

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

Tricolored Blackbird (*Agelaius tricolor*)
Survey Report 2005



July 7, 2006
(Revised September 19, 2006)

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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 of 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 MSHCP information needs identified in Section 5.3 or elsewhere in the document, and the information needs of the Permittees.

The primary preparer of this report was the Field Crew Leader, Andrew Miller. 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

Tricolored blackbirds (*Agelaius tricolor*, “TRBL”) are largely native to California, with over 99% of the population occurring within the state. They are a California species of special concern. Past surveys indicate that populations have been rapidly declining for decades, probably due to water diversions, land conversion, and heavy predation by mammals, corvids and black-crowned night herons (Beedy and Hamilton 1997; Beedy and Hamilton 1999). Few current or historic TRBL breeding colonies have been documented within the Plan Area. Due to their specific habitat requirements (mainly dense patches of emergent vegetation and nearby water), this species calls for site specific conservation within the MSHCP Conservation Area (Dudek & Associates 2003).

Survey Goals

In 2005, the Biological Monitoring Program conducted surveys for TRBL with the goal of determining whether MSHCP species objective 4 for this species was met:

“Within the MSHCP Conservation Area, maintain (once every 5 years) the continued use of, and successful reproduction within at least one of the identified Core Areas. Successful reproduction is defined as a nest which fledged at least one known young” (Dudek & Associates 2003).

The five Core Areas are listed as: 1) San Jacinto floodplain; 2) Mystic Lake/San Jacinto Wildlife Area; 3) Collier Marsh and Lake Elsinore Grasslands; 4) Alberhill; and 5) Vail Lake/Wilson Valley/eastern Temecula Creek

The objectives of the MSHCP Biological Monitoring Program TRBL survey season in 2005 were to 1) train surveyors to identify TRBL by sight, vocalization and behavior; 2) survey identified Core Areas and historic colonies in western Riverside County; and 3) estimate size of all colonies encountered using an established protocol.

METHODS

Protocol Development

Surveys for TRBL were carried out in conjunction with an effort to census all TRBL colonies in California in 2005, sponsored by the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), Point Reyes Bird Observatory, California Partners-in-Flight, UC Davis, EDAW, Audubon, and the Central Valley Bird Club. The protocol used was an updated version of Beedy and Hamilton’s (1997) “General Guidelines for Locating and Monitoring Tricolored Blackbird Colonies”. These guidelines are approved by the USFWS’s Migratory Birds and Habitat Programs and the CDFG’s Bird and Mammal Conservation Program.

The statewide effort was scheduled for two 3-day periods (22-24 April and 3-5 June 2005). Since TRBL colonies often relocate and attempt to nest again following major nesting

failure due to predation or other causes (Beedy and Hamilton 1997; Hamilton 1998), the count is limited to three days each survey period to avoid duplicate counts of breeding birds (EDAW 2005). The Monitoring Program only participated in the first 3-day period in 2005. Surveys were coordinated with the Riverside County coordinator for the statewide effort, Tom Paulek, CDFG.

Personnel and Training

Training was carried out on 16 April 2005 in a coordinated effort for the 2005 TRBL statewide census. All MSHCP biologists participating in this effort were trained to identify TRBL in the field by sight, sound, and behavior; and estimate breeding adult population within a colony. Training was carried out by Mike Green, USFWS, and Bill Hamilton, U.C. Davis, a published expert on TRBL ecology. The complete guidelines, survey forms, and additional notes taken from the 16 April 2005 TRBL training can be found in Appendix A and B (respectively) or by visiting <http://tricoloredsurvey.com/survey/surveyHome.aspx>.

Surveyors conducting TRBL surveys in 2005 included:

- Andrew Miller, Field Crew Leader (Regional Conservation Authority)
- Shirley Bartz (Regional Conservation Authority)
- Tom Paulek (CDFG, Riverside County TRBL survey coordinator)
- Annie Bustamante (CDFG)
- Ricardo Escobar III (CDFG)

Survey Site Selection

Local survey sites for the statewide survey effort were chosen based on historical accounts mentioned in the MSHCP (Dudek & Associates 2003), a list of historic TRBL detections in western Riverside County provided by California Partners-in-Flight (Table 1), and Tom Paulek's personal knowledge of potential and/or past breeding sites. Local land managers (Table 2) were also consulted prior to surveys to obtain information about potential nesting locations for TRBL colonies, current known colonies, and to avoid unnecessary travel to sites that contained poor habitat. Survey sites that were not included as Core Areas, but were mentioned as historic breeding locations in the MSHCP (Dudek & Associates 2003) and by Tom Paulek, included sections of the Santa Ana River Wildlife Area, Lake Matthews, and the Potrero Unit of the SJWA. Not all historical or potential sites identified were sampled because of time constraints and lack of personnel to cover all areas within the 3-day survey period. Priority was given to sites that fell within the MSHCP Core Areas for TRBL.

Survey Methods

Surveys for TRBL breeding colonies were carried out between 22 and 24 April in order to participate in the 2005 statewide TRBL census. Surveys consisted of driving or walking around potential suitable breeding habitat within survey sites and watching and listening for TRBL activity. Suitable habitat was defined as 1) areas with open accessible water bodies, and 2) presence of a protected nesting substrate, which is usually either flooded or thorny vegetation (Beedy 1989; Hamilton et al. 1995). Upon finding a TRBL colony surveyors remained at a safe

distance to avoid disturbing the colony. The colony was assessed for stage (e.g., nest-building, incubation, etc.), area occupied, spacing between nests, sex ratio and total number of breeding adults. Surveyors avoided remaining within active colonies for extended periods of time (i.e. hours), creating numerous trails, or disturbing vegetation near dense nesting clusters to prevent nest abandonment (Beedy and Hayworth 1992; Beedy and Hamilton 1997). All coordinates of observed TRBL colonies, breeding or non-breeding, were recorded using a GPS unit (Garmin 12XL) and plotted on a Riverside County map (Fig. 1).

Fledgling success was determined by observing juveniles that had left the nest and assembled either at the colony site or at locations between colonies and favorable foraging areas (Payne 1969). These fledglings are conspicuous, both because they are vociferous and because adults are feeding them as rapidly as possible (Beedy and Hamilton 1997).

Data Storage

Results of the April 22-24 surveys were submitted online (<http://tricoloredsurvey.com/survey/surveyHome.aspx>) as a requirement of the participation in the 2005 TRBL statewide census. Surveys routes were mapped and mailed to Leo Edson at EDAW, Inc. 2022 J Street, Sacramento, CA 95814. Results of the complete 2005 TRBL statewide census are also available at this website. For questions regarding the 2005 TRBL statewide census contact Leo Edson (916-414-5813; edsonl@edaw.com). Survey results for the Conservation Area are also stored in the Biological Monitoring Program office in Riverside.

RESULTS

All five Core Areas identified in the MSHCP were surveyed for TRBL. As mentioned above, the results of the statewide survey effort are available through the above website. This report only discusses survey results in the MSHCP Conservation Area. A total of five TRBL colonies were located in western Riverside County during the four survey days. Only two of the five colonies were within the MSHCP Conservation Area: one at the Davis Unit of the San Jacinto Wildlife Area (SJWA) and the other at the Potrero Unit of the San Jacinto Wildlife Area (Potrero; Fig. 1). Breeding activity (i.e. chorus, nest building, incubation, nestling, fledgling) was observed at both colonies, however, breeding success (fledglings observed) was only confirmed at Potrero. Details of each of the five colonies are provided below:

Colony 1 (Potrero): Colony 1 was located within the Potrero Unit of the SJWA. This is the only colony where successful breeding was documented (fledglings observed) in the Conservation Area. The colony bred in a small (approximately 0.5 acre) pond, densely vegetated by cattails (*Typha* spp.), with open water occurring in the middle of the pond. The colony was estimated to contain 500 breeding adults and was determined to be between nestling and fledgling breeding stages, since juveniles were observed outside of nests receiving food from adults and some adults (male and female) were observed delivering food to nests. This colony was not located within any of the MSHCP-identified TRBL Core Areas, but is within the MSHCP Conservation Area.

Colony 2 (Cahuilla): Colony 2 was observed on the Cahuilla Indian Reservation while driving to the Vail Lake/Wilson Valley/eastern Temecula Creek TRBL Core Area, and was not an intended

site location. It consists of a marshy pasture, primarily bulrush (*Scirpus spp.*) and some cattails (*Typha spp.*), just south of CA Highway 371. Birds were visible from and were counted from the highway. Surveyors did not enter the pasture or reservation land. An estimated 500 breeding adults were observed in this colony and they were determined to be between nestling and fledgling breeding stages. This colony was located outside of TRBL Core Areas and outside of the MSHCP Conservation Area. Therefore, the exact location of this colony is not contained within this document in order to comply with the wishes of the Cahuilla Indian Reservation Tribal biologist, Anthony Madrigal Jr. Only one visit to this colony was made.

Colony 3 (Lake Riverside): Colony 3 was observed on the northern and western portions of Lake Riverside within a gated community just west of CA Highway 371. Permission to enter the site was granted by Elaine Porges, a receptionist and member of the Community Association at the community offices. Adults were observed to be carrying nest building materials and delivering food to nests located within cattails (*Typha spp.*) and bulrush (*Scirpus spp.*). No fledglings were observed outside of nests and breeding success was not confirmed. The estimated breeding adults within this colony were 200 individuals. No further visits to this site were made. This site was located outside of TRBL Core Areas and not within the MSHCP Conservation Area.

Colony 4 (Perris Airport): Colony 4 was observed on private land at the Perris Airport. Tricolored blackbirds were observed nesting in several stands of exotic thistle (*Silybum marianum*) surrounded by black mustard (*Brassica nigra*). An estimated 1,000 breeding adults were observed within a colony that was determined to be between nestling and fledgling stages. Colony 4 was outside of the TRBL Core Areas and not within the MSHCP Conservation Area.

Colony 5 (SJWA): Colony 5 was the largest breeding colony (approx. 4-6 acres) found within the Plan Area with an estimated 10,000 breeding adults. The colony was located within the Davis Unit of the SJWA and TRBLs were observed carrying nesting material and food into fields of cheeseweed (*Malva parviflora*) and prickly lettuce (*Lactuca serriola*). Based on this behavior it would appear that the colony was in a nest building and nestling feeding stage, however Tom Paulek reported to us that upon return to this colony four days after his initial visit the colony had disappeared. The reason for the disappearance of the colony is unknown, but TRBLs are known to abandon colonies after disturbance (Beedy and Hamilton 1997). Although the SJWA is usually a dependable area for TRBL reproductive colonies (Paulek pers com.), no confirmation of breeding success exist for the SJWA in 2005. Colony 5 is within an MSHCP-identified Core Area.

DISCUSSION

Of the five TRBL colonies found in the MSHCP Planning Area in 2005, only one was found within a Core Area (SJWA), but it was the largest colony observed. Tom Paulek observed birds carrying nesting material and food indicating nest construction and feeding nestlings stages of a colony; however, their disappearance four days after leaves the outcome of this colony in doubt and is not likely to have resulted in successfully fledged juveniles. It is expected that TRBL colonies will nest at the SJWA in the future. If fledgling success is confirmed at this site in the future it will meet species objective 4 for TRBL.

The successfully breeding colony within the Potrero Unit of the SJWA does not fall within an identified Core Area for the TRBL. However, this site is within the MSHCP Conservation Area and is a promising site for continued fledging success with proper management (namely enlargement of the pond and opening marginal vegetation to increase amount of open water). Although this site is not a Core Area, it is an important breeding site because it constitutes the north-eastern limit of the TRBL distribution in the Planning Area. If the Potrero Unit of the San Jacinto Wildlife Area becomes a consistent breeding location for TRBL, it should be considered for inclusion as a TRBL Core Area.

Recommendations for Future Surveys

The species objectives for TRBL require the continued use of and successful reproduction within at least one of five Core Areas identified in the MSHCP. The Biological Monitoring Program observed a TRBL colony nesting in one Core Area in 2005 however, successful reproduction was not confirmed and probably did not occur. For future surveys we recommend a survey period of at least two weeks in the areas covered, especially the SJWA, between mid-April and mid-May, to document colony outcomes and fledgling success.

For future MSHCP monitoring purposes, the Partners-in-Flight survey protocol should be modified to document non-occupied historical sites. It should include a current general description of these sites, determination of whether TRBL habitat (primary and secondary) is present or absent, and a GPS coordinate.

Avoid colony disturbance

It is unknown what level of disturbance is possible without prompting TRBL colony abandonment. It is important within the Core Areas that disturbance by surveyors continue to remain at a minimum, especially early in colony establishment and nest constructing phases.

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Table 1. Partners-in-Flight historic TRBL detections

Month	Year	Pop. Est.	Township	Range	Sec.	Location
06	1992	250	3S	4W	5	SYCAMORE CANYON
04	1992	5000	3S	2W	32	MARSH A, POND 1
	1993	200	3S	2W	31	SAN JACINTO WILDLIFE AREA; W SIDE OF DAVIS RD
	1993	500	3S	2W	22	JACKRABBIT RD AND GILMAN HOT SPRINGS RD; GRAVEL PIT OPERATION
	1993	1000	3S	2W	29	SAN JACINTO WILDLIFE AREA
	1993	1000	3S	2W	29	SAN JACINTO WILDLIFE AREA
04	1994	75	3S	2W	29	MARSH B, SAN JACINTO WA
04	1994	200	3S	2W	23	JACKRABBIT RD @ GLEN IVY RD IN GRAVEL PIT
05	1994	300	3S	2W	29	MARSH B, SAN JACINTO WILDLIFE AREA
04	1994	400	3S	2W	29	MARSH A, SAN JACINTO WILDLIFE AREA
04	1994	1500	4S	2W	3	0.5 MI N OF RAMONA EXPWY ON BRIDGE RD
05	1994	5000	4S	2W	3	0.5 MI N OF RAMONA EXPWY ON BRIDGE RD
04	1995	500	4S	2W	3	0.5 MI N ON BRIDGE ST, E OF LAKEVIEW
05	1995	500	3S	2W	23	JACKRABBIT RD & GILMAN SPRINGS RD, GRAVEL/CEMENT PLANT
04	1995	1000	3S	2W	23	0.75 MI N ON GILMAN HOT SPRINGS RD FROM JACKRABBIT RD
04	1995	1000	3S	3W	12	E OF THEODORE ST, 0.25 MI S OF I-60
05	1995	1000	4S	2W	3	BRIDGE RD 0.5 M N OF RAMONA EXPWY, 2.9 MI E OF LAKEVIEW
05	1995	1250	3S	3W	12	0.5 MI S OF HWY 60 & THEODORE RD
04	1995	2000	3S	3W	12	S OF ST HWY 60, W OF THEODORE AVE
05	1995	2000	4S	1W	29	RESEARCH CELLS, EMWD H2O TREATMENT PLANT, SANDERSON AVE, SAN JACINTO
04	1996	125	3S	2W	20	RECLAIMED WATER RESERVOIR AREA, SAN JACINTO WILDLIFE AREA
04	1996	350	4S	2W	3	BRIDGE RD, .5 MI N OF RAMONA EXPRESSWAY
04	1996	750	3S	2W	29	MARSH A, SAN JACINTO WILDLIFE AREA, DAVIS RD
04	1996	2000	3S	2W	29	MARSH B, SAN JACINTO WILDLIFE AREA, DAVIS RD
05	1996	2500	3S	2W	29	MARSH B, SAN JACINTO WILDLIFE AREA
05	1997	6	3S	7W	18	PRADO DAM, PRADO LAKE
04	1997	350	3S	2W	29	MARSH A, SAN JACINTO WILDLIFE AREA
04	1997	400	3S	2W	29	MARSH B, SAN JACINTO WILDLIFE AREA
04	1997	400				RIVERSIDE QUARRY

Table 1. Continued from previous page

Month	Year	Pop. Est.	Township	Range	Sec.	Location
04	1997	600	4S	2W	3	0.5 MI N OF RAMONA EXPWY ON BRIDGE RD
04	1997	2000	3S	2W	23	0.25 MI E ON JACKRABBIT RD & GILMAN HOT SPRINGS RD, SAN JACINTO WILDLIFE AREA
04	1997	35000	4S	1W	30	HEMET EMWD COLONY; 2045 SAN JACINTO AVE
05	1999	60	2S	2W	23	PASTURELAND S. OF CALIMESA
04	1999	1000	3S	2W	29	SAN JACINTO WILDLIFE AREA POND 1 / MARSH A
04	2000	10000	4S	1W	30	HEMET SEWAGE

Received 3/30/2005

Wendy Watson

Wildlife Biologist

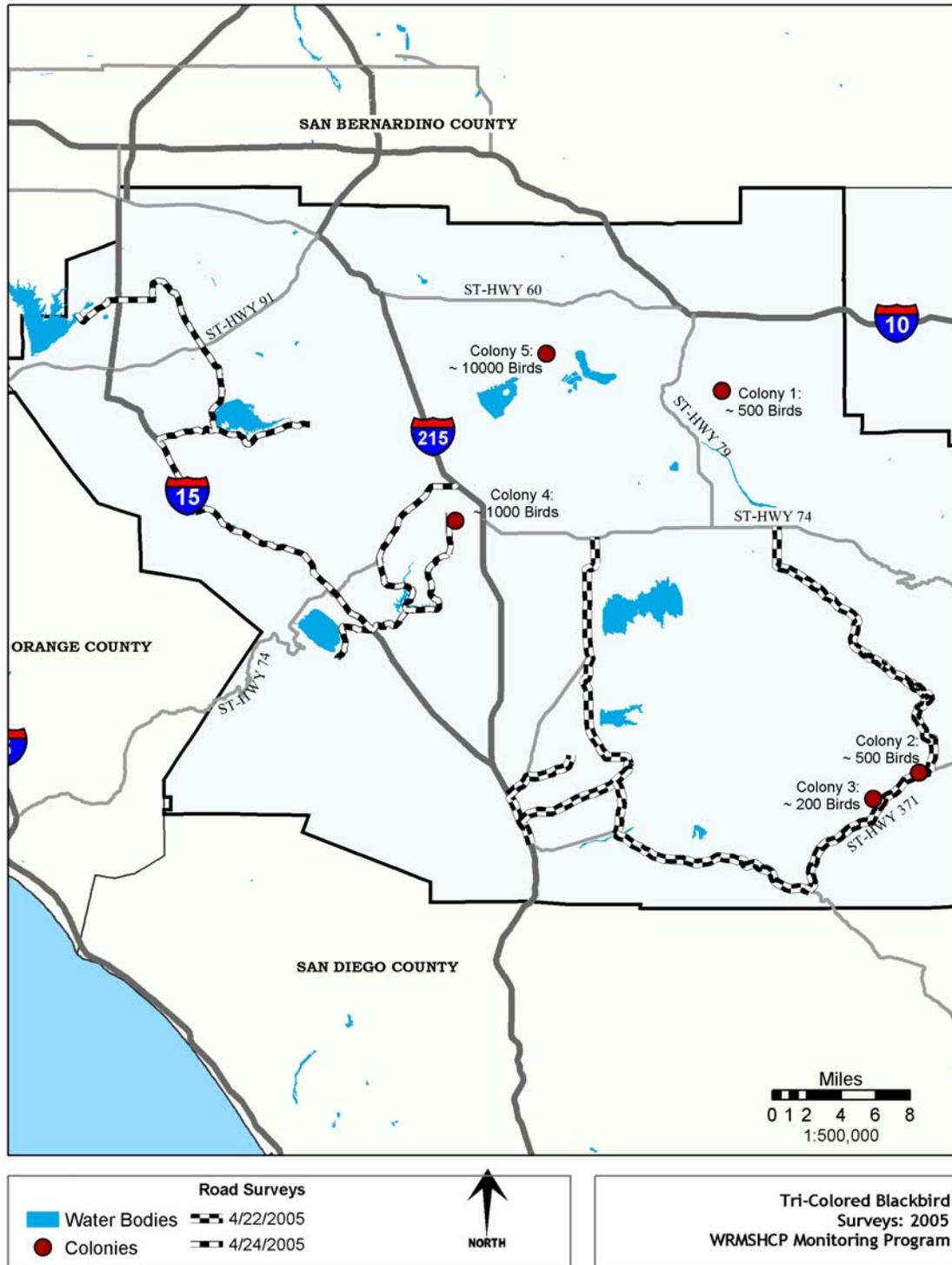
EDAW

2022 J Street

Sacramento, CA 95814

TEL: 916-414-5856 FAX: 916-414-5850

FIGURE 1. 2005 TRBL survey routes and detections.



APPENDIX A: 2005 Tricolored Blackbird Monitoring Form and Field Survey Form Instructions

Fill out a new form for each colony and ‘Save As’ using a new file name for each; use the occurrence # as file name, or useful locale name if new.

Observer			
Telephone		Email	
Address			

County of Observation		Date of Observation (m/d/yy)	
Start Time		End Time	
			Total Time

Nesting Colonies

Estimated Number of Adults		Estimated Sex Ratio (m:f)	
Some Singing?		Some Carrying nesting material?	
Some carrying food?		Have any young fledged?	
Primary Nesting Substrate		Percent of dominant substrate	
If Other:			
Secondary Nesting Substrate		Percent of secondary substrate	
If Other:			
Estim. Area of habitat occupied by nests		Estim. Area of habitat not occupied by nests	
Estimated Colony Length		Width	
Nearest Water Source used by colony			

Location We accept colony shapes drawn on the field maps provided on this website. Maps can be marked and then faxed to Leo Edson at (916) 414-5850.

UTM Northing		UTM Easting	
Directions			
Land Owner or local contact			
Comments			

(Source: <http://tricoloredsurvey.com/survey/surveyHome.aspx>)

Please include all requested information on the field survey form. Complete a separate form for each documented colony, and follow these specific instructions:

Top Section - Please complete all information. It is essential that survey forms include the county in which observations were made. Include your name, address, telephone and fax number, or e-mail address, so that we may contact you if we require additional information. Enter either start and stop time or total time, whichever most accurately will account for your actual time driving transects or at colonies looking for Tricolors.

Nesting Colonies – Estimate colony size as described above; also estimate sex ratio. Answer yes/no questions regarding the nesting behavior of the birds. Choose nesting substrate from one of the following options: bulrush-tule, Himalaya blackberry, California blackberry, blackberry, cattail, willows, cottonwood, Arundo, desert olive, mustard, thistle, nettles, prickly lettuce, mule fat, coyote brush, raspberry, rice, tamarisk, poison hemlock, wheat, barley, silage, other; if ‘other’, write in box below. Please estimate the area (in acres, square yards, or square feet) occupied by the colony and of available habitat. Please use a single whole number for these estimates. Please note the distance to nearest water and the type of water (e.g., freshwater marsh, open water).

Location – All past survey information has been incorporated into a database for Geographic Information System analyses. Providing meaningful accurate geographic locations on survey forms is important. The online data entry map enters these points automatically when you ‘add point’ to the map; we prefer this method of data submission. If filling out a data sheet by hand, please use Universal Transverse Mercator (UTM) or Latitude and Longitude coordinates (including minutes and seconds) if they can be readily determined. Regardless, please map the location of the observation as accurately as possible onto a field map for later entry via an interactive map on the project website. Make note of important location details under ‘Directions’. List landowner or local contact if known.

History – Information on historical nest colony sites is important in assessing trends, management and conservation needs, and breeding behavior. Please indicate in Comments if the observed colony is nesting in a known historic site, and when, in the past, the site was known to be active. Additional notes on habitat conditions, current or potential threats, and ownership (i.e., private or public) are valuable for future efforts.

Submitting Data

As soon as possible and within 24 hours of data collection, data should be submitted via an online form accessible through the project website (www.tricoloredsurvey.com) survey page which includes a link for entering results. Locations of all observed colonies will need to be indicated on an interactive map on the website before further data entry is possible (i.e., that recorded on data forms). Information from data forms will be entered subsequent to mapping colonies on the interactive map. All information submitted via the website will be stored in a Microsoft Access database enabling project coordinators to access the information immediately following entry. It is imperative that data be entered within 24 hours of collection to facilitate planned follow-up surveys to be conducted by Bill Hamilton at U.C. Davis. During follow-up surveys, foraging data will be collected at as many colonies as possible and detailed analyses of 25 randomly selected colonies on accessible property will be completed. If you have observations or comments on foraging habitats at colonies contact Bill at wjhamilton@ucdavis.edu. If, for whatever reason, you are unable to enter your data via the website within the specified timeframe, data forms and maps can be sent to Leo Edson via fax (916-414-5850) or email (edsonl@edaw.com).

As a last resort, results can be verbally conveyed to Leo by phone (916-414-5813).

Survey Routes

New this year, we will also be collecting information on routes surveyed. Please mail a map with your survey route marked on it, to Leo. Mail to: EDAW, Inc. 2022 J Street, Sacramento, CA 95814.

APPENDIX B: TRBL Survey Protocol and Training Notes

Locating colonies. TRBL is a colonial nesting species which nests in cattails, tules, briars, oats or other dense, inundated or spiny vegetation. During the southern California nesting season, from mid April – mid June, TRBL can be readily detected as they travel between feeding areas and colony sites. Nesting colonies are typically located where spiny vegetation or inundated vegetation surrounded by open water offer it protection from terrestrial predators. Surveys consist of driving around areas with suitable nesting habitat including water bodies with substantial marginal vegetation (cattails and bulrush), agricultural fields and abandoned agricultural fields. In addition to streams lakes and waterways, weedy fields, wheat and oat fields, and dairies (slurry pits can provide insects and grain and silage provide grain), and large drainage areas all offer TRBL foraging grounds. Streams of black birds leaving a nesting area or descending towards fields or ponds with large stands of cattails should be investigated. Watch for black birds that seem to be following the same flight line. This is a key behavior which can help observers distinguish TRBL from Red-winged blackbirds (REBL). REBL is territorial and do not travel in large groups to and from feeding areas as TRBL does.

The object of the Partners in Flight protocol that we employed is to estimate the number of *breeding adults*. It is important to clearly distinguish this from a population estimate incorporating non-breeding males and young of the year. These are not considered in this methodology.

After a colony is located surveyors observed from a distance in order to determine the breeding stage of the colony and to estimate the number of birds within it. All of the following steps should be followed in order to arrive at the best estimate of the breeding population. TRBL colonies can be bewilderingly large and chaotic. Position yourself a minimum of 100 m away from the colony edge so that your presence doesn't disturb incubating females and lead to nest abandonment, take your time and follow the procedure. The nest construction phase is the most delicate period. Observers should be sure they are not too close to nesting birds. Birds may choose to abandon the nesting colony if they are disturbed. Males are more sensitive to disturbance than females. A male that is spooked off during nest construction may ultimately result in nest failure because he may be less inclined to deliver food to nestlings for which he may not be assured of parentage (Hamilton pers. com.). During the nestling phase male behavior can be a guide to judging whether you are too close. If food carrying males alight in the colony but do not drop below to deliver it to the nestlings back off – you are too close.

1. Determine stage of colony: All of these nesting stages can be present at the same time. Try to characterize the majority of the birds you see.

- *Are substantial numbers singing?* **Chorus.** Birds may not be settled and may not breed at this location. If no further evidence of breeding is observed, come back in a few days before attempting to estimate colony size.
- *Are females carrying nesting material?* **Nest building.** *What type?* Nests are built entirely by the female, take four days to build and typically consist of three different phases. Large grasses (day 1), mud (day two / three), fine grasses (three / four).

- *Are males greatly outnumbered by quiet or flycatching females?* **Incubation.** Nonbreeding males form single sex flocks which forage independently. Once nest building is complete, breeding males join the single sex flock until eggs hatch and nestlings require feeding. The colony may appear quiet during incubation and size can be difficult to estimate. It's best to come back a few days later to observe birds during the nestling stage.
- *Are males and females delivering food to nests?* **Nestling.** This is the best time to estimate colony size.
- *Juveniles present at margins of colony?* **Fledgling.** Juveniles form crèche groups after fledging and continue to be provisioned by adults for several weeks. Be careful not to mistake them for adult birds as their density can exceed nesting density.

2. Determine the dimensions of the colony by walking the perimeter. Look for females flying in and alighting in reeds and dropping down to a presumed nest. It is useful to map out where they are not (open water, unsuitable habitat). Aerial photos may help if they are available. Draw the colony and estimate the distance from the edge of suitable habitat to where males and females settle into the substrate carrying food. This behavior indicates a nest somewhere below.

3. Determine spacing to nearest neighbor. Observe a single bird alight and watch it go down into the reeds. Patiently wait to observe other birds emerge or alight close to the original TRBL. Another possibility is to look for two females perched close together and watch them to see if other birds emerge or alight between them. The density of nests can be estimated by taking enough samples of nearest neighbors within the colony. Because the density of nesting may not be uniform across the colony, make enough counts to represent the variation. It's good to do this several times relative to the edges of the colony to get an estimate of how closely birds are nesting within the colony.

4. Determine sex ratio. Hamilton suggests a 2 females:1 male sex ratio is normal. Don't take this ratio for granted. Record numbers of male and female birds to get a feel for this ratio.

5. (Area) x (nest density) x (sex ratio) = total breeding adults. TRBL is a polygamous species with one male mating with and provisioning the young from several females. Nest monitoring suggests a two females to one male sex ratio (Hamilton pers. com.). There is one female per nest. Nest density is multiplied by 1.5 for total number of females and males.

During our training, Monitoring Program biologists visited a site near the Kern River that had an estimated breeding population of 90,000 birds occupying a 60 acre oat field. Subsequent nest counts via transects revealed 62,110 nests and a total of 93,165 birds by conventional accounting for males. This translates to 96.6% accuracy for the method described above. When followed step by step with repeat measures, this method will yield a reasonable estimate. The point of the method is to separate colonies of hundreds from colonies of thousands from colonies of ten's of thousands.