Trapping and Banding of Tricolored Blackbirds (*Agelaius tricolor*) in the Central Valley of California in 2010

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Introduction

The tricolored blackbird (*Agelaius tricolor*), hereafter "tricolor", is a North American songbird that is nearly endemic to California (Beedy and Hamilton 1999). Tricolor abundance has been reduced by approximately 90% in the past century due to several factors, including losses of its breeding and foraging habitats to agriculture and urbanization, deliberate poisoning and shooting, and harvest of its silage grain nesting substrate while eggs and young are still in the nests (Neff 1937, Beedy and Hamilton 1999, Cook and Toft 2005). Since 2006, severe losses in Tulare County in the southern San Joaquin Valley to predation by cattle egrets have reduced to near-zero the productivity of several large colonies (Meese 2008, 2010).

Despite several decades of field work, relatively little is known about the movements of birds within and among years, nor have basic life history traits (age-specific rate of mortality, life expectancy) been quantitatively estimated. Although large numbers of tricolors have previously been banded, previous investigators relied upon the banding of nestlings and movement data were obtained by shooting banded birds at their breeding colonies (Neff 1942, DeHaven and Neff 1973). The use of aluminum bands on nestlings has among its potential shortcomings the high mortality rate of nestlings, with consequent reduction in the rate of recapture or recovery (Lakhani and Newton 1983). The individualized marking and subsequent recapture of large numbers of adult and fledgling birds may provide information on movements, life history attributes, age structure, site fidelity, and longevity (Calvo and Furness 1992, Lebreton et al. 1992) and provide essential guidance for conservation actions.

This report describes the results of the fourth year of a multi-year study that is attempting to most efficiently trap and band birds by: 1) trapping and banding only adult and recently fledged birds, 2) trapping in multiple locations from the southern San Joaquin Valley to the central Sacramento Valley, and 3) using only federal aluminum bands to maximize the number of birds banded in a field season. These methods are intended to most efficiently accumulate information on patterns of movements and life history attributes.

This report is submitted pursuant to permit number SC-009330 and additional written permit obtained from the California Department of Fish & Game, Habitat Conservation Branch, and U.S. Fish & Wildlife Service contract in support of tricolored blackbird research and summarizes the methods and results of the 2010 trapping and banding effort.

Methods

Trapping. Previous experience (Meese 2007, 2008, 2009) demonstrated that tricolors may effectively be caught in two kinds of traps baited with cracked corn: 1) blackbird traps and 2) dove traps.

Blackbird Traps. I developed blackbird traps from modified Australian crow traps (Meese 2007). Each blackbird trap consisted of 2 4x4' side panels and 2 V-shaped 4x4' end panels of 1x2" galvanized steel mesh set within a 2x2" wooden frame held together by 2 ½" galvanized lag screws. The wire is set within ½" deep slots (dadoes) to reduce abrasion and the risk of injury to trapped birds. Two 30x48" roof panels rest upon 3x48" wooden slats that form a gap through which birds may enter but not escape. One eave has a 7x14" hole cut out of the wire that matches the dimensions of the door to a transport cage (see below) that is suspended from one eave with 2 galvanized hooks (Figure 1). Two small hooks ("S hooks") are attached to monofilament line and secured to the wire frame to hold the door to the transport cage open while trapping. The monofilament line is released to close the door to the transport cage, confining the birds inside, when the birds are removed from the trap and transported to the banding station.

See Meese and Simmons (2010) for additional information on blackbird trap design.

Figure 1. Blackbird trap used in 2010 showing transport cage hanging from far left eave.

Dove Traps. I constructed dove traps of 1x2" welded steel wire shaped like an "L" approximately 18" wide, 4' long, and 10" high (Fig. 2) deployed in tandem to create a "U" shape with the inside of the "U" forming an alcove that was baited with cracked corn. Tricolors enter the dove traps from the ground through one-way funnels that allow entry but prevent exit (Fig. 2).

Modified Dove Traps. Several weeks into the banding effort I constructed two additional traps based upon a new design. I created a single, large 4'x8'x10" dove trap by using plastic clips ("Kwik-klips"; Bass Equipment Co., Monett, MO) to hold together 2 4'x4'x10" sections. Each section had a 14"x7" opening that matched the opening on a transport cage (see below) and two funnels located 22" from the end and 4" from each transport cage. I placed 2 transport cages, one at each end of the trap, against the wall of the trap containing the two openings to form a U-shaped trap with an alcove that was baited with cracked corn. The doors of the transport cages were held open with S hooks attached to monofilament lines. Birds entered the modified dove traps through the two one-way funnels in exactly the same way as in the existing dove traps.

Transport Cages. I moved birds from the traps into 18x24x10" transport cages constructed of 1x1" welded steel wire, and carried the birds from the traps to the banding station in transport cages. Transport cages had same-size (14x7") doors as those on the blackbird and dove traps. A 6" diameter cuff made of elk hide was bolted to the roof of the transport cage through a 10" diameter frame. The cuff provides access into the transport cage for the banders while preventing the escape of birds (Figure 4).

To remove birds from dove traps, I would first hold the door to the dove trap open with an S hook, then place a transport cage against the now open end of the dove trap (Figure 2), attach an S hook on a 5' length of monofilament line to the transport cage door, and move to a position opposite the transport cage. When I moved away from the transport cage, the trapped birds would move out of the trap and into the transport cage. As soon as birds entered the transport cage, I released the monofilament line, closing the door to the transport cage and confining the birds inside.

The transport cages were integrated into the design of the modified dove traps, so to move birds out of the modified dove traps and into the transport cages I would slowly approach the modified dove trap from a position opposite the side with the transport cages, causing the majority of the birds to flee into the far transport cage. I would release the monofilament line to confine the birds to the transport cage. Any remaining birds would flee into the other transport cage as I released the monofilament line for the first transport cage. I released the second monofilament line and confined any remaining birds to the second transport cage. Both transport cages were then replaced with empty transport cages and their doors were held open by the S hooks on the monofilament lines.

All three trap designs allowed me to move birds out of the traps and into the transport cages for banding without handling the trapped birds, greatly reducing handling-induced stress to the birds.

See Meese and Simmons (2010) for additional information on traps and trapping methods.

Figure 2. Tricolored blackbirds about to be moved from the dove trap to the transport cage for banding.

Banding Station. The banding station consisted of a 6' long table and 4 plastic chairs set under a 15x15' nylon shade structure (Coleman GeoSport). Transport cages with birds to be banded were placed on to a 15" high metal support to facilitate handling. A transport cage containing birds was placed between two banders who would band birds simultaneously. If more than one transport cage containing birds was brought to the banding station, the additional transport cages containing birds were placed on the ground under the shade structure and covered with nylon shade cloth to reduce stress to the birds prior to banding.

A modified transport cage support consisting of a 17x23" rectangle of ¾" PVC standing on 15" legs of ½" PVC pipe was evaluated at the end of the banding season and found to offer greater stability and portability than the original metal support and will be used exclusively in the future.

Banding. Banding began in mid-May in the southern San Joaquin Valley. I and U.S. Fish & Wildlife Service collaborators from Kern National Wildlife Refuge habituated the birds to the cracked corn by providing cracked corn daily for 3 days prior to trapping at Unit 1 of Kern National Wildlife Refuge in Kern County. Banding continued through late July and followed the progression of colonies northward to Delevan NWR, Colusa County and then southward to Conaway Ranch and Yolo Bypass Wildlife Area, Yolo County, as they formed and then disbanded following breeding.

The blackbird trap was left open with roof panels removed and baited with cracked corn during the intervals between banding bouts, allowing the birds free access to the bait and further habituating them to the trap. Dove traps were removed from the trapping sites and stored upside-down a few feet away between banding bouts. Both blackbird traps and dove traps were used simultaneously in an attempt to maximize the capture rate as well as to assess the relative efficiency of the two trap types.

Trapping typically began between 0600 and 0700, when I would arrive, rebait the traps, replace the roof panels on the blackbird traps, and deploy the dove traps. I would then retreat a short distance (30-100 yards) to the banding station. Birds would typically enter the trap within seconds of my retreat, and I would wait for, in most cases, 15-30 minutes before returning to the trap to remove birds that had been captured.

Figure 3. Three transport cages containing tricolored blackbirds being moved from the traps to the banding station.

Figure 4. Removing birds from a transport cage for banding.

Birds were removed from the transport cage via an elk-lined cuff in the top (Figure 4), handled individually, and banded.

The trapping and banding of birds continued until the temperature approached 85°F, when banding activities ceased in an effort to minimize stress to the trapped birds.

All banding data were entered into Bandit, banding data management software developed by the USGS, and submitted to the USGS Bird Banding Laboratory in Laurel, Maryland within a week of the end of banding.

Trapping and Banding Locations. Birds were banded at 5 locations, as summarized below. Two of these 5 locations were on private property, and in both cases permission to access the property, to erect and maintain traps, and to trap and band birds was obtained from the landowners.

Site 1: Kern National Wildlife Refuge, Unit 1, Kern County: Avenal Gap USGS Quad, SW ¼ Section 5, T26S R23E; 35.72438, -119.57996 (NAD83)

Site 2: Bear Creek, Merced County: USGS Planada Quad, T7S R15E Section 2; 37.3,-120.3 (NAD83)

Site 3: Delevan National Wildlife Refuge Tract 43, Colusa County: USGS Moulton Weir Quad, SW ¼ Section 33, T17N R2W; 39.260, -122.0918 (NAD83)

Site 4: Conaway Ranch, Yolo County: Grays Bend USGS Quad, NW ¼ Section 11, T9N R2E; 38.6427, -121.7255 (NAD83)

Site 5: Yolo Bypass Wildlife Area, Yolo County: USGS Sacramento West Quad, T8N R3E; 38.5642, -121.6204 (NAD83)

Results

Banding. A total of 14,456 birds was banded at 5 sites, as summarized in Table 1, below. The specific days banded, and the number and sexes of birds banded on each date, are provided in Appendix I.

Table 1. Summary of 2010 banding results.

Site	Days Banding	Hours Banding	Number of Birds Banded	Males	Females	Hatch Year (HY)
Kern NWR	6	35.25	1148	108	1039	1
Bear Creek	1	5	229	3	226	0
Delevan NWR T43	12	67	8323	3396	4926	1
Conaway Ranch	12	55.75	4166	977	3131	58
Yolo Bypass W.A.	4	19.5	590	89	500	1
Column Totals	36	182.5	14,456 (79 birds per hour)	4,573 (31.6%)	9,822 (67.9%)	61 (0.4%)

First day of banding: 5/18/10 at Kern N.W.R., Kern County
Last day of banding: 7/30/10 at Conaway Ranch, Yolo County

I also captured and banded 72 yellow-headed blackbirds (*Xanthocephalus xanthocephalus*).

All birds were captured in either blackbird or dove traps; mist nets were not used to attempt to capture birds because no large crèches (groups of recently-fledged young) formed in any of the sites where banding was attempted, and mist nets were deemed relatively inefficient capture devices when compared to the traps utilized. As in the previous three years, the traps utilized are relatively ineffective at capturing fledglings,

although the new modified dove traps were relatively more effective at capturing fledglings because of the 1x1" wire mesh used for the transport cages.

Mortality. In rare instances, and despite an abundance of caution, adults died apparently as a consequence of increased stress associated with trapping and/or the handling associated with banding. A total of 9 birds, 8 adults and one HY bird that was killed by a Cooper's hawk (*Accipiter cooperii*), died during or immediately after being banded (0.06% of the total banded). When an adult died, its carcass was collected, chilled at 2-3^0 C, and then frozen within 8 hours. Frozen carcasses were deposited into the collections at the Department of Wildlife, Fisheries, and Conservation Biology Museum at the University of California, Davis on August 5, 2010.

Recaptures. A total of 810 birds, representing 483 unique recaptures, was recaptured during trapping and banding operations in 2010. A total of 48 birds was recaptured more than once. Of the 483 unique recaptures, 17 were originally banded by me in 2007, 51 were originally banded by me in 2008, 361 were banded by me in 2009, and 48 were originally banded by me at locations different than the recapture site earlier in 2010. In addition, 6 were banded by a colleague, Steve Simmons, at sites in Merced County.

Seven individuals were recaptured at two different times and locations following their original banding, and in all cases the distribution of dates and locations of original banding and recapture suggest 3 breeding attempts.

Resightings. There were only 3 resightings of color-banded birds in 2010. I observed two color-banded birds in Kern County in May, both at ECLA Ponds, and a third on the Crane Ranch in Merced County. Only the yellow color band was seen on the birds at ECLA Ponds, while red and yellow color bands were seen on the Crane Ranch bird, indicating that all 3 birds were banded in 2008, and the Crane Ranch bird was banded on the Crane Ranch in spring 2008.

Recoveries. The BBL reported the recoveries of two birds banded in 2009: one in Colusa County and a second in Yuba County.

Modified Dove Trap. The new modified dove trap incorporating the transport cages to increase trapping efficiency was safe and effective. It was deployed at three sites (Delevan T43, Conaway Ranch, and Yolo Bypass Wildlife Area) and at all three was as or more effective than the other two trap designs at capturing birds and was more efficient than the dove traps when transferring birds out of the traps and into the transport cages. The traps takes less than 10 minutes to set up and take down, are highly portable, and reduce the amount of space required for storage.

Grouping of Banded Birds. Banded birds did not occur with equal frequency in transport cages, rather banded birds tended to occur in groups, with many transport

cages containing no banded birds and others containing several. This clustering or grouping of banded birds was observed at all 5 banding locations.

Discussion

The modified "dove trap" incorporating the transport cages proved to be an improvement over the use of paired dove traps. The modified dove traps are effective at capturing large numbers of breeding tricolored blackbirds and "automate" the process of moving birds from the traps into the transport cages for subsequent transport to the banding station. The modified dove traps were also easier for one person to transport and require far less storage space as they fold into squares approximately 48x48x3". They also will enable me to carry more of these traps in my field vehicle (a Nissan Quest minivan).

Most captured birds typically entered the transport cage furthest from me upon my approach, minimizing time and stress to the birds while facilitating their transfer to the banding station. The few birds remaining in the trap would then flee from me and enter the other transport cage, completing the capture process. I believe that this new system represents an improvement over the methods used in the previous 3 years because of the very low mortality rate (0.06%), which is approximately 1/2 of last year's rate (0.1%; Meese 2009) and 1/6th of the rate in 2008 (0.35; Meese 2008), relatively large number of birds captured per unit time, portability, and ease of storage. The new trap design minimizes stress to the birds while maximizing trapping efficiency.

Unlike previous years, there was a much reduced sexual bias in birds captured and banded. I suspect that this is due to the greater use of the modified dove traps and the relatively lesser use of the blackbird traps, as both males and females appear to be equally likely to enter the dove traps whereas females were more likely to enter the blackbird traps (Meese 2009). The 67.9:31.6 female to male ratio is nearly exactly what one would expect if breeding colonies consist of twice as many females as males, and if each male breeds, on average, with two females.

The relatively small number (9, 0.06% of the total captured) of adults that died after being trapped suggests that our methods are generally safe, but any mortality is a concern. I have designed the traps and transport cages to reduce stress to captured birds to the minimum, and all trapping and banding activities ceased when temperatures rose above 85°F. The attempt to reduce mortality by modifying the traps appears to have paid off, as this year's rate of mortality was less than 1/2 that of last year's. Both trap designs now eliminate handling of captured birds until banding, and it is likely due to the reduction in handling and the associated reduction in stress the mortality was nearly eliminated.

The relatively large number of recaptures in only the fourth year of banding illustrates the effectiveness of our methods in documenting bird movements. The 483 unique

recaptures this year represent approximately twice the number of last year and 20 times the number of 2008 (Meese 2008, 2009). The recapture rate suggests that a trapping and banding program operating at multiple locations throughout the breeding season is an appropriate strategy for documenting the spatial and temporal movements of tricolors and will enable us, with a few more years of data, to estimate for the first time essential parameters such as life expectancy, age distribution, and mortality rates.

This year's movement data lend additional support to the suggestion that many tricolors may try to breed three times, generally once in the San Joaquin Valley and twice in the Sacramento Valley. This breeding pattern is suggested by the fact that all 7 birds recaptured twice in 2010 were recaptured in May, June, and July - in months following the March/April period when most birds breed for the first time. Additional evidence, ideally including 3 recaptures of the same bird in one season, in support of triple-breeding will be sought in future years.

Color-banding was discontinued this year due to the relatively small number of observations of color-banded birds and, thus, the relatively small contribution made by resighting data to the effort to document tricolor movements through space and time. There is a trade-off in using only aluminum bands, as these must be read (i.e. birds must be in the hand) in order to obtain useful information, restricting movement information to only those locations where banding occurs. Having color-banded birds eliminates the need for birds to be in the hand to obtain movement information, but since so few resightings of color-banded birds were reported, the actual contribution of resighting data to the entire movement data set has been minimal.

The effort to increase trapping and banding efficiency while keeping rates of injury and mortality to trapped birds to a minimum is on-going. This year's new trap design helps to increase the rate of capture by increasing the volume of the trap while simultaneously increasing the rate at which trapped birds can be transferred from the traps to the banding station.

This year's recaptures serve to confirm tentative conclusions about movement patterns and suggest new breeding patterns in adult tricolors:

- generally, adults breed first in the San Joaquin Valley and then again in the Sacramento Valley
- some birds appear to breed in Colusa County in June and again in Yolo County in July
- there is at least a tendency for birds that bred together in one location to subsequently breed together again in a different location, i.e., some suggestion of colony cohesion, rather than a complete re-assorting of birds following a breeding bout; colony cohesion may have genetic effects, as if birds prefer to mate with the same or familiar individuals, rates of outbreeding would be reduced

- I found additional evidence for breeding site fidelity – to date 249 of 825 recaptures (30%) have occurred at the original banding sites
- the recaptures of 7 birds twice in the same year, once in June and again in July at different locations, provides additional support for the suggestion that some birds try to breed three times per season, as both recaptures occurred in the Sacramento Valley, where birds occur following an initial breeding attempt in the San Joaquin Valley.

But perhaps the greatest surprise, and of most significance scientifically, came from the finding that significantly more birds were recaptured in groups than would have been expected by chance alone. The functional explanation of this grouping of recaptured birds is unknown, but the grouping of banded birds in transport cages suggests that birds are moving from one breeding site to another while conserving the spatial grouping of individuals within sites, i.e. birds that breed in close proximity in Kern County in April tend to breed in close proximity in Colusa County in May or June. The evolutionary advantages of breeding with familiar neighbors have been well documented in the closely related territorial red-winged blackbird (*Agelaius phoeniceus*) Beletsky and Orians 1989) but have yet to be examined in tricolors. The clustering of banded birds suggests that birds are breeding and foraging with familiar neighbors in successive breeding sites, and the clustering of banded birds will be examined in future trapping and banding efforts.

It is hoped that the relative success of the banding effort to date will justify a vigorous annual banding effort that will further document patterns of tricolor movements, help us to understand sources of mortality and relative rates of survivorship, and help to inform a long-term conservation strategy.

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Appendix I. Daily Banding Results. Kern National Wildlife Refuge is in Kern County, Bear Creek is in Merced County, Delevan T43 is part of Sacramento National Wildlife Refuge and is in Colusa County, Conaway Ranch is in Yolo County, and Yolo Bypass Wildlife Area (YBWA) is in Yolo County.

Site	Date	Hours Banding	Total Birds	Males	Females	HY
Kern NWR	5/18/10	7	201	4	197	-
Kern NWR	5/19/10	7.25	243	22	221	-
Kern NWR	5/20/10	5.75	311	62	249	-
Kern NWR	5/24/10	5	130	4	126	-
Kern NWR	5/25/10	4	115	4	111	-
Kern NWR	5/26/10	6.25	148	12	135	1
Bear Creek	6/02/10	5	229	3	226	-
Delevan T43	6/05/10	5	642	192	449	1
Delevan T43	6/06/10	5.75	698	287	411	-
Delevan T43	6/07/10	6.25	603	198	405	
Delevan T43	6/08/10	6.75	643	382	261	-
Delevan T43	6/09/10	4	463	297	166	
Delevan T43	6/10/10	9.5	1612	1116	496	
Delevan T43	6/11/10	4.75	349	241	108	
Delevan T43	6/16/10	5	304	79	225	-
Delevan T43	6/17/10	5.5	572	123	449	
Delevan T43	6/19/10	5.75	665	247	418	-
Delevan T43	6/21/10	5.5	575	126	449	-
Delevan T43	6/22/10	5	480	37	443	
Delevan T43	6/23/10	5	717	71	646	-
Conaway	7/03/10	4.5	627	71	555	1
Conaway	7/04/10	6	874	133	741	-
Conaway	7/05/10	6	674	103	571	-
Conaway	7/06/10	5.5	530	83	447	-
Conaway	7/08/10	5.25	336	127	209	-
Conaway	7/09/10	5.5	227	85	141	1
Conaway	7/13/10	4	69	20	49	-
Conaway	7/14/10	5.5	373	162	211	-
Conaway	7/15/10	4.5	226	97	129	-
Conaway	7/16/10	5	173	95	78	-
YBWA	7/19/10	3.5	195	11	184	-
YBWA	7/20/10	4.5	251	40	211	-

YBWA	7/21/10	5	63	11	52	-
YBWA	7/22/10	6.5	81	27	53	1
Conaway	7/28/10	2.5	33	1	0	32
Conaway	7/30/10	1.5	24	0	0	24
6 sites	36 banding days	182.5 hours	14,456 (79 birds/hour)	4,573 (31.6%)	9,822 (67.9%)	61 (0.4%)