

# Annual Summary of Redd Surveys in the Ventura River Basin for 2015-2016

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## **ABSTRACT**

Southern California steelhead (*Oncorhynchus mykiss*) have experienced dramatic declines in population and distribution across their historical range resulting in their placement on the endangered species list in 1997. Due to sampling concerns related to the patchy distribution and low abundance, redd surveys were conducted as a complete census of available spawning habitat within the Ventura River watershed (designated as a high priority system for recovery action by the National Marine Fisheries Service). 117 redd surveys were conducted over a survey area comprising approximately 41 stream miles beginning on December 9, 2016 and ending on June 6, 2016. Persistent drought conditions resulted in depressed rainfall, streamflow, and limited connectivity throughout basin. A total of 23 redds and 208 individual *O. mykiss* were observed over the course of the survey period. All observed redds were located in the upper reaches of the watershed and are believed to be products of resident individuals based on physical redd dimensions and spatial distribution.

## INTRODUCTION

A dramatic decline in southern California steelhead (*Oncorhynchus mykiss*) populations over the past century, due primarily to anthropogenic factors, resulted in the southern California distinct population segment (DPS) being listed under the Endangered Species Act (ESA) in 1997. Recovery of the species, as outlined in the ESA mandated recovery plan (NMFS 2012), aims to ensure the long-term persistence of viable, self-sustaining populations of anadromous *O. mykiss* across the DPS. Guidelines for implementation of monitoring called for in the NMFS recovery plan were put forth in Fish Bulletin 180 (Adams et al. 2011; NMFS 2012).

Low numbers and patchy distribution of spawning southern California *O. mykiss* preclude traditional random, spatially balanced surveys due to the large variances and little statistical power that would accompany associated abundance estimates (Adams et al. 2011). To address these challenges, monitoring in the Southern California currently focuses on conducting a complete census of the high priority watersheds as designated in the recovery plan (Adams et al. 2011). These priority watersheds (referred to as Core 1 systems) were identified as having the highest priority for recovery based on a number of factors including environmental conditions and the intrinsic potential of present *O. mykiss* populations (NMFS 2012).

Redd surveys may provide an index of the effective population size and when conducted on a complete census of available spawning reaches provide the best available means of obtaining spatial and temporal redd data for target watersheds (Gallagher 2007). Additionally, *O. mykiss* is the only salmonid present in the southern California region making species apportionment practices unnecessary. Redd surveys were conducted as a complete census of potential spawning habitat within the Ventura basin during the 2015-2016 survey season.

Surveyed reaches included areas above the Matilija Dam with known resident populations. Recent genetics data suggest a great deal of interplay between resident and anadromous life histories (Abadía-Cardoso 2016; Clemento et al. 2008). In light of these findings, and in anticipation of the Matilija Dam's removal, there is a need to assess resident spawning activity before these populations are reincorporated into anadromous waters. Further research is still needed to gain better understanding of potential resident contributions to anadromous life histories in the Ventura River basin.

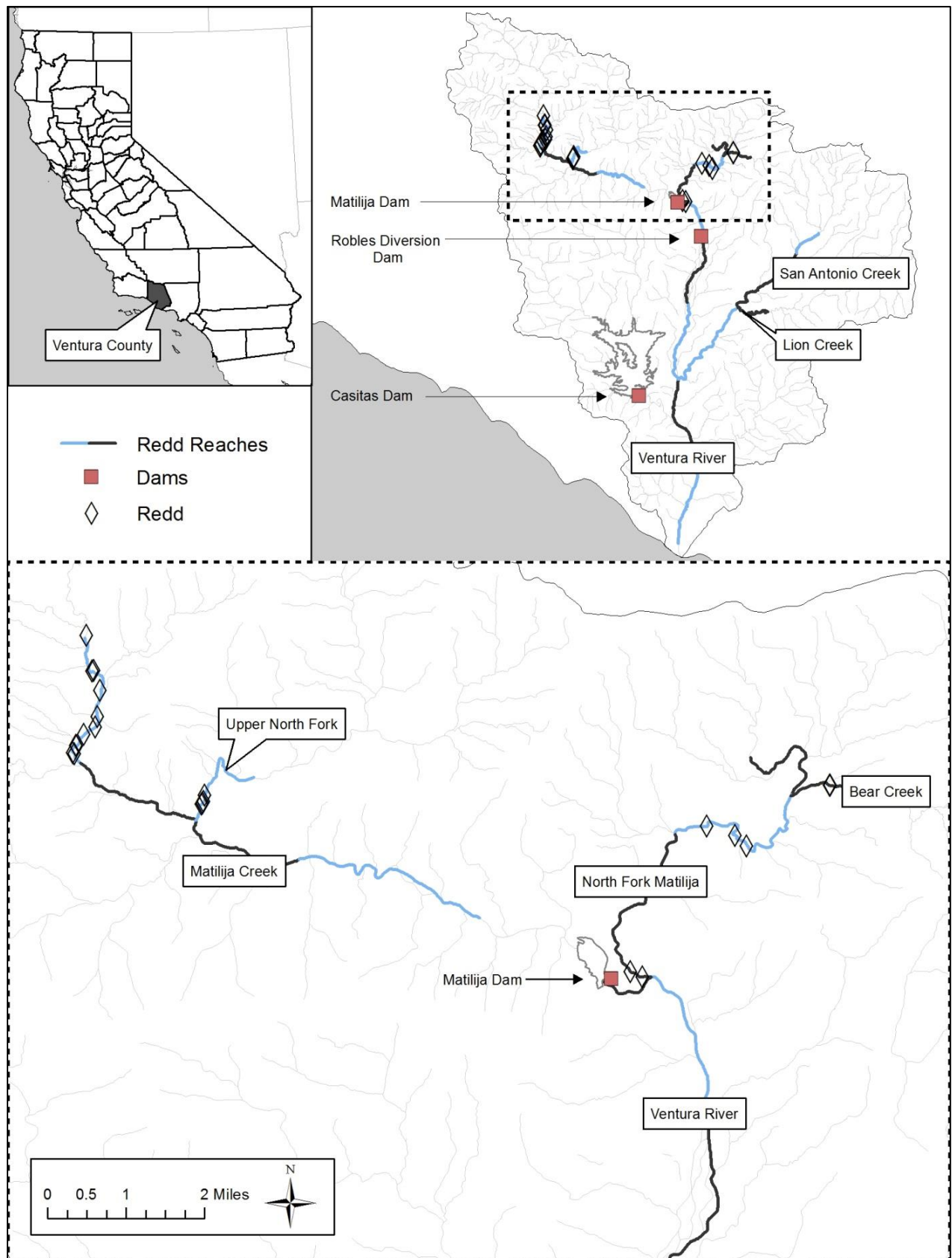
In conjunction with basin wide redd surveys, a fixed counting station (using sonar cameras) was operated on the lower Ventura River main stem to estimate anadromous adult *O. mykiss* escapement. Escapement estimates in concert with a census of redds throughout the watershed could be used to validate the utility of redd surveys in estimating abundance of anadromous *O. mykiss* in Southern California.

## METHODS AND MATERIALS

### Survey Area

The Ventura River watershed, a Core 1 system, is dominated by mountainous interior high peak elevations before flowing across a lower elevation coastal terrace and reaching the Pacific Ocean (NMFS 2012). It drains approximately 227 square miles and contains approximately 35 miles of anadromous water. Both the Casitas and Matilija dams act as total barriers to steelhead passage and prevent migration to upper watershed spawning and rearing habitat (Figure 1). The Robles Diversion is located on the Ventura main stem 1.5 miles downstream of the confluence of Matilija and North Fork Matilija Creeks and diverts flow from the Ventura River to Lake Casitas. The Robles diversion dam contains a fish-passage facility; however, the degree to which it alters natural migration rates has yet to be determined (NMFS 2012).

**Figure 1:** Map of survey reaches and redd locations in the Ventura River basin during the 2015-2016 spawning season. The section of Upper Matilija Creek immediately upstream of the dam was not surveyed due to a lack of available spawning habitat.



## Reach Survey Protocol

Spawning ground surveys were conducted following protocols adapted from Gallagher et al. (2007). Surveys were conducted on 17 reaches covering approximately 41 stream miles of potential spawning habitat (Figure 1). Reaches were selected based on known and historical *O. mykiss* presence. Reaches were designed to be completed in a single day and began and ended at easily identifiable landmarks (e.g. bridges or stream confluences) to reduce sampling confusion. Individual reaches were surveyed every 10-14 days based on staffing availability.

Teams of two surveyors, covering an average distance of 2.81 miles, walked stream reaches in an upstream direction when stream flows, weather, and staffing levels permitted. All fish observed, live or dead, were identified to species and sex when possible. Live *O. mykiss* observations were assigned a size class (2 inch size bins), location, and stage. *O. mykiss* carcasses were collected, noting the location, condition of the specimen, total and fork length and date, before being transferred to the NMFS for further analysis.

Newly discovered redds were measured for pot and tail spill dimensions, substrate size, and pot depth relative to the surrounding area. Redds were identified with a flag denoting redd record number, distance and bearing from the flag location, date identified, agency, and the redd age (1: New since last survey, 2: Previously identified and still measureable, 3: No longer measureable but still visible, 4: No redd apparent, only flag). When applicable (redd age 1 or 2 and/or a change in tail spill length) redds were re-measured by subsequent surveys.

Special status species were noted by survey teams when observed. Species of interest included California Red-legged Frogs (*Rana draytonii*), Southern Western Pond Turtles (*Actinemys pallida*), and Two-striped Gartersnake (*Thamnophis hammondi*). These observations were recorded opportunistically.

## Results

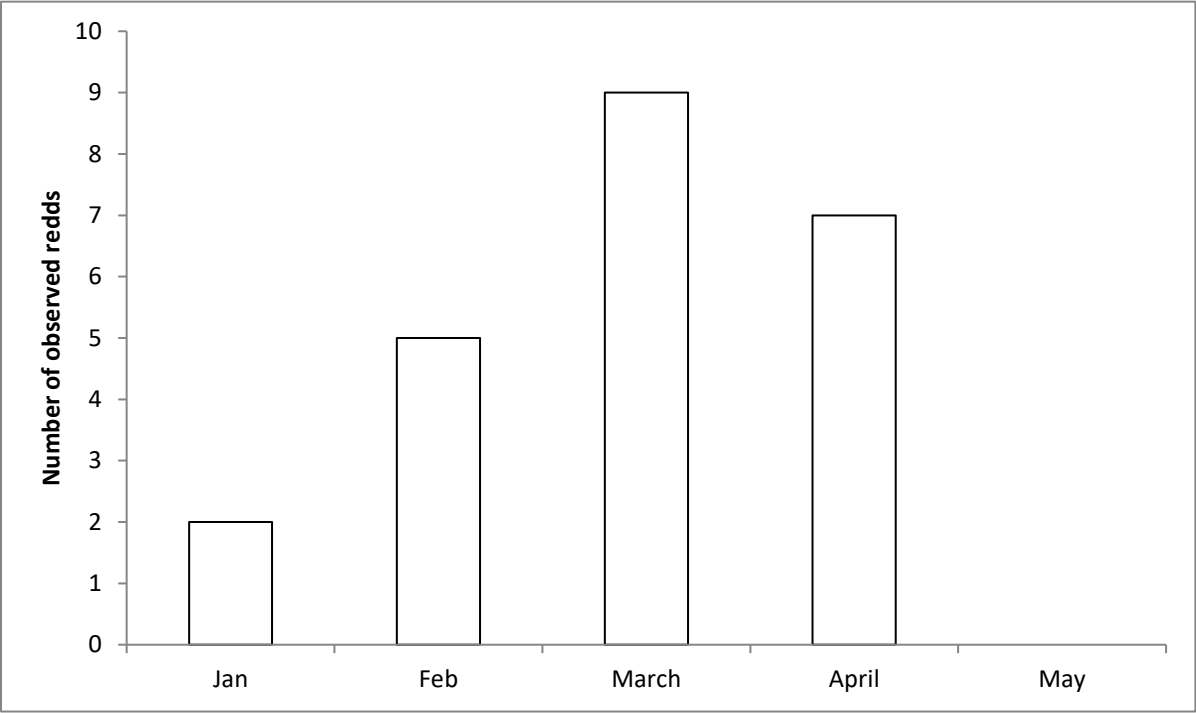
117 redd surveys were conducted over 17 reaches during the 2015-2016 spawning season. A total of 23 redds were observed with the first of the season identified on January 12, 2016 (Figure 1). 20 out of the 23 redds were subsequently identified on later surveys. New redds were identified over 4 months with peak spawning activity recorded during the month of March (9 redds observed) (Figure 2). A summary of redd measurements is provided below (

Table 1). Redd life (i.e., the duration of time redds remained detectable) ranged from 13 to 83 days with an average of 35 days.

Redds were located over 6 reaches, all of which are contained in the upper watershed. 16 of the 23 redds were located above the Matilija Dam in non-anadromous waters. The remaining 7 redds were spread amongst 3 redd reaches all contained in the North Fork Matilija Creek subbasin (North Fork Matilija Creek 1, North Fork Matilija Creek 2, and Bear Creek).

Bankside observations totaled 208 *O. mykiss*, the majority of which occurred in the uppermost reach of Upper Matilija Creek (59% of all observations) (Figure 3). Individuals were not marked or tagged resulting in the potential for redundant counts. Observations were only recorded when positive identifications could be made.

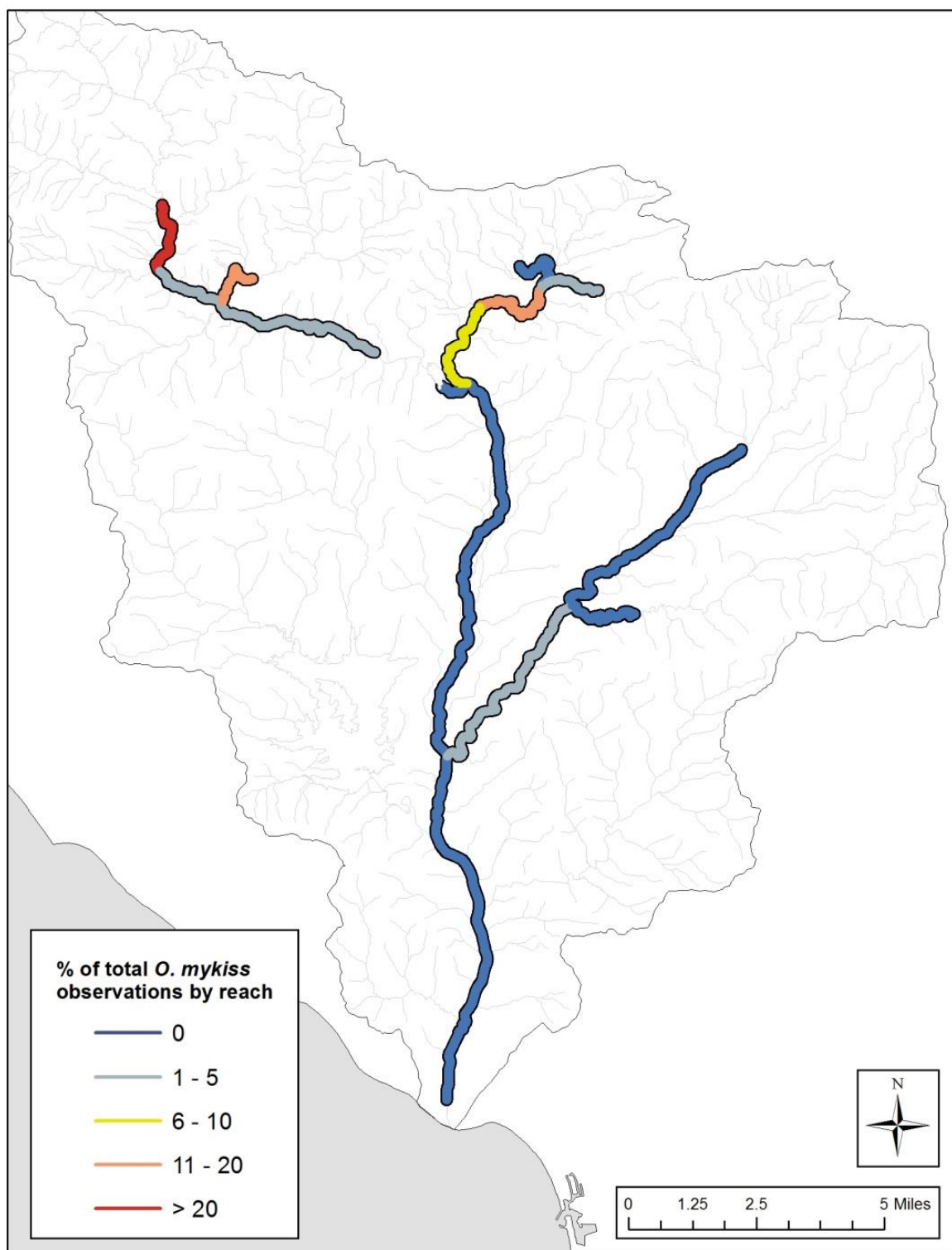
**Figure 2:** Initial observation of redds by month.



**Table 1:** Summary of dimensions for observed redds in the Ventura River basin.

Redd Dimensions (cm)	Minimum	Maximum	Average
Total Length	33.0	100.0	64.0
Pot Length	19.0	40.0	28.8
Tail Spill Length	14.0	60.0	35.2
Pot Depth	1.6	8.0	4.7
Tail Spill Width 1	13.0	40.0	27.1
Tail Spill Width 2	10.0	30.0	18.7
Pot Substrate	0.8	3.1	1.8
Tail Spill Substrate	0.3	2.0	0.8

**Figure 3:** Percentage of total 2015-2016 *O. mykiss* observations by reach.

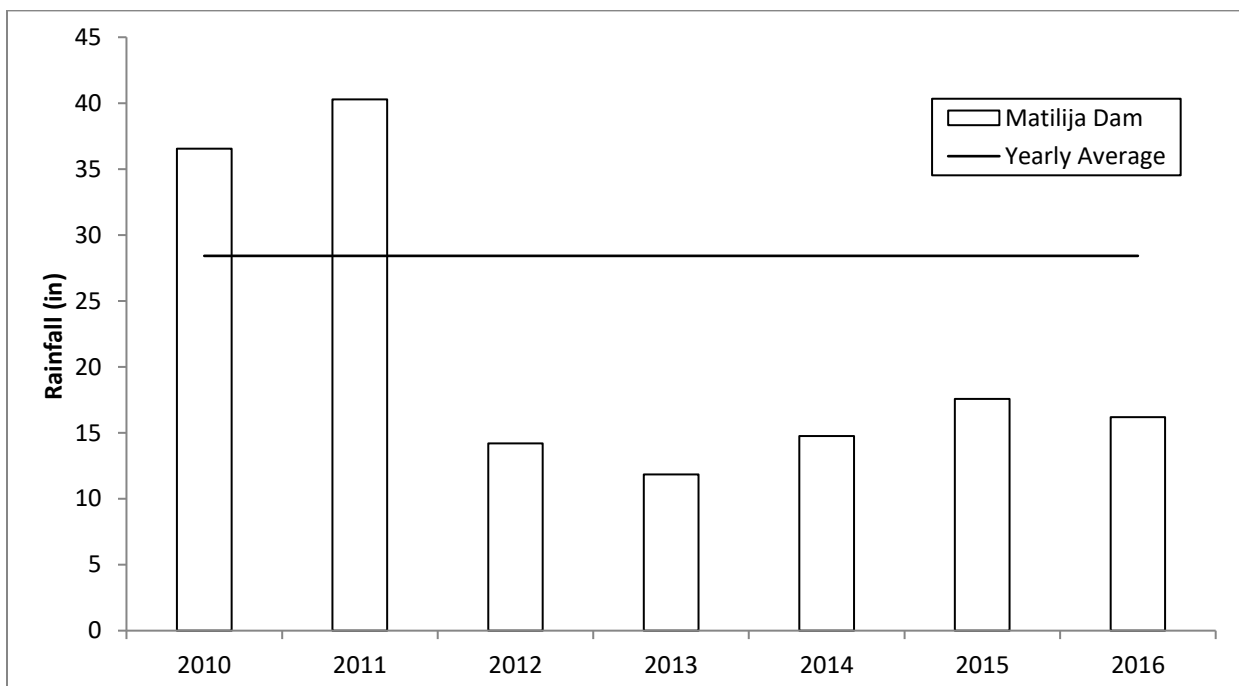


## DISCUSSION

The 2015-2016 spawning season was characterized by limited rainfall and low flow conditions stemming from a longstanding, severe drought (Figure 4). During the 2015-2016 spawning season only three rain events generated flows sufficient to bridge migration corridors separating the lower and upper watershed (Figure 5). Flows generated in each event were short lived; subsequently spawning grounds in the upper watershed remained disconnected for the vast majority of the spawning season. Spawning grounds exist in the lower watershed, primarily in San Antonio Creek, but no redds were identified. Redd detection in the lower watershed may have been affected by persistent high turbidity, heavy instream vegetation, and brought on by low flow conditions observed throughout the survey season.

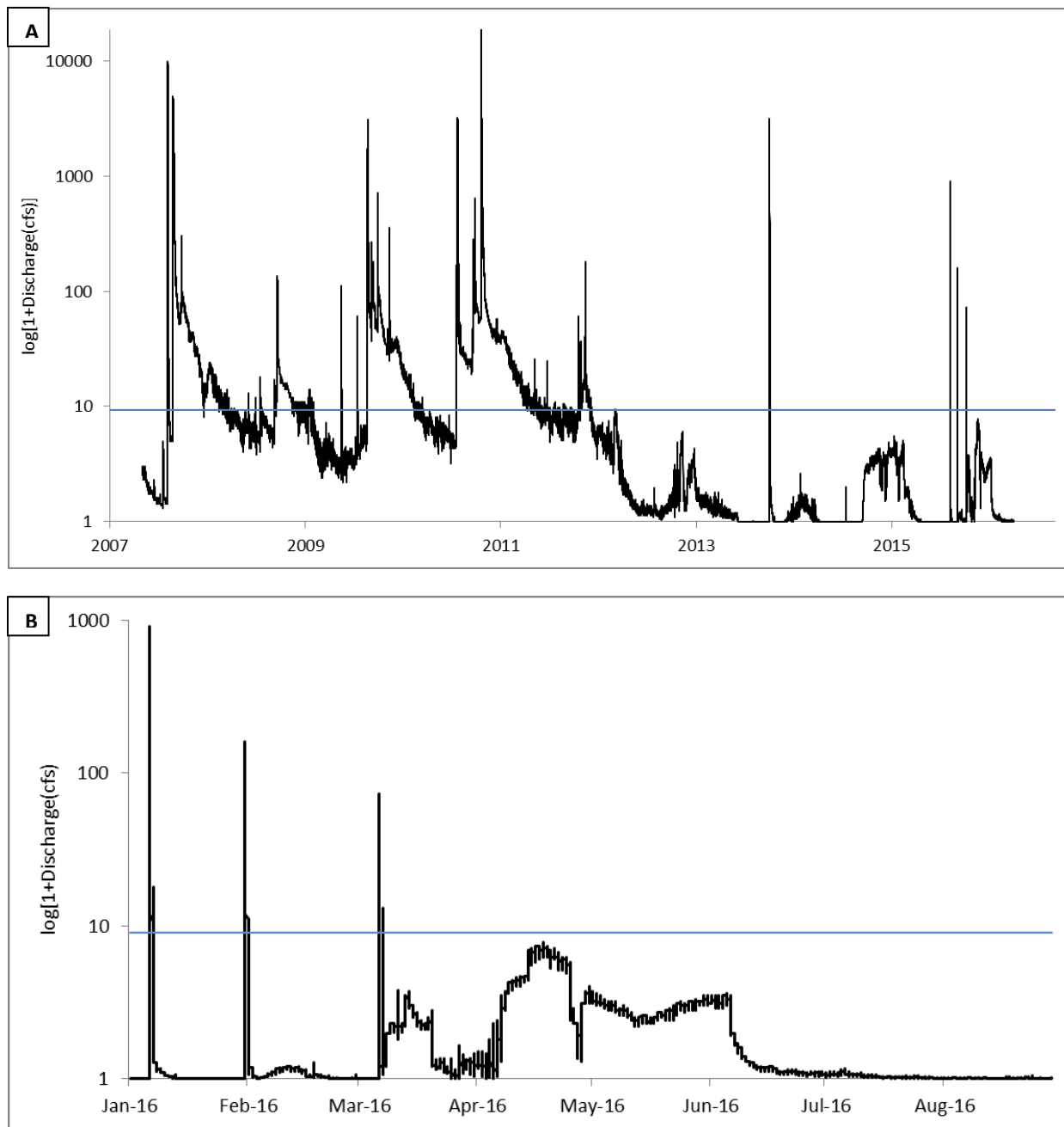
Given the limited opportunity for anadromous migration, in addition to the location and relatively small size of observed redds, we believe the seven redds located in anadromous reaches to be the products of resident *O. mykiss* (Zimmerman 2000). Additionally, Dual Frequency Identification Sonar (DIDSON) and Adaptive Resolution Imaging Sonar (ARIS) cameras, deployed in the Ventura River during each flow event, recorded no migrating, anadromous *O. mykiss*. These data suggest that no anadromous *O. mykiss* spawning occurred in the Ventura River basin during the 2015-2016 study period.

**Figure 4:** Yearly rainfall recorded at the Matilija Dam rain gauge (34.4838, -119.30572) operated by the Ventura County Watershed Protection District. The yearly average is based on rainfall data collected between 1949 and 2010.





**Figure 5:** Hydrographs depicting recorded discharge of the Ventura River from USGS stream gauge located at 34.352465°, -119.307823°, approximately one mile upstream of the Ventura River DIDSON site. (A) Flow data for 2007 through 2016 highlighting the downward trend in observed flows beginning in 2012. Ten cubic feet per second (cfs), denoted by the blue line, is the approximate threshold for steelhead migration and DIDSON deployment. (B) 2016 flow data for the USGS Ventura River stream gage. Only three storm events generated flows exceeding 10 cfs.



## **ACKNOWLEDGEMENTS**

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