REPRODUCTIVE SUCCESS OF RED-WINGED BLACKBIRDS IN NORTH CENTRAL OKLAHOMA

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THE general upward trend in the number of Red-winged Blackbirds (*Agelaius phoeniceus*) nesting in Oklahoma can probably be attributed to the large number of farm ponds, flood detention, and flood control dams which have beeen constructed in the last 23 years. During this period an estimated 161,000 farm ponds, flood detention, and flood control dams have been built in Oklahoma, and an additional 1,500 are being constructed every year (Anon, 1963). Presently, there are more than 4,500 farm ponds and flood control structures in the two north-central counties (Payne and Noble) selected for this study. Many of these do not have good redwing nesting habitat. However, ponds with good growths of cattails (*Typha* sp.) have high densities of nesting birds.

The major objectives of this study were to examine the phenology of redwing nesting and to determine their reproductive success in these new habitat situations. The effect on reproductive success of early versus late nesting, type of nesting cover, height of the nest above the surface of the ground or water, and water depth below the nest were considered.

METHODS AND GENERAL DESCRIPTION OF AREAS

Observations were conducted throughout the breeding season on ten study areas selected on eight ponds and two lakes. Only the larger nesting colonies were studied on the two lakes (Boomer and Yost).

Nests were numbered using a "Sanford's Marker Compact." The number was written on two or three stems or limbs supporting the nest. Blue was found to be the best color and remained readily visible for two or three weeks, at which time the nest could be re-marked, if necessary.

Initially, the following data were recorded: date, area, general weather conditions, time, number of redwings and nests in the area, and type of nesting vegetation. The height of the nest above the surface and the water depth were measured. The number of eggs and/or young were noted when present, and the ages of the nestlings were recorded. The nestlings were aged by the criteria used by Allen (1914). The subsequent history of each nest was recorded during a series of visits.

The number of active nests, those which contained at least one egg and which subsequent observations indicated were not abandoned, was used to determine the number of females using an area. This was necessary because usually fewer females than active nests were observed around a pond. Occasionally, more females were observed than there were active nests and in these cases, the actual number of females observed was used as a measure of the female population size.

The study areas varied in size from 0.25 to 7.3 acres (Table 1). The cattails growing around the borders of the ponds varied in stand density and area of coverage. All of

TABLE 1
SIZE, CATTAIL NESTING COVER, AND TERRITORIAL MALES

Area	Area (acres)	Cattails (acres)	Average number territorial males
Pond 9	0.60	0.03	3
Pond 30	0.60	0.08	2
Pond 51	0.25	0.12	2
Pond 52	1.00	0.90	7
Pond 53	0.40	0.10	5
Pond 63	0.50	0.08	4
Pond 64	0.30	0.15	5
Pond 66	0.25	0.25	3
Boomer Lake	4.50	1.00	9
Yost Lake	7.30	1.65	10
Total	15.70	4.36	50

the ponds, except Pond 53, had tall perches available on or adjacent to the pond. Male redwings used the tallest cattails and nearby fence posts for song perches in this area.

RESULTS

The average amount of cattails available per male varied from 0.01 acres (435 square feet) on Pond 9, which had the smallest amount of nesting cover, to 0.165 acres per male (7,187 square feet) on Yost Lake, which had the largest block of nesting cover (Table 1).

A few males already had established territories when the observations were first initiated on 8 April. Their number reached a peak during early May and then slowly declined. One male was still on territory on 29 July. However, it was not in the area on 31 July when observations were terminated.

The nesting cycle sequence continues with the arrival of the resident females and pairing behavior. Nero (1956) reported that the first female arrived at a nesting colony on a marsh in Wisconsin on 8 April. He also indicated that pair formation begins or actually occurs when a female enters a male's territory. Meanley and Webb (1963) stated "females usually move into territories and begin pairing after April 1 in Maryland." By the middle of April in New York, most of the females were paired (Case and Hewitt, 1963). Small flocks of female redwings were observed at various times on the study areas throughout April, which indicated that all females were not paired. There were four known pairs on the study areas by 17 April.

The tendency of male redwings to pair with more than one female has been reported by many authors: Wright (1907), Allen (1914), Linsdale (1938), Nero (1956), Case and Hewitt (1963), and Meanley and Webb (1963). Similarly, redwings were found to be polygynous in this study.

TABLE 2
NUMBER OF NESTS, ACTIVE NESTS, EGGS LAID, CLUTCH SIZE, EGGS HATCHED, YOUNG FLEDGED, AND PER CENT SUCCESSFUL NESTS FOR THE TEN STUDY AREAS

Area	Number of nests	Active nests	Eggs laid	Clutch size	Eggs hatched	Young fledged	Per cent successful nests
Pond 9	9	9	28	3.1	8	5	22.2
Pond 30	8	7	23	3.3	1	0	0.0
Pond 51	13	7	25	3.6	10	6	28.6
Pond 52	79	61	207	3.4	71	29	14.8
Pond 53	47	44	153	3.5	68	50	38.6
Pond 63	29	26	92	3.6	42	22	26.9
Pond 64	30	29	105	3.6	69	50	58.6
Pond 66	6	5	19	3.8	14	7	60.0
Boomer Lake	23	15	45	3.0	4	4	6.7
Yost Lake	62	40	124	3.1	42	23	17.5
Total	306	243	821	3.4	329	196	26.7

There were only 0.68 females per male early in the nesting season. This ratio increased to 1.95 by the peak period of nesting, which was in the third week of May. The sex ratio declined homewhat during the next three weeks and then increased to 2.19 during early July, when several females were renesting or attempting to raise a second brood. The average sex ratio for the period from 16 April to the end of July was 1.57 females per male.

The first nest, which contained two eggs, was located on 22 April. This coincides with the findings of Allen (1914) and Meanley and Webb (1963). Beer and Tibbits (1950) recorded their earliest nests on 25 April and 1 May in their two-year study in Wisconsin.

Some females built several nests before starting a clutch. This is illustrated by the fact that although 306 nests were fully completed and lined, only 243 of them were known to have been actively used by the female (Table 2). Early in the breeding season, female redwings appeared to be intolerant of disturbance and readily abandoned their nests. The rate of desertion was low (1.2 per cent) once the female had initiated a clutch or if nestlings were present.

Redwings were persistent renesters. Some females on ponds with high predator populations initiated nest after nest only to have them broken up. Generally, females will build a new nest when renesting or attempting a second brood. However, there were five instances where a female laid eggs in a nest in which the original clutch had been destroyed. This was observed early in the nesting season and only occurred once on any pond. No nest was used more than twice. Only one of the five nests mentioned above was successful.

TABLE 3
COMPARISON OF NUMBER, CLUTCH SIZE, YOUNG FLEDGED, AND NESTING SUCCESS BETWEEN EARLY AND LATE NESTS

Time of nesting	Active nests	Clutch size	Young fledged	Successful nests	Per cent successful nests
Before June 1	155	3.6	135	45	29.0
After June 1	88	3.2	61	20	22.7

There were 821 eggs laid in the active nests for an average clutch size of 3.4. The range was from one to five eggs with four being the most common number.

Allen (1914) reported that incubation began after the third egg and usually 11 days were required for the eggs to hatch. Using this information, incubation time determined during the present study varied from 10–13 days.

Three hundred and twenty-nine of the 821 eggs hatched, giving a hatching success of 38.9 per cent. One hundred and ninety-six young were fledged or 23.9 per cent of the total eggs resulted in fledged young. The results of many studies, Perkins (1928), Wood (1928), Wood (1938), Smith (1943), Beer and Tibbits (1950), and Williams (1960) have indicated that young were fledged from 48 per cent or more of the eggs.

Nesting success is another measure of reproductive success. A successful nest was one that fledged one or more young. Young fledged from 65 of the 243 active nests, which gave a nesting success of 26.7 per cent. This success was considerably lower than the 42 per cent reported by Wood

TABLE 4
NESTING SUCCESS IN RELATION TO KIND OF COVER

Nesting cover	Active nests		Nesting success
	Number	Per cent	
Old Cattails (*Typha*)	52	21.4	38.5
Old and new Cattails	83	34.2	19.3
New Cattails	89	36.6	29.2
Willows (*Salix*)	10	4.1	10.0
Dogwood (*Cornus*)	2	0.8	0.0
Buckbrush (*Symphoricarpus*)	2	0.8	50.0
Bulrush (*Scirpus*)	2	0.8	50.0
Lead Plant (*Amorpha*)	2	0.8	0.0
Buttonbush (*Cephalanthus*)	1	0.4	0.0
Total	243	99.9	26.7

TABLE 5
NESTING SUCCESS IN RELATION TO NEST HEIGHT ABOVE SURFACE OF GROUND OR WATER

Nest height (inches)	Active nests		Nesting success
	Number	Per cent	
0–12	34	14.0	38.2
13–24	125	51.4	27.2
25–36	53	21.8	22.6
Over 36	31	12.8	19.4
Total	243	100.0	26.7

(1938) and the 57 per cent obtained by Meanley and Webb (1963). However, Young (1963), in a two-year study in Wisconsin, obtained a nesting success of 35 and 24 per cent for 1959 and 1960 respectively.

The major losses of eggs and nestlings were due to egg and young removal, probably as a result of nest predation in most cases, and to nests tipping over and the eggs or young falling out. Of 243 active nests, eggs were removed from 105, young from 25; 36 nests containing eggs and eight nests containing young were destroyed when the vegetation or wind tipped the nest. Three nests were abandoned and one was lost to flooding.

Similarly, Smith (1943) and Beer and Tibbitts (1950) obtained results indicating that there was a greater loss of eggs than of nestlings. However, Peterson and Young (1950) for Common Grackles (*Quiscalus quiscula*), and Young (1963) for Red-winged and Yellow-headed blackbirds (*Xanthocephalus xanthocephalus*) found that losses of nestlings exceeded those of eggs.

In Oklahoma, early nests tended to be more successful than nests started after 1 June (late nests). This date was used as a separation criterion because it fell at the end of the first nesting period and before the initiation of most renesting. On nine of the ten ponds, early nests were more successful. The one exception, Pond 64, had a nesting success of 50 per cent for early nests compared to 85.7 per cent for late nests. Overall nesting success for early nests was 29.0 per cent compared to 22.7 per cent for late nests (Table

TABLE 6
NESTING SUCCESS IN RELATION TO WATER DEPTH

Water depth (inches)	Active nests		Nesting success
	Number	Per cent	
0–10	155	63.8	23.2
11–20	65	26.7	29.2
Over 20	23	9.5	43.5
Total	243	100.0	26.7

3). Nesting success among the study areas varied from zero to 62.5 per cent for early nests and from zero to 85.7 per cent for late nests. For the entire nesting season, nesting success varied among areas from zero to 60 per cent.

The average clutch size was larger for early nests (3.6 eggs) than for late nests (3.2 eggs). There were 0.87 young fledged per early nest compared to 0.69 young per nest for the later nests, another indication that early nests tended to be more productive.

The number of nests found in each type of nesting cover is presented in Table 4. The percentage of the total nests and active nests was independent of the type of supporting vegetation. For vegetation types containing at least 10 nests, nesting success was highest (38.5 per cent) in old cattails. This higher nesting success may have been due to old cattails being virtually the only nesting cover available early in the nesting season when nesting efforts were more successful.

A summary of the nest height above the surface of each pond is presented in Table 5. The highest nesting success (38.2 per cent) occurred among nests in lower situations. Nesting success decreased as the height of the nest increased. This decrease may be attributed to a majority of the nests' being constructed in cattails; the higher the nest the greater became the possibility of its tipping over and losing the contents.

The number of nests constructed above each of the three water depth categories is presented in Table 6. Nesting success increased directly with the depth of the water.

SUMMARY

During the 1965 breeding season the reproductive success of Red-winged Blackbirds was studied on eight ponds and two small lakes located in two north-central Oklahoma counties.

A few males were already on territory when observations were initiated on 8 April. Density of males on the study areas generally varied inversely with the size of the cattail nesting cover.

Four females were known to be paired by 17 April. The nesting peak occurred during the third week of May. Cattails furnished sites for over 90 per cent of the nests.

Generally, redwings built a new nest when they attempted to renest. However, on five occasions, a nest was used for two nesting attempts. This occurred early in the nesting season and only once on any pond.

Eight hundred and twenty-one eggs were laid in 243 active nests for an average clutch size of 3.4. Hatching success was 38.9 and young were fledged from 24 per cent of the eggs. Sixty-five nests fledged one or more young, giving a nesting success of 26.7 per cent.

Egg or young removal and nests tipping over were the major reasons for nest failure. Egg loss exceeded mortality of the young. The high nest densities in a limited area would make it possible for a single factor to destroy a large number of nests.

Nesting success was higher for nests initiated prior to 1 June. Average clutch size

was greater in early nests. Nests in old cattails were more successful. Over 50 per cent of the nests were constructed less than two feet above the ground or water. Nesting success was higher for nests in lower situations and decreased as nest height increased.

Approximately two-thirds of the nests were constructed above ground or above water that was less than 10 inches deep. Nesting success was greater as the depth of the water below the nest increased.

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