in the rock weir pools. The *O. mykiss* juveniles were able to move downstream past the trap and evade capture in two likely ways. They could have moved downstream during periods of the weekend that the trap was not operating or moved along the shoreline and through the two openings so that adult steelhead could pass upstream. If the trap was continued to be operated, additional *O. mykiss* juvenile would have likely been captured that could have been used to evaluate the first objective of downstream fish passage evaluation. However, from the fish attraction data alone, it is clear that *O. mykiss* juvenile are successfully navigating downstream through the Robles Fish Facility during the expected steelhead smolt migration period (Shapovalov and Taft 1954; Dettman and Kelley 1986; Spina et al. 2005).

The second objective of downstream fish passage evaluation is to capture and examine steelhead smolts and kelts and determine if there are any injuries that may have been caused by downstream passage through the Robles Fish Facility (NMFS 2003a). Also, like the first objective, this could not be fully evaluated due to a lack of data. The one *O. mykiss* juvenile captured in the trap was significantly descaled; however, this was not due to downstream passage through the Robles Fish Facility, but due to the fish becoming impinged in the plastic mesh of the trap holding box. If trapping was continued beyond 09 April, additional *O. mykiss* juveniles would have likely been capture and examined to determine if injuries were occurring as a result of passage through the Robles Fish Facility.

3.5 Downstream Fish Migration through the Robles Reach

<u>Introduction</u>

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

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

Methods

During the estimated smolt migration period of mid-March through mid-June, up to 15 steelhead smolts captured in the weir trap downstream of the Robles Fish Facility were to be tagged with radio transmitters and released downstream of the weir trap. Only steelhead smolts that exhibit steelhead smolt characteristics and in good physical condition were to be tagged. The smolting characteristics include: increased skin reflectance, larger heads, slimmer bodies, longer caudal peduncle, loss of parr marks, and darker margin of the dorsal fin (Beeman et al. 1995; Haner et al. 1995; Ando et al. 2005). These characteristics have been used in southern California to identify steelhead smolts migrating downstream (Spina et al. 2005).

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

After tagging and recovery, the steelhead were released downstream of the weir trap. Tagged steelhead were located on a daily basis as they migrate downstream for the first week after release and then at least weekly until the batteries die, the fish was lost, the fish entered the ocean, or was found dead. 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 $\pm$ 10 m (Lewis 2001). All determined locations were recorded on a map and datasheet. Every reasonable effort was made to determine the ultimate final location of each radio tagged steelhead and if any mortality occurred, the cause of the mortality was determined if possible. It is estimated, that at the most, one tag would be lost due to regurgitation during the study period; Hockersmith et al. (2000) measured a short-term regurgitation rate of 1.3% using the gastric method, Adams et al. (1998) measured a regurgitation rate of 4.2%, and Jepson et al. (2001) measured a 5.0% regurgitation rate. Beyond the 30-40 day period, the regurgitation rate typically increases dramatically.

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

Results

There was only one *O. mykiss* smolt tagged during 2009. The smolt was 163 mm FL and weighed 50 g. The smolt was captured on 22 March and tagged and released into weir pool #1 immediately downstream of the fish trap (Appendix 17). On 23 March of the following day, the smolt was relocated in weir pool #2; approximately 10 m downstream. On 24 March, the smolt was relocated approximately 100 m downstream of the fish trap holding in a riffle. On 25 March, the tagged smolt was relocated 1.9 km downstream of the trap. The smolt was holding in shallow warm water (23 °C) and the discharge was visually estimated at approximately 5 cfs. On the following day of 26 March, the *O. mykiss* smolt was relocated downstream about 50 m farther from the previous day and discovered dead in a glide habitat unit. The smolt was visually inspected and the areas of descaling were found to have an external infestation of the ubiquitous fungus *Saprolegnia*. The mean daily downstream migration rate was 500 m per day. However, the smolt remained near the release site for the first 24 h, and then began significant downstream movements. The greatest movement occurred between the second and third days after tagging and accounted for 1.8 km of the total movement.

Discussion

Due to only one *O. mykiss* smolt being captured and radio tagged, little information was available to evaluate the objective of the downstream evaluation of smolts through the Robles Reach. If the trap was operated beyond 09 April, more smolts would have likely been captured. Due to the dry conditions, there was a surface water connection to the lower river for only 3 weeks, from 06 March to 26 March (Lewis and Gibson 2009, in prep). Since the surface water connection was lost in the Robles Reach on about 26 March, additional downstream migration evaluations with tagged *O. mykiss* smolts would not have provided information to completely address the main objective.

4.0 ROBLES FACILITY OPERATIONS

4.1 Facility Status

The Robles Fish Passage Facility started the 2008-2009 season in a fully functional mode. The 2008-2009 season was characterized by a below-average rainfall year as measured at Casitas Dam. 14.82 inches of rain were measured at Casitas Dam. The average rainfall at the dam is 24.06 inches. No peak flows, as defined by the BA/BO occurred during the year. Two water diversion periods occurred during the year. The diversions occurred over 11 days in February and over 3 days in March. Two days of diversions in February and the 3 days in March were to download water from Lake Matilija. Some surface flow continued over the measurement weir until July 2009.

The 2008 Report identified several projects to be completed during the summer and fall. The principal projects were:

- Upgrading the brush drive system
- Modify the brush on the west side to match the brush on the east and make all modifications permanent.
- Adjust the notch on interim weir two.

- Install the raw water pump.
- Purchase and install a small crane to facilitate brush removal.
- Removal of reeds from fish passage facility.

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

Upgrade the brush drive system-The brush drive system was upgraded with 5-hp motors, variable frequency drives and new gear boxes. The purpose of the upgrade was to provide enough torque to the brushes so the brushes could continue to operate under high flow and debris loads with the shorter stiffer brushes.

Modify the brush on the West Side-The brush on the west side was modified with shorter, stiffer brushes, angled slightly and hinged in the middle to provide better contact with the screens. Both brushes are now configured the same. The modifications were based on the recommendations made by MWH Worldwide.

Adjust the notch on interim weir two-The notch on interim weir no. 2 was modified and additional cables were added. Some additional work will be needed this summer.

Install the Raw Water Pump-A raw water pump has been installed to facilitate the cleaning of the fish screens.

Purchase and Install small crane for diffuser and brush removal-Materials have been purchased to fabricate a small hoist to facilitate the removal of the diffuser panels and the brushes. The crane will be fabricated this summer and fall.

Removal of the reeds from the fish passage facility-The reeds were not removed prior to the start of the rainy season because the fish passage continued to have some flow even though the surface flow ended before the measurement weir.

Removal of *Arundo donax* from the forebay and channel-This year, removal of the non-native plants was accomplished by the same crews removing arundo for the

County as part of the Matilija Dam removal project. Other non-native plant removal was completed by the California Conservation Corps.

4.2 Flow Observations and Control

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

- Matilija Creek at Matilija Hot Springs – located approximately 2,100 feet downstream of Matilija Dam – good rating for low to moderate flows – operated by Casitas Municipal Water District, formerly a USGS station;
- Matilija Dam Stage Bubbler-Located at the dam, this gage provides the lake elevation. Under high flows, the dam acts as a weir. This is the primary flow measurement location under high flows and to determine if a peak has occurred.
- North Fork Matilija Creek – located approximately 3,000 feet upstream of its confluence with Matilija Creek – good rating for low to moderate flows – operated by the Ventura County Watershed District;
- Robles-Casitas Diversion Canal – located on the diversion canal approximately 1,300 feet downstream of the Robles Diversion Dam – trapezoidal channel with a good rating for flows up to 600 cfs;
- Ventura River near Meiners Oaks (VRNMO) – located approximately 540 feet downstream of the Robles Fish Passage spillway – concrete weir section – good rating to 70 cfs, use of equations above 70 cfs with poor ratings above 1000 cfs (no verifications at higher flows).
- Fish Ladder-A 4 path flow meter by Accusonics located near the Riverwatcher. Provides reasonable flow data in the 15 to 60 cfs range.
- Auxiliary Water Supply-An American Sigma flow meter.

All of the instruments can suffer from inaccuracies from time to time. The inaccuracies can be caused by clogging of bubbler lines, electronic creep, debris accumulating on sensors, changes to the measured cross sections, and equipment problems. For this reason, the data is verified against field measurements and observations. The information gathered from each of these locations has been reduced to the daily reporting of flows in the form of average cubic-feet per second. The spreadsheets are in Appendix 18 and graphically in Appendix 8.

The fish screens remained in place for the entire year.

No storm peaks occurred this year that triggered BA/BO required supplemental flow releases.

Facility Testing

Casitas has entered into an agreement with HydroScientific West to complete the first phase of the hydraulic testing. The performance testing was not completed during 2008-09 because of inadequate flows.

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 2008-09 fiscal years:

- **Fisheries Monitoring**:

Salaries & Benefits	$251,110
Equipment/Material	$ 53,854
	$304,964

- **Facility Operations**:

Salaries & Benefits	$ 32,380

Equipment/Materials	$ 32,123
Permit	$ 509
	$ 65,012

- **Capital Improvements**:

Brush Drive upgrades	$33,277
Material for Hoist	$ 1,166
	$34,443

4.4 Assessment of the Effectiveness to Provide Fish Passage

Hydraulic testing was not completed this year because of inadequate flows. The effectiveness of the Fish Passage was greatly limited this year by the lack of rainfall.

4.5 Recommendations Regarding the Prioritization of Future Activities

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

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

4.6 Recommendations on any Revisions Deemed Necessary to the Operations

Casitas continues to recommends that the construction of the 15-weir portion of the project be put on hold at least until the Matilija Dam Removal Project is completed. Preliminary plans for the High Flow Sediment Bypass and High Flow Fish Passage require this area to be graded to new elevations.

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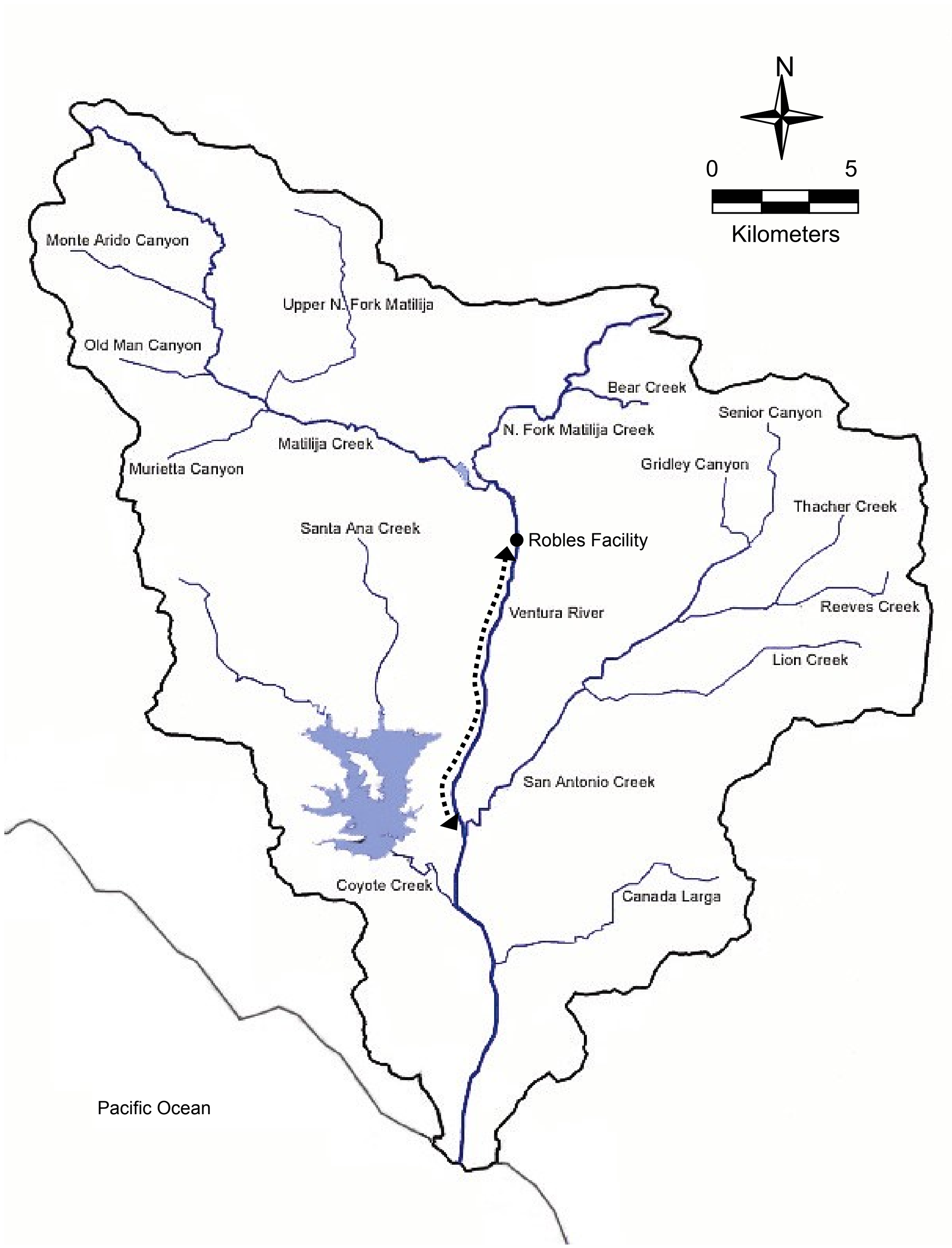
6.0 APPENDIXES

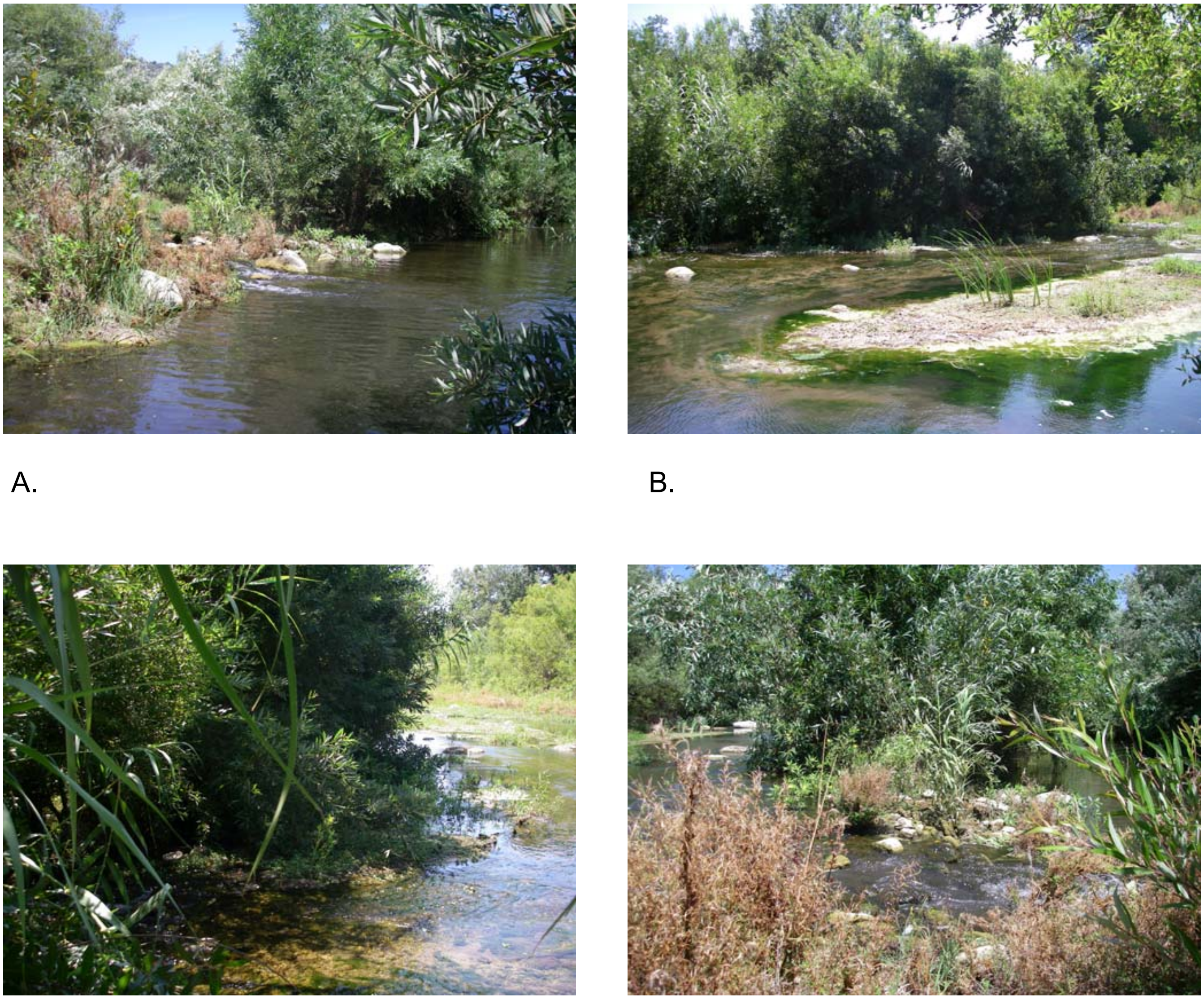


Appendix 1. Basin map of the Ventura River. The Robles Fish Passage Facility is identified by the black dot and the Robles Reach is identified by the dashed line downstream of the Robles Facility.

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

Habitat Unit No.	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)
0			0		River mouth				100					
109	34°20'27"	119°17'53"	7.5	RI	Near treatment plant	16.4	2.8	10	10	15	45	20	0	31.3
168	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
198	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
234	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
266	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
303	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
343	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.



A. B.

C. D.

Appendix 3a. Photos of potential impediment site number 109 during July, 2009, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

A.

B.

C.

D.

Appendix 3b. Photos of potential impediment site number 168 during July, 2009, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

A.

B.

C.

D.

Appendix 3c. Photos of potential impediment site number 198 during July, 2009, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

A.

B.

C.

D.

Appendix 3d. Photos of potential impediment site number 234 during July, 2009, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

A.

B.

C.

D.

Appendix 3e. Photos of potential impediment site number 266 during July, 2009, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

A.

B.

C.

D.

Appendix 3f. Photos of potential impediment site number 303 during July, 2009, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

A.

B.

C.

D.

Appendix 3g. Photos of potential impediment site number 343 during July, 2009, looking from: (A) downstream, (B) upstream, (C) right to left bank, and (D) left to right bank.

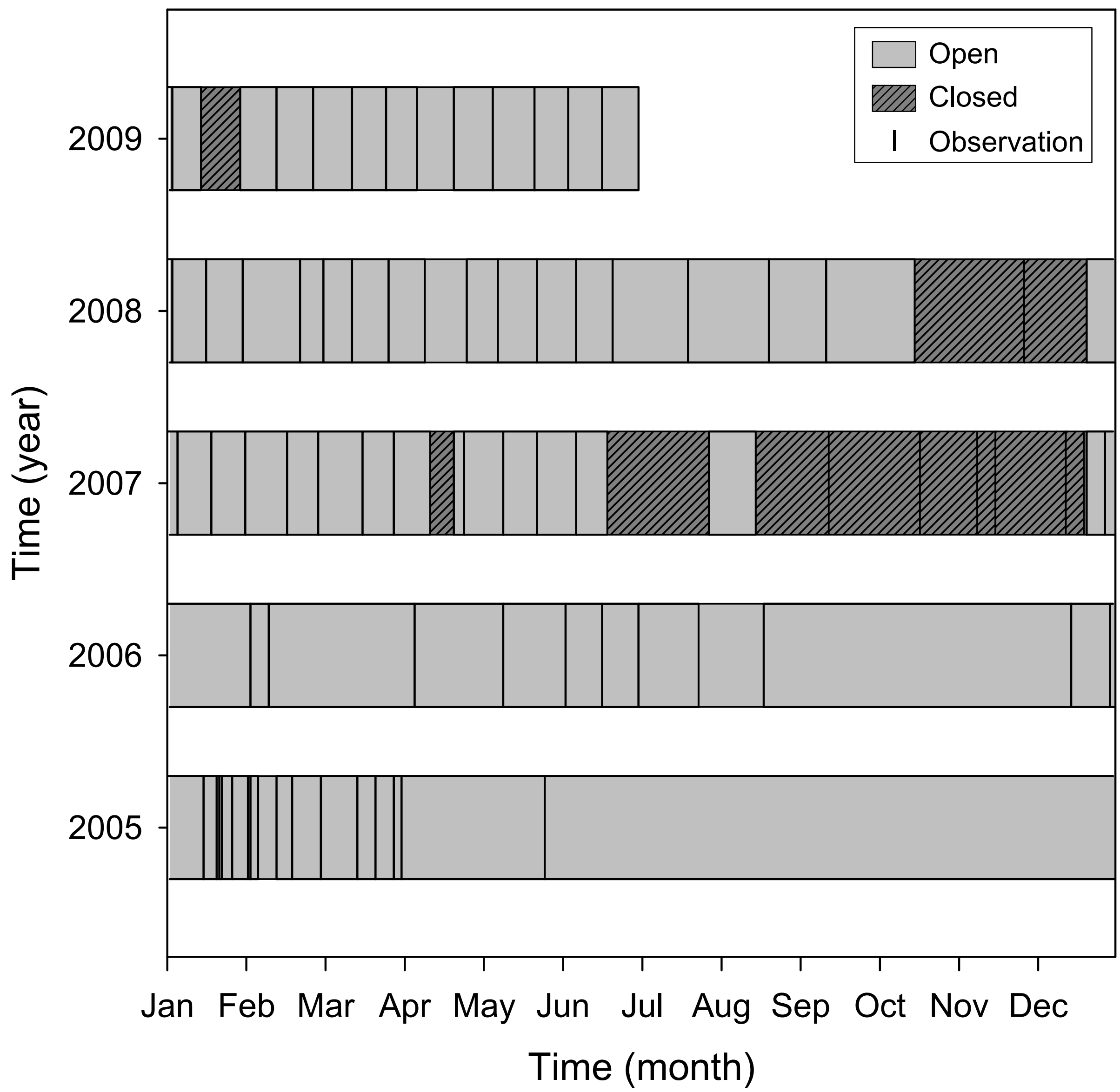
Appendix 4. Ventura River sandbar monitoring data from July 2008 through June 2009.

Date	Sandbar Open (Yes/No)	Time (24h)	Tide Height (ft)	Tidal State	High Tide Time (24h)	High Tide Height (ft)	Low Tide Time (24h)	Low Tide Height (ft)	Temp (°C)[a]	Discharge at Foster (cfs)[b]	Discharge at Robles (cfs)	Notes
18-Jul-08	Y	13:07	3.27	ebb	11:15	3.78	15:53	2.35	24.79	10.0	0.0	Open on east bank (EB)
18-Aug-08	Y	11:30	4.81	ebb	11:16	4.82	17:02	1.38	23.47	9.5	0.0	Open on east bank
09-Sep-08	Y	13:40	3.41	flood	18:10	4.81	12:25	3.27	24.53	7.6	0.0	Open on east bank
13-Oct-08	N[c]	10:35	4.81	ebb	08:48	5.79	15:17	0.23	15.07	5.5	0.0	If breach, open on EB
24-Nov-08	N[c]	11:40	1.24	ebb	06:45	5.89	13:53	-0.06	15.68	4.8	0.0	If breach, open on EB
18-Dec-08	Y	10:45	3.1	flood	13:37	4.14	8:18	2.31	10.70	5.1	3.0	Open near east bank
31-Dec-08	Y	10:15	5.03	flood	10:37	5.06	4:46	2.57	10.87	6.1	11.0	Open near east bank
02-Jan-09	Y	11:10	3.74	flood	12:06	3.85	6:50	2.46	11.09	6.3	4.0	Open near east bank
13-Jan-09	N[c]	14:25	1.64	ebb	10:19	6.19	17:22	-1.08	14.44	5.5	3.0	If breach, open near EB
28-Jan-09	Y	12:40	3.38	ebb	09:52	5.28	16:49	-0.29	-[d]	4.9	3.0	Open near east bank
11-Feb-09	Y	13:15	0.15	ebb	10:07	5.6	16:43	-0.57	-[d]	10.0	22.0	Open on east bank
24-Feb-09	Y	12:35	1.7	ebb	08:36	5.43	15:22	-0.47	-[d]	20.0	30.0	Open on east bank
12-Mar-09	Y	11:10	4.79	ebb	10:56	4.81	17:01	0.25	-[d]	14.0	19.0	Open on east bank
25-Mar-09	Y	9:00	4.81	flood	09:21	4.85	15:38	0.12	-[d]	14.0	14.0	Open on east bank
06-Apr-09	Y	10:52	2.71	ebb	07:51	5.03	14:22	-0.32	-[d]	11.0	6.0	Open on east bank
20-Apr-09	Y	10:47	1.83	ebb	06:56	4.03	13:28	0.48	18.53	9.6	4.0	Open on east bank
05-May-09	Y	14:00	0.7	flood	19:58	5.54	13:40	0.67	19.96	8.4	2.0	Open on east bank
21-May-09	Y	14:04	1.55	flood	19:45	5.8	13:29	1.47	18.32	9.1	1.0	Open on east bank
03-Jun-09	Y	14:01	1.88	flood	19:22	5.73	12:56	1.64	-[e]	8.1	0.0	Open on east bank
16-Jun-09	Y	12:43	2.29	flood	17:09	4.67	10:11	1.39	-[e]	12.0	1.0	Open on east bank
30-Jun-09	Y	12:52	2.55	flood	17:20	5.3	10:27	1.64	-[e]	8.4	0.0	Open on east bank

[a]Main St. bridge temperature logger at time of observation, approximately 800 m upstream of estuary/lagoon.
[b]USGS gauging station number 11118500, downstream of Foster Park.
[c]Sandbar was closed at low tide, but open during some high tides.
[d]No data due to temperature logger malfunction.
[e]No data due to temperature logger being removed from water by vandals.

Appendix 5. Ventura River estuary piscivorous bird survey data from July 2008 through June 2009.

Date	Time (24h)	Common Name and Number of Birds Observed									
		Gull	Cormorant	Tern	Pelican	Egret	Grebe	Heron	Merganser	Kingfisher	Total
18-Jul-08	13:08	166	7	34	7	0	0	1	0	0	215
18-Aug-08	11:30	256	9	0	1	0	0	0	0	0	266
09-Sep-08	13:40	310	10	115	0	3	0	0	0	0	438
13-Oct-08	10:25	153	9	0	0	4	0	0	0	0	166
24-Nov-08	11:40	164	33	0	2	0	0	0	0	0	199
18-Dec-08	10:50	147	19	0	2	2	1	1	0	0	172
13-Jan-09	14:25	313	0	4	17	0	0	2	0	0	336
28-Jan-09	12:40	375	23	0	35	1	4	0	0	0	438
11-Feb-09	13:15	105	18	0	0	0	0	0	0	0	123
24-Feb-09	12:35	240	17	0	2	1	0	0	1	0	261
12-Mar-09	11:10	78	53	1	2	1	0	0	0	0	135
25-Mar-09	09:00	188	16	0	67	2	0	0	2	0	275
06-Apr-09	10:52	311	30	15	16	2	0	0	0	0	374
20-Apr-09	10:47	235	45	41	10	0	0	0	0	0	331
05-May-09	14:00	349	47	31	41	1	0	0	0	0	469
21-May-09	14:04	253	50	7	18	0	0	0	1	0	329
03-Jun-09	14:01	81	42	2	7	0	0	0	0	0	132
16-Jun-09	12:43	80	30	8	3	0	0	0	0	0	121
30-Jun-09	12:52	46	13	6	5	5	0	1	0	0	76
Total		3,850	471	264	235	22	5	5	4	0	4,856



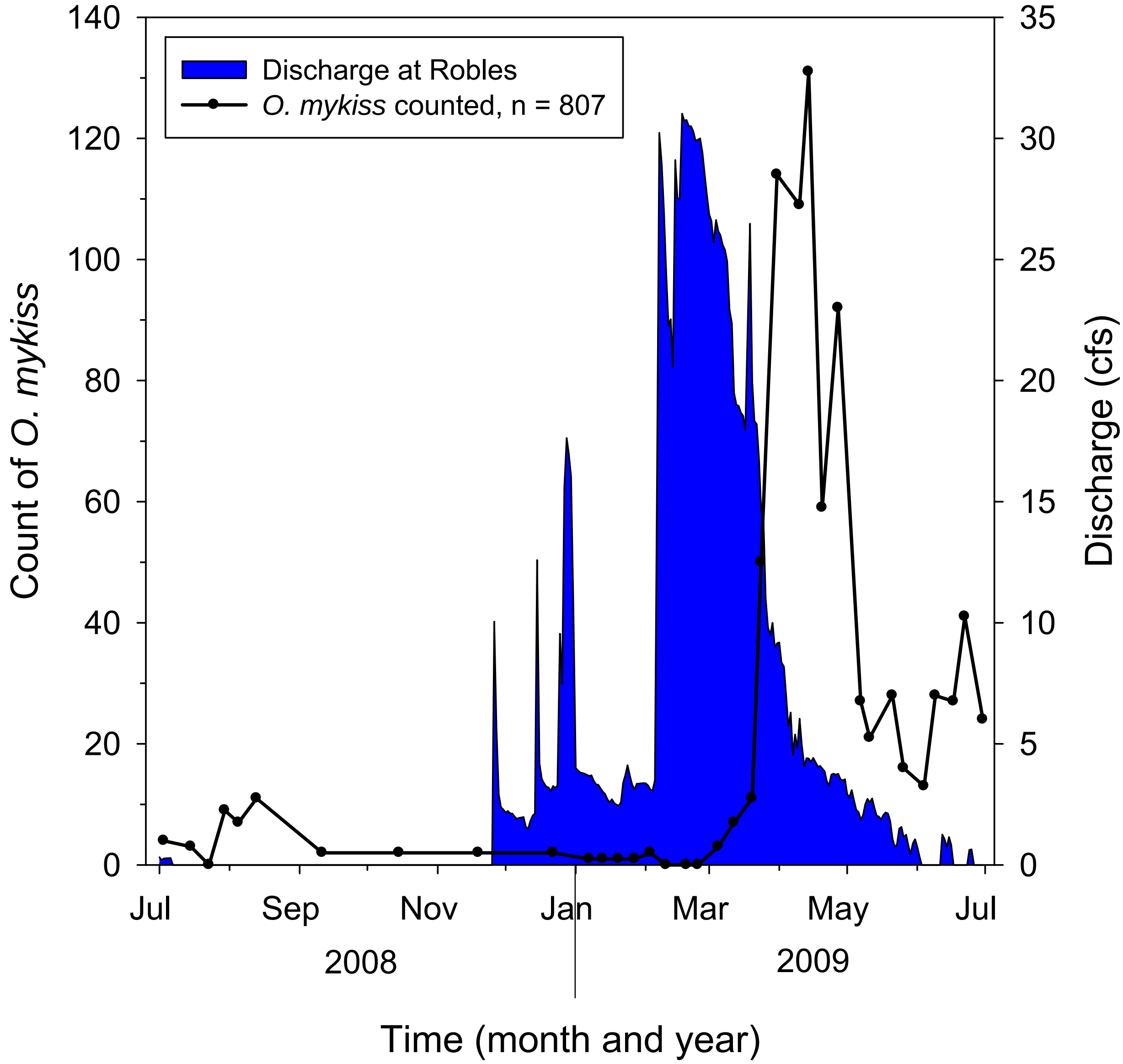
Appendix 6. Sandbar status at the mouth of the Ventura River from 2005 through July of 2009. Each observation is indicated by vertical lines and the sandbar status was assumed to remain the same until the next observation (Lewis and Gibson 2009, in prep).

Appendix 7. Fish attraction counts of *O. mykiss* in close proximity to the Robles Fish Facility from January through June of 2009.

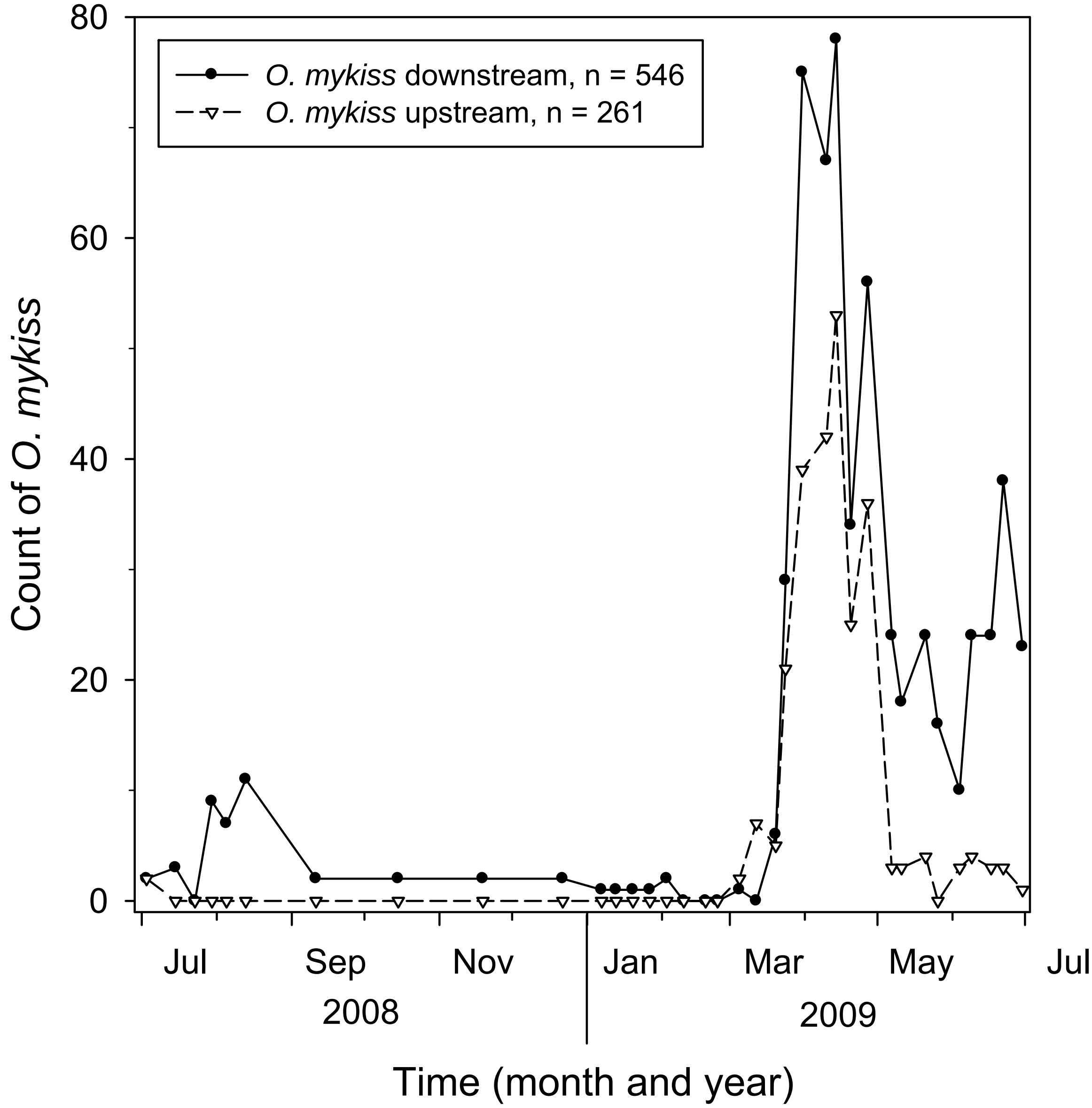
Date	Method	Location	Length (m)	Temp (°C)	Turbidity (NTU)	Robles Discharge (CFS)	Species[a]	Count
7-Jan-2009	Bank	Downstream	200	12	2	4	OMY	1
7-Jan-2009	Bank	Upstream	140	12	2	4	NFO	0
13-Jan-2009	Bank	Downstream	200	13	1	3	OMY	1
13-Jan-2009	Bank	Upstream	140	13	1	3	NFO	0
20-Jan-2009	Snorkel	Downstream	200	13	1	2	OMY	1
20-Jan-2009	Bank	Upstream	140	13	1	2	NFO	0
27-Jan-2009	Snorkel	Downstream	200	10	1	3	OMY	1
27-Jan-2009	Bank	Upstream	140	10	1	3	NFO	0
3-Feb-2009	Bank	Downstream	200	10	1	3	OMY	2
3-Feb-2009	Bank	Upstream	140	10	1	3	NFO	0
10-Feb-2009	Bank	Downstream	200	10	4	24	NFO	0
10-Feb-2009	Bank	Upstream	140	10	4	24	NFO	0
19-Feb-2009	Bank	Downstream	200	11	3	31	NFO	0
19-Feb-2009	Bank	Upstream	140	11	3	31	NFO	0
24-Feb-2009	Snorkel	Downstream	200	12	1	30	NFO	0
24-Feb-2009	Bank	Upstream	140	12	1	30	NFO	0
5-Mar-2009	Bank	Downstream	200	13	2	26	OMY	1
5-Mar-2009	Bank	Upstream	140	13	2	26	OMY	2
12-Mar-2009	Bank	Downstream	200	12	2	19	NFO	0
12-Mar-2009	Bank	Upstream	140	12	2	19	OMY	7
20-Mar-2009	Bank	Downstream	200	14	1	20	OMY	6
20-Mar-2009	Bank	Upstream	140	14	1	20	OMY	5
24-Mar-2009	Snorkel	Downstream	200	17	1	15	OMY	29
24-Mar-2009	Snorkel	Upstream	140	17	1	15	OMY	21
31-Mar-2009	Snorkel	Downstream	200	13	1	6	OMY	75
31-Mar-2009	Snorkel	Upstream	140	16	1	8	OMY	39
10-Apr-2009	Snorkel	Downstream	200	17	2	6	OMY	67
10-Apr-2009	Snorkel	Upstream	140	17	2	6	OMY	42
14-Apr-2009	Snorkel	Downstream	200	16	1	4	OMY	78
14-Apr-2009	Snorkel	Upstream	140	16	1	4	OMY	53
20-Apr-2009	Snorkel	Downstream	200	21	2	4	OMY	34
20-Apr-2009	Snorkel	Upstream	140	21	2	4	OMY	25
27-Apr-2009	Snorkel	Downstream	200	19	1	4	OMY	56
27-Apr-2009	Snorkel	Upstream	140	19	1	4	OMY	36
7-May-2009	Snorkel	Downstream	200	22	2	2	OMY	24
7-May-2009	Snorkel	Upstream	140	22	2	2	OMY	3
11-May-2009	Snorkel	Downstream	200	20	1	3	OMY	18
11-May-2009	Snorkel	Upstream	140	25	5	3	OMY	3
21-May-2009	Snorkel	Downstream	200	19	2	1	OMY	24
21-May-2009	Snorkel	Upstream	140	19	2	1	OMY	4
26-May-2009	Snorkel	Downstream	200	20	2	1	OMY	16
4-Jun-2009	Snorkel	Downstream	200	20	1	0	OMY	10

4-Jun-2009	Snorkel	Upstream	140	20	1	0	OMY	3
9-Jun-2009	Snorkel	Downstream	200	18	1	0	OMY	24
9-Jun-2009	Snorkel	Upstream	140	19	1	0	OMY	4
17-Jun-2009	Snorkel	Downstream	200	21	1	0	OMY	24
17-Jun-2009	Snorkel	Upstream	140	21	1	0	OMY	3
22-Jun-2009	Snorkel	Downstream	200	23	1	0	OMY	38
22-Jun-2009	Snorkel	Upstream	140	27	2	0	OMY	3
30-Jun-2009	Snorkel	Downstream	200	25	1	0	OMY	23
30-Jun-2009	Snorkel	Upstream	140	23	1	0	OMY	1
		Upstream	3,360				Upstream	261
		Downstream	5,340				Downstream	546
		Total	8,700				Total	807

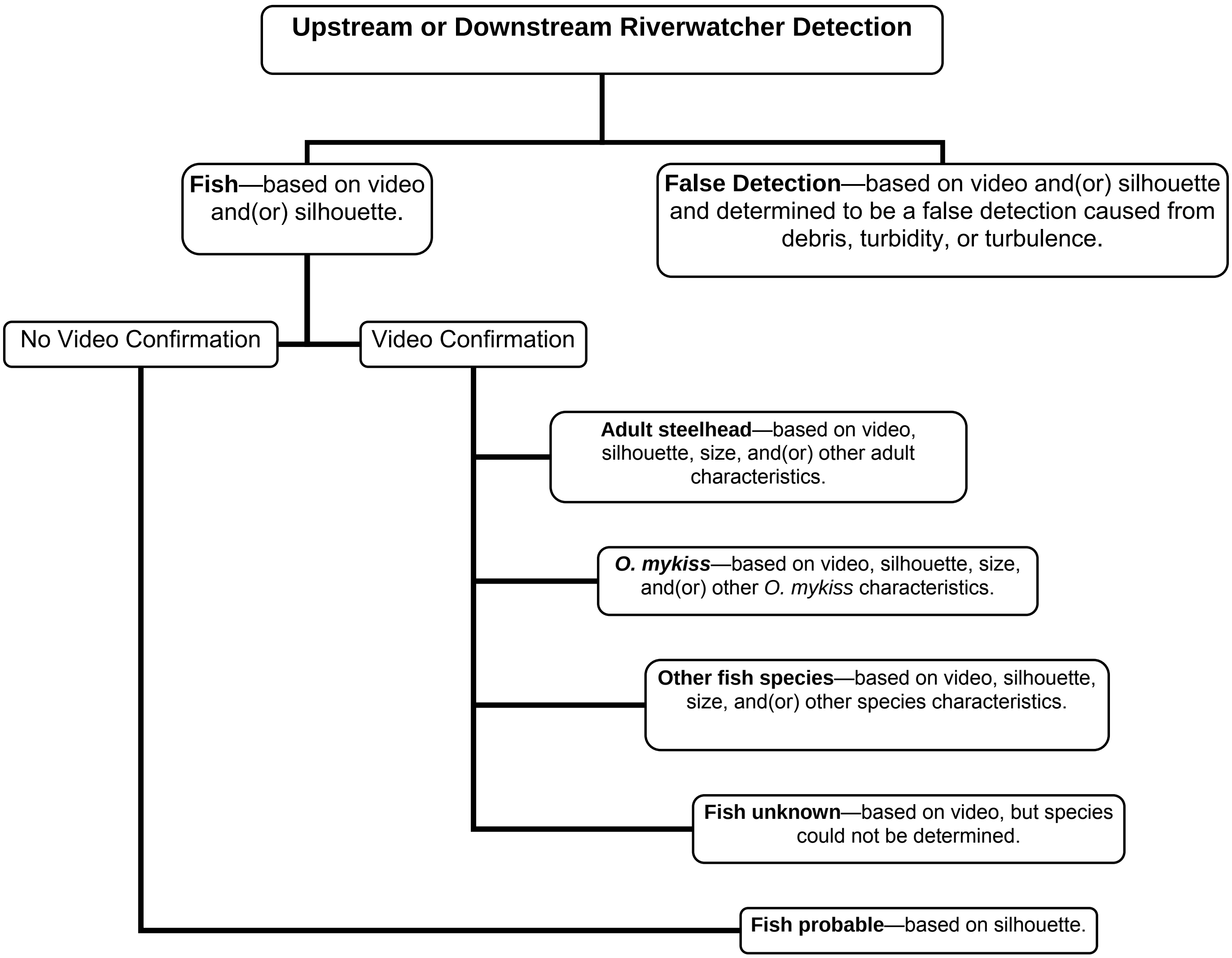
[a]Fish Species Codes: OMY = O. mykiss and NFO = no fish observed.



Appendix 8. Total count of *O. mykiss* observed during fish attraction surveys during the reporting year from July 2008 through June 2009 and discharge from the Robles Facility.



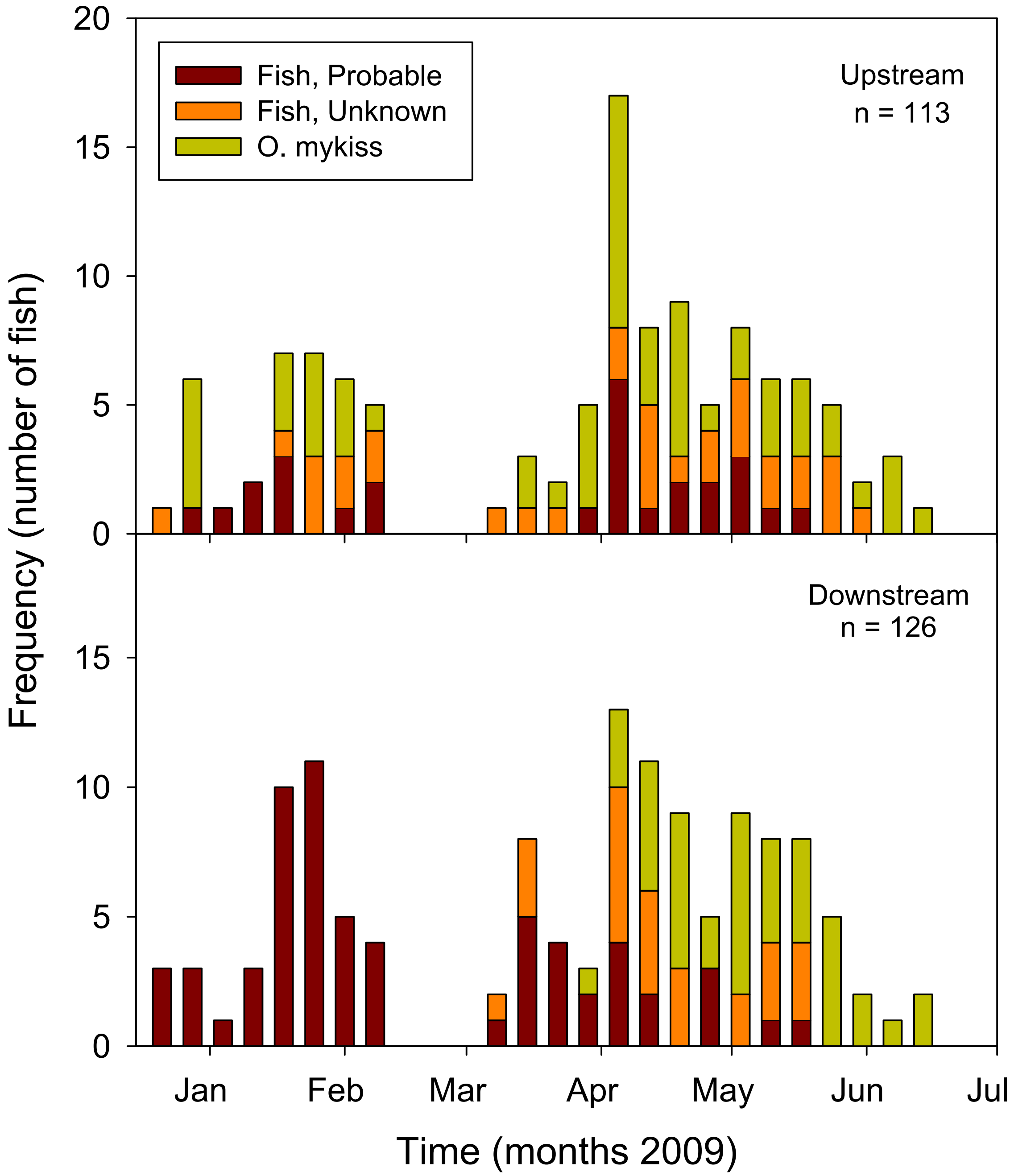
Appendix 9. Count of *O. mykiss* observed during fish attraction surveys upstream and downstream of the Robles Fish Facility during the reporting year from July 2008 through June 2009.



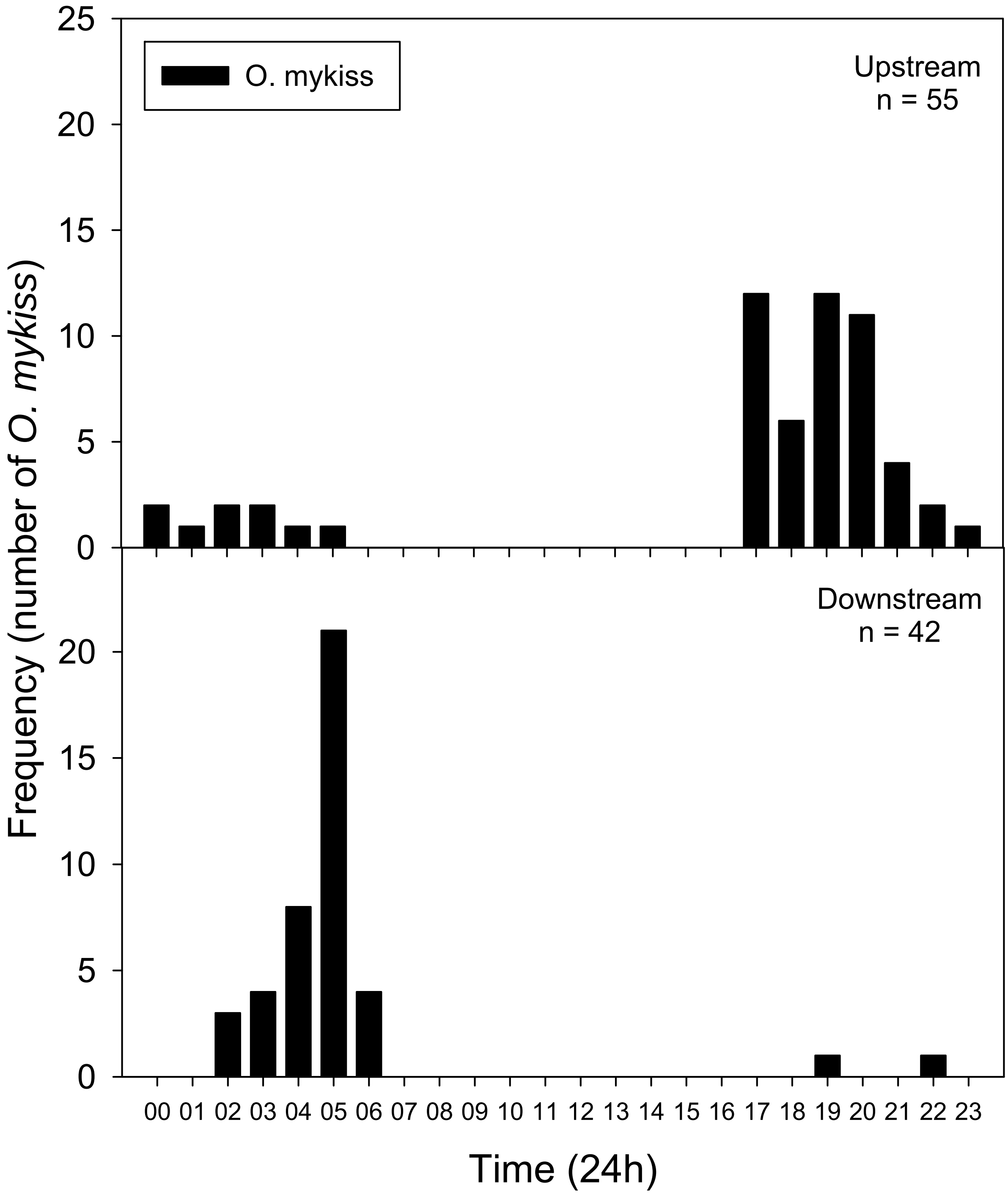
Appendix 10. Riverwatcher detection classification flow chart that outlines the pathways to classifying upstream and downstream detections.

Appendix 11. Summary of Riverwatcher detections classified as fish probable, fish unknown species, and *O. mykiss* from January through June of 2009.

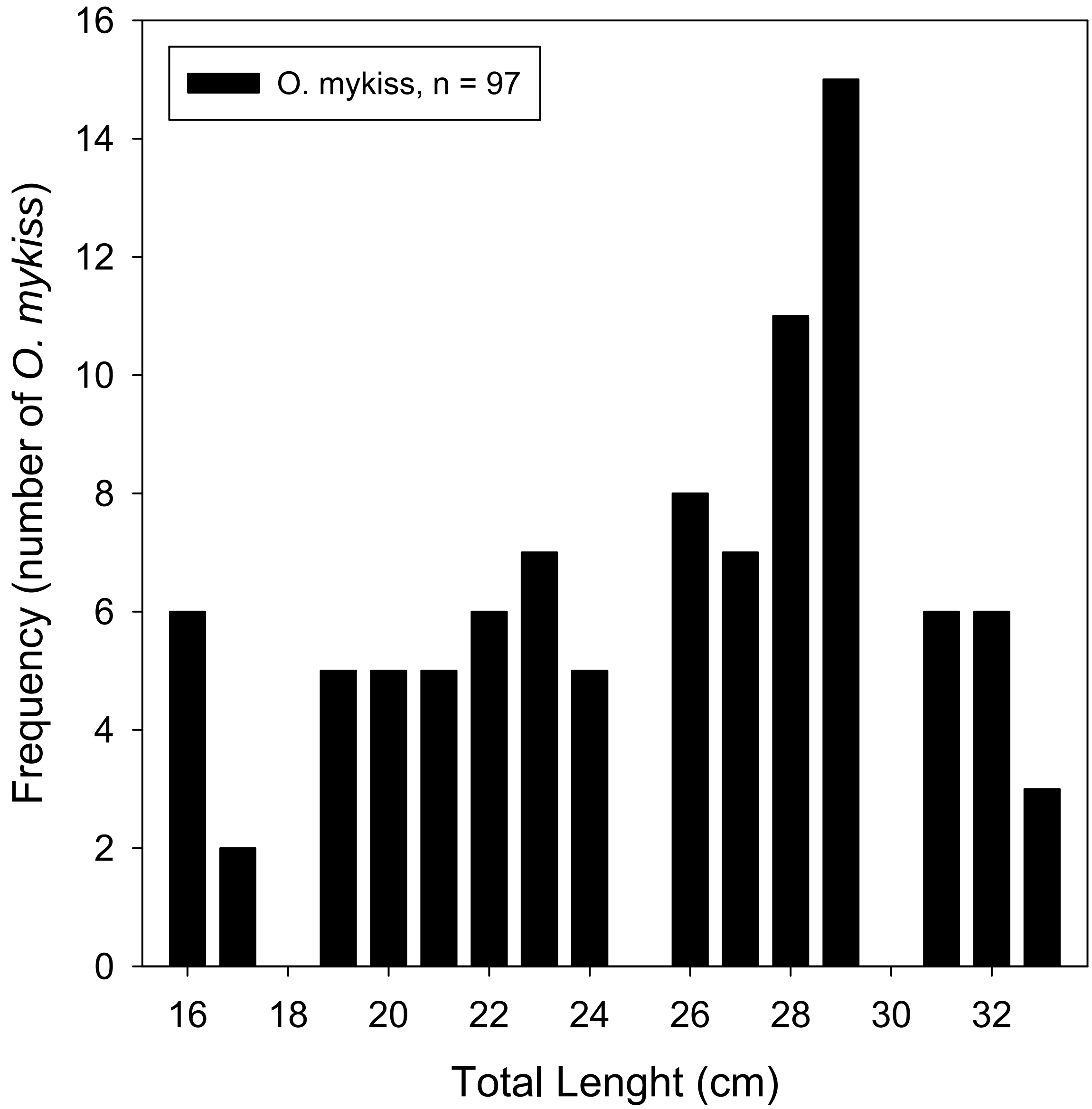
	Upstream	Downstream
Adult steelhead	0	0
O. mykiss, non-adult steelhead	55	42
Fish, unknown	31	25
Fish, probable	27	59
False detections	187	328
Total	300	454
Mean date-O. mykiss, non-adult steelhead	2-Apr-09	6-May-09
Mean date-fish, unknown	6-Apr-09	18-Apr-09
Mean date-fish, probable	18-Mar-09	21-Feb-09
Mean time-O. mykiss, non-adult steelhead (24h)	16:49	5:41
Mean time-fish, unknown (24h)	15:53	9:03
Mean time-fish, probable (24h)	15:31	7:24
Mean length-O. mykiss, non-adult steelhead (cm)	27	23
Mean length-fish, unknown (cm)	26	22
Mean length-fish, probable (cm)	27	24
Mean daily temperature-O. mykiss, non-adult steelhead (°C)	16.6	19.6
Mean daily temperature-fish, unknown (°C)	17.0	18.3
Mean daily temperature-fish, probable (°C)	16.0	13.6
Mean daily turbidity-O. mykiss, non-adult steelhead (NTU)	1.9	1.9
Mean daily turbidity-fish, unknown (NTU)	5.5	1.6
Mean daily turbidity-fish, probable (NTU)	2.8	3.3
Mean daily turbidity-false detections (NTU)	65.0	55.7
Mean daily discharge-O. mykiss, non-adult steelhead (cfs)	5	3
Mean daily discharge-fish, unknown (cfs)	6	6
Mean daily discharge-fish, probable (cfs)	6	7
Mean daily discharge-false detections (cfs)	18	16



Appendix 12. Weekly Riverwatcher upstream and downstream detections classified as fish probable, fish unknown species, and *O. mykiss* from January through June of 2009.



Appendix 13. Time (24h) of *O. mykiss* passage through the Riverwatcher in upstream and downstream directions from January through June of 2009.



Appendix 14. Length frequency distribution of *O. mykiss* detected passing through the Riverwatcher from January through June of 2009.

Appendix 15. 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)
1-Jan-09	06:19	Fish, Probable	21	Down	4	2.7	10.8
1-Jan-09	17:14	O. mykiss	24	Up	4	2.7	10.8
2-Jan-09	04:17	Fish, Probable	28	Up	4	2.5	10.9
2-Jan-09	04:20	Fish, Probable	17	Down	4	2.5	10.9
2-Jan-09	19:23	O. mykiss	31	Up	4	2.5	10.9
3-Jan-09	17:22	O. mykiss	29	Up	4	2.3	11.9
9-Jan-09	19:23	Fish, probable	30	Up	3	1.7	11.5
10-Jan-09	04:18	Fish, Probable	25	Down	3	1.8	10.6
13-Jan-09	17:15	Fish, Probable	43	Up	3	2.1	12.4
14-Jan-09	06:50	Fish, Probable	21	Down	3	2.0	11.8
15-Jan-09	05:39	Fish, Probable	26	Down	3	1.9	10.5
16-Jan-09	06:26	Fish, Probable	21	Down	3	1.8	11.0
16-Jan-09	17:21	Fish, Probable	29	Up	3	1.8	11.0
18-Jan-09	06:19	Fish, Probable	23	Down	3	1.7	11.5
19-Jan-09	06:18	Fish, Probable	26	Down	2	1.6	11.9
19-Jan-09	19:08	Fish, Probable	28	Up	2	1.6	11.9
20-Jan-09	06:19	Fish, Probable	25	Down	2	1.5	12.4
20-Jan-09	17:28	Fish, Probable	33	Up	2	1.5	12.4
21-Jan-09	06:22	Fish, Probable	28	Down	3	1.9	13.6
21-Jan-09	15:27	Fish, Probable	38	Down	3	1.9	13.6
21-Jan-09	15:27	Fish, Probable	40	Up	3	1.9	13.6
21-Jan-09	15:36	Fish, Probable	34	Down	3	1.9	13.6
21-Jan-09	18:18	Fish, Unknown	26	Up	3	1.9	13.6
22-Jan-09	06:30	Fish, Probable	23	Down	3	2.2	13.2
22-Jan-09	17:09	O. mykiss	25	Up	3	2.2	13.2
23-Jan-09	07:09	Fish, Probable	30	Down	4	1.9	13.5
23-Jan-09	11:13	Largemouth Bass	31	Up	4	1.9	13.5
23-Jan-09	18:28	O. mykiss	26	Up	4	1.9	13.5
24-Jan-09	05:29	Fish, Probable	17	Down	4	1.8	14.5
24-Jan-09	07:18	Fish, Probable	25	Down	4	1.8	14.5
24-Jan-09	16:33	Largemouth Bass	44	Up	4	1.8	14.5
24-Jan-09	17:10	O. mykiss	33	Up	4	1.8	14.5
25-Jan-09	05:56	Fish, Probable	23	Down	4	1.8	12.6
25-Jan-09	06:40	Fish, Probable	26	Down	4	1.8	12.6
25-Jan-09	11:46	Fish, Unknown	28	Up	4	1.8	12.6
25-Jan-09	15:29	Fish, Probable	33	Down	4	1.8	12.6
25-Jan-09	15:29	Largemouth Bass	40	Up	4	1.8	12.6
25-Jan-09	15:39	Fish, Probable	39	Down	4	1.8	12.6

25-Jan-09	17:40	O. mykiss	29	Up	4	1.8	12.6
26-Jan-09	03:59	Fish, Probable	30	Down	3	0.9	10.3
26-Jan-09	13:36	Fish, Probable	18	Down	3	0.9	10.3
27-Jan-09	17:43	O. mykiss	30	Up	3	0.9	9.4
28-Jan-09	06:08	Fish, Probable	26	Down	3	0.9	10.0
28-Jan-09	17:43	O. mykiss	31	Up	3	0.9	10.0
29-Jan-09	06:35	Fish, Probable	25	Down	3	1.0	10.9
29-Jan-09	17:39	O. mykiss	30	Up	3	1.0	10.9
30-Jan-09	05:59	Fish, Probable	24	Down	3	1.3	11.3
30-Jan-09	18:23	Fish, Unknown	26	Up	3	1.3	11.3
31-Jan-09	04:24	Fish, Probable	17	Down	3	1.7	11.7
31-Jan-09	06:06	Fish, Probable	30	Down	3	1.7	11.7
31-Jan-09	17:45	Fish, Unknown	31	Up	3	1.7	11.7
1-Feb-09	06:37	Fish, Probable	26	Down	3	2.1	11.7
1-Feb-09	17:35	Fish, Unknown	28	Up	3	2.1	11.7
2-Feb-09	06:02	Fish, Probable	26	Down	3	2.4	11.8
2-Feb-09	18:01	O. mykiss	28	Up	3	2.4	11.8
3-Feb-09	05:57	Fish, Probable	23	Down	3	1.5	11.6
3-Feb-09	21:05	Fish, Unknown	33	Up	3	1.5	11.6
4-Feb-09	18:15	O. mykiss	29	Up	3	1.6	11.5
5-Feb-09	06:12	Fish, Probable	24	Down	4	1.3	10.9
5-Feb-09	17:49	O. mykiss	29	Up	4	1.3	10.9
6-Feb-09	06:44	Fish, Probable	21	Down	16	27.3	11.4
6-Feb-09	14:14	Fish, Probable	25	Up	16	27.3	11.4
9-Feb-09	17:46	O. mykiss	30	Up	27	8.3	11.3
10-Feb-09	06:31	Fish, Probable	28	Down	24	4.4	9.6
10-Feb-09	07:31	Fish, Probable	29	Down	24	4.4	9.6
10-Feb-09	07:36	Fish, Probable	26	Up	24	4.4	9.6
10-Feb-09	07:36	Fish, Probable	27	Up	24	4.4	9.6
10-Feb-09	07:52	Fish, Probable	21	Down	24	4.4	9.6
10-Feb-09	17:50	Largemouth Bass	28	Up	24	4.4	9.6
12-Feb-09	06:08	Fish, Probable	24	Down	23	61.5	9.4
12-Feb-09	17:56	Fish, Unknown	21	Up	23	61.5	9.4
13-Feb-09	12:29	Fish, Unknown	26	Up	21	60.5	9.2
11-Mar-09	17:51	Fish, Unknown	17	Up	22	1.9	12.5
13-Mar-09	05:43	Fish, Probable	16	Down	19	1.8	14.2
14-Mar-09	18:47	Fish, Unknown	23	Down	19	1.6	13.9
15-Mar-09	05:29	Fish, Probable	18	Down	19	1.5	14.5
15-Mar-09	18:44	O. mykiss	25	Up	19	1.5	14.5
16-Mar-09	04:52	Fish, Probable	23	Down	19	1.3	14.9
16-Mar-09	18:20	O. mykiss	24	Up	19	1.3	14.9
16-Mar-09	23:18	Fish, Unknown	18	Down	19	1.3	14.9
17-Mar-09	05:33	Fish, Unknown	23	Down	18	2.1	16.3
18-Mar-09	05:31	Fish, Probable	21	Down	22	3.0	15.9
18-Mar-09	17:03	Fish, Unknown	23	Up	22	3.0	15.9

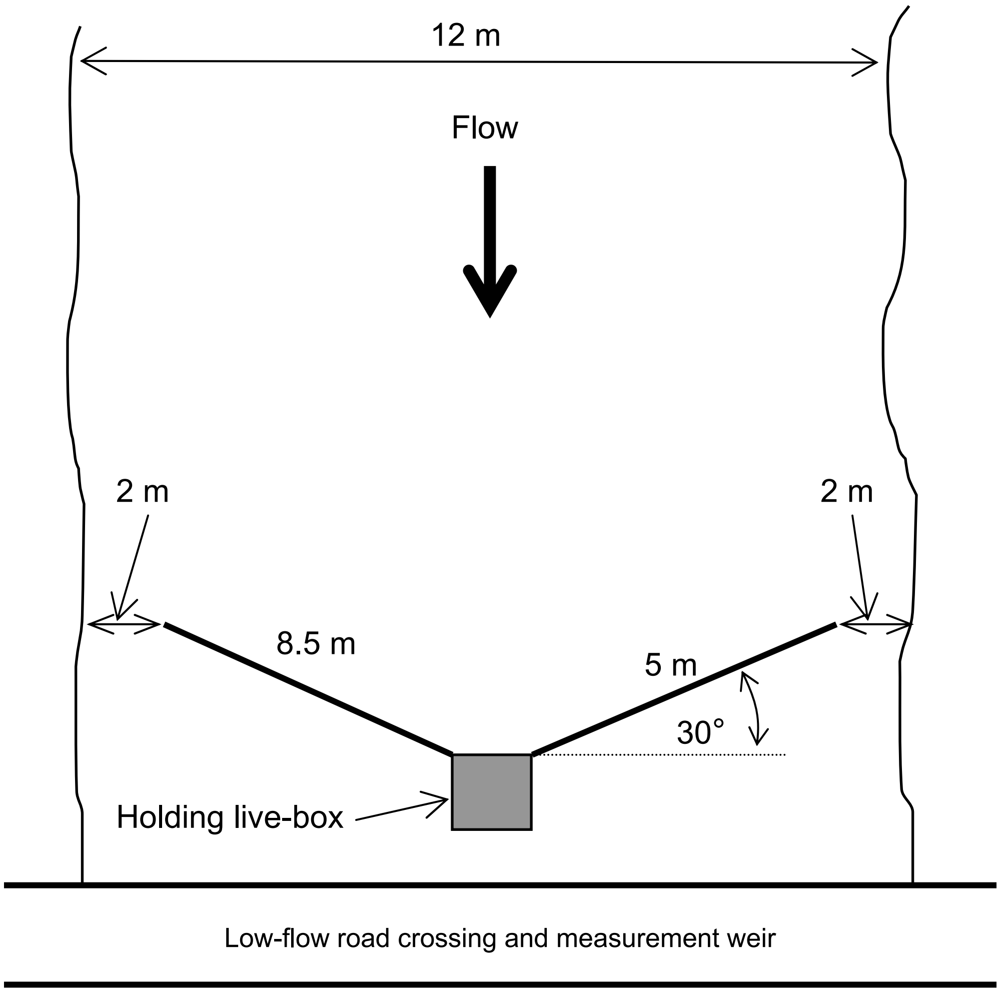
19-Mar-09	10:10	Fish, Unknown	17	Down	26	3.0	16.9
20-Mar-09	06:02	Fish, Probable	22	Down	20	1.8	14.5
20-Mar-09	08:21	Fish, Probable	18	Down	20	1.8	14.5
25-Mar-09	05:50	Fish, Probable	19	Down	14	1.7	15.5
25-Mar-09	22:43	Fish, Unknown	22	Up	14	1.7	15.5
28-Mar-09	00:29	Fish, Probable	17	Down	10	1.6	17.0
28-Mar-09	05:17	Fish, Probable	23	Down	10	1.6	17.0
28-Mar-09	18:21	O. mykiss	29	Up	10	1.6	17.0
28-Mar-09	19:18	Fish, Probable	19	Down	10	1.6	17.0
30-Mar-09	14:02	Largemouth Bass	29	Up	9	1.5	16.5
30-Mar-09	14:05	Largemouth Bass	35	Up	9	1.5	16.5
31-Mar-09	03:22	O. mykiss	21	Up	9	1.5	16.7
31-Mar-09	21:17	O. mykiss	29	Up	9	1.5	16.7
1-Apr-09	05:15	Fish, Probable	24	Down	9	1.5	16.6
1-Apr-09	17:03	Largemouth Bass	26	Up	9	1.5	16.6
1-Apr-09	22:41	O. mykiss	25	Up	9	1.5	16.6
2-Apr-09	02:49	O. mykiss	19	Up	8	1.5	16.5
2-Apr-09	05:06	Fish, Probable	21	Down	8	1.5	16.5
3-Apr-09	22:20	Fish, Probable	24	Up	8	1.5	17.2
4-Apr-09	05:15	O. mykiss	28	Down	7	1.5	15.9
4-Apr-09	18:09	Largemouth Bass	29	Up	7	1.5	15.9
5-Apr-09	01:03	Fish, Unknown	19	Down	6	1.5	15.6
5-Apr-09	06:09	Fish, Probable	26	Down	6	1.5	15.6
5-Apr-09	16:01	Fish, Unknown	18	Down	6	1.5	15.6
6-Apr-09	00:46	O. mykiss	28	Up	6	1.4	16.3
6-Apr-09	00:56	Fish, Probable	19	Up	6	1.4	16.3
6-Apr-09	03:29	O. mykiss	16	Down	6	1.4	16.3
6-Apr-09	19:40	O. mykiss	28	Up	6	1.4	16.3
6-Apr-09	19:49	Fish, Unknown	16	Down	6	1.4	16.3
6-Apr-09	21:40	Fish, Probable	22	Up	6	1.4	16.3
6-Apr-09	21:40	Fish, Probable	23	Up	6	1.4	16.3
6-Apr-09	21:40	Fish, Probable	17	Down	6	1.4	16.3
6-Apr-09	21:42	Fish, Probable	22	Up	6	1.4	16.3
7-Apr-09	04:19	Fish, Probable	19	Down	5	1.6	15.6
7-Apr-09	04:21	Fish, Probable	23	Up	5	1.6	15.6
7-Apr-09	04:39	O. mykiss	18	Up	5	1.6	15.6
7-Apr-09	04:51	Fish, Unknown	17	Up	5	1.6	15.6
7-Apr-09	05:02	O. mykiss	19	Up	5	1.6	15.6
7-Apr-09	05:41	Fish, Probable	23	Up	5	1.6	15.6
7-Apr-09	06:01	Fish, Unknown	25	Down	5	1.6	15.6
8-Apr-09	06:11	Fish, Unknown	26	Down	5	1.8	16.0
8-Apr-09	19:39	O. mykiss	31	Up	5	1.8	16.0
8-Apr-09	21:45	O. mykiss	23	Up	5	1.8	16.0
9-Apr-09	06:18	Fish, Probable	23	Down	5	3.4	15.7
9-Apr-09	15:20	Largemouth Bass	31	Up	5	3.4	15.7

9-Apr-09	19:28	O. mykiss	33	Up	5	3.4	15.7
10-Apr-09	06:15	O. mykiss	28	Down	6	1.6	15.4
10-Apr-09	19:58	O. mykiss	30	Up	6	1.6	15.4
10-Apr-09	22:33	Fish, Unknown	18	Down	6	1.6	15.4
11-Apr-09	06:21	O. mykiss	28	Down	5	1.5	15.7
11-Apr-09	12:29	Largemouth Bass	31	Up	5	1.5	15.7
11-Apr-09	15:56	Largemouth Bass	34	Up	5	1.5	15.7
11-Apr-09	19:33	O. mykiss	26	Up	5	1.5	15.7
11-Apr-09	19:47	Fish, Unknown	21	Up	5	1.5	15.7
12-Apr-09	04:13	Fish, Unknown	19	Down	4	1.4	16.8
12-Apr-09	05:36	O. mykiss	22	Down	4	1.4	16.8
12-Apr-09	06:00	Fish, Unknown	23	Down	4	1.4	16.8
12-Apr-09	17:06	Largemouth Bass	30	Down	4	1.4	16.8
12-Apr-09	19:36	Fish, Unknown	21	Up	4	1.4	16.8
13-Apr-09	06:15	Fish, Probable	21	Down	4	1.3	18.0
13-Apr-09	14:07	Largemouth Bass	24	Up	4	1.3	18.0
13-Apr-09	19:29	Fish, Probable	19	Down	4	1.3	18.0
13-Apr-09	19:33	O. mykiss	25	Up	4	1.3	18.0
13-Apr-09	19:59	O. mykiss	17	Down	4	1.3	18.0
13-Apr-09	20:54	Fish, Unknown	16	Up	4	1.3	18.0
14-Apr-09	06:22	Largemouth Bass	25	Down	4	1.4	18.4
14-Apr-09	13:02	Largemouth Bass	33	Up	4	1.4	18.4
14-Apr-09	19:22	Fish, Unknown	30	Up	4	1.4	18.4
14-Apr-09	22:36	Fish, Probable	21	Up	4	1.4	18.4
15-Apr-09	06:11	O. mykiss	26	Down	4	1.5	15.5
15-Apr-09	19:35	Largemouth Bass	25	Up	4	1.5	15.5
16-Apr-09	05:50	Fish, Unknown	23	Down	4	1.5	16.0
16-Apr-09	19:38	O. mykiss	28	Up	4	1.5	16.0
17-Apr-09	10:56	Largemouth Bass	29	Up	4	1.6	17.2
17-Apr-09	20:04	Fish, Unknown	30	Up	4	1.6	17.2
18-Apr-09	04:32	O. mykiss	16	Down	4	1.6	18.5
18-Apr-09	05:51	Fish, Unknown	28	Down	4	1.6	18.5
18-Apr-09	19:40	O. mykiss	25	Up	4	1.6	18.5
18-Apr-09	22:02	O. mykiss	16	Down	4	1.6	18.5
19-Apr-09	02:10	O. mykiss	23	Up	4	1.7	19.8
19-Apr-09	02:21	O. mykiss	18	Down	4	1.7	19.8
19-Apr-09	05:21	O. mykiss	21	Down	4	1.7	19.8
19-Apr-09	05:47	O. mykiss	23	Down	4	1.7	19.8
19-Apr-09	11:44	Fish, Probable	19	Up	4	1.7	19.8
19-Apr-09	12:20	Largemouth Bass	25	Up	4	1.7	19.8
19-Apr-09	13:50	Fish, Unknown	22	Down	4	1.7	19.8
19-Apr-09	19:19	Fish, Unknown	35	Up	4	1.7	19.8
19-Apr-09	20:04	Largemouth Bass	30	Up	4	1.7	19.8
20-Apr-09	05:56	Fish, Unknown	24	Down	4	1.8	20.4
20-Apr-09	19:57	Fish, Probable	28	Up	4	1.8	20.4

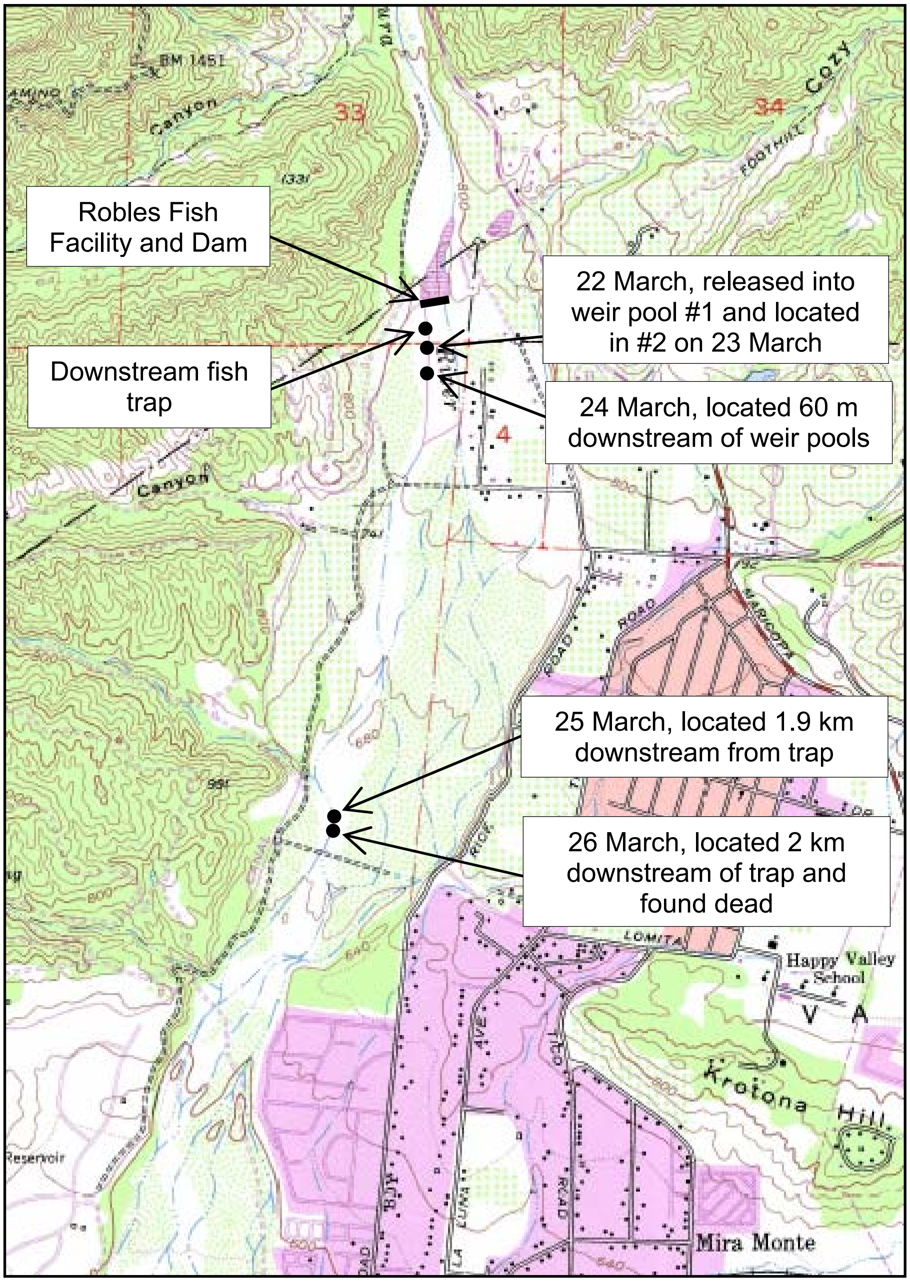
21-Apr-09	05:48	O. mykiss	29	Down	4	2.0	20.0
21-Apr-09	19:52	O. mykiss	25	Up	4	2.0	20.0
21-Apr-09	19:52	O. mykiss	21	Up	4	2.0	20.0
22-Apr-09	04:20	O. mykiss	31	Down	3	2.6	19.5
22-Apr-09	20:04	O. mykiss	28	Up	3	2.6	19.5
23-Apr-09	21:03	Largemouth Bass	21	Down	3	3.2	17.7
24-Apr-09	06:06	O. mykiss	29	Down	4	1.2	16.2
24-Apr-09	19:48	O. mykiss	29	Up	4	1.2	16.2
25-Apr-09	05:33	Fish, Unknown	30	Down	4	1.6	16.6
25-Apr-09	20:17	O. mykiss	24	Up	4	1.6	16.6
26-Apr-09	05:28	O. mykiss	23	Down	4	2.0	17.3
26-Apr-09	19:56	Largemouth Bass	30	Up	4	2.0	17.3
27-Apr-09	18:12	Largemouth Bass	44	Up	4	2.4	17.5
27-Apr-09	20:02	Largemouth Bass	34	Up	4	2.4	17.5
28-Apr-09	11:21	Fish, Probable	18	Down	4	2.3	17.5
28-Apr-09	20:05	Fish, Unknown	23	Up	4	2.3	17.5
29-Apr-09	05:36	O. mykiss	29	Down	3	2.2	17.5
29-Apr-09	05:43	Fish, Probable	33	Down	3	2.2	17.5
1-May-09	19:57	Fish, Probable	28	Up	3	2.0	18.5
2-May-09	00:00	Fish, Unknown	25	Up	3	1.9	20.0
2-May-09	00:52	Fish, Probable	23	Down	3	1.9	20.0
2-May-09	03:44	Fish, Probable	21	Up	3	1.9	20.0
2-May-09	20:00	O. mykiss	31	Up	3	1.9	20.0
3-May-09	05:29	O. mykiss	29	Down	3	1.8	20.4
3-May-09	20:14	Fish, Probable	33	Up	3	1.8	20.4
3-May-09	21:01	O. mykiss	22	Up	3	1.8	20.4
4-May-09	05:26	O. mykiss	17	Down	3	1.7	20.5
4-May-09	05:33	O. mykiss	22	Down	3	1.7	20.5
4-May-09	20:42	Fish, Probable	31	Up	3	1.7	20.5
5-May-09	05:20	O. mykiss	25	Down	2	1.7	21.0
5-May-09	20:50	Fish, Probable	24	Up	2	1.7	21.0
6-May-09	02:10	Fish, Unknown	16	Down	2	1.6	22.1
6-May-09	05:30	O. mykiss	25	Down	2	1.6	22.1
6-May-09	20:52	Fish, Unknown	31	Up	2	1.6	22.1
7-May-09	05:32	Fish, Unknown	30	Down	2	1.8	21.8
7-May-09	13:03	Largemouth Bass	43	Down	2	1.8	21.8
7-May-09	13:09	Largemouth Bass	43	Up	2	1.8	21.8
7-May-09	13:12	Largemouth Bass	39	Down	2	1.8	21.8
7-May-09	13:12	Largemouth Bass	50	Up	2	1.8	21.8
7-May-09	13:18	Largemouth Bass	41	Down	2	1.8	21.8
7-May-09	13:18	Largemouth Bass	39	Up	2	1.8	21.8
7-May-09	13:26	Largemouth Bass	43	Down	2	1.8	21.8
7-May-09	20:39	Fish, Unknown	28	Up	2	1.8	21.8
8-May-09	05:25	O. mykiss	26	Down	2	2.2	20.5
8-May-09	20:31	Fish, Unknown	26	Up	2	2.2	20.5

9-May-09	05:27	O. mykiss	29	Down	3	3.1	21.2
9-May-09	20:31	O. mykiss	33	Up	3	3.1	21.2
10-May-09	05:32	O. mykiss	21	Down	3	4.1	21.2
10-May-09	20:13	Largemouth Bass	28	Up	3	4.1	21.2
11-May-09	03:34	O. mykiss	18	Down	3	5.0	20.3
11-May-09	05:25	O. mykiss	24	Down	3	5.0	20.3
11-May-09	19:16	Largemouth Bass	36	Up	3	5.0	20.3
11-May-09	20:28	O. mykiss	30	Up	3	5.0	20.3
12-May-09	20:31	O. mykiss	31	Up	3	3.9	20.2
13-May-09	05:34	Fish, Probable	21	Down	2	2.8	20.5
13-May-09	20:42	O. mykiss	28	Up	2	2.8	20.5
14-May-09	05:20	Fish, Unknown	21	Down	2	1.7	21.1
14-May-09	14:13	Largemouth Bass	41	Down	2	1.7	21.1
14-May-09	14:14	Largemouth Bass	44	Up	2	1.7	21.1
14-May-09	14:21	Largemouth Bass	39	Down	2	1.7	21.1
14-May-09	20:40	Fish, Unknown	33	Up	2	1.7	21.1
15-May-09	05:12	Fish, Unknown	33	Down	2	1.5	22.0
15-May-09	15:57	Fish, Unknown	19	Down	2	1.5	22.0
15-May-09	20:51	Fish, Probable	29	Up	2	1.5	22.0
16-May-09	05:15	O. mykiss	23	Down	2	1.4	22.8
16-May-09	21:18	Fish, Unknown	23	Up	2	1.4	22.8
17-May-09	05:12	Fish, Unknown	26	Down	2	1.3	23.2
17-May-09	22:07	O. mykiss	30	Up	2	1.3	23.2
18-May-09	05:21	Fish, Unknown	21	Down	2	1.1	23.1
18-May-09	20:32	O. mykiss	29	Up	2	1.1	23.1
19-May-09	05:15	Fish, Probable	26	Down	2	1.2	22.2
19-May-09	05:19	O. mykiss	16	Down	2	1.2	22.2
19-May-09	20:25	Fish, Probable	18	Up	2	1.2	22.2
19-May-09	20:52	Fish, Unknown	30	Up	2	1.2	22.2
20-May-09	05:09	Fish, Unknown	24	Down	2	1.4	21.9
21-May-09	02:39	Fish, Unknown	29	Up	1	1.5	22.1
21-May-09	05:21	O. mykiss	26	Down	1	1.5	22.1
21-May-09	23:54	O. mykiss	28	Up	1	1.5	22.1
22-May-09	05:04	O. mykiss	18	Down	1	1.5	21.7
23-May-09	02:37	O. mykiss	19	Down	1	1.6	21.6
25-May-09	02:33	Fish, Unknown	33	Up	2	1.6	19.6
25-May-09	02:41	O. mykiss	26	Down	2	1.6	19.6
25-May-09	04:11	Fish, Unknown	31	Up	2	1.6	19.6
25-May-09	04:16	O. mykiss	29	Down	2	1.6	19.6
26-May-09	20:44	O. mykiss	16	Up	1	1.6	20.4
28-May-09	03:07	O. mykiss	26	Up	1	1.7	22.2
28-May-09	03:23	O. mykiss	22	Down	1	1.7	22.2
28-May-09	04:45	O. mykiss	16	Down	1	1.7	22.2
30-May-09	00:44	Fish, Unknown	21	Up	1	1.7	20.2
30-May-09	04:58	O. mykiss	18	Down	1	1.7	20.2

31-May-09	20:55	O. mykiss	22	Up	1	1.7	20.5
1-Jun-09	04:24	O. mykiss	19	Down	1	1.8	20.6
2-Jun-09	20:55	Fish, Unknown	22	Up	0	1.6	21.4
3-Jun-09	04:23	O. mykiss	24	Down	0	1.4	19.7
11-Jun-09	21:39	O. mykiss	21	Up	0	1.4	18.2
13-Jun-09	01:12	O. mykiss	28	Up	1	1.4	18.3
13-Jun-09	04:44	O. mykiss	20	Down	1	1.4	18.3
13-Jun-09	20:55	O. mykiss	29	Up	1	1.4	18.3
14-Jun-09	03:55	O. mykiss	23	Down	1	1.2	20.0
16-Jun-09	00:38	O. mykiss	22	Up	1	1.1	21.3
16-Jun-09	05:10	O. mykiss	23	Down	1	1.1	21.3



Appendix 16. Top view of downstream migrant smolt trap layout in the Ventura River below the Robles Fish Facility.



Appendix 17. Locations of a radio-tagged *O. mykiss* smolt during downstream migration from Robles Fish Facility in March of 2009.

Appendix 18. Ventura River and Robles Fish Facility flow assessment for water year 2009-2009.

October														
Water Year 2008 - 2009														
	(1)	(2)	(1)+(2)			(3)	(4)	(5)	(4)+(5)		(5) X 1.98			-
	Source Stream Daily Flows					Robles Facility Daily Flows							Field Measurement	
	Matilija Ck	North Fork	Sum of Creek		Forebay	Fishway	VRNMO	Diversion	Total Inflow		Robles			
Oct-08	D/S Dam	Matilija Ck.	Flows		Avg. Depth	Ladder	Weir	Canal			Diversion		Matilija Creek	VRNMO
	(cfsd)	(cfsd)	(cfsd)		(ft)	(cfsd)	(cfsd)	(cfsd)	(cfsd)		(AF)		(cfsd)	(cfsd)
1	3	1	4		0.6	0	0	0	0		0			
2	3	1	4		0.6	0	0	0	0		0			
3	3	1	4		0.6	0	0	0	0		0			
4	3	1	4		0.8	0	0	0	0		0			
5	3	1	4		0.8	0	0	0	0		0			
6	3	1	4		0.8	0	0	0	0		0			
7	3	1	4		0.7	0	0	0	0		0			
8	3	1	4		0.7	0	0	0	0		0			
9	3	1	4		0.7	0	0	0	0		0			
10	3	1	4		0.6	0	0	0	0		0			
11	3	1	4		0.7	0	0	0	0		0			
12	3	1	4		0.7	0	0	0	0		0			
13	3	1	4		0.7	0	0	0	0		0			
14	3	1	4		0.7	0	0	0	0		0			
15	3	1	4		0.7	0	0	0	0		0			
16	3	1	4		0.7	0	0	0	0		0			
17	3	1	4		0.6	0	0	0	0		0			
18	3	1	4		0.6	0	0	0	0		0			
19	3	1	4		0.6	0	0	0	0		0			
20	3	1	4		0.7	0	0	0	0		0			
21	3	1	4		0.7	0	0	0	0		0			

22	3	1	4		0.7	0	0	0	0		0			
23	3	1	4		0.6	0	0	0	0		0			
24	3	1	4		0.6	0	0	0	0		0			
25	3	1	4		0.6	0	0	0	0		0			
26	3	1	4		0.6	0	0	0	0		0			
27	3	1	4		0.6	0	0	0	0		0			
28	3	1	4		0.6	0	0	0	0		0			
29	3	1	4		0.7	0	0	0	0		0			
30	3	1	4		0.7	0	0	0	0		0			
31	3	1	4		0.7	0	0	0	0		0			
Totals	97	25	121			0	0	0	0		0			

November

Water Year 2008 - 2009

	(1)	(2)	(1)+(2)			(3)	(4)	(5)	(4)+(5)		(5) X 1.98			-
	Source Stream Daily Flows					Robles Facility Daily Flows							Field Measurement	
	Matilija Ck	North Fork	Sum of Creek		Forebay	Fishway	VRNMO	Diversion	Total Inflow		Robles			
Nov-08	D/S Dam	Matilija Ck.	Flows		Avg. Depth	Ladder	Weir	Canal			Diversion		Matilija Creek	VRNMO
	(cfsd)	(cfsd)	(cfsd)		(ft)	(cfsd)	(cfsd)	(cfsd)	(cfsd)		(AF)		(cfsd)	(cfsd)
1	3	1	5		0.9	0	0	0	0		0			
2	3	1	4		0.9	0	0	0	0		0			
3	3	1	4		0.9	0	0	0	0		0			
4	3	1	4		0.9	0	0	0	0		0			
5	3	1	4		0.9	0	0	0	0		0			
6	3	1	4		0.9	0	0	0	0		0			
7	3	1	4		0.9	0	0	0	0		0			
8	3	1	4		0.8	0	0	0	0		0			
9	3	1	4		0.9	0	0	0	0		0			
10	3	1	4		0.8	0	0	0	0		0			

11	3	1	4		0.9	0	0	0	0		0			
12	3	1	4		0.8	0	0	0	0		0			
13	3	1	4		0.8	0	0	0	0		0			
14	3	1	4		0.7	0	0	0	0		0			
15	3	1	4		0.7	0	0	0	0		0			
16	3	1	4		0.7	0	0	0	0		0			
17	3	1	4		0.7	0	0	0	0		0			
18	4	1	4		0.8	0	0	0	0		0			
19	4	1	4		0.8	0	0	0	0		0			
20	3	1	4		0.8	0	0	0	0		0			
21	3	1	4		0.7	0	0	0	0		0			
22	4	1	4		0.8	0	0	0	0		0			
23	4	1	4		0.9	0	0	0	0		0			
24	4	1	4		0.9	0	0	0	0		0			
25	4	1	5		1.0	0	0	0	0		0			
26	4	3	7		1.8	10	10	0	10		0			
27	4	2	6		1.4	6	6	0	6		0			
28	4	2	5		1.2	3	3	0	3		0			
29	4	1	5		1.1	2	2	0	2		0			
30	4	1	5		1.1	2	2	0	2		0			
Totals	101	25	127			23	23	0	23		0			

December														
Water Year 2008 - 2009														
	(1)	(2)	(1)+(2)			(3)	(4)	(5)	(4)+(5)		(5) X 1.98			-
	Source Stream Daily Flows					Robles Facility Daily Flows							Field Measurement	
	Matilija Ck	North Fork	Sum of Creek		Forebay	Fishway	VRNMO	Diversion	Total Inflow		Robles			
Dec-08	D/S Dam	Matilija Ck.	Flows		Avg. Depth	Ladder	Weir	Canal			Diversion		Matilija Creek	VRNMO
	(cfsd)	(cfsd)	(cfsd)		(ft)	(cfsd)	(cfsd)	(cfsd)	(cfsd)		(AF)		(cfsd)	(cfsd)

1	4	1	5		1.1	2	2	0	2		0			
2	4	1	5		1.1	2	2	0	2		0			
3	4	1	5		1.1	2	2	0	2		0			
4	4	2	5		1.1	2	2	0	2		0			
5	4	1	5		1.1	2	2	0	2		0			
6	4	1	5		1.1	2	2	0	2		0			
7	4	1	5		1.2	2	2	0	2		0			
8	4	1	5		1.1	2	2	0	2		0			
9	4	1	5		1.1	2	2	0	2		0			
10	4	1	5		1.1	2	2	0	2		0			
11	4	1	5		1.1	2	2	0	2		0			
12	4	1	5		1.1	2	2	0	2		0			
13	4	1	5		1.1	2	2	0	2		0			
14	4	2	5		1.1	2	2	0	2		0			
15	4	4	8		1.9	13	13	0	13		0			
16	4	2	6		1.4	4	4	0	4		0			
17	4	2	6		1.3	4	4	0	4		0			
18	4	2	5		1.2	3	3	0	3		0			
19	4	2	5		1.2	3	3	0	3		0			
20	4	2	5		1.2	3	3	0	3		0			
21	4	2	5		1.2	3	3	0	3		0			
22	4	2	5		1.2	3	3	0	3		0			
23	4	2	5		1.2	3	3	0	3		0			
24	4	2	5		1.2	3	3	0	3		0			
25	4	4	8		1.4	10	10	0	10		0			
26	5	3	7		1.3	7	7	0	7		0			
27	10	2	13		1.7	16	16	0	16		0			
28	11	2	13		1.8	18	18	0	18		0			
29	10	2	12		1.9	17	17	0	17		0			
30	10	2	12		2.0	16	16	0	16		0			
31	10	2	12		2.0	11	11	0	11		0		8.63	10.3
Totals	150	53	204			164	164	0	164		0			

January

Water Year 2008 - 2009

	(1)	(2)	(1)+(2)			(3)	(4)	(5)	(4)+(5)		(5) X 1.98			-
	Source Stream Daily Flows					Robles Facility Daily Flows							Field Measurement	
	Matilija Ck	North Fork	Sum of Creek		Forebay	Fishway	VRNMO	Diversion	Total Inflow		Robles			
Jan-09	D/S Dam	Matilija Ck.	Flows		Avg. Depth	Ladder	Weir	Canal			Diversion		Matilija Creek	VRNMO
	(cfsd)	(cfsd)	(cfsd)		(ft)	(cfsd)	(cfsd)	(cfsd)	(cfsd)		(AF)		(cfsd)	(cfsd)
1	10	2	11		2.0	4	4	0	4		0			
2	10	2	11		2.0	4	4	0	4		0			
3	10	2	11		1.9	4	4	0	4		0			
4	9	2	11		1.9	4	4	0	4		0			
5	9	2	11		1.9	4	4	0	4		0			
6	9	2	11		1.9	4	4	0	4		0			
7	9	2	11		1.9	4	4	0	4		0			
8	9	2	11		1.7	4	4	0	4		0			
9	9	2	10		1.6	3	3	0	3		0			
10	8	2	10		1.7	3	3	0	3		0			
11	8	2	10		1.8	3	3	0	3		0			
12	8	2	9		1.7	3	3	0	3		0			
13	8	2	10		1.7	3	3	0	3		0			
14	8	2	10		1.7	3	3	0	3		0			
15	8	2	10		1.6	3	3	0	3		0			
16	7	2	9		1.6	3	3	0	3		0			
17	7	2	9		1.6	3	3	0	3		0			
18	7	2	9		1.6	3	3	0	3		0			
19	7	2	9		1.6	2	2	0	2		0			
20	7	2	9		1.6	2	2	0	2		0			
21	7	2	9		1.6	3	3	0	3		0			
22	8	2	10		1.8	3	3	0	3		0			
23	9	2	11		1.9	4	4	0	4		0			

24	9	2	11		2.0	4	4	0	4		0			
25	8	2	10		1.9	4	4	0	4		0			
26	8	2	10		1.7	3	3	0	3		0			
27	8	2	10		1.7	3	3	0	3		0			
28	8	2	10		1.7	3	3	0	3		0			
29	8	2	10		1.7	3	3	0	3		0			
30	8	2	10		1.8	3	3	0	3		0			
31	8	2	10		1.7	3	3	0	3		0			
Totals	254	54	307			102	102	0	102		0			

February														
Water Year 2008 - 2009														
	(1)	(2)	(1)+(2)			(3)	(4)	(5)	(4)+(5)		(5) X 1.98			-
	Source Stream Daily Flows					Robles Facility Daily Flows							Field Measurement	
	Matilija Ck	North Fork	Sum of Creek		Forebay	Fishway	VRNMO	Diversion	Total Inflow		Robles			
Feb-09	D/S Dam	Matilija Ck.	Flows		Avg. Depth	Ladder	Weir	Canal			Diversion		Matilija Creek	VRNMO
	(cfsd)	(cfsd)	(cfsd)		(ft)	(cfsd)	(cfsd)	(cfsd)	(cfsd)		(AF)		(cfsd)	(cfsd)
1	8	2	10		1.7	3	3	0	3		0			
2	8	2	10		1.7	3	3	0	3		0			
3	7	2	9		1.7	3	3	0	3		0			
4	7	2	9		1.7	3	3	0	3		0			
5	9	2	11		1.8	4	4	0	4		0			
6	16	9	25		3.2	16	16	0	16		0			13.47 cfs
7	21	10	31		4.9	30	30	0	30		0			
8	22	7	30		4.4	29	29	0	29		0			
9	24	5	29		4.0	27	27	0	27		0			19.83 cfs
10	20	4	24		3.6	24	24	0	24		0			
11	19	4	23		3.3	22	22	0	22		0			

12	37	4	40		4.0	23	23	28	51		56			
13	37	4	41		3.9	21	21	29	50		58			
14	30	4	34		4.8	29	29	0	29		0			
15	27	3	30		4.6	28	28	0	28		0			
16	26	31	57		5.2	30	28	28	55		54			
17	26	24	50		5.6	31	31	22	53		43			26.1 cfs
18	No data	15	15		5.7	31	31	36	66		71			
19	No data	11	11		5.5	31	31	18	49		36			
20	42	9	51		5.2	31	31	10	40		19			
21	39	7	46		5.3	31	31	6	37		12			
22	36	6	42		5.3	30	30	4	34		8			
23	35	6	41		5.2	30	30	3	33		6			
24	34	6	40		5.1	30	30	1	31		2			
25	32	5	38		4.9	30	30	0	30		0			
26	30	5	36		4.8	29	29	0	29		0			
27	29	5	34		4.5	29	29	0	29		0			
28	28	5	33		4.3	28	28	0	28		0			
Totals	650	197	847			654	652	184	836		365			

March														
Water Year 2008 - 2009														
	(1)	(2)	(1)+(2)			(3)	(4)	(5)	(4)+(5)		(5) X 1.98			-
	Source Stream Daily Flows					Robles Facility Daily Flows							Field Measurement	
	Matilija Ck	North Fork	Sum of Creek		Forebay	Fishway	VRNMO	Diversion	Total Inflow		Robles			
Mar-09	D/S Dam	Matilija Ck.	Flows		Avg. Depth	Ladder	Weir	Canal			Diversion		Matilija Creek	VRNMO
	(cfsd)	(cfsd)	(cfsd)		(ft)	(cfsd)	(cfsd)	(cfsd)	(cfsd)		(AF)		(cfsd)	(cfsd)
1	27	5	32		4.1	27	27	0	27		0			

2	26	5	31		4.1	27	27	0	27		0			
3	25	5	30		3.9	26	26	0	26		0			
4	26	5	32		4.1	27	27	0	27		0			
5	26	5	31		4.0	26	26	0	26		0		MCK 20.1 / NF 4.92	
6	25	5	29		4.0	26	26	0	26		0			
7	25	5	29		3.9	26	26	0	26		0			
8	25	5	29		3.9	25	25	0	25		0			
9	22	5	27		3.7	25	25	0	25		0			
10	21	5	25		3.4	23	23	0	23		0			
11	20	4	24		3.3	22	22	0	22		0			
12	18	4	22		3.1	19	19	0	19		0			
13	18	4	22		3.1	19	19	0	19		0			
14	18	4	22		3.1	19	19	0	19		0			
15	18	4	22		3.1	19	19	0	19		0			
16	18	4	22		3.0	19	19	0	19		0			
17	18	4	21		3.0	18	18	0	18		0			
18	53	4	57		4.0	22	22	24	46		47			
19	60	3	63		5.0	26	26	36	63		72			
20	22	3	25		3.4	20	20	4	24		7			
21	17	3	20		3.0	18	18	0	18		0			
22	17	3	20		3.1	18	18	0	18		0			
23	16	3	20		2.9	17	17	0	17		0			
24	16	3	19		2.7	15	15	0	15		0			
25	15	3	18		2.7	14	14	0	14		0			
26	13	3	16		2.5	11	11	0	11		0			
27	12	3	16		2.4	10	10	0	10		0			
28	12	3	16		2.3	10	10	0	10		0			
29	12	3	15		2.4	10	10	0	10		0			
30	12	3	15		2.3	9	9	0	9		0			
31	13	3	16		2.3	9	9	0	9		0			
Totals	667	119	787			601	601	64	665		126			

April															
Water Year 2008 - 2009															
	(1)	(2)	(1)+(2)			(3)	(4)	(5)	(4)+(5)		(5) X 1.98			-
	Source Stream Daily Flows					Robles Facility Daily Flows							Field Measurement	
	Matilija Ck	North Fork	Sum of Creek		Forebay	Fishway	VRNMO	Diversion	Total Inflow		Robles			
Apr-09	D/S Dam	Matilija Ck.	Flows		Avg. Depth	Ladder	Weir	Canal			Diversion		Matilija Creek	VRNMO
	(cfsd)	(cfsd)	(cfsd)		(ft)	(cfsd)	(cfsd)	(cfsd)	(cfsd)		(AF)		(cfsd)	(cfsd)
1	12	3	15		2.3	9	9	0	9		0			
2	11	3	14		2.2	8	8	0	8		0			
3	11	3	14		2.2	8	8	0	8		0			
4	11	3	14		2.1	7	7	0	7		0			
5	11	3	14		2.1	6	6	0	6		0			
6	10	3	13		2.1	6	6	0	6		0			
7	9	3	12		2.0	5	5	0	5		0			
8	9	3	12		2.0	5	5	0	5		0			
9	9	3	12		2.0	5	5	0	5		0			
10	9	3	12		2.0	6	6	0	6		0			
11	9	3	12		2.0	5	5	0	5		0			
12	9	3	12		1.9	4	4	0	4		0			
13	9	3	12		2.0	4	4	0	4		0			
14	9	3	12		1.9	4	4	0	4		0			
15	9	2	12		1.9	4	4	0	4		0			
16	9	2	12		1.9	4	4	0	4		0			
17	9	2	12		1.9	4	4	0	4		0			
18	9	2	12		1.8	4	4	0	4		0			
19	9	2	11		1.9	4	4	0	4		0			
20	9	2	11		1.8	4	4	0	4		0			
21	9	2	11		1.8	4	4	0	4		0			
22	8	2	10		1.7	3	3	0	3		0			
23	8	2	10		1.7	3	3	0	3		0			

24	8	2	10		1.8	4	4	0	4		0			
25	8	2	10		1.8	4	4	0	4		0			
26	8	2	10		1.7	4	4	0	4		0			
27	8		8		1.8	4	4	0	4		0			
28	8		8		1.7	4	4	0	4		0			
29	8		8		1.7	3	3	0	3		0			
30	7		7		1.7	4	4	0	4		0			
Totals	278	63	341			145	145	0	145		0			

May														
Water Year 2008 - 2009														
	(1)	(2)	(1)+(2)			(3)	(4)	(5)	(4)+(5)		(5) X 1.98			-
	Source Stream Daily Flows					Robles Facility Daily Flows							Field Measurement	
	Matilija Ck	North Fork	Sum of Creek		Forebay	Fishway	VRNMO	Diversion	Total Inflow		Robles			
May-09	D/S Dam	Matilija Ck.	Flows		Avg. Depth	Ladder	Weir	Canal			Diversion		Matilija Creek	VRNMO
	(cfsd)	(cfsd)	(cfsd)		(ft)	(cfsd)	(cfsd)	(cfsd)	(cfsd)		(AF)		(cfsd)	(cfsd)
1	7		7		1.6	3	3	0	3		0			
2	7		7		1.5	3	3	0	3		0			
3	7		7		1.6	3	3	0	3		0			
4	7		7		1.5	3	3	0	3		0			
5	7		7		1.4	2	2	0	2		0			
6	7		7		1.4	2	2	0	2		0			
7	7		7		1.3	2	2	0	2		0			
8	7		7		1.3	2	2	0	2		0			
9	7		7		1.5	3	3	0	3		0			
10	7		7		1.5	3	3	0	3		0			
11	7		7		1.5	3	3	0	3		0			
12	7		7		1.5	3	3	0	3		0			

13	7		7		1.5	2	2	0	2		0			
14	7		7		1.4	2	2	0	2		0			3.2 cfs
15	7		7		1.4	2	2	0	2		0			
16	7		7		1.4	2	2	0	2		0			
17	7		7		1.4	2	2	0	2		0			
18	7		7		1.4	2	2	0	2		0			
19	7		7		1.4	2	2	0	2		0			
20	6		6		1.3	2	2	0	2		0			
21	6		6		1.2	1	1	0	1		0			
22	6		6		1.1	1	1	0	1		0			
23	6		6		1.1	1	1	0	1		0			
24	6		6		1.3	2	2	0	2		0			
25	6		6		1.3	2	2	0	2		0			
26	6		6		1.2	1	1	0	1		0			
27	6		6		1.2	1	1	0	1		0			
28	5	1	6		1.1	1	1	0	1		0			
29	5	1	6		1.1	0	0	0	0		0			
30	5	1	6		1.2	1	1	0	1		0			
31	5	1	6		1.2	1	1	0	1		0			
Totals	194	4	198			58	58	0	58		0			

June														
Water Year 2008 - 2009														
	(1)	(2)	(1)+(2)			(3)	(4)	(5)	(4)+(5)		(5) X 1.98			-
	Source Stream Daily Flows					Robles Facility Daily Flows							Field Measurement	
	Matilija Ck	North Fork	Sum of Creek		Forebay	Fishway	VRNMO	Diversion	Total Inflow		Robles			
Jun-09	D/S Dam	Matilija Ck.	Flows		Avg. Depth	Ladder	Weir	Canal			Diversion		Matilija Creek	VRNMO
	(cfsd)	(cfsd)	(cfsd)		(ft)	(cfsd)	(cfsd)	(cfsd)	(cfsd)		(AF)		(cfsd)	(cfsd)
1	5	1	6		1.1	1	1	0	1		0			

2	5		5		1.1	0	0	0	0		0			
3	5		5		1.1	0	0	0	0		0			
4	5		5		1.0	0	0	0	0		0			
5	5	1	6		1.0	0	0	0	0		0			
6	5	1	6		1.1	0	0	0	0		0			
7	5	1	6		1.1	0	0	0	0		0			
8	5	1	6		1.1	0	0	0	0		0			
9	5	1	6		1.1	0	0	0	0		0			
10	5	1	6		1.1	0	0	0	0		0			
11	5	1	6		1.1	0	0	0	0		0			
12	5	1	6		1.2	1	1	0	1		0			
13	5	1	6		1.2	1	1	0	1		0			
14	5	1	6		1.1	1	1	0	1		0			
15	5	1	6		1.2	1	1	0	1		0			
16	5	1	6		1.1	1	1	0	1		0			
17	5	1	6		1.0	0	0	0	0		0			
18	5	1	6		1.0	0	0	0	0		0			
19	5	1	6		1.0	0	0	0	0		0			
20	5	1	6		1.0	0	0	0	0		0			
21	5	1	6		1.1	0	0	0	0		0			
22	5	1	6		0.9	0	0	0	0		0			
23	5	1	6		1.0	0	0	0	0		0			
24	5	1	6		1.1	1	1	0	1		0			
25	5	1	6		1.0	1	1	0	1		0			
26	5	1	5		0.9	0	0	0	0		0			
27	5	1	5		0.9	0	0	0	0		0			
28	5	1	6		0.8	0	0	0	0		0			
29	5	1	5		0.8	0	0	0	0		0			
30	5	1	5		0.8	0	0	0	0		0			
Totals	150	20	169			7	7	0	7		0			