

# THE CONDOR

VOLUME 44

MARCH-APRIL, 1942

NUMBER 2

## MIGRATION OF THE TRICOLORED RED-WING IN CENTRAL CALIFORNIA

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In 1930 the writer was assigned to a study of the distribution, population, economic status, and control of the Tricolored Red-winged Blackbird (*Agelaius tricolor*) in California. In the course of subsequent seasons, reports by the author have covered various parts of the study, the most important being one on distribution and population which was published in the Condor (39, 1937:61-81).

Throughout the entire period of observation of this species its extremely gregarious and erratic nature has been impressed upon me. Variations from year to year have often been readily visible, and study of those conditions which might logically have caused the variations have failed to produce an explanation for them. During a given season the marsh growth of a county in central California may have been thickly populated by large colonies of these birds; in the next season or one closely succeeding, it might have shown a minimum of colonies, although to the human eye conditions were unchanged. In most of the counties of the Sacramento Valley, in some of the counties of the San Joaquin Valley, and in a few of the coastal counties, there is always ample food for these birds; also there are abundant acreages of cattail marshes which would furnish nesting locations for far more birds than are now present. Likewise, during certain cold winters this bird has been noted in great numbers in the Sacramento Valley, whereas in other noticeably mild winters the bird has been found in the same area only in small numbers.

At the present time no logical explanation is at hand for the many erratic variations that have been observed. Theories have from time to time developed, only to be cast aside as further observation disproved them. The suspicion persists that this species, so unusual and interesting in many of its life habits, is sheerly and illogically erratic in its seasonal movements and activities.

Since the migrations or seasonal movements of these blackbirds have a direct bearing on the depredations they commit, banding was attempted in order to shed more light on this phase of their natural history. This report attempts to summarize the data resulting from scattered volunteer banding as well as those resulting from extensive banding operations carried on officially under the writer's supervision in the period from 1931 to 1940.

The Tricolored Red-wing is primarily a California species, entering Oregon apparently only in the region of Klamath Falls; hence all banding has been done by persons operating in California. According to the records of the Fish and Wildlife Service a total of 19,700 Tricolors, including 16,300 handled under the writer's supervision, had been banded at the close of the calendar year 1940.

Banding since 1931 has been restricted to nestlings in the large nesting colonies described by the writer in his report of 1937 (*loc. cit.*). Numbers of nests within a single colony may, as reported therein, vary from a few to more than 100,000 nests. Therefore

it is possible for the operator to band large numbers of birds in a relatively short time if he is willing to work knee to hip deep in dense cattails under a sultry sun. In the writer's experience one person can by hard work place as many as 500 to 700 bands per day. In a dense colony one can frequently place close to 100 bands per hour, but if the nests are scattered, the average falls far lower, and five to seven hours of such labor is an exhausting day for even the huskiest bird student.

Banding normally should take place between the seventh and tenth days after the eggs have hatched. By the tenth day it is common to see the unfeathered young leave the nest and climb about in the thick marsh growth or fall into the water below; even in the latter instance they swim freely to near-by stalks and climb to safety above the water level. When banding has been properly timed and executed, little mortality results.

Banding as applied to this species has been intermittent and occasional. Until the writer's study aroused interest in them in 1930, only 736 Tricolors had been banded. In 1931 a field party which included Dr. T. I. Storer, Dr. J. M. Linsdale, T. T. McCabe, and others, banded 2150 nestling Tricolors in two nesting colonies in Glenn and Colusa counties. Work under the writer's supervision has taken place for the most part in Merced County, and to lesser extent in Glenn, Colusa, and Sacramento counties, with incidental bandings elsewhere, and has covered the years from 1932 to 1940, inclusive, excepting 1934 and 1935. In 1939, Mr. C. V. Duff, of Hollywood, became interested in the species, and after visiting a colony in Kern County with the writer returned to the area and banded 600 nestlings near Connor Station, in the Buena Vista Lake district. Table 1 summarizes the banding of Tricolored Red-wings through 1940, as represented in the banding files of the Fish and Wildlife Service and furnished to the writer by Mr. F. C. Lincoln.

The writer has found it impracticable to attempt to trap adult birds because of the pressure of other work.

TABLE 1  
Tricolored Red-wings banded in California, 1924-1940

Year	Number banded	Year	Number banded
1924	28	1933	1400*
1925	596	1934	0
1926	88	1935	0
1927	0	1936	10*
1928	13	1937	2500*
1929	0	1938	7200*
1930	8	1939	3000*
1931	2153	1939	600
1932	1202*	1940	1000*

\*Banded by or under supervision of the writer.

Almost all of the return records that are at hand today are those of birds that have been killed or found dead. Only one or two of the records are of birds accidentally captured alive and released. In the earlier part of the study period, several of the banded birds were killed by poisoned baits used as a means of blackbird control in fields of milo maize and rice. Wherever the writer had any connection with the control operations, he examined every dead bird that could be found. During the period from 1935 to 1940 blackbird depredations in rice fields were of lesser intensity, and control operations by means of poisoned baits were almost entirely discontinued.

Market hunting of blackbirds in the interior valleys of California became a thriving business in about 1928 or 1929, and a dependable market for them was developed largely through Italian produce firms in the larger cities. During the depression years the

number of men so engaged increased markedly, but decreased by 1936 or 1937. Using automatic shotguns and firing into dense masses of blackbirds feeding on rice stubble, these market hunters killed large numbers of all species of blackbirds; one group of market hunters shipped nearly 400,000 dressed blackbirds from one Sacramento Valley shipping point in five seasons, and during the winter season of 1935-1936 they shipped about 88,000 birds. The writer asked certain of these groups to turn in all bands that they found, and the results proved them to be fine cooperators. Not all market hunters were informed, however, and accordingly many bands may not have been turned in.

Numerous blackbirds are shot by ranchers or by bird herders hired by them to drive the flocks away from their crops, which consist of rice, milo maize, soft-shelled almonds, and some others. Few of these birds are ever examined by the rancher, whose only interest is to drive the birds away from his crops. Consequently, it is highly probable that many bands are lost on birds so killed. On some occasions the rancher does notice a band on the leg of a bird, and a few have been reported from this source.

Many people, frequently town or city dwellers, find pleasure in getting into the country and shooting at something, and because blackbirds are abundant, they commonly are used as targets. A number of bands has been received from such shooters.

The ratio of returns to birds banded, however, is extremely low, particularly in instances where no trapping of adults is attempted. With 19,700 Tricolors banded during the past 20 years, and with only 93 return records listed, the percentage is 0.47. Even so, the information that has resulted from the banding of the past few years has been of value and applies directly to problems arising in the protection of farm crops commonly attacked by Tricolored Red-wings.

#### BANDING LOCATIONS

For the 736 birds banded prior to 1930, the writer does not have information concerning the banding locations. From return records it is evident that part of the total of 28 birds for 1924 were banded in the vicinity of Laguna Beach, Orange County, and that at least part of the 13 birds banded in 1928 were banded near Redlands, San Bernardino County.

*Kern County.*—This county, the southernmost in the great San Joaquin drainage, is normally well populated with Tricolored Red-wings. With the high Tehachapi Mountains forming its southern boundary and with its fairly extensive nesting areas and abundant grainfields to furnish food, it offers a location where blackbird banding would produce information of interest and value. However, only 600 birds have been banded, these near Connor Station, east of Buena Vista Lake, on June 3, 1939, by C. V. Duff of Hollywood.

*Merced County.*—Grinnell (Pac. Coast Avif. No. 11, 1915:104) called the central San Joaquin Valley the metropolis of the species. Merced County lies near the southern extremity of the rice-producing area where blackbirds are of major economic importance. Most of California's 100,000 to 125,000 acres of rice are to be found in the interior valley, in an area extending from extreme northern Fresno County to Butte and Glenn counties some 220 miles northward. Under these circumstances it was desirable to ascertain the normal range of the abundant Tricolor population of the Merced County marshes, to find out where they went after the nesting season, and to determine what effect their numbers might have upon rice culture. Consequently, the writer's banding operations have been centered in this county.

Banding in Merced County was instituted in 1933 by an assistant, Mr. M. R. Gross, who banded 1200 nestlings in three separate marshes. No banding was done here in 1934, 1935, or 1936. In 1937, with assistant Calvin Stevens, 2500 nestlings were banded in six marshes ranging from Los Baños to Snelling. In 1938, with the assistance of Calvin and Wilbur Stevens, 7200 nestlings were banded in three colonies at Los Baños, Livingston, and Snelling. The same men in 1939 cooperated in banding 3000 nestlings, all in marshes some seven miles northeast of Los Baños; in 1940, 1000 more were banded in the same general area.

*Stanislaus County.*—Ten nestlings were banded near Oakdale in June 1936 by cooperator L. E. Macomber. Thus far no returns have been received from this banding.

*Sacramento County.*—On June 8, 1932, the writer banded 100 nestlings, and on June 7, 1933, 200 more in a marsh some 18 miles east of Sacramento; no returns have been received from this group.

*Sutter County.*—On May 29, 1932, 100 nestlings were banded in a marsh about 20 miles north of Sacramento, but no returns have been received.

*Glenn County.*—On May 30 and 31, 1931, Mr. T. T. McCabe, Dr. T. I. Storer, Dr. J. M. Linsdale, and others, banded 2150 nestlings in nesting colonies between Glenn and Princeton; since one colony was very close to the county line it may possibly have been in Colusa County.

On June 21 and 22, 1932, the writer banded some 1000 nestlings in two colonies, one six miles east of Willows, the other four miles northeast of Norman.

#### RETURN RECORDS

*Southern California.*—Only three return records are known from the region south of the Tehachapi Mountains (fig. 13). Two birds marked at Laguna Beach, Orange County, were recovered, one near Sawtelle, Los Angeles County, the other near Fallbrook, San Diego County. One bird banded at Redlands, San Bernardino County, was found dead almost five years later between Redlands and Beaumont.

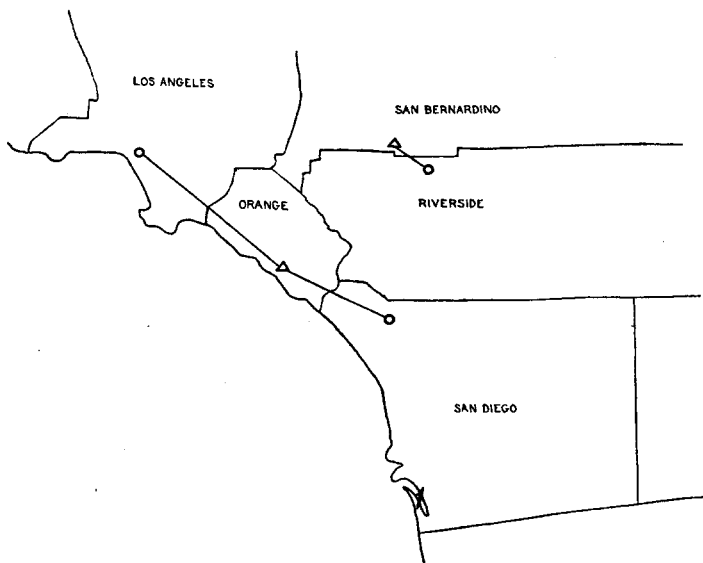


Fig. 13. Return records of banded Tricolored Red-winged Blackbirds in southwestern California; 1924-1928. Triangle marks banding locality; circles, points of recovery.

*Kern County.*—Thus far only one return record has been received from the 600 birds banded in this county; this one was shot in 1940 about 140 miles northwest of the original banding location, near Dos Palos, Merced County (fig. 14).

*Merced County.*—Figure 15 is a composite illustration of the movement of birds raised in this county as shown by the total of 69 return records. Of these, 20 were within the county, while 49 were outside the county. The diameter of the circle is approximately 40 miles, and within it are situated all of the banding stations, about 12 in number, and all of the 20 return records obtained within Merced County.

The most distant record is the one bird returned from Willows, Glenn County, about 175 miles in an air line from the banding location at Los Baños.

*Glenn County.*—From the 2150 nestlings banded by McCabe and his party in 1931, 13 return records have been received. Of these, seven occurred within the shaded square (fig. 14) which also encloses the banding stations. All seven were killed in blackbird control operations in rice fields. One of the six records outside the area furnishes the present distance record, the bird being shot at Sanger, Fresno County, about 225 miles away.

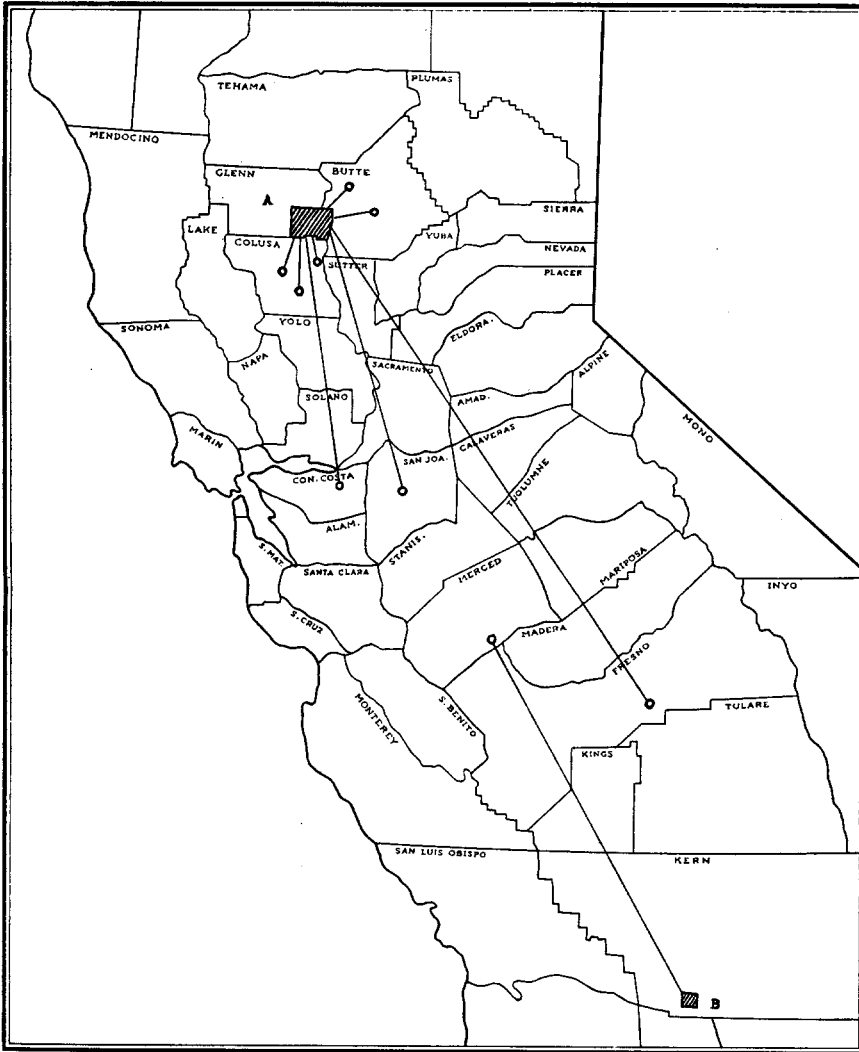


Fig. 14. Returns from nestling Tricolored Red-wings banded in Glenn County (A) from 1930 to 1933 and in Kern County (B) in 1939.

From the 1000 nestlings banded by the writer in virtually the same locations in 1932, only six return records were received, one occurring within the shaded square of figure 14, the other five outside. The most distant was a bird shot at Brentwood, Contra Costa County.

DISCUSSION

Because of the small number of return records, any discussion of dispersal from the breeding grounds must be considered as preliminary and incomplete. As already stated, nesting distribution is erratic. Winter populations in the central valleys have also exhibited the same erraticism without evident correlation with weather conditions. However, as early as 1931 the writer noted that winter populations were far greater than summer populations in those areas contiguous to the delta of the Sacramento and San



Banding in Glenn County in 1931 and 1932 added evidence as to the wintering range, as returns were received from Colusa, Contra Costa, and San Joaquin counties where the Glenn County birds apparently wintered in company with birds from the San Joaquin Valley.

From Merced nesting and banding locations the trail to the delta and coastal areas is represented by the following returns received up to February 15, 1941.

County	Specific locations
Stanislaus	Turlock, Oakdale
San Joaquin	French Camp, Stockton, Lodi, Roberts Island, Staten Island, Sherman Island
Sacramento	Thornton, Sacramento
Contra Costa	Pittsburg, Antioch, Walnut Creek, Nichols
Yolo	Woodland
Solano	Denverton, Vallejo
San Mateo	Pescadero
Santa Clara	Gilroy

From banding in Glenn County, the winter locations include Maxwell and Williams in Colusa County, Brentwood in Contra Costa County, and Stockton in San Joaquin County.

Throughout the entire period only six return records have come from points south of Merced County. One was the record flight from near Willows, Glenn County, to Sanger, Fresno County. The other five, all of Merced County banding, were recovered, respectively, at Fresno, Firebaugh, Riverdale, Dairyland, and Lemoore. In Duff's one return record, the bird moved from Connor Station, Kern County, about 140 miles northward to Dos Palos, Merced County.

In October 1938 the first record came in which showed there was movement between the Merced nesting marshes and the Sacramento Valley rice fields. During the remainder of the winter of 1938-39 and that of 1939-40 others followed until at the present time the writer has 20 return records for birds which moved from Merced to the central Sacramento Valley (Trowbridge, Colusa, Maxwell, Delevan, and Willows). Most of these were birds of the year, but others were one and one-half years old.

It is fairly evident that the Tricolored Red-wing of the San Joaquin Valley does not migrate southward in winter except casually. The few southerly records as compared with the extensive northwesterly movement definitely indicates that their preference in winter is for the alluvial plains adjacent to the delta, for farming areas of the coast and bay districts, and for rice-stubble fields of Glenn and Colusa counties. Indeed, Mr. Duff's one record from Kern County birds makes it appear that possibly this northwesterly autumn-winter migration may extend the whole length of the great valley.

Recovery records of Merced County birds shot in the Sacramento Valley rice fields occur mostly in October, November, and December; these birds might later in the winter have wandered back southward. One record of recovery on May 17, 1939, in Colusa County, however, indicates that some at least were remaining to nest.

Normally one would have expected the major movement of these Tricolors to be from northerly nesting grounds to more southerly wintering grounds. This was the primary hypothesis in 1930 when the writer undertook investigations of blackbird deprecations in the rice fields in the San Joaquin and Sacramento valleys. Although this thesis has proved fairly accurate for the latter valley, it has proved definitely inaccurate for the San Joaquin area, and the transfer within 90 days of populations from Los Baños to Willows complicates the problem of deprecations in the Sacramento Valley.

Blackbird damage to rice and other grain crops in the area herein considered decreased after 1932 and since 1935 has been at a rather consistently low ebb. True there are each year instances of severe injury locally to various crops, usually small in extent, but there has been no large-scale attack over thousands of acres such as occurred in and prior to 1931.

Incomplete as it is, the information thus far developed by banding has furnished a working basis for interpretation of blackbird activity, and of the possible effect of the application of control operations if they should again become necessary. Already the banding data herein contained has been of practical use. Called to inspect certain areas of blackbird depredation on small acreages of crops located within the so-called delta area, and finding that the Tricolor was the species involved, the writer has, in several instances, convinced the grower that mere herding off by gunfire was the only practical method of crop protection because control by more aggressive methods would necessitate destruction of birds in great numbers from far distant counties and would entail expense not justified by the damage suffered.

The banding project has not continued long enough to determine longevity of the species. In table 2 is given the recovery of banded birds by seasons, showing that to date the oldest banded bird recovered was approximately six and one-half years of age; it was killed at Sacramento late in December 1939. Only those years are listed when some return records were received.

TABLE 2  
Recovery of banded birds by years  
Number recovered

Year	Number banded	1924	1927	1931	1932	1933	1934	1937	1938	1939	1940
1924	28	1	1								
1928	13				1						
1931	2153			7	2	1	3				
1932	1202				2	5					
1933	1400					4				1	
1937	2500							3	2		2
1938	7200								24	15	
1939	3600									13	3
1940	1000										2

Since in January of 1941 the writer was transferred to Denver, Colorado, far removed from the haunts of the Tricolored Red-wing, it is hoped that this paper may arouse interest among California banders to the end that banding activity may be continued and extended into other counties within the range of the species. By so doing a full understanding of the erratic migratory wanderings of this most interesting bird may eventually be possible.

#### SUMMARY

The Tricolored Red-wing (*Agelaius tricolor*) is a species of gregarious and erratic habits. In California, to which it is largely confined, it frequently causes serious damage to several crops such as rice, milo maize, and sunflower.

Between 1924 and 1940, 19,700 tricolors were banded by all cooperators, 16,300 of them under the writer's direct supervision. Since 1930 only nestlings have been banded; 730 birds banded prior to that date were of age unknown to the writer.

The 93 return records on file represent only 0.47 per cent of the birds banded. Many blackbirds killed by ranchers and others are never examined for bands.



Banding south of the Tehachapi Mountains has been so limited that only three returns are on file, and no theory as to movements there can be formulated.

A total of 14,910 nestlings has been banded in Merced County in the San Joaquin Valley in the course of five seasons, in marshes ranging from Snelling at the east to Los Baños on the west. Six hundred were banded in Kern County in 1939. Return records from these birds afford evidence that there is little southward movement after nesting is completed. Instead, the movement is northwestward toward the Sacramento-San Joaquin delta, thence either westward in the area contiguous to the bays and into the coastal farming areas or on northward into the center of the rice-growing counties of the Sacramento Valley.

From the 3345 nestlings banded at points from Sacramento to Willows, in the Sacramento Valley, only 19 bands were returned. These few returns indicate a southward movement to the delta region in winter.

The longest distance represented by any of the records is of a bird banded by T. T. McCabe and party near Willows in 1931 and killed seven months later at Sanger, Fresno County, 225 miles distant.

The oldest bird thus far recovered was six and one-half years of age.

*Fish and Wildlife Service, Denver, Colorado, September 15, 1941.*