

## TERRITORIAL BEHAVIOR AND AGE COMPOSITION IN A POPULATION OF MOCKINGBIRDS AT A FEEDING STATION

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This paper is based on banding records of the Mockingbird (*Mimus polyglottos*) studied at Pasadena, California. It is an attempt to report and explain from banding records and observations the actions and ages of the birds and the assemblages and also the behavior of their various age groups. It is not concerned with individual birds except as they contributed to the understanding of a group. In a sense it is a sequel to a previous paper, "Mockingbirds, Their Territories and Individualities" (Michener and Michener, Condor, 37, 1935:97-140), which should be consulted for a description of the banding station, technique in the use of the color-bands, and conditions existing among the mockingbird population at that time. It seems nearly certain that the behavior patterns described in 1935 are the more usual ones and that the modification described herein resulted from an unusual concentration of food provided at a feeding station.

The banding program described in 1935 continued until 1940 but on a reduced schedule in 1939 and still more so in 1940. The observation of birds wearing color-bands continued until 1946; by then none was left that carried a complete set.

From the beginning of our study, we used raisins very freely to attract mockingbirds. A food tray at each of two east windows in one room was the greatest attraction, and observation convinced us, particularly after 1935, that some part of the mockingbird population within a radius of a quarter of a mile funneled through our yard. The great increase in attendance produced a modification of the conditions in our yard so that we became uneasily aware that the description of mockingbird behavior given in 1935 no longer held.

By 1936 we could state these changes rather definitely. There were many more mockingbirds entering the traps and eating at the food shelves; and, moreover, the territory holders were behaving differently:

1. We saw none of the courting activity of song by the male, the flying to a favorite food shrub, the "hew-hew" of the pairs together.

2. There were no nests in our yard.

3. There was less song around the house, that is, near the feeding places, where formerly the song perches were so favored.

4. While the birds held and defended the winter territories as before, summer defense seemed gone. Sometimes the occupant of the territory containing the food trays did sing a note or two on the roof before dropping down to the raisins to eat, but he ate and left exactly as did the rest.

5. The back part of our lot that had been so strictly divided into territories shared this new acceptance of changed conditions. In March and April, the height of the nesting season, one could find there perhaps a dozen mockingbirds at one time, most of them with color-bands, eating, bathing in the hose spray, or sitting in the bushes.

6. Repeatedly some male seemed to be claiming a territory. He sang low in the shrubs, became more bold, went higher to sing and then he was gone. He did not seem to be driven away. It was as though he had reconsidered.

The color-band combinations were read from the window. The list for the day (not a timed record except at certain times) was filed and later the band numbers were correlated with the color-band record—a check on the reading as well as a necessity for any study of the records. A sheet was made for each bird for each year it appeared, and

every record of it was entered upon its sheet for that year. These sheets and the trapping records supplemented by notes and the records of birds reported to us are the basis of this account.

A young bird which had not yet completed its postjuvenile molt is here termed a juvenile; any bird which had completed such molt, even though it may have been hatched the preceding summer, is called "adult"; thus, birds in first winter plumage are not segregated from older ones.

In our earlier paper there is an account of a pair of mockingbirds which occupied the territory in which the window traps were placed. The beginning of the use of these trays dates from that time. This pair (red-sub-R and yellow-sub-R) brought their young to this food; we watched the young as they were taught to eat there and saw them come there to eat alone later. The *Feijoa* tree nearby was visited by other adults for the food its thick, sweet petals afforded. The territory owner permitted this after a first

Table 1

Number of Mockingbirds Recorded by Sight Compared with Number Trapped

	1936	1937	1938	1939	1940
<b>Juveniles</b>					
Sight records	40	40	24	6	1
Per cent of total banded with sight records	51.9	39.6	21.8	28.6	5.5
Trap records only	37	61	86	15	17
Per cent of total banded with trap records only	48	60.4	78.2	71.4	94.4
Total banded	77	101	110	21	18
<b>Adults</b>					
Sight records	143	224	224	238	73
Per cent of total banded with sight records	264.8	132.5	260.5	626.3	235.5
Trap records only	29	99	53	18	24
Per cent of total banded with trap records only	53.7	58.6	61.6	47.4	77.4
Total banded	54	169	86	38	31

resistance, singing often as they came but not otherwise claiming ownership. When the flowers were gone visitors ceased to come. But adults did bring young to the shrubs nearby to feed them raisins. These juveniles used the shelves; we were amused by their show of begging to be fed. Later they came alone and again amused us by their assumption of the manner of adults claiming a territory. They did not sing but spent much time there *chipping* constantly. The adults did not do this at this season and we knew the immature birds would be driven out as soon as the adult owner wished to assert his winter claim to the territory.

With this earlier picture in mind, we were surprised to note after 1936 that most of the birds now coming to the food shelves were old birds. This opinion was based on their manners at the food shelves for all were color-banded and the combinations were too many to recognize without reference to the records. Of course, the known territory holders were recognized and young juveniles could be identified readily as such. Table 1 was prepared to see if the facts were as we suspected. This table shows for five years, beginning with 1936, for juveniles and adults, the number of birds recorded at these food shelves, the number with trap records only and the total number banded. It also shows the percentage of the total banded in the two age groups that had sight records and that had trap records only. In looking at it, it should be remembered that the years 1939 and 1940 are not important for the number banded. They represent decreasing activity in the banding program but the observation of the color-banded birds was con-

tinued. The decrease of these in 1940 represents the difficulty of obtaining the raisins for food and in the war years very few were available.

Table 1 shows that there were a great many more adults than juveniles frequenting the shelves and that our feeling that there had been a change in behavior was justified. It shows that, with increasing numbers of juveniles banded, the actual number of them using the food shelves decreased as did the percentage of juveniles banded each year that were seen at these shelves. For the adults, remembering that each bird often made a great many visits in a day, it is clear how their increasing use of this food was enabling them to monopolize the shelves. It will be noted that the total number of adults banded in any year bore no constant relationship to the number of juveniles banded that year but varied greatly. But the percentage of adults banded each year that failed to be seen at the food shelves (trap records only) is surprisingly close to the same figures for juveniles. Therefore, the flood of old birds coming to the food at the shelves represents birds banded in previous years—the old and experienced territory-holders of the vicinity. These were the ones that in earlier years had learned of this unfailing food source. It should be stated that this was not the only place in the yard where raisins were obtainable. They were always in the traps and around the traps so the resulting records could not be explained by competition for food limited to a single source.

Beginning in 1933 all mockingbirds were banded with the full set of colored bands. When in 1936, and subsequently, the lists of color-banded birds at the food shelves were made, it was always possible to determine when each bird was banded. Table 2 was made to shed more light on the ages of these adults that were coming to the shelves. It shows the number of mockingbirds banded as juveniles in 1933, 1934 and 1935 known to be alive in later years by trapping and by sight records. Some birds were known both by trapping and by sight records and every bird trapped as an adult in more than one year, shown in table 2, was also noted in sight records. Some, as adults, were known only by sight subsequent to banding.

Table 2 shows that the older birds used the food shelves in preference to the traps and also that trapping figures alone give, for these birds, a less accurate measure of survival ages than the color-band method because there are, in almost every case, substantially fewer known to be alive in a certain later year by trapping than the sight records show to be still extant. If the trapping figures for 1934 and 1935 are disregarded, the disparity is still greater. In conjunction with table 1 it seems fair to assume that birds banded as juveniles did not make any extensive use of the food shelves when immature, but that, as they grew older, many held territories near enough to the area in which they were reared to use these food sources for themselves and their young.

In our 1935 paper reference was made to certain juvenal birds which, while still immature, made efforts to hold small territories in our yard. There were also small groups of young birds—two, four, or even as many as ten—seen sitting quietly together in a shrub while one sang the juvenal type of song. These birds stayed with us for some time. For some of them there are many pages of notes. On the other hand there were a great many more juveniles banded for which one single entry appears, or they were present two or three days. The number of sight observations in later years indicates, as shown in table 2, that after summer dispersal they did, in many cases, return to this vicinity near which we assumed they were reared and acquired territories or mated with birds already territory holders. It seemed probable that a juvenile that had endeavored as an immature bird to hold a place of its own might be most apt to be one that would return as an adult. From the sheets of sight records for 1936, nine such birds were found that had records of from 8 to 57 appearances at the food trays. Of these nine juveniles

two stayed around our yard until late August, two until late September and two until driven out, to our knowledge, on October 27. Three were recorded as trying to hold small territories, another as a very persistent singer. Of the nine, six did return in 1937 and were again identified at the food trays. They had territories nearby but not in our yard. With this beginning, although it was apparent from the records shown in table 1 that the juveniles had used the food shelves less and less, more were looked for that might add to this list of young birds known at the food shelves as young or later as adults. Among the records for juveniles at these shelves for the years 1937, 1938 and 1939 only one had more than five entries. That one had thirteen and evidently did obtain

Table 2  
Juvenal Mockingbirds Banded in 1933-1935 Known to be Alive in Later Years

Year of banding	By Trapping Record <sup>1</sup>							
	1934	1935	1936	1937	1938	1939	1940	
1933 136 banded	20	6	6	4	3	1	0	27 retrapped in later years
1934 97 banded		8	13	5	5	0	0	16 retrapped in later years
1935 115 banded			20	11	7	3	1	20 retrapped in later years
	By Sight Records							
1933 136 banded			11	8	6	8	2	24 in sight records in later years
1934 97 banded			22	9	5	6	1	34 in sight records in later years
1935 115 banded			23	25	9	6	3	43 in sight records in later years

<sup>1</sup> The left hand column gives for each year the number of birds banded; the next seven columns, the number that returned to the traps or that were seen and identified by their colored bands in years subsequent to that of banding. One bird might return more than one year and the ones that returned in any one year would perhaps differ from the ones that returned the preceding or following years. The number in the last column is the actual number of individuals involved in the returns for the banding year in the first column.

a foothold, for it had trap records for that year until December. After 1936, however, one or sometimes two sight records on the sheet of a juvenile is the rule. This change in the use of the food shelves therefore seems dated with some definiteness.

Additional evidence that juveniles that remained the longest in our yard were the ones most apt to return as adults was obtained from the first years of our color-banding program (1933-1936). Such juvenal birds were divided into three groups: (1) recorded by sight records as here less than a week (172 birds of which 17 or 9.8 per cent returned as adults); (2) here less than a month but more than a week (52 birds of which 9 or 17.3 per cent returned as adults); and (3) recorded as here longer than a month or for more than one period during the summer (55 birds of which 28 or 50.9 per cent returned as adults). This seems added evidence of the return of juveniles to the vicinity of their original home and also that the ones that stayed longest here were the ones most apt to return. It should be noted that these records were made in years with extremely favorable nesting conditions as judged by the number of young recorded by us.

Why did most of these young birds relinquish the use of the food trays? The answer to this would seem to be that the behavior of the adults was such that it excluded the

timid, slow and inexperienced. The adults in procession that came to the food alighted in the shrubs nearby or on the roof above it. They went to the food one at a time, ate one to three or four raisins rapidly and, if feeding young, picked up all they could carry and left. The next bird then came to the food. This does not mean that there were never two or even three on a tray at one time, but usually there was only one. The order of precedence was rarely questioned. There was rapid and steady replacement. Occasional slow-ups were due to individual idiosyncrasies. One female, a well-known bird, was always slow. She sat long on a perch above the tray and always long at the tray. She had occupied a territory including the window shelves the preceding winter. Another disturbing bird always ate only apple and took endless time to do it. The bushes filled with waiting birds at these times. Watching indoors, our own tension built up until some aggressive bird would stand no more delay and would dart at the apple eater. She would leave immediately. But the most serious cause of a traffic snarl was the arrival of a young bird at the food. It seemed confused and uncertain. It might simply stand still

Table 3  
Number of Mockingbirds Banded from 1925 to 1940

Year	Juveniles	Adults	Total
1925	1	9	10
1926	12	19	31
1927	2	7	9
1928	29	15	44
1929	58	21	79
1930	22	17	39
1931	4	11	15
1932	3	13	16
1933	136	41	177
1934	97	18	115
1935	115	45	160
1936	77	54	131
1937	101	169	270
1938	110	86	196
1939	21	38	59
1940	18	31	49

and not eat, or it might beg from any adult that came to the tray. Soon adults began coming anyway, ignoring it till one more assertive than the others drove it away. The records suggest that once was enough. There was food elsewhere.

To present convincing evidence of the rapidity of replacement in this procession of adults, they were sometimes watched and recorded for a timed period. On May 14, 1939, in a thirty minute period 96 birds were counted. This was a greater number than could be identified, but 57 band combinations were recorded and 14 were put on the "unbanded" tally count. On another day, 80 combinations were listed in a one-hour period. Such a count always showed many repeat visits from individual birds. It seems true that the change to this specialized use of these food shelves was a gradual one that had, by 1937, become quite fixed and accepted by both juveniles and adults.

Table 3 shows the number of juvenal and adult mockingbirds banded by us during the years from 1925 to 1940. This record shows that there were great fluctuations in the numbers of birds banded in different years. This does not represent fluctuating operation of the banding station. The intensive feeding program is certainly reflected in the great increase beginning in 1933. It probably coincided with extremely favorable conditions also. There was a relatively high peak in the number banded in 1929. In almost every

species of birds banded in any conspicuous number these peaks occur. It is also noticeable that different years show a great difference in the ratio of juveniles to adults banded. These facts are basic to an understanding of the age groups represented in different years.

Thus, in table 4, the mockingbirds that were identified each year from 1936 to 1940 are broken down into age groups to present a picture of the birds known to be present during each of those years. Although the station operation was reduced in 1939 and more in 1940, the two years are included because the identification of color-banded birds continued. In table 4 it should be noted that the at-least-one-year-old birds consist of all adults banded in any one year. Most of these are banded in the spring or summer but there are, in addition, a few that come in late autumn which could therefore be less than a year of age but which are included to avoid for so few another category of a fractional part of a year.

In table 4 one surprising point is evident: birds two years old practically equaled or outnumbered those one year old in every year but one. This, of course, is not entirely

Table 4  
Mockingbirds Identified by Either Trap or Sight Records

Identified birds	1936	1937	1938	1939	1940
Juveniles	77	101	110	21	18
1 Yr. old	24	25	27	23	5
At least 1 Yr. old	54	169	86	38	31
2 Yrs. old	36	34	13	22	13
At least 2 Yrs. old	17	35	98	45	10
3 Yrs. old	14	13	15	13	8
At least 3 Yrs. old	8	17	23	57	13
4 Yrs. old	0	10	9	11	3
At least 4 Yrs. old	12	11	4	15	11
5 Yrs. old	0	0	10	6	3
At least 5 Yrs. old	3	12	8	5	4
6 Yrs. old	1	0	0	13	1
At least 6 Yrs. old	0	3	5	4	3
7 Yrs. old	1	1	0	0	2
At least 7 Yrs. old	1	0	5	5	0

true because the at-least-one group probably consists chiefly of birds one year old. Because a remarkably consistent number of one-year-olds returned each year, the difference in numbers of one- and two-year birds cannot be explained by variation in banding effort. The one-year-olds as a group would probably be the juveniles we had banded early in the previous year, juveniles that were the offspring from nearby territories and that had stayed long in our yard and knew it. Now, as adults, they would, if possible, settle in our immediate neighborhood.

The greater number of two-year-olds may be attributed to a second group of birds, those banded later in the summer that come when juveniles are dispersing, and for these we often have no records in the first year beyond the date of banding. They occur near the feeding station only as local vagrants, and as one-year-olds evidently return to the vicinities of their original homes. Many of these would settle within the one-fourth-mile radius of our station. Later they would learn of the food supply at our trays, but only gradually, and apparently some of them did not learn this in their first year as adults. This seems reasonable and especially so in view of the fact that the distance from which some of these birds were known to come was greater than our closely watched birds ever seemed to go from their home territories. This was not, as has been stated, the behavior of local mockingbirds in the earlier years of our station operation. Thus, whereas nor-

mally the numbers representing different age groups in a stable population would be expected to decrease annually, here the two-year-old class does not do so for the reasons just given. This influx of adults must certainly affect territorial phenomena near the feeding station.

In 1938, however, the two-year-olds were reduced to less than half of the one-year-olds for that year. The total of 169 adults banded in 1937 may offer an explanation. In 1938 the food shelves were crowded, and two-year-olds beginning to use the shelves were to some extent forced back to the traps for food by the numbers of experienced birds at the shelves. This is suggested by the fact that in 1938 more two-year-olds were recorded by trapping than by sight, indicating that a large proportion of them resorted to the traps.

Attention should be called to the effect on the station population, from 1938 to 1940, of the large group of adults banded in 1937. It may be found in the at-least-two group

Table 5

## Greatest Known Age Reached by Mockingbirds Banded between 1925 and 1940

Age-groups and totals banded	Greatest known age	Number of individuals	Per cent of total
Juveniles, 806	1 year	90	11.0
	2 years	63	7.8
	3 years	34	4.2
	4 years	29	3.6
	5 years	20	2.5
	6 years	20	2.5
	7 years	6	.7
	8 years	2	.2
	9 years	2	.2
	10 years	2	.2
	11 years	1	.1
	12 years	1	.1
	Adults, 594	At least 2 years	129
At least 3 years		87	14.6
At least 4 years		50	8.4
At least 5 years		32	5.4
At least 6 years		27	4.5
At least 7 years		8	1.3
At least 8 years		2	.3
At least 9 years		3	.5
At least 10 years		1	.2

of 1938 and the at-least-three group of 1939 and, in spite of reduced feeding and observation, a rather impressive carry-over as evident for birds at-least-four in 1940.

In table 3 it may be seen that in 1931 and 1932 almost no juveniles were banded. We also knew of the death of three of the seven that were banded. That lean period is observed in the birds listed in table 4. In 1936 the zeros for birds known to be four and five years of age should be expected, also the ones for birds of five and six in 1937, for those of six and seven in 1938 and those for seven in 1939. On the other hand, the large number of juveniles banded in 1933 and for the following years produces a very consistent number of three-year-olds in 1936, 1937, 1938 and 1939 and of four-year-olds in 1937, 1938 and 1939. The 13 six-year-olds of 1939 also recall that banner year for juveniles.

Many small bits of interesting information were found in assembling the records for table 4. For one bird never trapped after 1936, there are sight records until 1941. Another

was not recorded between 1936 and 1942. Several with trap records as juveniles had trap records for the following year, some for the two following years and then only sight records at the food shelves. On the other hand, a few adults were recorded only from trap records and for several years.

In order to make a report on the ages reached by the mockingbirds that have visited our station all records for them have been reviewed. This report (table 5) is made from color-band identifications by us or others, trapping records, and all reports of dead birds. The greatest known age reached by an individual is all it offers. Many lived longer and some were older than the recorded age because in adults the age at banding could be only entered as at-least-one year. There were 806 juveniles banded and 594 adults; but more adults than juveniles appear in our records for this report. The reasons for this have been discussed in examining table 4. Practically all of the records in table 5 for the oldest birds came from the color-band identifications. There would be more of them were the bands more durable. Birds wearing only remnants of their band combinations were observed after 1940 in increasing numbers. If a single band were gone, the bird was placed in an age group which represented the last used combination that could have degenerated into the three bands it wore. It is therefore clear that these ages are all below rather than above the true ages.

#### SUMMARY

From 1936 to 1940, following establishment of feeding trays as a source of abundant food for a population of color-banded mockingbirds at Pasadena, California, the proportion of adults increased and the proportion of juveniles decreased. The adults consisted of old and experienced territory-holders from areas within one-fourth mile of the feeding stations. Compared with previous years, a persistent and proportionally large traffic of adults moved into and out of the area now holding the feeding stations. No breeding territories were established there, when in former years typical territorial occupation by a number of pairs took place. Older birds used the food shelves in preference to traps, and survival data based on sight records are therefore more extensive than those based on trap records. Juveniles that remained the longest near the feeding station were the ones most apt to return as adults in subsequent years. Of birds banded as juveniles only 11 per cent were recovered after one year. Recovery percentages for birds banded as adults were higher. Mockingbirds may reach an age of at least 12 years.

*Pasadena, California, May 15, 1951.*