Western Riverside County
Multiple Species Habitat Conservation Plan (MSHCP)
Biological Monitoring Program

Riparian Bird Survey Report 2007

13 March 2008

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NOTE TO READER:

This report is an account of survey activities undertaken by the Biological Monitoring Program for the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP). The MSHCP was permitted in June 2004. The Biological Monitoring Program monitors the distribution and status of the 146 Covered Species within the Conservation Area to provide information to Permittees, land managers, the public, and the Wildlife Agencies (i.e., the California Department of Fish and Game and the U.S. Fish and Wildlife Service). Monitoring Program activities are guided by the MSHCP species objectives for each Covered Species, the information needs identified in MSHCP Section 5.3 or elsewhere in the document, and the information needs of the Permittees.

While we have made every effort to accurately represent our data and results, it should be recognized that our database is still under development. Any reader wishing to make further use of the information or data provided in this report should contact the Monitoring Program to ensure that they have access to the best available or most current data.

The primary preparer of this report was the 2007 Avian Program Lead, Matt Talluto. If there are any questions about the information provided in this report, please contact the Monitoring Program Administrator. If you have questions about the MSHCP, please contact the Executive Director of the Western Riverside County Regional Conservation Authority (RCA). For further information on the MSHCP and the RCA, go to www.wrc-rca.org.

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INTRODUCTION

Thirteen MSHCP-Covered bird species are found frequently or exclusively in riparian areas: Cooper's hawk (*Accipiter cooperi*, "COHA"), downy woodpecker (*Picoides pubescens*, "DOWO"), least Bell's vireo (*Vireo bellii pusillus*, "LBVI"), MacGillivray's warbler (*Oporornis tolmiei*, "MGWA"), Nashville warbler (*Vermivora ruficapilla*, "NAWA"), sharp-shinned hawk (*Accipiter striatus*, "SSHA"), southwestern willow flycatcher (*Empidonax traillii extimus*, "WIFL"), tree swallow (*Tachycineta bicolor*, "TRES"), western yellow-billed cuckoo (*Coccyzus americanus occidentalis*, "YBCU"), white-tailed kite (*Elanus leucurus*, "WTKI"), Wilson's warbler (*Wilsonia pusilla*, "WIWA"), yellow-breasted chat (*Icteria virens*, "YBCH"), and yellow warbler (*Dendroica petechia brewsteri*, "YWAR"). The Plan Area is part of the present or historical regular breeding range for the following 9 of these Covered Species: COHA, DOWO, LBVI, WIFL, TRES, YBCU, WTKI, YBCH, YWAR. The remaining 4 species (MGWA, NAWA, SSHA, and WIWA) are found within the Plan Area only during migration, with the exception of small, occasional breeding populations, particularly at higher elevations.

The species objectives for LBVI, WIFL, YBCU, WTKI, YBCH, and YWAR require the demonstration of both use and successful reproduction within 75% of specified Core Areas every 3 (LBVI, WIFL, YBCU, WTKI) or 5 (YBCH, YWAR) years. The plan specifies Core Areas, but no reproductive objectives for COHA, DOWO, and TRES. The objectives for these species require demonstration of use of 75% of Core Areas every 8 years. Although NAWA rarely breed in the Plan Area, the plan specifies conservation of 3 Core Areas centered on historical and potential breeding populations in the San Bernardino National Forest. These Cores must be shown to be occupied every 8 years to meet the objectives for this species. Because MGWA, SSHA, and WIWA rarely breed in the Plan Area, no breeding requirement is specified by the plan, nor are there any Core Areas identified. For these species, the plan requires that the status and distribution be reported a minimum of once every 8 years. The goals of the riparian bird study in 2007 were therefore as follows:

Survey Goals:

A) Determine the distribution, density, and occupancy during the breeding season of riparian Covered bird species and other co-occurring bird species within riparian habitats.

B) Determine the distribution during migration of Covered riparian bird species not breeding within the Plan Area.

C) Model the effects of survey-specific variables (e.g., temperature, time of day, weather conditions) on detection probabilities for riparian bird species to assist with future survey protocol design.

D) Collect habitat data and test the effects of habitat variables on the occupancy rates of Covered bird species.

E) Determine whether least Bell's vireo, southwestern willow flycatcher, western yellow-billed cuckoo, white-tailed kite, and yellow warbler are successfully reproducing within their respective Core Areas.

F) Evaluate whether applicable species objectives for riparian bird species are being met.

METHODS

Protocol Development

The survey methods for the riparian bird survey were based on multiple visits to point transect stations. This is an extension of the protocol that was initially developed and tested by the Center for Conservation Biology (CCB; U.C. Riverside 2005). This method allows multiple analyses to be performed on the data collected, including estimates of bird densities, occupancy rates, and estimates of detection probabilities. This method also allows for the computation of numerous population state variables with corrections for detection probability, including Proportion of Area Occupied (PAO; MacKenzie et al. 2006), density using distance sampling (Buckland et al. 2001), and availability using auditory removal models (Farnsworth et al. 2002). The data can be manipulated *post hoc* so that comparisons can be made with more traditional relative abundance indices, including both fixed and unlimited-radius scenarios (e.g., Hutto et al. 1986). The numbers of repeat visits were determined from detection probabilities calculated based on data generated in 2004 by the CCB.

We implemented a vegetation sampling protocol to improve models of target species' occupancy of riparian habitat within the Plan Area. This protocol was designed to capture aspects of coarse-scale vegetation structure and diversity thought to be most indicative of Covered Species habitat requirements.

Point transects are not an efficient means to collect data on reproductive success. To address reproductive species objectives, we designed a pilot nest searching project targeting passerine Covered Species with reproductive species objectives (LBVI, WIFL, YBCU, YBCH, and YWAR).

Personnel and Training

All field personnel demonstrated proficiency at both visual and aural identification of Covered riparian birds as well as other common co-occurring riparian bird species. All observers practiced visual and aural identification for several weeks prior to the beginning of field surveys. No observer began surveys before passing an examination by correctly identifying recordings of all riparian Covered Species and greater than 80% of a sample of typical co-occurring species. Personnel were also trained in visual distance estimation. All personnel demonstrated proficiency with survey techniques before field surveys commenced. Personnel conducting riparian bird surveys in 2007 included:

- Matt Talluto, Avian Program Lead (Regional Conservation Authority)
- Andy Boyce (Regional Conservation Authority)
- Amanda Breon (Regional Conservation Authority)
- Conan Guard (Regional Conservation Authority)
- Angela Hyder (Regional Conservation Authority)
- Bill Kronland (Regional Conservation Authority)
- Lynn Miller (Regional Conservation Authority)
- Robert Packard (Regional Conservation Authority)
- Lee Ripma (Regional Conservation Authority)

- Kim Skahan (Regional Conservation Authority)
- Carol Thompson (Regional Conservation Authority)
- Joe Veverka (Regional Conservation Authority)
- Laura Weisel (Regional Conservation Authority)

Personnel involved in the nest searching project received additional training in the reproductive biology of the nest searching target species. Prior to beginning field surveys, all personnel practiced techniques and protocols to be used in the project on common, non-covered species. All observers demonstrated proficiency in the field with common species before proceeding to work with Covered Species. Personnel performing nest searching and monitoring in 2007 included:

- Conan Guard, Nest Searching Project Lead, (Regional Conservation Authority)
- Robert Packard (Regional Conservation Authority)
- Carol Thompson (Regional Conservation Authority)

Riparian vegetation sampling crews were trained as the bird sampling effort was ending. All crew members were instructed in the identification of common riparian plants, and in the preparation of specimens and the use of dichotomous keys when field identification was not successful. All crew members were trained in the use of sampling equipment including densiometers, clinometers, and laser rangefinders. Personnel participating in riparian vegetation sampling included:

- Matt Talluto, Avian Program Lead (Regional Conservation Authority)
- Jason Hlebakos, Lead Botanist (Regional Conservation Authority)
- Andy Boyce (Regional Conservation Authority)
- Amanda Breon (Regional Conservation Authority)
- Angela Coates (Regional Conservation Authority)
- Debbie De La Torre (Regional Conservation Authority)
- Rosina Gallego (Regional Conservation Authority)
- Conan Guard (Regional Conservation Authority)
- Angela Hyder (Regional Conservation Authority)
- Ariana Malone (Regional Conservation Authority)
- Ryann Loomis (Regional Conservation Authority)
- Lynn Miller (Regional Conservation Authority)
- Robert Packard (Regional Conservation Authority)
- Lee Ripma (Regional Conservation Authority)
- Esperanza Sandoval (Regional Conservation Authority)
- Kim Skahan (Regional Conservation Authority)
- Carol Thompson (Regional Conservation Authority)
- Joe Veverka (Regional Conservation Authority)
- Laura Weisel (Regional Conservation Authority)
- Nicholas Peterson (California Department of Fish and Game)

Study Site Selection

Potential survey locations within the Conservation Area were mapped by selecting riparian vegetation, including riparian woodland, scrub, and forest, using an updated GIS vegetation layer (CDFG et al 2005). We randomly selected sampling points along stream segments with mapped riparian vegetation, and stratified our sampling points by Core Area (or by general region when no Core Areas were defined). All points were a minimum of 250 m apart. The number of points selected within each area was roughly proportional to the total vegetated stream length, although we attempted to sample a minimum of 5 points within each area, so some small areas or areas with little riparian vegetation were oversampled relative to larger areas. In addition to the randomly located points, an additional 2-4 points were randomly located in each area to serve as alternates. When, on an initial visit, a point was inaccessible due to poor terrain or private property, the closest alternate point was selected instead. Point locations along the Santa Margarita River were not selected in this fashion, as the Santa Margarita Ecological Reserve (SMER) already had point stations installed along the river. The Monitoring Program utilized these preexisting point stations when sampling within SMER.

We surveyed 239 points in 1940 ha (4794 acres) of riparian habitat, including 179 points within 13 riparian Core Areas (Figure 1). One Core Area, Wasson Canyon, was not surveyed during 2007. This was due to a mapping error that resulted in no riparian vegetation within Wasson Canyon being included in the initial stratification and site selection. Core Areas with the same name share the same boundaries for all species with the exception of the Temescal Wash, Alberhill Creek, and Lake Mathews/Estelle Mountain Cores. For COHA, LBVI, WIFL, YBCH, YBCU, and YWAR, Temescal Wash and Alberhill Creek are a single Core. Streams directly tributary to Temescal Wash within the Estelle Mountain Reserve, including Olsen and Dawson Creeks, were also included in the survey as part of the Temescal Wash Core. For DOWO, Alberhill Creek and Temescal Wash (including previously mentioned portions of the Estelle Mountain Reserve) are considered separate Cores. For WTKI, Temescal Wash/Alberhill Creek is a single Core, and Estelle Mountain is a separate Core. Because no conservation had occurred in Temescal Wash at the beginning of surveys, no points were surveyed there. The Santa Ana Watershed Association (SAWA) performed LBVI surveys in the Prado Basin/Santa Ana River, San Timoteo Canyon, and Temescal Wash/Alberhill Core Areas. SAWA surveys focused on mapping territories and monitoring the reproductive status of LBVI within these Cores. Observations from these surveys were used to augment Monitoring Program survey results.

Survey Methods

Point Transects

Survey methods are detailed in the *2007 Western Riverside County MSHCP Riparian Bird Survey Protocol* (Appendix A). Observers recorded birds for 10 min at each survey point. During the survey, observers recorded data for the first individual of every species observed. Subsequently observed individuals were only recorded if they were a Covered Species. This allowed us to record data on the detectability, abundance, and distribution of non-covered species within the Plan Area without compromising the ability to detect and record Covered Species. Upon observing a bird, observers recorded the exact time of observation relative to the start of the point count, the species, exact distance from the point to the bird (visually estimated or measured with a laser rangefinder), age class and sex of the bird, if known, the location of the bird (inside riparian habitat, outside riparian habitat, flying over riparian habitat, or flying through riparian habitat), and the cues used to identify the bird (visual, aural, drumming, etc.). Observers also recorded temperature, wind speed, and weather at each point.

All points were visited 4 times during the survey. The first sampling period began 2 April 2007 and ended 4 May 2007. The second period lasted from 12 May 2007 to 14 June 2007, the third lasted from 15 June 2007 to 29 June 2007, and the fourth lasted from 2 July 2007 to 26 July 2007.

Nest Monitoring

We performed a pilot nest searching and monitoring project during the spring 2007 survey to address the reproductive species objective for LBVI, WIFL, YBCU, YBCH, and YWAR. When these species were observed during point transects, nest searchers returned to the location to observe birds for breeding behavior and, if possible, locate nests. These nests were then revisited to determine nest success. A nest was considered successful if it produced at least 1 chick that survived until fledging. If a fledgling was observed within a Core Area, this was assumed to represent a successful nest, even if no actual nest was found. Nest searching methods are detailed in the *2007 Western Riverside County MSHCP Nest Searching Protocol* (Appendix B). This project was intended to evaluate the effort required to successfully locate nests for these species and determine if focused nest searching and monitoring efforts would be required to determine the status of reproductive species objectives.

Vegetation Sampling

Vegetation sampling methods are detailed in the *Riparian Bird Vegetation Assessment Protocol* (Appendix C). We placed three 10 m radius semicircular sampling plots within 100 m of each bird sample point. One of these plots was always located with the center of the straight axis of the plot at the original bird sample point. The second plot was located randomly within 56 m of the original point, and the third was located randomly between 56 and 100 m from the original point. Vegetation sampling plots were placed a minimum of 25 m from other sample points and a minimum of 5 m from the edge of the riparian area. The straight axis was always located within riparian habitat and parallel to the stream channel. Plots that overlapped with unvegetated or open water portions of the stream were moved away from the stream until the entire edge of the plot was located within riparian habitat. Random plots that fell outside of the riparian area were relocated to be within riparian habitat.

At each vegetation sample plot, we measured shrub canopy cover by using an ocular tube (“Moosehorn”) at 31 locations, spaced 1 m apart along the straight axis of the plot and in a line extending perpendicular from the center of the straight axis. Five spherical densiometer measurements were also made to measure overall canopy cover. These measurements were spaced 5 m apart along the axes of the plot. As an overall measurement of habitat quality within the sample plot, observers visually estimated the percent cover of riparian vegetation. We counted the number of snags with dbh > 10 cm as well as the number of fallen logs with diameter > 10 cm. For both tree (defined as height greater than 3 m) and shrub (woody plants less than 3 m in height) layers, we used measuring poles or clinometers to measure the height of the tallest and an average-height plant. We also counted the total number of living trees by species greater than 10 cm dbh. To quantify the herbaceous layer, we visually estimated percent cover within four 1 m transects. Herbaceous plants were grouped into the following categories: grasses, sedges and rushes, cattails and bulrushes, poison-oak, nettles, and other.

For a more general characterization of the habitat near the bird survey point, we also visually estimated the percent cover of riparian vegetation and open water within 100 m of the point.

Data Analysis

We estimated densities and population sizes for breeding species (COHA, DOWO, LBVI, NAWA, TRES, WIFL, WTKI, YBCU, YBCH, YWAR) using program DISTANCE (Thomas et al 2006). This method estimates detection probability based on distance sampling data and uses this information to provide a corrected density estimate. We estimated density of Covered Species stratified by Core Area. Because distance sampling requires relatively large sample sizes (40-60 detections per stratum for a simple model with no covariates), we could not calculate individual detection probabilities for specific Core Areas. Species with too few detections to fit a reliable global detection function were not analyzed using this method.

We evaluated multiple detection functions for each species analyzed using both half-normal and hazard-rate key functions with either cosine or polynomial adjustment terms. The model that minimized Akaike's Information Criterion (AIC) was selected and used for all further analysis. When model fit was poor (determined visually and using χ^2 goodness of fit tests), models were truncated and pooled by hand.

We used program PRESENCE (Hines 2006) to calculate the Proportion of Area Occupied (PAO). This analysis determines point-level detection probabilities based on multiple visits to the same locations and then estimates the proportion of the survey area occupied by the target species. This method cannot determine population size nor can it detect trends in population size, but it can provide information about whether the overall range of a species is expanding or contracting when observations from multiple years are compared. An advantage of PAO analysis is that it is more robust than distance sampling at lower sample sizes (MacKenzie et al. 2006). For all occupancy models, we compared models assuming a constant detection probability across all 4 visits to models that allowed detection probability to vary with time.

Vegetation data were incorporated as site-specific covariates for ψ (the proportion of area occupied) into occupancy models in PRESENCE. We only included covariates in models for species with > 30 detections. Due to the large number of potential covariates and the small number of detections for most species, not all covariate combinations could be tested. Instead, we used available literature to form specific hypotheses about the effects of vegetation characteristics on the probability of occupancy for each species (Table 1).

We also included sample-specific covariates for detection probability (temperature and time of day as continuous variables; wind speed, weather, and noise as categorical variables; Table 1) in occupancy models. Because sample-specific covariates quickly increase the number of parameters in a model, relatively large sample sizes are needed to support these multi-covariate models. Rather than including these covariates in models for Covered Species likely to have low sample sizes, we modeled these covariates using some of the most abundant riparian birds: song sparrow (*Melospiza melodia*; "SOSP"), Bewick's wren (*Thryomanes bewickii*; "BEWR"), ash-throated flycatcher (*Myiarchus cinerascens*; "ATFL"), Nuttall's woodpecker (*Picoides nuttallii*; "NUWO"), California towhee (*Pipilo crissalis*; "CALT"), and spotted towhee (*Pipilo maculates*; "SPTO"). Although we cannot directly infer the effect of these covariates on the detectability of Covered Species, general trends in the models may reveal factors important

Table 1. Description of covariates used in occupancy analyses.

Variable Name	Description	Species Evaluated
Site-specific covariates		
salix	% cover (0-100%) of Salix spp.[1]	LBVI, YBCH, YWAR
shrub	% cover (0-100%) of all shrubs < 3 m in height.[1]	LBVI, YBCH, YWAR
populus	Number of Populus fremontii individuals > 10 cm dbh	YBCH
totCover	Total cover of all trees and shrubs[1]	COHA, YBCH
stem	Total number of tree stems > 10 cm dbh	COHA
height	Average height of trees in the plot	COHA
Sample-specific covariates		
noise	Categorical estimate of ambient noise (not including bird noise)	AFTL, BEWR, CALT, NUWO, SOSP, SPTO
temperature	Temperature (degrees celcius)	AFTL, BEWR, CALT, NUWO, SOSP, SPTO
time of day	Number of minutes since sunrise	AFTL, BEWR, CALT, NUWO, SOSP, SPTO
weather	Categorical weather description (clear, partly to mostly cloudy, foggy to rainy)	AFTL, BEWR, CALT, NUWO, SOSP, SPTO
wind speed	Wind speed estimate (measured on the Beaufort wind scale)	AFTL, BEWR, CALT, NUWO, SOSP, SPTO

[1]Measured 1.0 m from the ground using a mooshorn ocular tube

to detectability in the riparian bird community as a whole and suggest improvements to future riparian bird monitoring protocols.

Model selection for both occupancy and distance models was performed using AIC. Models were created using a forward stepwise procedure until the model minimizing AIC was identified.

RESULTS

Distribution of Covered Species within Core Areas

The MSHCP identifies a total of 12 Core Areas for the 10 riparian bird species with defined Core Areas. In 2007, we sampled 11 of these areas, as well as additional areas not defined as Cores (Figure 1). Wasson Canyon was the only Core Area not surveyed, although survey personnel were present in the area during the 2006 and 2007 seasons and recorded any Covered Species observed. Covered Species were present in all areas surveyed, and, with the exception of YBCU, all Covered Species with defined Core Areas were observed in at least 1 Core (Table 2).

In 2007, we observed a total of 31 COHA individuals in 8 of 9 sampled Core Areas, as well as in 4 additional areas. COHA were also observed incidentally in 3 Core Areas and 1 non-core area in 2007. Combining survey and incidental observations, we have observed COHA in 9 of 10 Core Areas (90%) within the current 3-year period.

In 2007, we observed a total of 11 DOWO individuals in 1 of 5 sampled Core Areas, as well as in 2 additional areas. DOWO were also observed incidentally in 1 Core Area and 3 non-core areas in 2007, and in 1 additional non-core area in 2006. Combining survey and incidental observations from 2006 and 2007, we have observed DOWO in 2 of 5 Core Areas (40%) within the current 3-year period.

In 2007, we observed a total of 46 LBVI individuals in 7 of 8 sampled Core Areas, as well as in 1 additional area. LBVI were also observed incidentally in 1 non-core area in 2007 and in 2 additional non-core areas in 2006. Combining survey and incidental observations from 2006 and 2007, we have observed LBVI in 7 of 8 Core Areas (88%) within the current 3-year period.

In 2007, we observed a total of 9 NAWA individuals in the Conservation Area, including one within the San Bernardino National Forest (where all NAWA Cores are located). However, all of these individuals were present only during migration. No NAWA were observed post-migration.

In 2007, we observed a total of 20 TRES individuals in 2 of 5 sampled Core Areas, as well as in 4 additional areas. TRES were also observed incidentally in 1 Core Area and 1 non-core area 2007 and in 3 additional non-core areas in 2006. Combining survey and incidental observations from 2006 and 2007, we have observed TRES in 3 of 6 Core Areas (50%) within the current 3-year period.

In 2007, we observed a total of 2 WIFL individuals in the Conservation Area, both of which were not in Core Areas. We observed WIFL incidentally in 1 Core Area and 2 non-core areas in 2007, and in 3 non-core areas in 2006. However, all of these individuals were present only during migration. No WIFL were observed post-migration, and no individuals were

Table 2. Detections of covered riparian bird species within survey areas in 2007. Shaded cells indicate Core Areas for Covered Species with defined cores. P07 and P06 indicates a species that was detected incidentally in 2007 or 2006, respectively.

Study Areas	# Points Surveyed	Area Surveyed (ha)	Number of Detections												
			COHA	DOWO	LBVI	NAWA[1]	TRES	WIFL	WTKI	YBCH	YBCU	YWAR	MGWA	SSHA	WIWA
Cleveland National Forest	27	71.6	6	--	--	1	2	P06	P06	--	--	2	1	--	P07
Lake Perris/San Jacinto Wildlife Area	8	72.3	P07	P07	--	1	P07	1	P07	--	--	8	P07	--	2
Lake Skinner/Diamond Valley Lake	31	75.3	4	P07	9	1	P07	1	P07	2	--	12	1	7	5
Murrieta Creek	7	14.1	P07	--	1	--	1	--	--	--	--	--	--	--	5
Prado Basin/Santa Ana River	9	533.4	1	6	7	--	3	P07	--	14	--	33	1	--	1
San Bernardino National Forest	42	189.6	6	3	P06	1	P06	P06	P07	--	--	7	P06	3	5
San Timoteo Canyon	9	43.4	1	2	9	1	--	--	1	7	--	16	--	--	4
Temecula Creek	4	21.0	P07	--	2	--	--	--	--	2	--	--	--	--	1
Temescal Wash, Alberhill Creek, Estelle Mountain[2]	31	90.5	5	P07	11	--	2	--	P07	P06	--	11	P07	--	2
Vail Lake	5	7.6	1	--	--	P06	--	--	--	--	--	P06	--	P07	P06
Wasson Canyon	0	0	P07	--	P07	--	--	P07	--	P06	--	P07	--	--	--
Wilson Valley	6	9.6	--	--	1	--	1	--	P07	--	--	--	1	--	1
Badlands	22	85.4	5	P07	6	1	P06	P06	P07	--	--	12	P06	3	3
Iron Spring Canyon	4	3.2	--	P06	--	1	--	--	--	--	--	1	--	--	2
Santa Margarita Ecological Reserve	24	28.2	1	--	--	--	11	P07	1	6	--	14	P07	--	5
Santa Rosa Plateau	10	42.0	1	--	P06	2	P06	--	P07	P06	--	P06	--	P07	1
Totals	240	1937.9	31	11	46	9	20	2	2	31	0	116	4	13	37
Occupancy objective met?			Yes	No	Yes	No	No	No	No	No	No	No	N/A	N/A	N/A
Reproductive objective met?			N/A	N/A	No	No	N/A	No	No	No	No	No	N/A	N/A	N/A

[1]NAWA Core Areas have been combined for this table, but are discussed separately in the text.

[2]Includes Temescal Wash and tributary streams in Estelle Mountain, as well as Alberhill Creek. Temescal Wash and Alberhill creek are considered separate Cores for DOWO, and Estelle Mountain and Temescal Wash are separate Cores for WTKI. These have been combined for clarity but are treated separately in the text.

confirmed as the southwestern subspecies. Although southwestern WIFL are visually and aurally indistinguishable from other subspecies, the southwestern subspecies is the only subspecies that nests in the plan area, and can be confirmed by the observation of nesting behavior or by its presence after 22 June (Sogge et al. 1997; USFWS 2000).

In 2007, we observed a total of 2 WTKI individuals, both in non-core areas. WTKI were also observed incidentally in 5 Core Areas and 3 non-core areas in 2007, and in 1 non-core area in 2006. Combining survey and incidental observations from 2006 and 2007, we have observed WTKI in 5 of 10 Core Areas (50%) within the current 3-year period.In 2007, we observed a total of 46 YBCH individuals in 3 of 5 sampled Core Areas, as well as in 2 additional areas. YBCH were also observed incidentally in 1 Core Area and 2 non-core areas 2006. Combining survey and incidental observations from 2006 and 2007, we have observed YBCH in 4 of 5 Core Areas (80%) within the current 3-year period.

All 5 YBCU Core Areas were sampled by the Monitoring Program in 2007. No YBCU were observed in the Core Areas or any other areas, either incidentally or during surveys.

In 2007, we observed a total of 116 YWAR individuals in 4 of 8 sampled Core Areas, as well as in 6 additional areas. YWAR were also observed incidentally in 1 Core Area in 2007 and in 1 Core Area and 1 non-core area in 2006. Combining survey and incidental observations from 2006 and 2007, we have observed YWAR in 6 of 9 Core Areas (67%) within the current 3-year period.

Three Covered riparian species (MGWA, SSHA, and WIWA) are not normally present during the summer breeding season, but are frequently encountered during spring migration. We observed 4 MGWA in 4 areas during surveys in 2007. We also observed MGWA incidentally in an additional 3 areas in 2007 and 2 areas in 2006. We observed 13 SSHA in 3 areas during surveys in 2007. We also observed SSHA incidentally in an additional 2 areas in 2007. We observed 37 WIWA individuals in 2007. During the early part of the season, WIWA were widespread in the Plan Area, and were observed in all of the areas where surveys were performed. All 3 species were present primarily during the first of the 4 surveys, with few observations after early May.

Nest Monitoring

A total of 4 LBVI nests were located during 2007 nest monitoring surveys. Fledglings were observed at the Lake Skinner and Murrieta Creek Core Areas. The Santa Ana Watershed Association also performed nest surveys for LBVI. They observed LBVI fledglings in the following Core Areas: Prado Basin/Santa Ana River, San Timoteo Canyon, and Temescal Wash/Alberhill Creek. During 2007, LBVI were observed successfully reproducing in a total of 5 of 8 Core Areas (63%).

A total of 3 YWAR nests were located during 2007 nest monitoring surveys. Fledglings were observed at the Prado Basin/Santa Ana River and Temescal Wash/Alberhill Creek Core Areas. During 2007, YWAR were observed successfully reproducing in a total of 2 of 8 Core Areas (25%).

No WIFL or YBCU were observed during the breeding season, so no nest searching was initiated for these species. Although YBCH were observed throughout the season and presumably breed within the Plan Area, no nests were located during nest searching efforts.

Density Models

We recorded too few detections to adequately fit distance models for all Covered Species except YWAR. We observed a mean density of 1.64 YWAR/ha within riparian habitat in the Conservation Area (95% CI: 0.86 to 2.71), for an estimated population size of 2117 individuals (95% CI: 1113 to 3496; Table 3). These estimates do not include the Prado Basin, because we could not obtain access in time for surveys. Detection probability for YWAR was 0.11 (95% CI: 0.081 to 0.14).

Table 3. Results of distance sampling analysis for yellow warbler in 2007 riparian bird surveys. Values are based on a detection probability of 0.11 (95% CI 0.081 - 0.14). Values are means with 95% confidence intervals.

Survey Area	Density (individuals/ha)		Number of Individuals	
Core Areas				
Murrieta Creek	0	--	0	--
Prado Basin/Santa Ana River	3.43	(1.74 - 5.76)	1831	(926 - 3072)
San Bernardino National Forest	0.13	(0.015 - 0.34)	24	(3 - 65)
San Timoteo Canyon	1.56	(0.67 - 2.92)	68	(29 - 127)
Temecula Creek	0	--	0	--
Vail Lake	0	--	0	--
Temescal Wash, Alberhill Creek, Estelle Mountai	0.31	(0.13 - 0.59)	29	(11 - 54)
Wilson Valley	0	--	0	--
Other Survey Areas				
Badlands	0.47	(0.14 - 0.92)	40	(12 - 79)
Cleveland National Forest	0.084	(0.00 - 0.23)	6	(0 - 17)
Iron Spring Canyon	0.24	(0.00 - 0.91)	1	(0 - 3)
Lake Perris/San Jacinto Wildlife Area	0.75	(0.20 - 1.52)	55	(15 - 110)
Lake Skinner/Diamond Valley Lake	0.35	(0.12 - 0.66)	26	(9 - 50)
Santa Margarita Ecological Reserve	0.51	(0.20 - 0.98)	14	(6 - 28)
Santa Rosa Plateau	0	--	0	--
Total	**1.64**	**(0.86 - 2.71)**	**2117**	**(1113 - 3496)**

Occupancy and Vegetation Analysis

We recorded observations based on up to 4 visits to point stations in order to determine detection probability and proportion of area occupied using the occupancy models in program PRESENCE. We used covariate models in PRESENCE to analyze vegetation data and sample-specific covariates (temperature, ambient noise, weather, time of day, and wind speed). The number of detections of NAWA, WIFL, and YBCU were too small to perform this analysis, and there were too few DOWO and TRES observations to model vegetation covariates. Detection probability (p) remained constant throughout the survey period for COHA ($p = 0.049$), DOWO ($p = 0.066$), LBVI ($p = 0.53$), and YBCH ($p = 0.39$), but decreased significantly late in the season for TRES (range = 0.049-0.44) and YWAR (range = 0.14-0.59; Table 4).

Occupancy estimates ranged from 0.0077 (YBCH) to 0.18 (DOWO), although precision was low for species with small sample sizes (COHA, DOWO, TRES; Table 4). We included habitat covariates in models for all species except DOWO and TRES; these covariates significantly improved model fits compared with models with no covariates.

The presence of trees was strongly predictive of COHA occupancy. The most strongly supported model predicted a probability of occupancy of 0.15 when no trees > 10 cm dbh were present, rising to over 0.90 with the presence of > 2 trees / plot. A model with nearly equal support predicted a later decline in occupancy probability at sites with more than 18 trees, although this may be an artifact of the small number of forested plots sampled. The percent cover of *Salix* sp. was positively associated with LBVI, YBCH, and YWAR occupancy, although the effect declined after 30% cover for YBCH (Figure 2). Total shrub cover was also positively correlated with LBVI presence.

Table 4. Occupancy analysis results for target species with sufficient sample sizes for the analysis. Parenthetical values are 95% confidence intervals.

Species	n[1]	p_t[2]		p_*[3]	□□	
LBVI	46	p = 0.53	(0.40-0.66)	0.95	0.029	(0.011-0.073)
TRES	20	p_1 = 0.44 p_2 = 0.34 p_3 = 0.049 p_4 = 0.098	(0.18-0.74) (0.13-0.63) (0.0063-0.29) (0.022-0.34)	0.68	0.085	(0.043-0.16)
YWAR	116	p_1 = 0.46 p_2 = 0.59 p_3 = 0.27 p_4 = 0.14	(0.32-0.60) (0.44-0.73) (0.17-0.41) (0.069-0.25)	0.86	0.14	(0.089-0.21)
DOWO	11	p = 0.066	(0.0097-0.34)	0.24	0.18	(0.025-0.65)
YBCH	46	p = 0.39	(0.24-0.56)	0.86	0.0077	(0.0025-0.023)
COHA	31	p = 0.049	(0.033-0.073)	0.18	0.13	(0.03-0.43)

[1]Number of detections at sample sites

[2]Survey period-specific detection probability (probability of detecting bird if present during a single visit)

[3]Cumulative detection probability (probability of detecting species over 4 visits)

[4]Proportion of habitat area occupied by the species

Sample sizes for Covered Species were too small to model sample-specific covariates for detection probability, so we analyzed these covariates using data from more common species (ATFL, BEWR, CALT, NUWO, SOSP, SPTO). Sample sizes for these species ranged from 265-501, compared with 111 for YWAR, the most commonly observed Covered Species.

None of the sample-specific variables tested were uniform in their effect on detection probability for these 6 species; however, the effects that were included were generally consistent. Detection probability decreased by as much as 0.20 when observers reported that ambient noise was interfering with their ability to hear birds for 3 of the 6 species tested. SOSP was the only species with the opposite pattern; detection probability increased with increasing ambient noise. Although temperature was included in 2 models, in both cases the magnitude of the effect was so small as to make it biologically unimportant (e.g., a decrease in p of 0.01 with a corresponding increase in temperature of 50 degrees). Detection probability decreased substantially with time of day in 4 of the 6 models. Average detection probability for the 6 species tested was 0.50 at sunrise and 0.37 at 5 hours after sunrise. Cloudy weather also affected detectability; in 3 models, mostly cloudy to overcast conditions were associated with an increase in detection probability ranging from 0.06-0.23. Too few rainy days were sampled to determine if rain had any effect on detection probability. Wind was the only covariate tested lacking a consistent effect across multiple species. In 3 models, wind had no effect. For CALT, detection probability increased by 0.14 when wind speed exceeded 5 km/h compared with calm conditions. For NUWO, detection probability decreased by 0.24 when wind speed exceeded 5 km/h. Finally, wind speed was associated with very small changes in detection probability for SOSP; detectability was highest during a slight (1-5 km/h) wind and lowest with no wind.

DISCUSSION

Nest Searching and Monitoring

Monitoring program biologists were able to locate nests and fledglings for 2 of the 5 targeted species in 2007. Relatively few nests were located, due to the difficulty of nest searching in densely vegetated habitats. We conclude that the method can be successful at documenting the presence of successful nests within Core Areas, although the level of effort required to effectively document the *absence* of successful nests within an area is likely to be prohibitive.

Occupancy Models

Percent cover of willows (*Salix* sp.) was correlated with both LBVI and YWAR occupancy. This effect was linear, indicating that there was no detectable threshold effect of willow cover on occupancy in either species, nor is there a willow density that is too high to provide habitat for these species. This relationship should be interpreted with caution, however, due to the small number of sites with high *Salix* density. *Salix* cover at our sites averaged 4%, with few sites exceeding 30% cover, suggesting that the proportion of riparian habitat used by YWAR and LBVI could be increased by encouraging willow growth or increasing willow cover through habitat restoration efforts.

Salix presence was also correlated with YBCH occupancy, but, unlike YWAR and LBVI, YBCH appeared to prefer sites with moderate densities. Few sites exceeded the willow density beyond which YBCH occupancy declined. In the majority of riparian areas, YBCH presence may be more probable if willow densities increase. The presence of cottonwoods (*Populus fremontii*) may also increase the probability that a site will be used by YBCH.

Species Objectives

Cooper's hawks have been observed within 90% of their Core Areas. We conclude that the Core Area occupancy species objective is being met, and that no further monitoring is required until the next 8-year period.

Downy woodpeckers have been observed in 40% of their Core Areas. We did not detect enough DOWO to compute density, occupancy, or detection probability. The low number of detections may be a function of either low numbers in the Conservation Area or very low detection probability. Without definitive information on DOWO detection probabilities, we cannot draw any conclusions about the status of DOWO in the Conservation Area. However, the high survey effort in both 2006 and 2007, combined with the very low encounter rate for this species, suggests the species objectives are not currently being met.

Least Bell's vireos have been observed occupying 88% of their Core Areas during the breeding season, but fledglings have only been observed in 63% of Core Areas. Currently, LBVI have been observed using the Wilson Valley and Temecula Creek Cores, but no fledglings have been found. No LBVI have been observed in the Vail Lake Core, which has little conserved riparian habitat. We conclude that the occupancy species objective for LBVI is currently being met, but that more information is needed to determine if the reproductive objective is being met. Because the amount of conserved riparian habitat within the Vail Lake and Wilson Valley Core Areas is small, it is less likely that LBVI are present within the conserved portion of these areas. More conservation within these Cores may be needed to meet the species objectives for this species.

The species objectives for Nashville warbler require occupancy within 3 Core Areas, demonstrated once every 8 years. Although the plan does not specify that NAWA must breed in these Cores, nor that these Cores must be occupied during the breeding season, the description of these Cores as breeding areas implies that these areas should be occupied by NAWA throughout the breeding season, and that migrating NAWA that pass through these areas are not sufficient to demonstrate use of these Cores.

Only 2 of the NAWA Core Areas are defined in the plan. The third Core is specified as a breeding location to be identified in the future. Given that no NAWA have been observed by the Monitoring Program in the Plan Area during the breeding season, no third Core Area can be defined at this time, nor can we determine whether species objectives are being met. Given the lack of detections during the breeding season, and given that only the extreme southern edge of the normal breeding range for NAWA is encompassed within the Plan Area (Williams 1996), it is possible that breeding within the Plan Area is an irregular phenomenon for this species, making it difficult to demonstrate compliance with the species objectives.

We observed tree swallows in 50% of their Core Areas, indicating the species objective for occupancy is not being met. However, TRES have been observed in a number of areas outside defined Core Areas, suggesting that the Cores as defined are not entirely appropriate for gauging the effectiveness of the plan at conserving this species. In particular, more TRES individuals were observed in the Santa Margarita Ecological Reserve (SMER) than in any other location, despite the fact that SMER is not considered a Core Area for this species. We conclude that, although the species objectives are not currently being met, more study is needed to determine the true distribution of this species within existing reserves, and that new Core Areas may need to be defined to reflect the actual distribution and status of this species.

No breeding willow flycatchers were observed in the Plan Area in 2007. We therefore conclude that neither the occupancy nor the reproductive objective for this species is being met. Furthermore, it is unlikely that the objectives will be met for this species due to a lack of appropriately structured habitat within 4 of the 6 Core Areas. Currently, only the Prado Basin/Santa Ana River and San Timoteo Canyon Core Areas contain enough willow flycatcher habitat to support regular breeding. To meet the species objectives for this species, conservation efforts should focus on acquiring or developing multi-strata riparian habitat with a willow understory component within the Murrieta Creek, Temecula Creek, Vail Lake, and Alberhill/Temescal Wash Core Areas.

We observed very few white-tailed kites in 2007, although they were much more numerous during the 2006 riparian bird survey. Combining 2006 and 2007 data, we have observed WTKI in 50% of Core Areas. However, a number of WTKI have been observed outside Core Areas, and their numbers within the Plan Area seem to vary greatly between years. We conclude that, although the species objectives are not currently being met, more study is needed to determine the true distribution of this species within existing reserves. Population sizes may fluctuate drastically between years, making it difficult to gauge the true conservation status of this species with data from only a single year. Future monitoring studies of WTKI should encompass multiple years and should include an attempt to determine the factors responsible for varying WTKI abundance in the Plan Area.

We observed Yellow-breasted chat in 80% of Core Areas in 2006 and 2007, although no breeding chats have been located. The occupancy portion of the species objectives for YBCH is being met, however, more information is needed on breeding activity. Because this species is secretive and difficult to detect except during the breeding season when singing is frequent, and because nesting habitat for this species tends to be thick and difficult to work in, it will likely require considerable effort and expense to locate fledglings in all occupied Core Areas (Eckerle and Thompson 2001).

We observed no yellow-billed cuckoo in the Plan Area in 2007, and only a single individual (likely migratory) in 2006. The last confirmed YBCU breeding observation in the Plan Area was in 2001 in the Prado Basin. Given the lack of observations during the past 2 years of surveys, it is very unlikely that the species objectives for YBCU are being met. However, it is possible that some YBCU continue to breed in the Plan Area, particularly given that the Monitoring Program was unable to obtain access to historical YBCU breeding areas for 2006 and 2007 surveys.

In 2006 and 2007, we observed yellow warblers in 67% of their Core Areas. All of the Cores lacking YWAR observations have very little intact riparian habitat in conservation. Furthermore, YWAR were observed in nearly every area surveyed in 2007 that did contain significant riparian habitat. Therefore, although the occupancy and reproductive species objectives were not demonstrated by the 2007 surveys, it is likely that additional conservation of riparian habitat in Wilson Valley, Murrieta Creek, and Temecula Creek would result in the documented presence of YWAR in those Cores.

Recommendations for Future Surveys

Based on 2007 survey results, the point-transect method employed in 2006 and 2007 has yielded cumulative point-level detection probabilities of greater than 0.8 for only three species (LBVI, YWAR, and YBCH). It is likely that these three species can be reliably detected when present using this method. The addition of a fifth survey period, and a reduction of the length of time within and among survey periods, may be sufficient to raise these detection probabilities above 0.95. The total number of samples should be maintained, although increased effort in small Cores could help ensure that a lack of observations of a particular species actually indicates absence of that species.

Three species (TRES, DOWO, and COHA) had enough observations to perform an occupancy analysis, but detection probabilities that were too low to conclude that the species was adequately detected if present. This may in part be due to imprecise estimates due to low sample sizes, particularly for DOWO ($n = 11$). Additional focused survey effort may be required to detect these species.

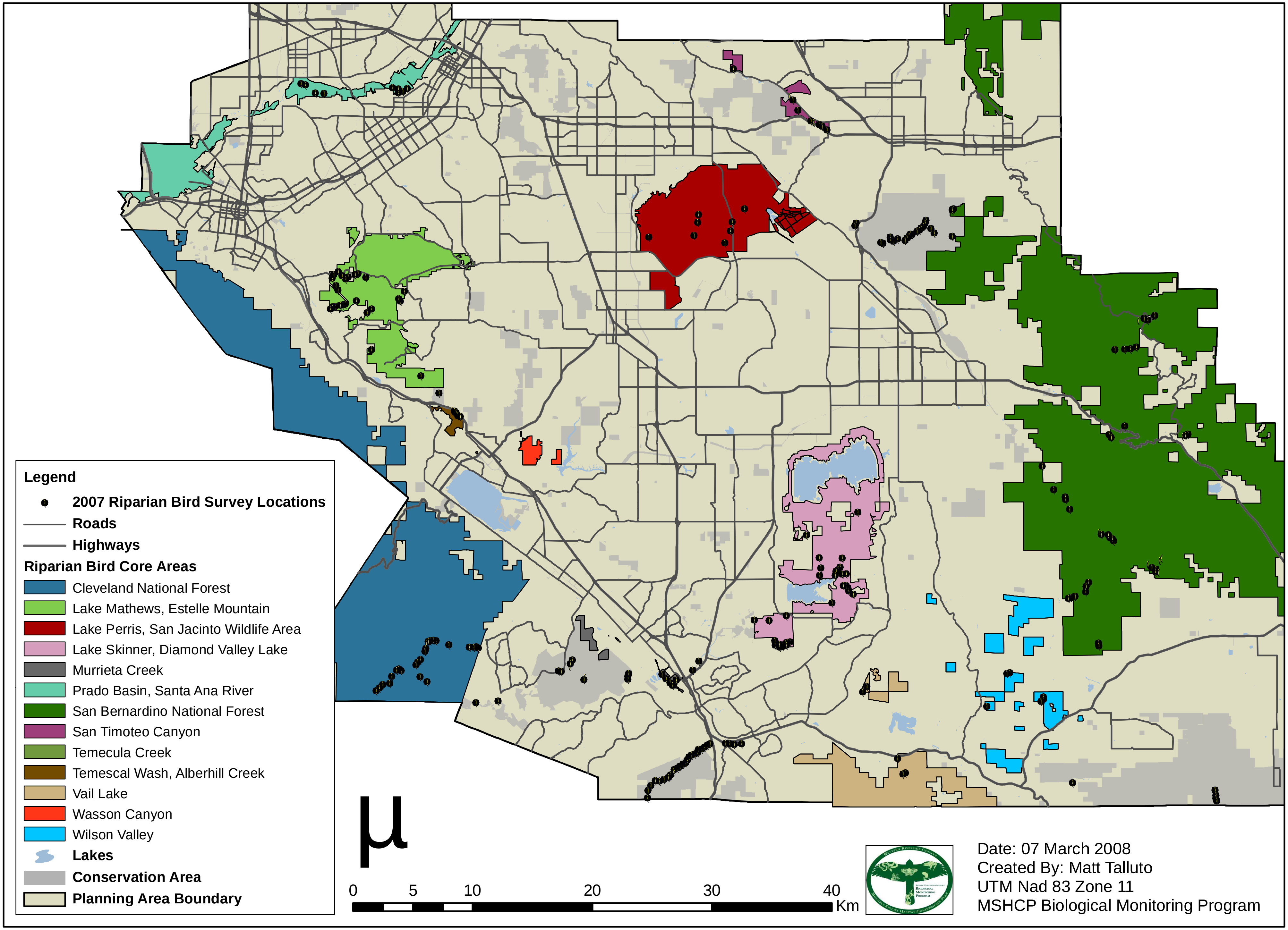
The remaining 4 Covered riparian birds that are present during the breeding season (NAWA, WIFL, WTKI, YBCU) had sample sizes that were inadequate for occupancy analysis. NAWA, WIFL, and YBCU are extremely rare during the breeding season, and thus an occupancy design may be inappropriate for evaluating the status of these species. WTKI appear to have a variable presence within the plan area, as the encounter rate of WTKI during 2006 was considerably greater than in 2007. Therefore, this species may only be adequately detected as a result of multi-year surveys.

Several Core Areas for riparian bird species currently contain relatively little conserved riparian habitat. Specifically, the Vail Lake and Wilson Valley Core Areas both contain less than 10 ha (25 acres) of riparian habitat, while the Temecula Creek and Murrieta Creek Core Areas contain less than 21 ha (52 acres) of conserved riparian. The next smallest Core Area has more than twice as much conserved riparian habitat as Temecula Creek. Furthermore, the habitat that is conserved within these Cores is qualitatively relatively degraded compared with habitat in other Core Areas. The combination of little conserved habitat and poor quality habitat is very likely responsible for the poor performance of these Cores with respect to their use by Covered riparian bird species. Nine of the 10 riparian bird species have species objectives calling for their use of at least 2 of these 4 currently small Core Areas. If the species objectives for most riparian bird species are to be met, it is likely that additional conservation of high quality riparian habitat, and restoration of existing degraded habitat will be necessary in these 4 small Core Areas.

Although no breeding YBCU have been observed in the past 2 years, no conclusions can be made on their presence or absence in the Plan Area due to the inability of the Monitoring Program to access historic YBCU breeding areas. Access should be obtained for these areas, and intensive surveys should be performed there to determine if any YBCU continue to breed in the Plan Area. Other Core Areas for this species were adequately surveyed, and therefore it is likely that YBCU are absent from these areas. Habitat improvements, including increasing the density of willow vegetation, increasing the width of the riparian area, and decreasing disturbance in the area surrounding the riparian zone, may be necessary before YBCU will use these areas.

Focused reproductive surveys should be conducted to determine if species with breeding objectives are successfully breeding within their Core Areas. These surveys should include nest location, nest monitoring, and confirmation of the presence of fledglings, with survey effort allocated to habitats most likely to support the species with reproductive objectives. Ideally, this effort would be conducted concurrently with a presence-absence survey to more conclusively confirm the absence of a species when necessary. If adequate personnel are not available for a combined effort, the nest searching survey should focus on allocating as many personnel as possible to areas where target species have been observed in previous surveys, as each species will require a relatively high level of effort to confirm reproduction within each Core Area.

Figure 1. 2007 Riparian Bird Survey Locations and Core Areas.



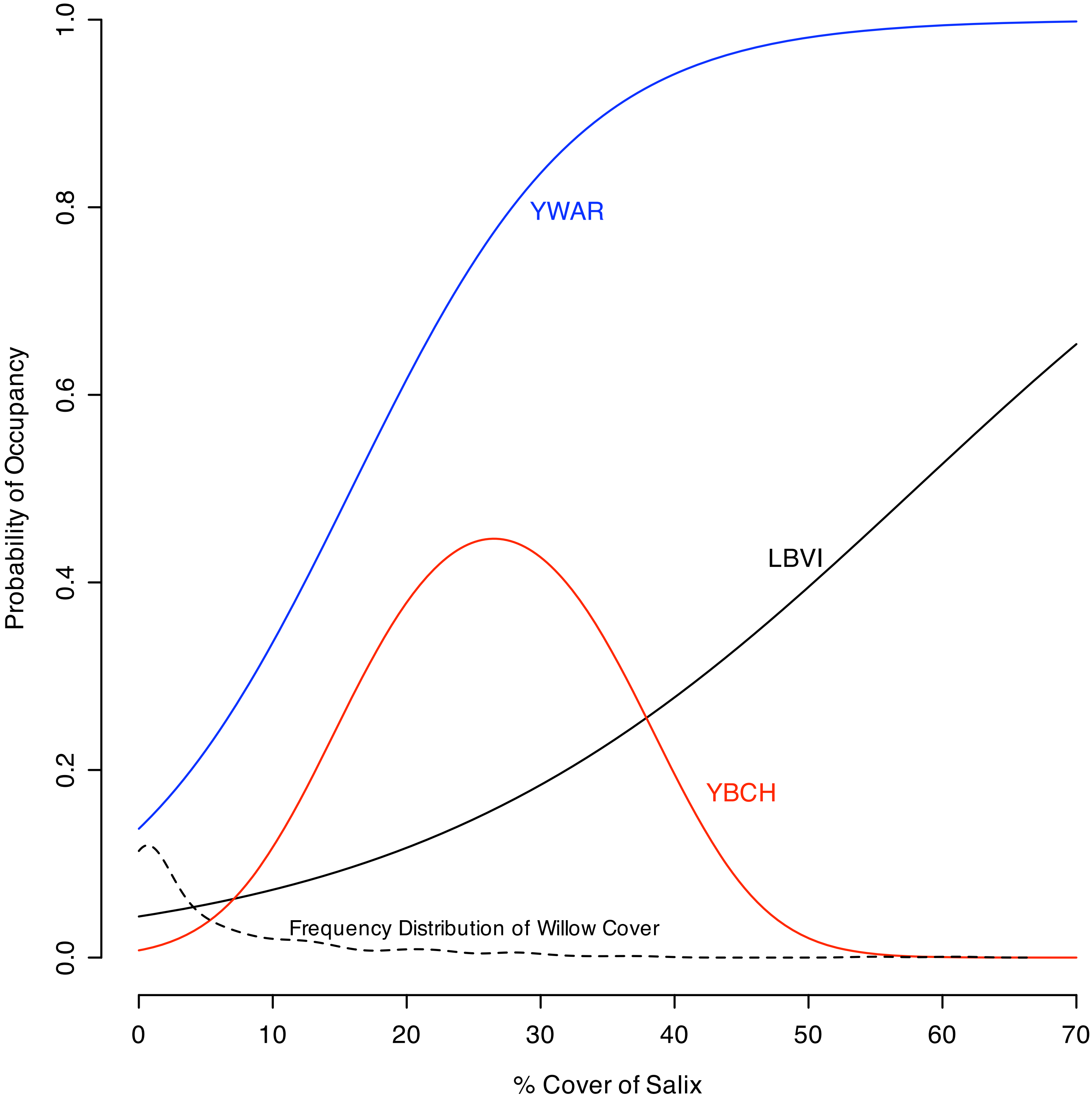


Figure 2. Relationship between probability of occupancy and willow cover for three riparian bird species. A frequency distribution for the willow data is also shown.

REFERENCES

Buckland, S. T., Anderson, D. R., Burnham, K. P., Laake, J. L., Borchers, D. L., and Thomas, L. 2001. *Introduction to distance sampling: Estimating abundance of biological populations.* Oxford University Press, New York.

California Department of Fish and Game (CDFG), Aerial Information Systems (AIS), and California Native Plant Society (CNPS). 2005. *Vegetation - Western Riverside Co.* [ds170]. Publication Date: 2005-07-31. Online: http://bios.dfg.ca.gov/

Eckerle, KP, and Thompson, CF. 2001. Yellow-breasted Chat (*Icteria virens*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology.

Farnsworth, G. F., K. H. Pollock, J. D. Nichols, T. R. Simons, J. E. Hines, and J. R. Sauer. 2002. A removal model for estimating detection probabilities from point-count surveys. Auk 119:414-425.

Hutto, R. L., S. M. Pletschet, and P. Hendricks. 1986. A fixed-radius point count method for nonbreeding and breeding season use. The Auk. 103:593-602.

MacKenzie, D. I., Nichols, J. D., Royle, J. A., Pollock, K. H., Bailey, L, L., Hines, J. E. 2006. *Occupancy estimation and modeling: Inferring patterns and dynamics of species occurrence*. Elsevier, London.

Sogge, M. K., R. M. Marshall, S. J. Sferra, and T. J. Tibbitts. 1997. A Southwestern Willow Flycatcher natural history summary and survey protocol. Technical Report NPS/NAUCPRS/NRTR-97/12. USGS Colorado Plateau Research Station, Northern Arizona University, Flagstaff, Arizona.

University of California, Riverside, Center for Conservation Biology. 2005. Final Report: Western Riverside County Multiple Species Habitat Conservation Plan Monitoring Program. Prepared for California Department of Fish and Game, under contracts titled: Inland Ecosystems of California: Resource Assessment Project and Western Riverside County and Sierra Nevada Wildlife Assessment Project. May 4, 2005.

USFWS. 2000. Southwestern Willow Flycatcher Protocol Revision 2000.

Williams, JM. 1996. Nashville Warbler (*Vermivora ruficapilla*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology.

Appendix A: Western Riverside County MSHCP Biological Monitoring Program Protocol for Riparian Bird Surveys

January 2007

Goal: Determine the distribution of riparian bird species in the Conservation Area. Provide information about the use of Core Areas for covered riparian species. Record locations of species with reproductive species objectives to direct nest monitoring efforts. Examine potential habitat covariates for riparian species. Determine detection probability, occupancy, and density for riparian birds.

Objectives

To achieve the above goal(s), surveys will be conducted at randomly selected points in riparian habitat within the Conservation Area. Surveys generally will follow the procedures of variable-radius point-count methodology, as outlined in Ralph et al. (1995). These methods can be used to estimate bird densities, occupancy rates, and associated estimates of detection probabilities. This combination of field methods and study design will allow for flexible and thorough analyses using presence-absence data (e.g., MacKenzie et al. 2002), distance sampling (Buckland et al. 2001), and auditory removal models (Farnsworth et al. 2002). Data also can be transformed *post hoc* so that comparisons can be made to more traditional relative-abundance indices, including both fixed- and unlimited-radius scenarios (e.g., Hutto et al. 1986).

Timing

Riparian bird surveys will be conducted from March-July, 2007. This will be divided into up to 6 survey periods lasting 3-4 weeks each.

Survey Locations

Surveys will be conducted on accessible lands in riparian habitat within the Conservation Area. Potential locations will be located every 250m along streams in the conservation area, selected using GIS layers of streams and riparian vegetation. In 2007 we will survey approximately 220 points within appropriate locations.

METHODS

Point Station Description

Points will be randomly selected from potential locations, with stratification to ensure even sampling between core areas. Observers will navigate to potential locations using GPS and install a wooden stake to mark the point. Survey points will be located within 50 meters of the GPS locations, and will be located halfway between the stream center and the edge of the riparian vegetation. This location will be recorded with the GPS unit and used to navigate to the point during surveys.

Survey Techniques

All observers must demonstrate the ability to visually and acoustically identify riparian birds before beginning surveys. Observers must pass an exam by correctly identifying all covered species occurring primarily in riparian habitats and at least 85% of other species, which will be taken from a list of common riparian species..

Point count surveys will be conducted between sunrise and noon, but surveys will be terminated if the temperature exceeds 35 degrees C, if wind speed exceeds a 4 on the Beaufort Wind Scale, or if precipitation exceeds more than a light drizzle. Each observer will perform between two and six surveys each day, depending on the accessibility and conditions of each individual station. Each point-count survey will be 10 minutes in length.

As the observer is approaching the point, he/she should record data in all fields on the datasheet for any birds that flush upon approach. In the 'Time Encountered' column on the data sheet, the observer should write "UA," indicating the bird was observed on arrival. If these birds are re-observed during the survey period, they should be re-recorded, and the original "UA" record should be crossed out.

After commencing the 10-minute survey, at the first observation of each species, the species, sex, age, behavior, distance, and time interval should be recorded, as per the instructions below. Only the first individual for a species will be recorded, with the exception of brown-headed cowbirds and covered species. For these species, every *individual* will be recorded in the manner described above. Each survey should last ***exactly*** 10 minutes; e.g., an individual bird first recorded at minute 10:01 should be recorded as "in transit."

Birds that are encountered 'in transit' should be noted at the bottom of the data sheet. These are new bird species that are observed while walking between point stations. Birds that are observed on approach but are not flushed can be recorded as in transit if they are not observed during the ten minute point count. In-transit birds should only be noted if they have not been recorded as part of the point-counts for that drainage. Birds recorded in transit will be treated as incidental observations and will not be used in any analyses.

In the case that the riparian area is narrow, it will be possible to identify birds that are in adjacent, non-riparian habitats. Observers should record whether each bird is within or outside riparian habitat. In the column labeled "location," the observer will record whether the bird is observed Inside, Outside, Flying Over, or Flying Through the riparian area. "Inside" indicates a bird that is actively using the riparian area: birds flycatching, flying between perches, flying completely inside the riparian area without landing and perching on vegetation or on the ground are all considered "Inside." Birds that fly through the riparian area without landing are considered "Flying Through." This category applies when a bird enters and leaves the riparian area without perching, and is beneath the vegetation canopy. Birds that fly over the riparian vegetation well above the canopy are considered "Flying Over." Birds that are outside the riparian area, whether flying or perched, are considered "Outside." Note that soaring birds, such as raptors, crows, etc, are "Outside, " **not** "Flying Over," unless they fly directly over the riparian area.

All birds that are detected but remain unidentified at the end of the 10-minute point-count survey should be pursued after the end of that survey (if they are still visible or audible), so that species-diversity information is maximized. If positive identification is made, then the observation record(s) from the survey should be updated with the corrected species & age information. No other information (e.g., distance, behavior) should be changed. All birds newly discovered at this time will not be included in the list generated during the point-count survey, but rather recorded in the same fashion as those discovered during travel between point-station locations. Record these as "in transit" at the bottom of the data sheet.

For point-count stations that are in close proximity, individual birds observed during a survey at one station, but that were recorded at a previous station, should be coded in a manner where they can be excluded/included from subsequent analyses. Generally, these "double-counted" birds are eliminated from most analyses, but distance sampling estimates (esp. detection probabilities) can sometimes be improved by treating these observations as independent.

Point-count stations will be re-surveyed at least 4 times during each breeding season. All points will be surveyed within a 3-4 week period, with replicate surveys occurring in subsequent survey periods. Whenever possible, a different observer should conduct the survey during each visit to reduce the effects of observer bias (Ralph et al. 1995). The time of day a point is surveyed should also be changed during each visit. This will minimize any temporal biases associated with variations in bird behavior (e.g., male singing rates [=detection probability] that might decline from early to late morning).

Equipment

Handheld GPS Unit	Anemometer
Thermometer	Rangefinder
Binoculars	Digital Timer

LITERATURE CITED

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. Introduction to distance sampling. Oxford University Press. New York, NY. 432 pages.

Farnsworth, G. F., K. H. Pollock, J. D. Nichols, T. R. Simons, J. E. Hines, and J. R. Sauer. 2002. A removal model for estimating detection probabilities from point-count surveys. Auk 119:414-425.

Hutto, R. L., S. M. Pletschet, and P. Hendricks. 1986. A fixed-radius point count method for nonbreeding and breeding season use. The Auk. 103:593-602.

MacKenzie, D. I., J. D. Nichols, G. B. Lachman, S. Droege, J. A. Royle, and C. A. Langtimm. 2002. Estimating site occupancy rates when detection probabilities are less than one. Ecology 83:2248-2255.

Ralph, C. J., S. Droege, and J. R. Sauer. 1995. Managing and Monitoring Birds Using Point Counts: Standards and Applications. USDA Forest Service General Technical Report PSW-GTR-149.

Appendix B: Western Riverside County MSHCP Biological Monitoring Program Protocol for Passerine Nest Searching and Monitoring

January 2007

Goal: Document the reproductive status of selected Covered Species within their Core Areas. Species to be surveyed include Yellow Warbler (YWAR), Southwestern Willow Flycatcher (WIFL), Yellow-breasted Chat (YBCH), California Gnatcatcher (CAGN), and Least Bell's Vireo (LBVI).

Objectives

To achieve the above goal(s), nest monitoring of target species will be conducted. Monitored nests will be found during nest searching surveys or observed on point and transect counts.

Timing

Nest searching and monitoring will occur during the reproductive period for each species, beginning in February for CAGN, April for most other species, and ending in June-August, depending on weather conditions.

Survey Locations

Surveys will be conducted on accessible lands in riparian and coastal sage scrub (CSS) habitat within the Conservation Area. Only Core Areas for the above target species will be included in the survey.

METHODS

Nest Searching

All observers must demonstrate the ability to visually and acoustically identify the above species before beginning surveys. Observers must pass an exam by correctly identifying all of the above species and distinguishing them from similar, potentially co-occurring species.

Survey locations will be selected based on data collected during riparian point counts (Spring 2006-2007) and CSS transects (Fall 2006, Spring 2007). When one of the target species is detected during a survey, a nest search will be initiated within one week. If recently recorded observations of the above species are not available early in the season, initial nest searches may also begin at locations recorded in 2006. Any incidental observations of the above species within Core Areas will also be investigated.

For each species and within each Core Area, we will attempt to monitor enough nests to provide a 95% probability of observing at least one successful nest, determined using nest success rates published in previous studies (Table1). Once a successful nest is observed within a particular Core Area, no further monitoring for that species is necessary, and all markers from actively monitored nests will be removed.

Nest searching techniques will be species-specific rather than habitat-specific. As a result, searchers should be familiar with the breeding phenologies of each species studied. Nest searching will involve a combination of walking areas where target species have been recently observed, and patient behavioral observation of birds encountered. The methods for finding nests outlined by Martin and Geupel (1993) will provide the focus of the efforts of the Monitoring Program. As most nest searchers will employ a combination of different techniques to find nests, and every searcher has their own strengths, there is no standardized method.

Nest searching can be labor intensive; however the learning curve rises sharply in a short amount of time with careful training and practice. Paying special attention to being alert, familiarity with the habitat(s) being searched, and species-specific breeding phenologies will also help observers to quickly become efficient at finding nests (Martin and Geupel 1993). Appropriate training and opportunity for practice will be provided before the breeding season begins.

Observers will spend approximately one hour at the starting location searching for the target species. If the species is located, observers will attempt to identify nest locations. If several points to be searched lay along the same riparian area or CSS transect, searchers should walk directly between them (if possible) as a way to saturate the site to be searched. This is because a bird detected on a count or transect may be at the edge of their territory, outside the territory, or simply flying overhead to land outside the count or transect area. Nests of target species do not have to be located within point count radii or transect area; points and transects are only to focus search efforts.

Nests can be found at any stage of the nesting cycle. However the earlier a nest can be found, the more accurate any extrapolations for fledging dates will be. Also, for many species of Passerines, nesting success decreases with each nesting attempt as the breeding season progresses (Sockman 1997). Therefore, it is important for searchers to be in the field when mated pairs are establishing territories and before nest construction begins.

Nest Monitoring

Once a nest has been located, it will be marked using a handheld GPS unit. The marked location will be a minimum of 10 m from the nest. This point will be mapped by hand on the datasheet along with the actual nest location and nearby landmarks. The location of the GPS point will also be marked with biodegradable flagging tape. No markers of any kind will be placed within 10 m of the nest.

On the initial visit to a nest, observers will record behavioral observations of the adults from a distance. Observers will then approach the nest and record the number of eggs and hatchlings, approximate age of the hatchlings, approximate distance of the nest from the ground, and the species of any supporting vegetation. During all nest checks, care must be taken to minimize physical disturbance to the nest itself and to the structure of the vegetation surrounding the nest. **The nest and nest contents should not be**

touched by any observers. To monitor nests that are above eye level, poles with small mirrors attached will be used to observe nest contents. For nests that are out of range of the poles, verification of nest status can only be determined by patient observation.

Nests will be approached on subsequent visits only if there is clear evidence that the nest has been depredated or abandoned, or if an approximate fledging date could not be determined on the first visit. Observers will attempt to monitor located nests from at least 10 m away and will only come closer than 10 m of the nest when absolutely necessary to determine the current status of the nest. Time spent this close to the nest will be kept to a minimum to avoid stressing the birds and attracting predators. On subsequent visits, observers will repeat behavioral observations from a distance, and also record the presence of any fledglings visible outside the nest.

After a fledging date is estimated, final visits will be made within one day of the approximate fledging date to determine if a nest has successfully fledged young. Any nest being checked, if not being looked into directly, must be observed long enough to verify nest status. Status during construction is obvious because the birds will be gathering and carrying nesting material. The best indicator that the nest is still in the incubation stage is that the female will remain on the nest except to periodically forage and stretch, and will be significantly less detectable within the territory.

Nest searching and monitoring is rather invasive to the host birds. Studies have shown that nests that have higher frequencies of investigator disturbance have the highest rates of predation (Sockman 1997). We will attempt to recheck nests as little as possible, which requires that the fledging date be accurately forecasted. Estimating the date a nest will fledge is the easiest if the nest is found during the construction or nestling stages. Intervals between nest checks will most likely decrease as nests near their forecasted fledge dates. Data gathered during nest checks can vary widely according to the questions being examined. For this project, nest contents will only be checked upon the initial locating of the nest (and possibly a second check). All other subsequent nest checks will be done at a distance with binoculars or spotting scope. Great care needs to be taken in approaching the nest from different directions to avoid creating visible trails and focusing human scent for predators to pick up on.

Equipment

Binoculars
Pole with mirror attached
Handheld GPS Unit
Spotting Scope
Flagging Tape
Data Sheets

LITERATURE CITED:

Braden, G.T. 1999. Does nest placement affect the fate or productivity of California gnatcatcher nests? The Auk 116(4):984-993.

Brown, B. T. 1993. Bell's Vireo. *In* The Birds of North America, No. 35 (A. Poole,P. Stettenheim and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington DC: The American Ornithologists' Union.

Cain III, J. W., M. L. Morrison and H. L. Bombay. 2003. Predator activity and nest success of Willow flycatchers and Yellow warblers. J. of Wildlife Management 67(3):600-610.

Martin T.E., and G. R. Geupel. 1993. Nest-monitoring plots: methods for locating nests and monitoring success. Journal of Field Ornithology 64: 507-514.

Ricketts, M.S. and G. Ritchison. 2000. Nesting success of Yellow-breasted chats: Effects of nest site and territory vegetation structure. Wilson Bulletin 112(4):510-516.

Sockman, K. W. 1997. Variations in life-history traits and nest-site selection affects risk of nest Predation in the California Gnatcatcher. The Auk 144(3): 324-332.

Table 1 – Approximate number of nests needed to provide a 95% probability of observing at least one successful nest per Core Area.

Species	Nest Success	Nests required per Core Area	Number of Core Areas	Total Nests Required	Source
California Gnatcatcher	0.21	11	12	132	Braden 1999
Yellow Warbler	0.52	5	7	35	Cain et al. 2003
Yellow-breasted Chat	0.45	6	4	24	Rickets and Ritchison 2000
Least Bell's Vireo	0.53	4	7	28	Brown 1993
Willow Flycatcher	0.37	7	5	35	Cain et al. 2003

Appendix C: 2007 Riparian Point Count-Vegetation Association Protocol

Objective

The purpose of incorporating vegetation work into the overall design of the avian surveys of riparian bird diversity and abundance in Western Riverside County is to examine the relationship between avian community composition and riparian vegetation structure. It will furthermore add to the robustness of the study by providing for enhanced statistical models in our analysis.

Methods

We will use GIS to randomly locate three points within the effective radius of riparian point count stations. For the purposes of vegetation sampling, the point counts will be assumed to have a radius of 100 m. The points will form the center of the long axis of a semicircular plot with a 10 m diameter, and no vegetation sampling will be done within 5 m of the edge of the point count radius, so the point centers will all be located within an 85 m radius of the riparian point. Points will be located at least 25 m from each other.

The first point will always be at the same location as the riparian point count. A second point will be selected between 27 and 56 m from the original point station. The final point will be located between 56 and 85 m from the original point. Field crews will navigate to these points using handheld GPS units using the UTM 11S NAD83 coordinate system. If, due to GIS error, the randomly selected points are not accessible, the field crew will navigate toward the central original point, stopping at the nearest location that is acceptable for sampling. Surveyors will only sample points that fall in the riparian zone.

At each sampling location, observers will take measurements within a 10 m radius semicircular plot. The GPS point location will be centered on the straight edge of the plot, which will be located at the edge of the stream channel parallel to the stream in the case of the two randomly selected points, or somewhere between the stream channel and the outer edge of the riparian zone in the case of the original point count station.. Observers will extend a 20 m tape parallel to the stream channel to mark the straight edge of the plot, and a 10 m tape extended at a right angle to the stream channel in the direction of the outer edge of the riparian zone will mark the plot radius. If the stream channel curves along the length of the 20 m tape, the plot will be moved far enough so that it is completely within riparian habitat.

Cover and canopy density will be measured using two methods. A "moosehorn" or ocular tube will be used at 31 locations to measure the density of shrub and tree strata individually, and a spherical densiometer will be used at 5 locations to measure overall canopy cover.

Instructions

The top portion of the data sheet will include data about the point count location and will be the same for all of the subplots associated with a given point station. For this portion of the data, the original point count station must be located. At the top of the data sheet, record the names of the observers, the point number, and the date.

Estimate the % of Riparian vegetation that is within a 100m radius of the site center (where the point count was conducted). For this estimate, the stream and stream channel are considered riparian only if they are covered by a tree or shrub canopy or if they contain emergent vegetation (e.g. cattails, bullrush). Also estimate the % of the 100 m radius point area that is covered by standing and flowing water.

Record the dominant adjacent (within a 1 km radius) land use, using the codes on the side of the data sheet (N: National Forest, P: Habitat Preserve, U: Urban/Development, and O: Other, to be indicated in the notes). Also record the predominant adjacent vegetation type, using the codes on the side of the data sheet (S: Shrubland, G: Grassland, W: Oak Woodland, C: Coniferous Forest, or O: Other).

The Remaining portion of the datasheet will be used to gather subplot information. There will be three datasheets for each site. Every page should have the point number, subplot number, and page number written down at minimum; other header information only needs to be written only on the first page.

You will be given three sampling points. Navigate to the first point (the original point count location), and orient yourself so that you are facing the stream. This will be the centerpoint for the first plot. If the stream curves so that the plot edge enters the stream channel, move the center point away from the stream until the entire plot is located outside of the stream. Note that if riparian plants are growing below a bank, this can still be sampled, but avoid sampling a channel with no plant cover if it is clearly a regularly flooded stream channel.

Establish a survey area of radius 10m. To do so, extend a meter tape 10m in either direction parallel to the stream. A perpendicular tape of 10m should be established as well, perpendicular to the stream, from the sub-plot center toward the riparian edge (away from the stream). Should the perpendicular transect extend beyond the edge of the riparian zone, the long axis of the plot can be moved toward the stream, or across the stream in the case of narrow streams with small riparian zones, to fully fit the plot within the riparian zone. If the total width of both sides of the riparian zone is less than 10 m, then terminate the 10 m transect at the edge of the riparian zone and continue it from the center point at an angle of 45° to the streambed.

For each subplot, estimate the percent of the survey plot that contains the riparian vegetation. From this point on, all estimates will be *of the riparian zone only*. Count the number of snags greater than 10 cm dbh in the riparian zone. A snag refers to a standing, partly or completely dead tree, often missing a top or most of the smaller branches. Count the number of logs (defined as coarse woody debris of diameter greater than 10cm). Also count the number of tree stems by species. Trees are defined as all vegetation >3m in height. Count only trees with a dbh of >10cm.

The next section involves quantifying the separate layers of the vegetation community. Use sections of PVC pipe to measure the tallest as well as average height of the shrub layer. Tallest and average height of the canopy/tree layer should be measured using a rangefinder or a clinometer. Shrubs are defined as any vegetation in the height class (>0.5m and <3.0m), while the tree class is comprised of all vegetation >3.0m in height.

A good estimate of the height of the tree can be had by measuring your horizontal distance from the tree with a rangefinder and then measuring the distance to the top of the tree. It is very important that you measure the distance to the highest part of the tree, and that the horizontal distance is exactly at eye level. After you have made those measurements, spot the location on the tree trunk where you made your horizontal measurement, and approach the tree and measure the distance from that point to the ground. This measurement can also be made by measuring the distance to the trunk at eye level, then measuring the angle to the top of the tree using a clinometer.

We will then estimate the herbaceous cover using a 1m^2 quadrat. We will take data from four quadrats placed within the sample area. These will be placed at the endpoints of two perpendicular transects (at 10m) and at the midpoint of each (at 5m). If the transect is continued in a 45 degree angle to the perpendicular transect, due to placement in a narrow stream, the quadrat will be placed at the end of this transect. Estimate the total cover of all of the categories present on the datasheet. Enter 0.2 if the cover is greater than 0 but less than 1 %.

Use the spherical densiometer to measure canopy closure. Use this devise at 1m above ground and record measurements from the plot center and each of the sites where vegetation cover was quantified using the quadrats, for a total of 5 observations. The densiometer should be held 12 to 18 inches in front of you, or far enough away to avoid interfering with the reflected image. Divide each marked square into four quadrants. Count the total number of quadrants covered more than 50% by vegetation. If most squares are covered, it is also acceptable to count the number of open quadrants and subtract this number from 96.

At every meter interval along both transects (parallel to the riparian corridor and perpendicular), use the ocular tube to record Canopy, Shrub or Open, depending on what is observed in the cross-hairs held 1m above the ground. This should be recorded at each meter interval for a total of 31 points (21 along the transect that is parallel to the stream and 10 along the perpendicular transect). At each point, also record the species of overstory (unless Open).