NEST BUILDING AND EGG LAYING BY REDWINGED BLACKBIRDS IN RESPONSE TO ARTIFICIAL MANIPULATIONS

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THE responses of breeding birds to many external stimuli have been well reviewed by Lehrman (1959), Eisner (1960), and van Tienhoven (1961). The studies performed by Emlen (1941) on the Tricolored Blackbird (*Agelaius tricolor*) are especially relevant to this paper because of some similarities of this icterid to the Redwinged Blackbird (*Agelaius phoeniceus*). Orians (1961) reports the similarities and differences in the ecology and social systems of the Redwinged and Tricolored Blackbirds.

The objectives of the present study were to assess some of the external stimuli that affect physiological and related behavioral patterns in the Red-wing. The two main objectives were to 1) determine responses of Red-wings to artificial nest manipulations, compared with those reported by Emlen (1941) for the Tricolored Blackbird, and 2) discover if Red-wings are determinate or indeterminate layers.

Emlen found that the Tricolored Blackbird usually lays its first egg on the day following nest completion. Payne (1965) reports that Tricolored Blackbirds usually lay their first egg in the morning following completion of the nest but that Red-wing females have a range of 1–4 days. In addition Payne notes that all Tricolored Blackbirds had ovulated on the day of lining the nest, whereas six of eight Red-wing females taken from lined nests had not ovulated. I have made similar observations on Red-wings. Payne states that "clutch size of Redwinged Blackbirds is apparently determined by the development of the ovary a few days before the final egg is laid."

Holcomb and Twiest (1968) present data on the time between nest completion and egg laying for 42 upland and marsh breeding Red-wings in May and June. These show a mean delay in laying of 2.0 days after nest completion, with a range of between 0 and 5 days. They also report that it required about 2.0 days to reach a platform stage, 4.3 days to complete a nest bowl without a lining, and usually 1 additional day to line the nest.

METHODS

This investigation was undertaken at Fremont, Nebraska in 1966 where more than 200 Red-wing nests were studied from early May to early July. Nests were visited each day, starting at the time of nest building in the majority of cases. Experimental plans for nest manipulations were:

1. Nest complete—reduce to platform.
2. Nest bowl complete without lining—reduce to platform.

TABLE 1

RESPONSES OF REDWINGED BLACKBIRD FEMALES TO NEST MANIPULATIONS

Type of nest manipulation	No. of nests	No. of nests abandoned	No. of days before laying after manipulation	Additional observation
Nest complete, reduced to platform	3	3		
Nest bowl complete, reduced to platform	4	1	1–4	One abandoned after laying one egg on a weak platform
Lining added to incomplete nests	7	1	2–4	One female removed the lining and replaced it with her own
Nest complete, lining removed	10	0	1–2	Two females rebuilt a complete lining; 8 placed only a small amount of grass lining in nest
Eggs placed in nest without lining	8	1	2–3	One egg removed by each of 3 females; 6 females completed lining the nest and eggs not removed were kept above the lining
One egg in nest, lining removed	1	1		
Two eggs in nest, lining removed	1	0		Female did not reline her nest, but continued laying

3. Nest bowl complete without lining—take lining from another nest and place in nest.
4. Nest complete—remove lining.
5. Nest bowl complete without lining—place 1 or 2 eggs in the nest.
6. Nest complete with 1 egg—remove lining, leave egg.
7. Nest complete with 2 eggs—remove lining, leave eggs.

I placed artificial eggs of the same size and color as Red-wing eggs in nests to supplement the number of eggs. The females accepted them in these experiments and in other behavior studies on the Red-wing. Thus the influence of the artificial eggs on the behavior reported here is discounted. Forty nests served as controls.

The egg manipulations were:

1. Eggs were added to make a full clutch of four eggs when the nest contained: a, no eggs (nest lining absent); b, no eggs (nest complete); c, one egg; d, two eggs; e, three eggs.
2. Eggs were removed while laying in three ways: a, a fixed number removed on one day, i.e., if two eggs were present, both were taken on the same day and no further eggs were removed; b, one egg was removed on the day the second egg was laid, and one egg was removed each day thereafter always leaving one egg; c, an egg was removed each day beginning with the first; no eggs remaining.

RESPONSES TO MANIPULATIONS

Table 1 gives the responses of Red-wing females to the different nest manipulations. Although there were individual variations, it is apparent

TABLE 2
CLUTCH SIZE OF REDWINGED BLACKBIRDS IN CONTROL NESTS AND IN RESPONSE TO ADDITION OR REMOVAL OF EGGS

	No. of nests	Mean clutch	No. of nests with clutch of 2	3	4	5
Eggs added when:						
a. No eggs present (no nest lining)	7[1]	3.3	2	1	4	
b. No eggs (nest lined)	13	3.6		6	6	1
c. 1 egg	13	3.7		5	7	1
d. 2 eggs	5	3.6		2	3	
e. 3 eggs	4	4.0			4	
Method of egg removal:						
a. Fixed number one day	6	3.5		3	3	
b. One each day, leaving one	8	4.1		1	5	2
c. One each day, leaving none	5	3.6		2	3	
Control nests	40	3.7		13	26	1

[1] One of eight females abandoned the nest.

that Redwinged and Tricolored Blackbird females respond similarly in the test categories (5, 6, and 7) that can be compared.

Table 2 shows the average clutch size and frequency of different clutch sizes in control nests and nests in which eggs were added or removed. Control nests and experimental nests were dispersed throughout May and June. As Holcomb and Twiest (MS) found a significantly larger clutch size in May nests than in June nests of Red-wings in Michigan and Ohio, it was necessary to determine whether the population being studied showed a difference. The mean number of eggs was 3.70 for 40 control nests (3.76 for 17 May clutches and 3.65 for 23 June clutches, with no significant difference at the 0.05 level). Thus the distribution of nests between May and June in the different categories did not effect mean clutch size.

The data were subjected to analysis using a 2-sided Student's *t*-test to determine if a significant difference existed between the mean values for the control group (3.7) and the 3.3 mean value for the group where eggs were added before any eggs were laid in nests without linings, as well as for the group where eggs were taken from the nests, leaving only one egg each day, having a mean value of 4.1. There were no significant differences ($P > 0.05$). The information from this study shows that it was not possible to change clutch sizes in female Redwinged Blackbirds by adding or removing eggs from their nests.

Emlen (1941) reports a tendency for Tricolored Blackbirds to lay smaller clutches when eggs were added to nests, especially when added early in laying. He further states that the laying period was not prolonged by

artificial removal of eggs. His experiments differed somewhat from those reported here because he removed a fixed number of eggs from all nests; in many instances after the female had laid at least three eggs.

Dunham and Clapp (1962) removed eggs from the nests of captive Canaries (*Serinus canarius*) and reported no effect on clutch size. Davis (1955) summarized the literature dealing with determinate and indeterminate laying in birds. He removed and added eggs to nests of Barn Swallows (*Hirundo rustica*) and obtained similar data for Black-billed Magpies (*Pica pica*). He concluded that both were determinate layers. He stated that a species may be considered an indeterminate layer if the addition of eggs to the nest, at the start of laying, results in a reduction of clutch size, and if the daily removal of eggs results in an increase. By these standards no species has been proved to be indeterminate.

Some species adjust their clutch size upward to compensate for removal of eggs and others reduce their clutch size to compensate for addition of eggs. I suggest that species able to adjust clutch size upward be referred to as indeterminate-increased size and that those capable of decreased clutch size be referred to as indeterminate-decreased size. A species that is capable of adjusting clutch size surely is indeterminate to some degree. The degree to which it is indeterminate has been effected by its evolutionary history and reflects survival ability. Some species probably benefit from this ability, whereas others may not.

All of the data from this study on egg-laying behavior for Red-wings suggest that the number of eggs laid cannot be influenced by addition or removal of eggs. This reinforces the report by Payne (1965) that only a few ovarian follicles are developed sufficiently in Red-wings to be involved in the formation and size of the clutch. Even when an external stimulus occurred in the form of eggs before the beginning of the laying period, there was no effect on clutch size.

Acknowledgments

It is a pleasure to acknowledge the Chapman Memorial Fund of the American Museum of Natural History for aid in completing this study. I am indebted to James Linder for assistance in the collection of data and to Robert W. Belknap, Charles B. Curtin, and especially David E. Davis for making comments regarding the manuscript.

Summary

Redwinged Blackbird nests were altered artificially by removing or adding nest material to their nest. The time interval between nest building and egg-laying was not affected. Few birds abandoned nests. All completed nests reduced to platforms were abandoned. Four nests, complete except for lining, when treated similarly had some building continued and each

received at least one egg. Most artificially completed nests were accepted by females. When nest linings were removed from complete nests, some were completely relined but most had only a partial lining. Eggs placed in nests without linings were sometimes removed; often the lining was replaced with eggs remaining above it. When linings were removed after egg laying had begun, one female abandoned, and one continued laying without a nest lining. On the whole, Red-wings responded almost identically as Tricolored Blackbirds did to similar treatment.

When eggs were removed or added to nests previous to or during the egg-laying period, laying was neither significantly shortened nor prolonged. The Red-wing appears to be a determinate layer. It is difficult to compare the present findings with those of Emlen (1941) for the Tricolored Blackbird with regard to removal of eggs, because he removed a fixed number. However, he did report a tendency toward smaller clutches in supplemented nests, especially those treated early in laying.

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Accepted 3 December 1969.