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STUDY OF PREROOSTING BEHAVIOR IN CAPTIVE REDWING BLACKBIRDS

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The original objectives of this study were (1) to determine the relation of light and roosting activities, (2) to study effects of weather changes upon overt behavior and (3) to observe seasonal changes in activity of the Redwing Blackbird, *Agelaius phoeniceus*. These objectives were not attained because escape of the flock forced premature termination of the study, but experience gained in management of the captive flock, and insight into the problems studied, are matters of possible value to others working in the field.

The study was conducted on the campus of Miami University at Oxford, Ohio, from December, 1956 through December, 1957. Equipment and supplies were provided by the Margaret B. and William G. Pickrel Fund for Faculty Research at Miami University. I am grateful to Provost C. W. Kreger for his part in making these funds available and for his encouragement during the work.

Fifteen immature male Redwing Blackbirds were confined in a wire mesh cage 10 ft × 10 ft × 30 ft on the Miami University Campus. The cage sits with its long axis north and south, with woods on the east side and the two ends, and university buildings near by the west side. One building, occupied by a rifle range, was about 25 ft from the southwest corner of the cage. Food shelters with open sides and roosting shelters which could be entered through holes were located at each end of the cage, about five ft from the ground. Food was provided in chick feeders, and water for drinking and bathing was placed in a flat pan on the ground. Both food and water were continually available.

The cage was made of three-quarter in. wire mesh stretched over a framework of 4 in. × 4 in. wooden posts set at five-ft intervals along the 30-ft sides, connected at the tops by longitudinal and cross pieces. The ends of the cage received further support from the shelter boxes which were firmly fastened to the uprights. A walk-in door gave access to the cage and small openings on the outside of the shelter boxes permitted replenishing food and cleaning without entering the cage. The wire mesh was extended two ft below the surface of the ground to prevent rodents tunneling. The only rodent trouble came from immature chipmunks which could enter through the small mesh.

The size and design of the cage proved well-suited to their purpose. The birds had room to fly freely, yet remained within easy observation distance. The greatest fault with the cage was that the wire mesh was easily broken by vandals and the flock was lost. Later an eight-ft fence of heavy expanding metal was erected around the cage, so future flocks will be relatively safer.

I estimated the overall activity of the flock by counting the complete flights from one end of the cage to the other. Flights beginning or ending other than at one end of the cage were not counted. During periods of intense activity I

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could not keep notes while counting flights so temporary records were made on recording tape, recording my voice as I counted the flights. Later the records were played back and transcribed to paper by hand. I also kept a record of light intensity at five min. intervals, using a photographic light meter directed toward the sky overhead. Temperature, cloud, and precipitation records were kept throughout the study. Dewpoint records were discontinued when the temperatures fell below freezing, and wind records were discontinued after experience showed that, due to the sheltered position of the cage, direct winds rarely affected the birds. Observations were made from an automobile or from a sentry box placed for the purpose about 30 ft from the cage.

Although the study could not be completed, the few data collected contain useful information and so are presented below.

TABLE 1

At 28 of 33 observations, 84.8%, activity began when light intensity was below 70 ft-c

Light at which activity began	Times Observed
29 to 20 ft-c	4
39 to 30 ft-c	7
49 to 40 ft-c	3
59 to 50 ft-c	5
69 to 60 ft-c	5
79 to 70 ft-c	4
89 to 80 ft-c	1
120 to 100 ft-c	2

TABLE 2

At 29 of 39 observations, 74%, maximum activity was between 5 and 20 ft-c

Light during 5 minutes of maximum activity	Times observed
9 to 5 ft-c	10
14 to 10 ft-c	8
19 to 15 ft-c	11
24 to 20 ft-c	4
29 to 25 ft-c	2
34 to 30 ft-c	2
39 to 35 ft-c	1
60 to 45 ft-c	1

Flight, in the captive Redwing Blackbird flock, was largely restricted to morning and evening periods, with very little flight during the middle of the day. The morning period began at dawn and continued until the sun was high. Evening flights began when the sun was low and continued until all had roosted. During these two periods the birds repeatedly flew the length of the cage, often in rapid succession, with interruptions to feed and drink. For this study I chose to make observations during the evening flight periods for the first two weeks of each month. This would enable me to observe not only light influence but also weather-influenced changes and seasonal changes in rate of activity. After the February observations, the cage unfortunately became damaged, thereby allowing all the birds but one to escape. Failing to trap more birds during spring migration, I made a few additional observations of the solitary bird during the summer and again in December. These latter data are too few to be significant but they are included as a matter of interest.

Initiation of evening flight period.—On some occasions evening flights had already begun when I reached the cage, but of the 33 times beginning of flight activity was observed the light intensity was below 80 ft-c on 29 evenings, 88 percent of the total (table 1). One of the exceptions was on February 10, when evening flights began while light intensity was about 200 ft-c. On that day a wild male Redwing Blackbird was present, flying back and forth over the cage, stimulating the captives to extreme agitation. Ten minutes later the light reading was 50 ft-c. Apparently activity initiated by the arrival of the wild bird merged with the usual preroosting behavior, which proceeded as usual after the wild bird flew away. On the other three evenings, when flights began at unusually high light intensity, I could see no wild redwings from my position in the car but I

suspected their presence from the behavior of the caged birds. Evidence that reduced light intensity was a major factor in initiating evening flight activities in the caged Redwings is very strong.

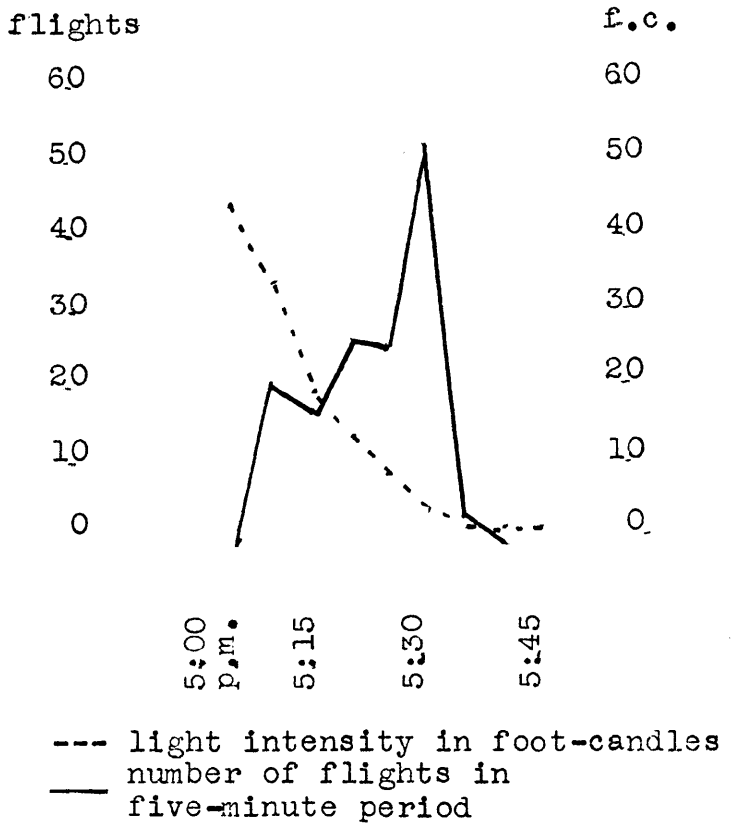

FIGURE 1. Comparison of rate of activity with light intensity. December 7, 1956.

Period of greatest activity.—Figure 1 shows a sample graph of evening flight frequency compared with light intensity. The graph was made from data recorded on December 7, 1956 and was chosen because it is typical of the activity pattern. From complete inactivity, flights increased in frequency to a peak, then declined rapidly as the birds entered the roost. Table 2 shows the light intensities at which this peak occurred in terms of numbers of flights in five-min periods. At 29 of the 39 observation periods this activity peak occurred when the light was between 9 and 20 ft-c. More data should be available before drawing any firm conclusions as to light influence in this case. Observations of the solitary bird made in the summer did not show the same consistency in the pattern of activity; therefore, social facilitation must be considered as a possible factor in determining the activity pattern.

Entering the roost.—The caged birds did not enter the roosts until the light was below 20 ft-c (table 3). This applied not only to the prepared shelters but to roosts in brush or on tops of shelters that were used in mild weather. The first birds to enter the roosts did not stay but flew out again. Usually several minutes elapsed between the time of first entry and the time roosting was com-

pleted. The interval was occupied by competition for roosting places, sometimes with intense aggressive behavior. Short feeding intervals were noted in some cases. I made no study of possible roosting territory.

Completion of roosting.—In all cases observed activity ended at light intensities varying from 1 to 5 ft-c (table 4). This seemed to be determined by light from the sky as recorded by the light meter rather than by total visibility. On evenings when snow covered the ground or when there was bright moonlight, the birds roosted while area visibility was very good; but on other evenings when the sky was relatively brighter, they were active after visibility was poor. Apparently the light intensity of the sky rather than general visibility of objects around them induced roosting and cessation of activity in these birds.

TABLE 3

At 19 of 39 observations, 48.7%, the first birds entered the roost at light intensity between 5 and 1 ft-c

Light at which first enterest roost	Times observed
20 to 16 ft-c	4
15 to 11 ft-c	10
6 to 10 ft-c	5
5 to 1 ft-c	19

TABLE 4

At 18 of 39 observations, 46%, roosting was completed at 2 ft-c

Lights at which activity stopped	Times observed
5 ft-c	4
4 ft-c	6
3 ft-c	6
2 ft-c	18

Seasonal variation in activity.—Table 5 shows the amount of activity as measured by counts of complete flights from end to end of the cage in different months. Records made in December, January, and February show increasing activity as the season progressed. Omitted from this record are the data for February 10, the day the wild Redwing stimulated the caged birds to unusual activity. On that day the total of counts recorded was 1029. Since this figure was far above the next highest count, 580, I thought best to exclude it from the calculations, as its inclusion distorts the gradual seasonal increase in activity shown by the other figures. Added to the table as a matter of interest are the data recorded at the few summer and winter observations made of the solitary Redwing. While no conclusions can be drawn from so few figures, they do suggest (1) a great increase in flight activity during summer and a subsequent decrease in winter, and (2) a great increase in activity of a solitary bird as compared with a flock. On several occasions a wild female Redwing perched on or near the cage containing the captive male. On each occasion the male stopped other activities and perched quietly until the female flew away. These observations of the solitary bird suggest that further study of flocks and flock size may be profitable.

Weather observations.—Effects of weather changes upon number of flights made by the birds under observation could not be determined by the methods used in this study. The data on quality of light as determined by cloudy vs. clear or partly clear sky, and the effect upon activity indicate that on days of complete overcast there was higher frequency of counts below the mean for the period, and that the reverse was true on clear or partly clear days. Analysis of these data gives a Chi-square value of 1.56, which is not statistically significant at the one percent level. No tentative conclusions can be reached without many more data of these kinds.

Beginnings of adult display.—Vocalization at first consisted of a variety of call notes. On December 8, 1956 I made the first note of an imperfect song resembling the adult ko-ka-ree song. The first full, typical ko-ka-ree song was

noted on January 10, 1957 at noontime on a day of bright sunshine and snow cover. The full song was first heard during evening activity on February 3, 1957, and thereafter it was heard with increasing frequency. Display of epaulets was first observed on December 7, 1956, and thereafter was seen daily with or without accompanying song.

TABLE 5

Seasonal record of total numbers of flights made by the captive Redwing Blackbirds during evening activity periods

A Redwing flock	Total flights	Number of observations	Maximum per day	Minimum per day	Mean	$\pm \sigma$
Dec. 5–16 1956	1835	12	304	27	152.9	89.4
Jan. 1–14 1957	3107	13	468	59	239.0	136.7
Feb. 2–17 1957	4685	13	580	135	362.7	138.9
Totals	9627	38	580	27	253.3	196.2
A solitary Redwing July-Aug. 1957	2227	8	541	90	278	159.2
Dec. 1957	268	5	174	5	54	64.5

Food preferences.—Although the birds were trapped by using shelled corn as bait, they refused to eat shelled corn in the cage as long as other food was available. During the first weeks oats and cracked corn were preferred to other food, but after the birds learned to eat sunflower seeds they were taken in increasing quantities. Oats and cracked corn were eaten in varying quantities throughout the study, but wheat, mixed songbird seed and prepared protein feed for poultry were never eaten. Insects were taken frequently.

Conclusions.—1. Preroosting activity in Redwing Blackbirds is initiated and terminated by variations in intensity of light from the overhead sky.

2. Evidence for the influence of light intensity and quality upon the rate of over-all activity is inconclusive, due to the paucity of data. These effects should be subjects of further study.

3. There is probably a seasonal cycle of activity which interacts with social effects. Detailed studies of the activities of flocks and solitary birds extending through at least one year should yield more evidence on these points.

4. The effects of weather changes upon overt behavior cannot be determined by the methods used in this study. They should be investigated under controlled laboratory conditions.