

**YELLOW-BILLED CUCKOO SURVEYS IN THE SOUTH FORK KERN RIVER  
VALLEY IN 2009**

*Final Report*



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**U.S Fish and Wildlife Service  
Sacramento Office**

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## **Executive Summary**

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In 2009, 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 69 detections, across four survey periods during the Yellow-billed Cuckoo breeding season (mid-June to mid-August). The majority of our detections (58 of the 69) 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 11 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 (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. 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 and 2009 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), Audubon California's Kern River Preserve (KRP), and the Canebrake Ecological Reserve (CER). 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.

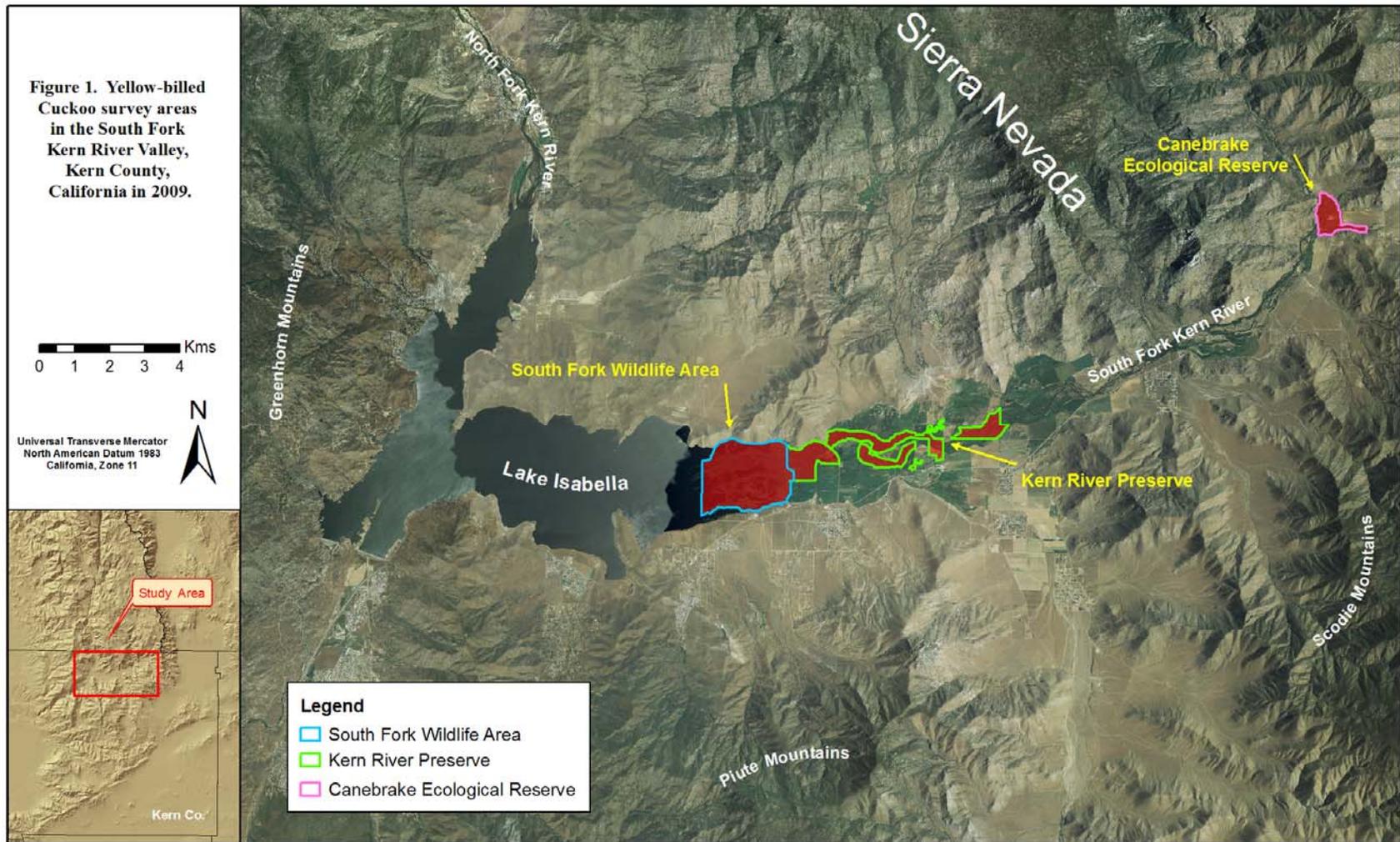
| <b>YEAR</b> | <b>Estimated No. pairs</b> |
|-------------|----------------------------|
| 1985        | 9                          |
| 1986        | 9                          |
| 1987        | 3                          |
| 1988        | 3                          |
| 1989        | 6                          |
| 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), the U.S. Forest Service South Fork Wildlife Area (SFWA), and the California Department of Fish and Game Canebrake Ecological Reserve (CER), all 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.).



## *Surveys*

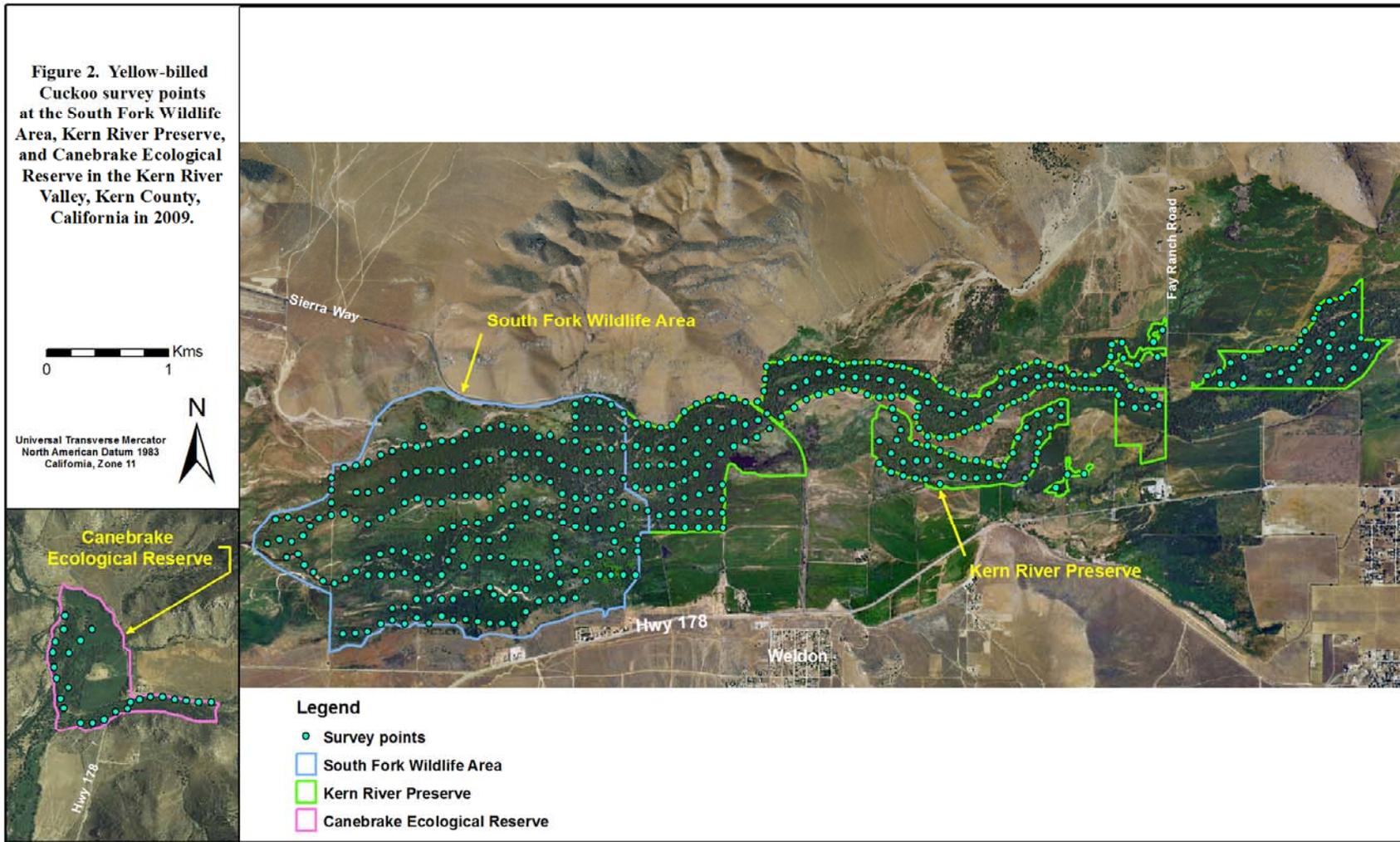
We followed the standardized Halterman et al. (2008) Yellow-billed Cuckoo survey protocol. Prior to surveying, we plotted survey points on aerial photos and assigned GPS locations (UTM's) to all points. We plotted survey points every 100 meters along the edge of or within suitable habitat. Points were 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, 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 (available from M. Halterman) 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, Kern River Preserve, and Canebrake Ecological Reserve in the Kern River Valley, Kern County, California in 2009.**



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. If we detected more than one cuckoo at a survey point, we counted it as only one detection in our survey results.

### ***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 presence or absence on multiple visits to sites during the season when a species is detectable. Information from individuals detected  $\geq 1$  time provides probability of detection estimates, which can be used to account for individuals never detected. Through the logit function, the model allows for the inclusion of covariate information, such as site characteristics (e.g., habitat type and patch size) that could influence both probability of detection and occupancy rates, and sampling characteristics (e.g., time of day or year and weather) that could affect probability of detection. 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 South Fork Wildlife Area and at one location in the Kern River Preserve. 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.

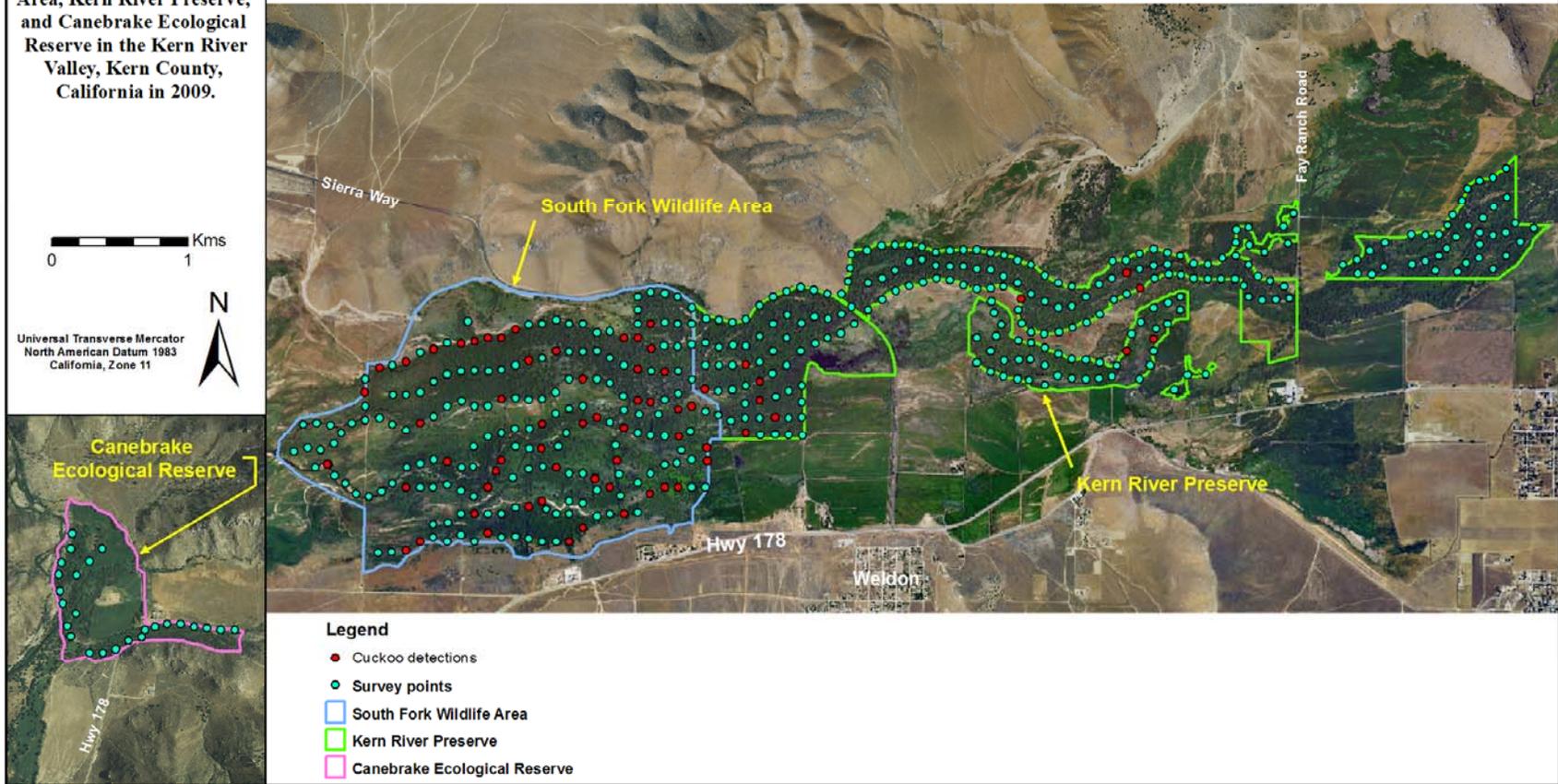
## RESULTS

We completed four surveys at all sites except the Canebrake Ecological Reserve from 15 June to 8 August, 2009 for a total of 52 survey days and 238 official survey hours. We surveyed Canebrake Ecological Reserve during the second and third survey periods which corresponds to the peak in Yellow-billed Cuckoo breeding activity and is when we expected to have the greatest probability of detecting cuckoos. We had a total of 69 detections across all survey periods and sites in the South Fork Kern River Valley in 2009 (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 2009 (Table 2, Figure 4). M. Halterman (personal communication) has suggested that the number of cuckoo detections during the second survey period which corresponds to the peak in breeding season activity 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. 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 2009.

| Survey Period    | Survey dates      | Number YBCU detections |
|------------------|-------------------|------------------------|
| 1                | 15 June – 25 June | 9                      |
| 2                | 02 July – 11 July | 21                     |
| 3                | 17 July – 29 July | 17                     |
| 4                | 01 Aug – 08 Aug   | 22                     |
| Total Detections |                   | 69                     |

**Figure 3. Yellow-billed Cuckoo detections at the South Fork Wildlife Area, Kern River Preserve, and Canebrake Ecological Reserve in the Kern River Valley, Kern County, California in 2009.**



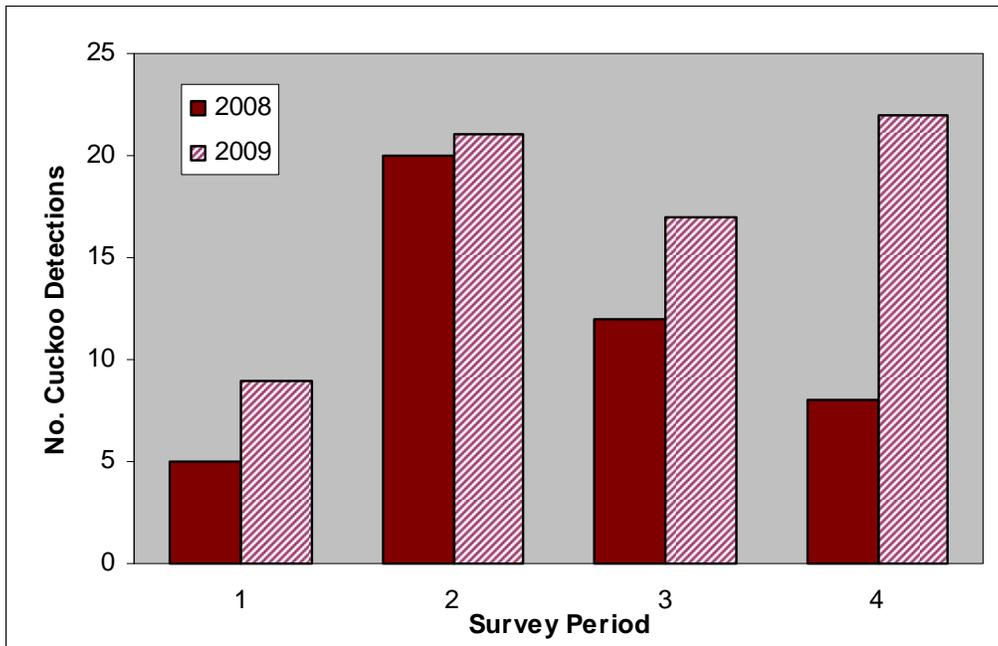


Figure 4. Number of Yellow-billed Cuckoo detections (Cuckoos detected  $\geq 300$  m apart) for each survey period in 2008 and 2009.

We detected the majority of cuckoos at the South Fork Wildlife Area (Table 3, Figure 3). Throughout the complete 2009 survey season, we had 11 detections outside of the South Fork Wildlife Area on the Kern River Preserve, up from the three cuckoo detections we had in the Kern River Preserve in 2008. We did not detect any cuckoos at the Canebrake Ecological Reserve.

Table 3. Number of Yellow-billed Cuckoo detections (Cuckoos detected  $\geq 300$  m apart) at each survey area for each survey period in 2009.

| Survey Area                  | <u>No. cuckoo detections</u> |          |          |          | Total |
|------------------------------|------------------------------|----------|----------|----------|-------|
|                              | Period 1                     | Period 2 | Period 3 | Period 4 |       |
| Kern River Preserve          | 1                            | 3        | 3        | 4        | 11    |
| South Fork Wildlife Area     | 8                            | 18       | 14       | 18       | 58    |
| Canebrake Ecological Reserve | n/a                          | 0        | 0        | n/a      | 0     |

## *Nests*

In mid to late July, we spent approximately 10 personnel days searching for Yellow-billed Cuckoo nests. We found two confirmed cuckoo nests and one potential nest, all located at the South Fork Wildlife Area. The two confirmed nests were active when found, but of indeterminable fate. We also confirmed the presence of juvenile Yellow-billed Cuckoos at two additional locations in the South Fork Wildlife Area.

## *Occupancy Analysis*

Using the Program PRESENCE, we obtained probability of detection estimates for each survey period (Table 4). Overall, our detection estimates were higher in 2009 than in 2008. In contrast to 2008, when probability of detection was highest for the second survey period, our estimates were high in the second, third, and fourth survey periods in 2009. In addition, our estimates of the proportion of the area occupied for each site and for all sites combined was higher in 2009 than in 2008 (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 0.54 in 2009, up from 0.42 in 2008.

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

| Survey Period | Probability of detection (SE) |             |
|---------------|-------------------------------|-------------|
|               | 2008                          | 2009        |
| 1             | 0.35 (0.13)                   | 0.44 (0.12) |
| 2             | 0.83 (0.11)                   | 0.71 (0.11) |
| 3             | 0.49 (0.13)                   | 0.60 (0.12) |
| 4             | 0.49 (0.13)                   | 0.82 (0.09) |

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

| Survey Site | Occupancy estimate (SE) |             |
|-------------|-------------------------|-------------|
|             | 2008                    | 2009        |
| SFWA        | 0.75 (0.31)             | 0.95 (0.07) |
| KRP         | 0.14 (0.16)             | 0.20 (0.11) |
| CER         | 0.00                    | 0.00        |
| All Sites   | 0.42 (0.09)             | 0.54 (0.09) |

## **DISCUSSION**

As in 2008, the South Fork Kern River Valley (SFKRV) continued to contain breeding Yellow-billed Cuckoos in 2009. 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 reasonable number of cuckoos, especially in the South Fork Wildlife Area. Based on the number of cuckoo detections during the second survey period, which typically corresponds to the peak of the cuckoo breeding season, the number of breeding pairs only slightly increased from 20 in 2008 to 21 in 2009. Across all survey periods, the number of detections in 2009 was higher than in 2008, but it is difficult to determine if this represents an increase in Yellow-billed Cuckoo numbers. In 2009, we had higher numbers of cuckoo detections at the Kern River Preserve than in 2008, which suggests an increase in cuckoo numbers at that site. As in 2008, in 2009 we had no detections at the Canebrake Ecological Reserve, suggesting this area was not utilized by breeding Yellow-billed Cuckoos.

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 Kern River Valley, previous research reported the estimated number of breeding pairs. Since we did not conduct comprehensive nest searches, it is difficult for us to provide such estimates. Researchers are currently working to develop consistent methods for data interpretation and reporting that will make accurate comparisons between sites and with previous and future data possible. As described above, one possible method to estimate the number of breeding pairs is to use the number of detections during the second survey period, but it is unclear how accurate this estimate is and how it could vary at different sites and across multiple years.

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, therefore providing a more accurate and robust 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 period, as we documented in 2009. The second survey period may not correspond to

the peak in breeding activity at all sites and across all years and therefore may not be the best estimate by which to interpret survey results.

We used occupancy modeling for our 2008 and 2009 survey data to provide estimates of probability of detection and proportion of the area occupied (occupancy). In 2009, the overall estimate of the proportion of area occupied by Yellow-billed Cuckoos along the South Fork Kern River was 0.54, up slightly from 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 also increased in 2009, meaning that Yellow-billed Cuckoos were more likely to be detected in 2009 than in 2008, especially during the third and fourth survey periods.

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, it appears that approximately 54 % 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 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 2009.

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 South Fork Wildlife Area. But as lake levels rise, cuckoos move east away from the lake and inhabit more of the Kern River Preserve. Additionally, when lake levels are kept low for multiple years, the number of Yellow-billed Cuckoos appears to increase. 2008 and 2009 were relatively low level years for Lake Isabella,

and this may help explain for the large occurrence of cuckoos in the South Fork Wildlife Area. Due to questions regarding the structural integrity of the dam at Lake Isabella, the Army Corps of Engineers plans to keep Lake Isabella lake levels low for the next several years. This may mean that cuckoo numbers could continue to be relatively high in the SFKRV in subsequent years as they continued to be in 2009. In the SFKRV the specific characteristics that promote the shift in distribution and the apparent increase in cuckoo numbers remain unknown.

## **CONCLUSIONS AND RECOMENDATIONS**

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 (food, availability of nest sites, etc.) by which this occurs remains unclear. Since lake levels are expected to be kept at 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. 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 2009.

| 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,<br>6/19,6/20,<br>6/21,6/22,<br>6/24 | Carlene<br>Henneman,<br>Martina<br>Pernicano,<br>Sean Roedl | 1          | 7/2,7/4,<br>7/5,7/6,<br>7/16  | Martina<br>Pernicano,<br>Sean Roedl                         | 4          | 7/17,7/18,<br>7/19,7/21,<br>7/29                     | Carlene<br>Henneman,<br>Martina<br>Pernicano,<br>Sean Roedl | 4          | 8/1,8/2,<br>8/3,8/5,<br>8/10 | Carlene<br>Henneman,<br>Martina<br>Pernicano,<br>Sean Roedl | 4          |
| South Fork Wildlife Area     | 6/20,6/21,<br>6/22,6/23,<br>6/25               | Carlene<br>Henneman,<br>Martina<br>Pernicano,<br>Sean Roedl | 8          | 7/7,7/8,<br>7/9,7/10,<br>7/11 | Carlene<br>Henneman,<br>Martina<br>Pernicano,<br>Sean Roedl | 19         | 7/18,7/21,<br>7/22,7/23,<br>7/24,7/25,<br>7/28, 7/29 | Martina<br>Pernicano,<br>Sean Roedl                         | 17         | 8/5,8/7,<br>8/8              | Carlene<br>Henneman,<br>Martina<br>Pernicano,               | 19         |
| Canebrake Ecological Reserve | n/a  |   |            | 7/10                          | Carlene<br>Henneman   | 0          | 7/19   | Carlene<br>Henneman   | 0          | n/a                          |   |            |