

**YELLOW-BILLED CUCKOO SURVEYS IN THE SOUTH FORK KERN RIVER  
VALLEY IN 2010**

*Final Report*



Photo by A. Fasoli

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## **Executive Summary**

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In 2010, we conducted comprehensive surveys for Yellow-billed Cuckoos in riparian habitat along the South Fork of the Kern River in the Kern River Valley, CA. We had a total of 71 detections, across four survey periods during the Yellow-billed Cuckoo breeding season (mid-June to mid-August). The majority of our detections (68 of the 71) were on the South Fork Wildlife Area, which is located at the west end of the South Fork Kern River where it enters Lake Isabella. We had 3 detections at the Kern River Preserve and no detections at the Canebrake Ecological Reserve.

The South Fork Kern River Valley continues to be an important area for breeding Yellow-billed Cuckoos. Because local cuckoo populations fluctuate drastically from one year to the next, continued surveys are vital to understanding its use by Yellow-billed cuckoo populations. The SFKRV presents a unique opportunity to better understand the habitat characteristics that promote cuckoo occupancy within a relatively small geographic area. Lake Isabella water levels appear to influence local Yellow-billed Cuckoo distribution and numbers, but the exact mechanism (habitat structure, food, availability of nest sites, etc.) by which this occurs remains unclear.

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# **Yellow-billed Cuckoo Surveys**

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## **INTRODUCTION**

The Yellow-billed Cuckoo (*Coccyzus americanus*) is a neotropical migrant that historically bred throughout most of the continuous United States (Hughes 1999). In the western U.S., Yellow-billed Cuckoo range and population numbers have declined dramatically during the past 100 years and the cuckoo has been nearly extirpated from much of its historic range (including Washington, Oregon, Idaho, and Nevada) (Laymon and Halterman 1987, Hughes 1999). These declines are largely attributed to loss of riparian habitat and have resulted in interest by state and federal agencies, and private conservation organizations to monitor western populations. In turn, the Yellow-Billed Cuckoo has been listed as: (1) endangered by the California Department of Fish and Game; (2) a Species of Special Concern by the Arizona Game and Fish Department; (3) a sensitive species by the U.S. Forest Service; and (4) a candidate for Federal Endangered Status by the U.S. Fish and Wildlife Service.

Once considered a common breeder in California, the Yellow-billed Cuckoo suffered severe population reduction (Grinnell and Miller 1944) by 1940 and in 1987 was estimated to occupy only 30 percent of its historical range (Laymon and Halterman 1987a). California statewide surveys conducted in 1977 (Gaines and Laymon 1984), 1986/1987 (Laymon and Halterman 1987b), and 1999 (Halterman et. al 2001) found Yellow-billed Cuckoo populations were concentrated mostly along the Sacramento River from Red Bluff to Colusa, along the South Fork of the Kern River, and portions of the Lower Colorado River. Population estimates on the Sacramento and Kern Rivers from the 1999 surveys were similar to those of the 1986/1987 surveys, but lower when compared to the 1977 survey. The populations on the Lower Colorado River appeared to suffer severe declines in the 12 years from the 1986/87 to the 1999 surveys, but have increased since then (McNeil et al. 2011). The Kern and Sacramento Rivers contain riparian habitat characterized by high canopy cover, fairly extensive understory, and structural diversity, characteristics thought to be important of Yellow-billed Cuckoo breeding habitat

(Laymon and Halterman 1989, Halterman 1991). These features may be largely responsible for the continued use of these sites by breeding cuckoos.

Research on the South Fork of the Kern River in California began in 1985 and continued for 18 years (Laymon and Halterman 1985, 1986, 1990; Laymon and Whitfield 1988; Laymon, et al. 1989, Laymon et al. 1997, Laymon and Williams 1999, 2002). This research was comprised of population estimates, breeding ecology, and cuckoo habitat associations. The estimated number of breeding pairs for each year fluctuated considerably over this time period with a low of three breeding pairs in 1987 and 1988 and a high of 24 pairs in 1992 (Table 1). These drastic changes over short temporal scales make it difficult to predict local Kern River populations from year to year. Before 2008, no surveys had been conducted on the Kern River since 2004.

During the 2008, 2009 and 2010 summer seasons, we conducted presence/absence surveys for Yellow-billed Cuckoos within the South Fork of the Kern River in the Kern River Valley, CA. Because cuckoos exhibit little territoriality, have large overlapping home ranges, and are quiet, secretive birds, it is difficult to accurately estimate their populations (Hughes 1999, Halterman 2002). The Southern Sierra Research Station (SSRS) conducted comprehensive, repeatable surveys for Yellow-billed Cuckoos in all potentially suitable, riparian habitat within the South Fork of the Kern River. This report includes survey results of the South Fork Wildlife Area (SFWA), and Audubon California's Kern River Preserve (KRP). These data can be compared with past survey results and are essential in developing an effective management plan for the Yellow-billed Cuckoo.

Table 1. Estimated number of breeding Yellow-billed Cuckoo pairs in the Kern River Valley from 1985-2000.

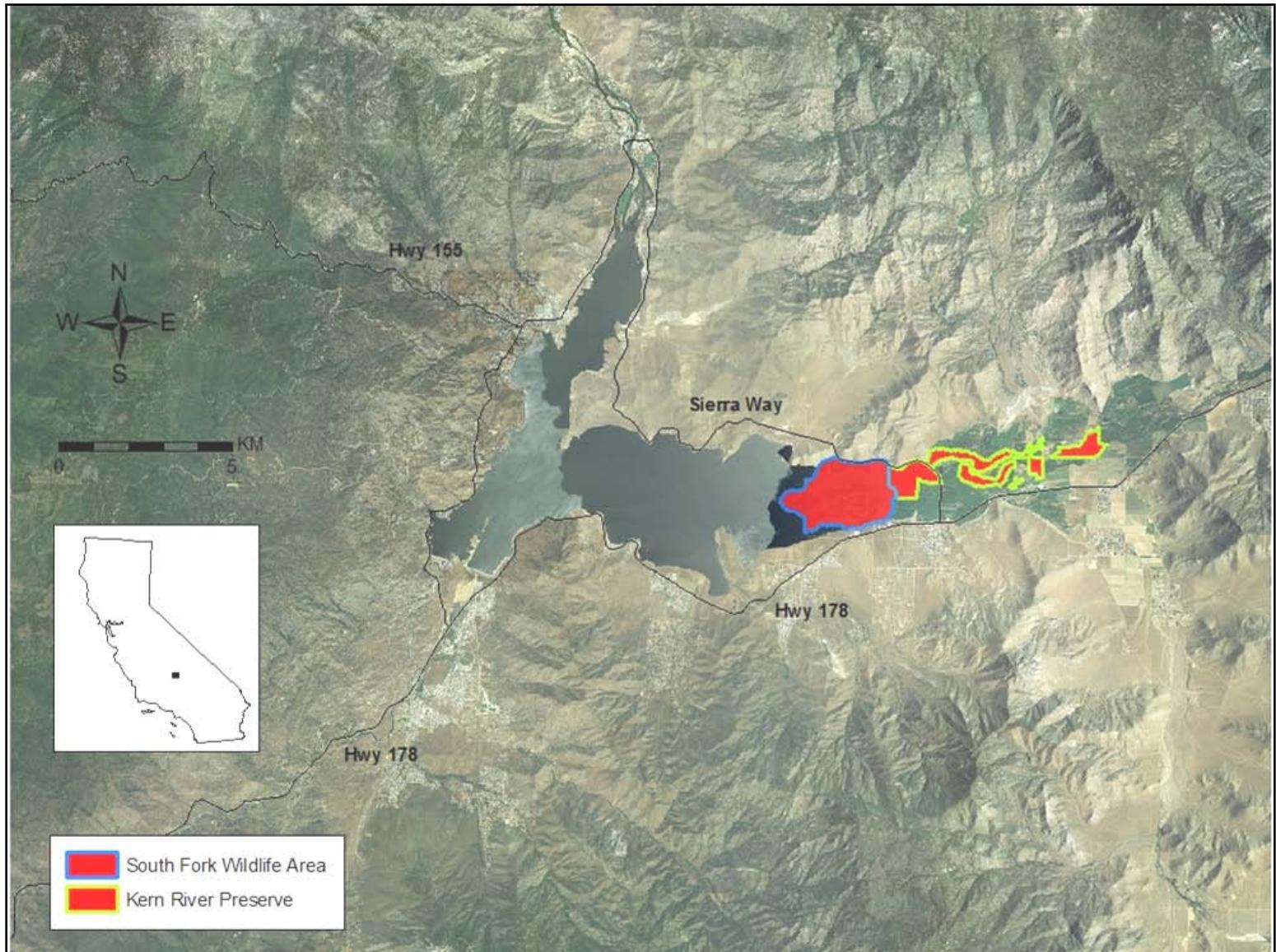
YEAR	Estimated No. pairs
1985	9
1986	9
1987	3
1988	3
1989	6
1990	2
1991	12
1992	24
1993	19
1994	19
1995	13
1996	14
1997	5
1998	10
1999	8
2000	12

## METHODS

### *Study Area*

The South Fork Kern River Valley (SFKRV) is located in south-central California in northern Kern County, in the southern foothills of the Sierra Nevada mountain range (Figure 1). The valley is characterized by mixed land-use of grazing/pasture, agriculture, human development, and native riparian forest. The study area we surveyed included the Audubon California's Kern River Preserve (KRP), and the U.S. Forest Service South Fork Wildlife Area (SFWA) located within the South Fork of the Kern River Valley, CA (Figure 1). The 3,300 acre riparian forest in the South Fork Kern River Valley is one of the largest remaining contiguous tracts of riparian habitat in California and one of the best remaining examples of a native deciduous riparian system in California. Populations of a number of bird species of concern are found on the South Fork Kern. Twelve of the 17 riparian focal species listed in the Riparian Habitat Joint Venture's (RHJV) bird conservation plan breed there, including the federally listed endangered Southwestern Willow Flycatcher, the California listed endangered Yellow-billed Cuckoo, the California Species of concern Tri-colored Blackbird, and the California species of concern, Yellow Warbler. The significance of this riparian habitat has led to its being named a Portfolio site by the RHJV.

Riparian vegetation in the South Fork Kern River Valley is dominated by red willow (*Salix laevigata*), Goodding's black willow (*Salix gooddingii*), Fremont cottonwood (*Populus fremontii*), and a variety of understory plants such as mule fat (*Baccharis salicifolia*), mugwort (*Artemisia douglasiana*), and hoary nettle (*Urtica dioica* ssp. *holosericea*). The forest also contains open areas of mule fat and hoary nettle, and marshes dominated by cattails (*Typha* spp.), broad fruited bur-reed (*Sparganium auricarnum*), and tules (*Schoenoplectus* spp.).



**Figure 1. Yellow-billed Cuckoo survey areas in the South Fork Kern River Valley, Kern Co., California in 2010.**

## ***Surveys***

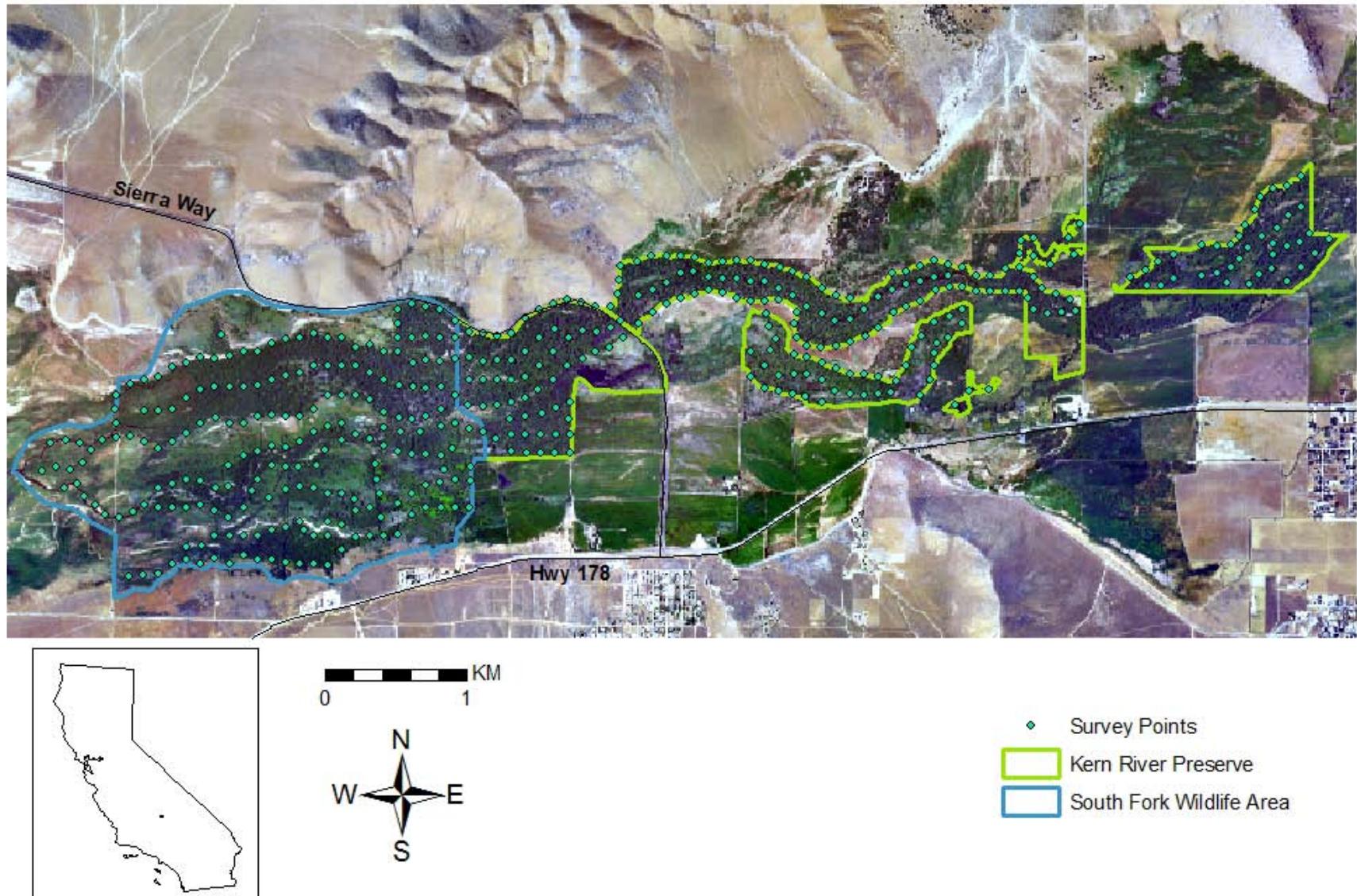
We followed the standardized Halterman et al. (2008) Yellow-billed Cuckoo survey protocol.

Prior to surveying, we plotted survey points on aerial photos and assigned GPS locations (UTM's) to all points. We plotted survey points every 100 meters along the edge of or within suitable habitat. Points were no farther than 15 m from forest edge and plotted in transect lines through habitat when it exceeded 200m in width (Figure 2). In 2009 and 2010, we expanded surveys from 2008 to include locations west of Patterson Lane, along the eastern edge of Lake Isabella (Figure 2).

We performed four complete surveys corresponding to recommended survey periods 1-4 (Halterman et al. 2008) at each site during the field season (mid June to mid August). We spaced surveys 12 to 20 days apart and all surveys took place between sunrise and 1200. Surveys were not conducted if winds exceed 8 mph, or if it was raining hard enough to make hearing difficult.

We used call-playback techniques for all surveys. We broadcast a “kowlp” call using a portable MP3 player attached to a small portable speaker powerful enough to broadcast the call approximately 100 m through vegetation. We arrived at the survey point and waited one minute to listen for unsolicited cuckoo calls (i.e., cuckoos that may be calling before broadcast of the calls). After the initial listening period, we broadcast five “kowlp” calls, spaced 1 minute apart. In the minute between calls, we listened and watched carefully for cuckoos. After the fifth and final “kowlp” we listened and watched an additional minute.

When we detected a cuckoo at a survey point, the broadcast was terminated. The UTM coordinates, time of detection, estimated distance and compass direction to the cuckoo, type of vocalization, and behavior were recorded on standardized data forms (modified from Halterman et al. 2008). We moved 300 m from the point of the cuckoo detection before conducting the next broadcast to avoid detecting the same cuckoo. All observations regarding individual movements, and possible detection of the same individual were recorded under the comment section of the datasheet.



**Figure 2. Yellow-billed Cuckoo survey points at the South Fork Wildlife Area and Kern River Preserve in Kern River Valley, Kern Co., California in 2010.**

For data interpretation and based on suggestions by Halterman et al. (2008), we classified a “detection” as any cuckoo detected at least 300 m apart during the same survey period.

### ***Occupancy Analyses***

We evaluated the application of Yellow-billed Cuckoo survey data to the most recent statistical advances in occupancy modeling (MacKenzie et al. 2005). Recent advances in statistical techniques based on presence-absence data use probabilistic arguments to derive probability of detection when it is <1 and to provide a model and likelihood-based method for estimating proportion of sites occupied. The sampling method consists of recording cuckoo detections or non-detections on multiple visits to sites during the season when a species is detectable. This establishes a detection history for each site which is used to generate probability of detection estimates, which can be used to account for individuals present, but never detected. We performed this analysis using the software program PRESENCE (URL: <http://www.mbr-pwrc.usgs.gov/software.html>). With these statistical techniques, we can model underlying variation in cuckoo occupancy within and between sites, and if surveys are continued in future years, within and between years. Currently, these analyses are a preliminary step in obtaining probability of detection and occupancy estimates which can easily be compared from year to year. Ultimately, with the future collection of habitat data, these applications could help us to better understand what habitat characteristics promote Yellow-billed Cuckoo occupancy.

### ***Nest Searching***

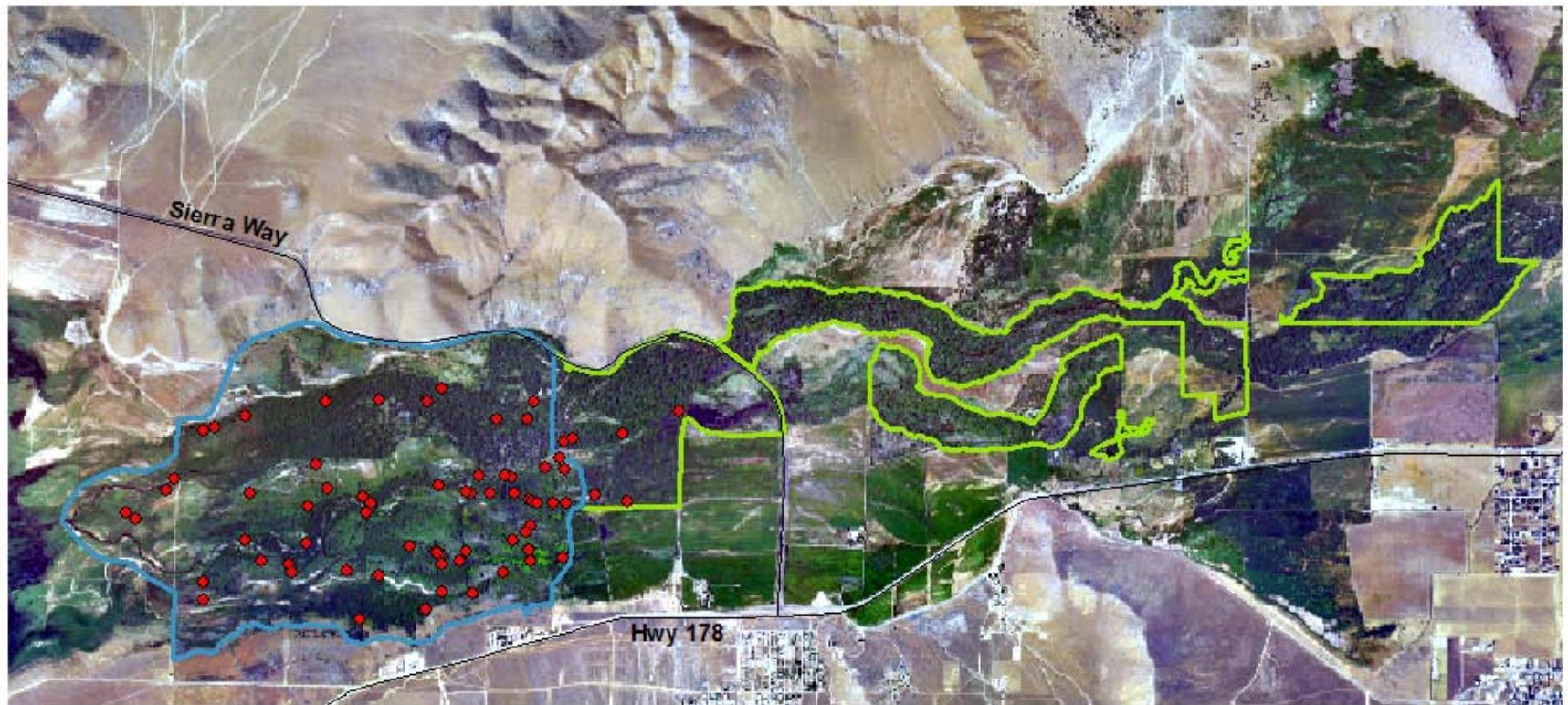
Although nest searching was not a primary objective of this study, we did note all nesting activity observed while surveying. We devoted some time to nest searching at the SFWA. Nest searching was done with two to three people working together and triangulating on vocalizations, which often occur at the nest. We attempted to maintain a minimum of 30 m distance from the area we suspected contained the nest. If a cuckoo began giving alarm calls (a soft “knock-knock-knock”), we left the area immediately and returned later (at least several hours) to resume searching. When we found a nest, we marked the GPS location a minimum of 10 m from the nest to avoid undue disturbance. A more accurate reading was taken later when the nest was inactive.

## RESULTS

We completed four surveys at all sites from 15 June to 10 August, 2010 for a total of 54 survey days and 286 survey hours. We had a total of 71 detections across all survey periods and sites in the South Fork Kern River Valley in 2010 (Table 2, Figure 3). Unlike in 2008, when we detected a high number of cuckoos only during the second survey period, we detected high numbers of Yellow-billed Cuckoos during the second, third, and fourth survey periods in 2010 (Table 2, Figure 4). In 2009, we detected 21 yellow-billed cuckoos in the second period, only slightly up from the 20 detections in the second period of 2008. We detected the lowest number of cuckoos during the first period which corresponds to when cuckoos first arrive and begin establishing nest sites (Halterman et al. 2008) and when cuckoos may also be less responsive to call broadcast.

Table 2. Number of Yellow-billed Cuckoo detections (cuckoos detected  $\leq$  300 m apart) for each survey period in 2010.

Survey Period	Survey dates	Number YBCU detections
1	15 June – 26 June	14
2	30 June – 10 July	20
3	14 July – 24 July	20
4	30 July – 10 Aug	17
Total Detections		71

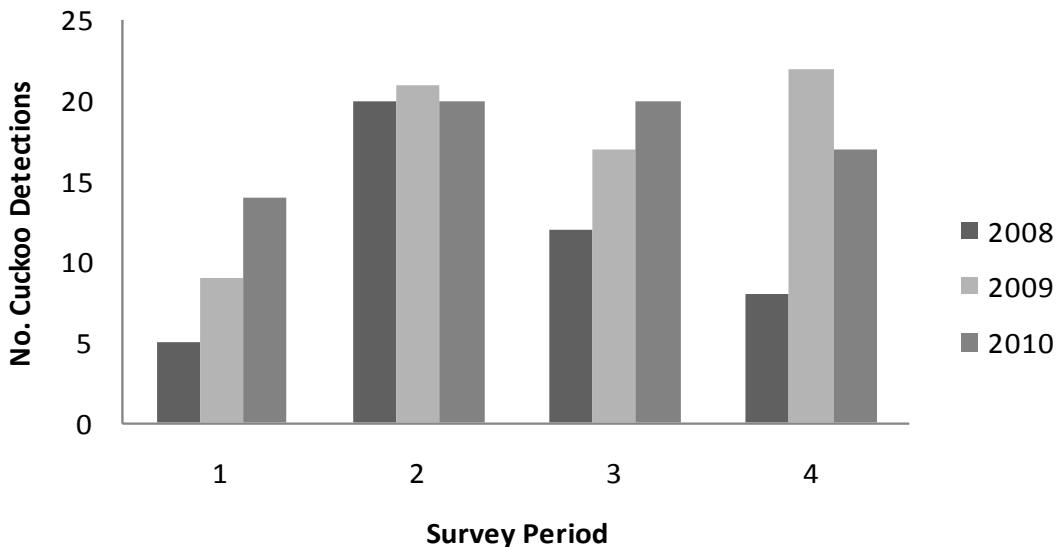


0 1 KM



- Cuckoo Detections
- Kern River Preserve
- South Fork Wildlife Area

**Figure 3. Yellow-billed Cuckoo detections at the South Fork Wildlife Area and Kern River Preserve in the Kern River Valley, Kern Co., California in 2010.**



**Figure 4. Number of Yellow-billed Cuckoo detections (Cuckoos detected  $\geq 300$  m apart) for each survey period in 2008 and 2009.**

We detected the majority of cuckoos at the SFWA (Table 3, Figure 3). Throughout the complete 2010 survey season, we had three detections outside of the SFWA on the KRP, less than the 11 from 2009, but the same as 2008.

**Table 3. Number of Yellow-billed Cuckoo detections (Cuckoos detected  $\geq 300$  m apart) at each survey area for each survey period in 2010.**

Survey Area	No. cuckoo detections				Total
	Period 1	Period 2	Period 3	Period 4	
Kern River Preserve	0	1	1	1	3
South Fork Wildlife Area	14	19	19	16	68

### Nests

In mid to late July, we spent approximately seven personnel days searching for Yellow-billed Cuckoo nests. We found one confirmed cuckoo nest and one potential nest, all located at the SFWA. The confirmed nest was active when found, but of indeterminable fate.

### ***Occupancy Analysis***

Using the Program PRESENCE, we obtained probability of detection estimates for each survey period (Table 4). Our detection estimates were different from 2008 and 2009. In general, they were more stable throughout the four survey periods than in 2008 or 2009. Probability of detection was consistently high for the second survey period for all three years, although it was the highest for period four in 2009. In addition, our estimates of the proportion of the area occupied for the SFWA and KRP were less in 2010 when compared to 2009, but not significantly so (Table 5). As expected from naïve detection numbers (not accounting for probability of detection), occupancy was highest at the South Fork Wildlife Area. Our overall estimate of proportion of sites occupied for all area surveyed was 0.53 in 2010, similar to 0.54 in 2009.

**Table 4. Detection probabilities for Yellow-billed Cuckoos for each survey period in 2008, 2009 and 2010.**

Survey Period	Probability of detection (SE)		
	2008	2009	2010
1	0.35 (0.13)	0.44 (0.12)	0.62 (0.12)
2	0.83 (0.11)	0.71 (0.11)	0.74 (0.11)
3	0.49 (0.13)	0.60 (0.12)	0.67 (0.11)
4	0.49 (0.13)	0.82 (0.09)	0.61 (0.12)

**Table 5. Occupancy estimates for Yellow-billed Cuckoos for each survey site in 2008, 2009 and 2010.**

Survey Site	Occupancy estimate (SE)		
	2008	2009	2010
SFWA	0.75 (0.10)	0.95 (0.07)	0.82 (0.10)
KRP	0.14 (0.09)	0.20 (0.11)	0.07 (0.06)
CER	0.00	0.00	n/a
All Sites	0.42 (0.09)	0.54 (0.09 )	0.53 (0.09)

## **DISCUSSION**

The South Fork Kern River Valley (SFKRV) has had a relatively stable population of breeding Yellow-billed Cuckoos for the past three years. Although we are not able to provide precise estimates of the number of breeding pairs in the SFKRV, the high number of detections suggests there were a relatively high number of cuckoos, especially in the SFWA. Over the past three years, there were no discernible patterns in the number of detections by survey period. The relatively high number of detections in the second survey period was the only consistent pattern during the three years. The number of detections in 2010 was slightly higher than in 2009, but it is difficult to determine if this represents an increase in Yellow-billed Cuckoo numbers.

Due to differences in past survey methods and a lack of current reporting methodologies, interpretation of Yellow-billed Cuckoo survey results can be difficult. In the SFKRV, previous research reported the estimated number of breeding pairs. Since we did not conduct comprehensive nest searches, we cannot provide accurate estimates of pair numbers.

One potential method of estimating Yellow-billed Cuckoo pairs is using the number of detections during the second survey period which typically corresponds to the peak in breeding season activity. M. Halterman (personal communication) has suggested that the number of cuckoo detections during the second survey period may be the best estimate of the number of breeding pairs, especially at locations like the Kern River Valley, where the majority of potential habitat is surveyed. This, however, may not be a good method because it can lead to an overestimate of cuckoo numbers. Sometimes two or more Yellow-billed Cuckoos are detected at one station and are counted as two or more detections. These would be counted as two pairs, when in reality it was one pair. In addition, when survey routes are close together (i.e. <300m apart), you could detect the same cuckoos on different days from adjacent survey routes. This too would lead to an overestimate of the Yellow-billed Cuckoo population. If this method was used on our study, then one would conclude that the number of cuckoos was the same for all three years, despite other evidence that indicate there were less cuckoos in 2008 than in 2009 and 2010. In addition, the second survey period may not correspond to the peak in breeding activity at all sites and across all years and therefore is probably not be the best estimate by which to interpret survey results. Researchers are currently working to develop consistent methods for

data interpretation and reporting that will hopefully make accurate comparisons between sites and with previous and future data possible.

Another potential method to interpret survey results is to use occupancy estimates. Rather than reporting only the number of detections, occupancy estimates incorporate a probability of detection and therefore account for those individuals present but never detected, providing a more accurate and robust occupancy estimate. Occupancy estimates are more easily compared from year to year and help account for years when there are high numbers of detections outside the second survey period, as we documented in 2010.

We used occupancy modeling for our 2008 to 2010 survey data to provide estimates of probability of detection and proportion of the area occupied (occupancy). In 2010, the overall estimate of the proportion of area occupied by Yellow-billed Cuckoos along the South Fork Kern River was 0.53, the same as 2009 and slightly higher than the 2008 estimate of 0.42. By site, occupancy also increased at both the South Fork Wildlife Area and the Kern River Preserve from the 2008 estimates. Probability of detection estimates were higher in 2009 and 2010, meaning that Yellow-billed Cuckoos were more likely to be detected in 2009 and 2010 than in 2008. This suggests that there were more cuckoos in 2009 and 2010 than in 2008.

Estimates of occupancy and probability of detection are useful in two primary ways. Modeling of occupancy and detection allows for the inclusion of covariate information, which we could use to help understand differences across survey sites and over multiple years. In 2009 and 2010, it appears that over 50 % of the area we surveyed was classified as occupied while taking probability of detection into account. That leaves a large portion of riparian habitat in the South Fork unoccupied. Currently, we do not have a clear understanding of why much of the Kern River Preserve and all of Canebrake Ecological Reserve (for 2008 and 2009) were unoccupied by Yellow-billed Cuckoos. Future collection of habitat information and food distribution at either the local or landscape scale could help to explain this variation. In addition, covariate information could be included to help understand the differences in probability of detection from 2008 to 2010.

Cuckoo distribution within the SFKRV is known to fluctuate from year to year and previous research suggests that as lake levels of Lake Isabella change, so do the locations of breeding Yellow-billed Cuckoos (Laymon and Halterman 1985, 1986, 1990; Laymon and Whitfield 1988; Laymon, et al. 1989, Laymon et al. 1997, Laymon and Williams 1999, 2002). It appears that when lake levels are low, most cuckoos are found in the SFWA. But as lake levels rise, cuckoos move east away from the lake and inhabit more of the KRP. Additionally, when lake levels are kept low for multiple years, the number of Yellow-billed Cuckoos appears to increase. The lake levels were relatively low in 2008 and 2009, and this may help explain the large occurrence of cuckoos in the South Fork Wildlife Area. However, the lake levels were moderate in 2010, but there were about the same number of Cuckoos as 2009. In the SFKRV, the specific characteristics that promote the shift in distribution and the apparent increase in cuckoo numbers remain unknown.

However, the age structure of the habitat may be a possible explanation for the shift in the Yellow-billed Cuckoo distribution in the SFKRV. Recent research on the Lower Colorado River and other areas indicate that Yellow-billed Cuckoos may need a heterogenous mixture of mature and young stands of native trees to fulfill both their foraging and nesting requirements (McNeil et al. 2011). The riparian habitat on the KRP tends to be dominated by older trees (i.e. >25 years old) and doesn't contain many stands of younger trees (i.e. >10 years). In contrast, the SFWA contains stands of multiple ages due to the numerous inundation events that have occurred the past 30 years. Thus, the cuckoos may have shifted into to SFWA due to the presence of both mature and young stands of trees.

## **CONCLUSIONS AND RECOMMENDATIONS**

The South Fork Kern River Valley continues to be an important area for breeding Yellow-billed Cuckoos. Because local cuckoo populations can fluctuate drastically from one year to the next, continued surveys are vital to understanding its use by Yellow-billed Cuckoo populations. The SFKRV presents a unique opportunity to better understand the habitat characteristics that promote cuckoo occupancy within a relatively small geographic area. Lake Isabella water levels appear to influence local Yellow-billed Cuckoo distribution and numbers, but the exact mechanism (habitat structure, food, availability of nest sites, etc.) by which this occurs remains

unclear. Since lake levels are expected to be kept at somewhat low levels for the next several years, future collection of survey and habitat data could allow us to examine if the numbers of cuckoos will remain high or even increase and what characteristics (i.e. habitat characteristics, food resources, available nesting sites) promote these changes. Detailed home-range analysis using radio telemetry could help us to understand specific habitat requirements and provide insight into utilization of food resources, two Yellow-billed Cuckoo research areas that require further understanding.

## **ACKNOWLEDGMENTS**

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**Appendix A. Summary of survey dates, surveyors, and Yellow-billed Cuckoo detections in 2010.**

Survey Area	Survey Period 1			Survey Period 2			Survey Period 3			Survey Period 4		
	Dates	Surveyors	Detections	Dates	Surveyors	Detections	Dates	Surveyors	Detections	Dates	Surveyors	Detections
Kern River Preserve	6/15,6/16, 6/17,6/18, 6/19,6/20, 6/21, 6/22	Nicholas Schmeding, Tim Schneider, Mary Whitfield	0	6/30,7/1, 7/2,7/3, 7/4, 7/5, 7/7	Nicholas Schmeding, Tim Schneider, Mary Whitfield	1	7/14, 7/15,7/16, 7/17,7/18, 7/21	Nicholas Schmeding, Tim Schneider, Mary Whitfield	1	7/30, 7/31, 8/4,8/6, 8/7,	Nicholas Schmeding, Tim Schneider	1
South Fork Wildlife Area	6/18,6/19, 6/21,6/22, 6/23,6/24, 6/25,6/26	Martina Pernicano, Nicholas Schmeding, Tim Schneider,	14	7/1, 7/5, 7/6,7/7, 7/8,7/9, 7/10	Martina Pernicano, Nicholas Schmeding, Tim Schneider	19	7/19, 7/20,7/21, 7/22,7/24	Martina Pernicano, Nicholas Schmeding, Tim Schneider	19	8/2,8/5, 8/7,8/9, 8/10	Nicholas Schmeding, Tim Schneider, Mary Whitfield	18