RED-WINGED BLACKBIRD NESTING PATTERNS IN A SMALL MARSH IN UPSTATE NEW YORK

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Introduction

Numerous studies have been published concerning the nesting patterns of Red-winged Blackbirds (*Agelaius phoenicus*). Most of these studies have reported on marshes or upland areas of 1 ha or larger. This paper reports on a 0.037 ha marsh with a dense concentration of nests and a very successful hatch and fledge rate.

Study Site

The marsh, with an area of 370 m^2 covered by cattails (*Typha* sp.), is located in Tompkins County, New York, 8 km northeast of Dryden (Fig. 1). Water covered about 320 m^2 of the marsh in mid-May with a maximum depth of 60 cm and no open water. The marsh is near the south edge of a 3 ha meadow. Homes lie about 200 m to the north and south. There are raccoons, dogs, and cats in the area. There are bushes and trees 2-4 m tall on the margins of the marsh and a line of 10-15 m tall trees about 20 m south of the marsh. These trees and bushes are used as perches by the Red-winged Blackbirds.

There are no larger marshes within one km of this marsh, although small marshes with cattails are common in depressions in forests and fields. A pond 500 m away has a cattail border and Red-winged Blackbirds nest in this border and in nearby ditches. No nesting activity was noted in the adjacent upland grasses and fields.

Results

Field work was completed during the spring and summer of 1985. Nesting was allowed to proceed undisturbed until a casual survey of the marsh was made on 17 May. Nests with eggs were observed on that date. The first detailed survey was made on the morning of 22 May. A second survey was made on 29 May and subsequent surveys were made twice-weekly until mid-June, after which surveys were made at 7-10 day intervals through July.

Six nests were located during the first survey. Nest seven was discovered on 29 May (Fig. 1). All nests were built over water in cattails from the previous year. New cattails were below nest level on 22 May, though many exceeded nest level by 1 June. The nests were near the top of the old cattails and exposed clearly to the sky. The average depth of water below the seven nests was 20 cm (range 15-28 cm) and the distance from the water surface to the top of the nest averaged 41 cm (range 36-55 cm). There was no relationship between water depth and nest height.

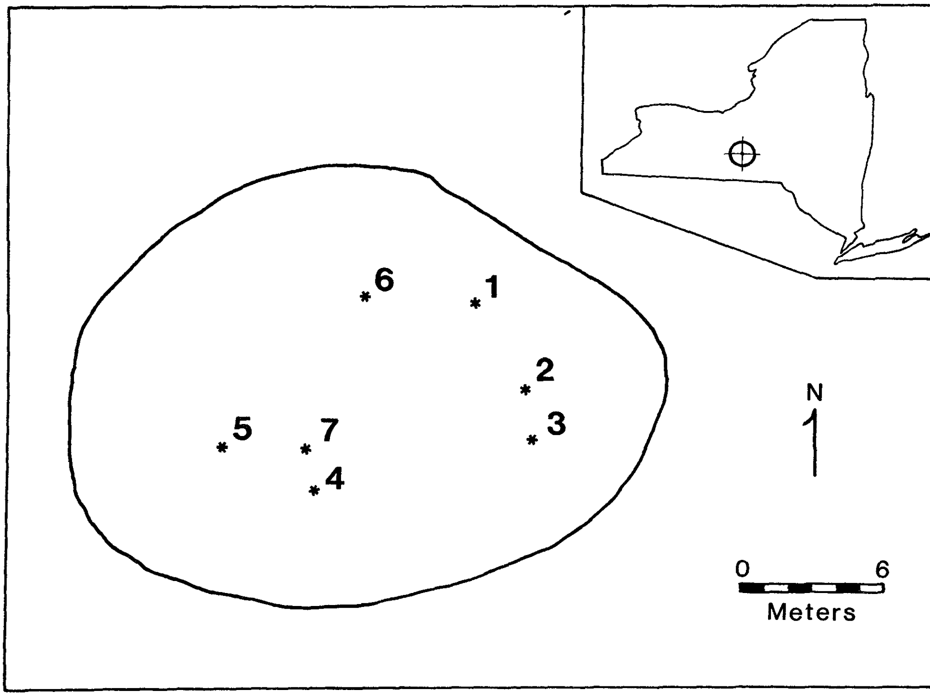

Fig. 1. Map of study site showing nest locations.

There were four eggs in each nest on 22 May, except that nest 2 contained four young birds. Nest 7, discovered a week later, had three nestlings on 29 May. The nestlings in nest 2 on 22 May are considered an early hatch, since Case and Hewitt (1963) reported that the earliest hatch they encountered in 926 nests over three years near our study site was during the last week of May. Four males were seen near the marsh but only two showed aggressive and territorial behavior, often chasing the other two males away.

On 29 May, nests 3 and 5 still contained eggs, whereas nestlings were present in other nests (Table 1). No mortality had occurred as all nests with four eggs on 22 May contained four eggs or nestlings on 29 May. New cattails were approaching nest height but old cattails dominated the scene in the marsh. Nest 2, with the most mature nestlings, was tipping at an angle of about 20° from horizontal, perhaps from the weight of the birds.

We expected some nests to be lost on our survey on 1 June due to the strong winds (30-50 km/hr) and a thunderstorm (10 mm of rain) on the previous day. However, this weather brought no mortality to the nestling blackbirds. Eggs in nests 3 and 5 had hatched. Birds in nest 2, which hatched at least ten days before, were gone and presumed fledged. This nest had not tilted further and it is unlikely that the nestlings were spilled. No losses of nestlings occurred in nests 1, 6, or 7 but nest 4, with four nestlings on 29 May, had only three on 1 June. Many new cattails were above nest level on 1 June but were not affecting the stability of the nests in old cattails. Water level in the marsh had not changed from 22 May.

On 4 June all nestlings in nests 3, 4, and 5 were still present. Nests 1 and 7 were intact but empty and we presume that the birds fledged. The birds in nest 4 were about to fledge. Nest 6 was also empty except for one dead nestling. This bird was probably one or two days from leaving the nest when it died. No signs of aggression were visible. New cattails were well above the nest level by 4 June and the marsh was taking on a green color rather than the brown of old cattails.

Birds had fledged from nest 4 when observed at 16:00 on 7 June. Nests 3 and 5 still had four nestlings. A survey on 11 June showed all nests were empty but females were still displaying aggressive behavior toward the observers, probably due to fledglings in the marsh area.

Table 1. Summary of nest activity. "E" and "N" indicate the number of eggs and nestlings in the nest.

	Nest													
Date	1		2		3		4		5		6		7	
	E	N	E	N	E	N	E	N	E	N	E	N	E	N
22 May	4			4	4		4		4		4		—	—
29 May		4		4	4			4	4			4		3
1 June		4		0		4		3		4		4		3
4 June		0				4		3		4		1 dead		0
7 June						4		0		4				
11 June						0				0				

	1	2	3	4	5	6	7
Beginning of Incubation	12 May	9 May	19 May	14 May	19 May	12 May	11 May
Hatch Date	23 May	20 May	30 May	25 May	30 May	23 May	22 May
Fledging Date	3 Jun	31 May	10 Jun	5 Jun	10 Jun	3 Jun	2 Jun

Total Eggs Layed in Seven Nests	33*
Eggs Hatched	27 (82% of eggs)
Birds Fledged	25 (93% of nestlings)

*This assumes five eggs per nest for nests first observed eight or more days after incubation began.

Surveys were also made on 19 June, 29 June, 6 July, 16 July, and 25 July. New cattails were 50 cm above the old cattail level by 19 June. No renesting or aggressive behavior of Red-winged Blackbirds was observed on any of these visits to the marsh. Water depths had decreased substantially by 29 June with no water below nest 3 and an average of only 9 cm below the other six nests.

The approximate dates of incubation, hatching, and fledging are shown in Table 1, based on our observations and the assumption of an 11 day incubation and 11 days between hatching and fledging. Nero (1984) reported that the usual period of incubation, beginning after the third egg is laid, is eleven to twelve days. Case and Hewitt (1963) examined 926 nests over three years near our study site and found incubation periods were 10, 11, or 12 days after the last egg was layed and nestlings usually left the nest 10, 11, or 12 days after hatching.

The average number of eggs laid in active Red-winged Blackbird nests is between three and four (Neff and Meanley, 1957; Orians, 1961; Meanley and Webb, 1963; Case and Hewitt, 1963; Goddard and Board, 1967; Dolbeer, 1976; Crawford, 1977; Caccamise, 1977). We observed no more than four eggs in a nest. In calculating hatch success rates, however, we have assumed that five eggs were laid in nests that were first observed at least eight days after incubation began. This makes our reported hatch rates conservative since the actual number of eggs was likely to be 4 in these nests.

Birds that were in the nests one week after hatching were considered fledged if nestling mortality was not observed later. This is consistent with the method of Meanley and Webb (1963). In practice, most birds reported fledged were observed in the nest 8-10 days after hatching.

Discussion

The points of discussion in this study include 1) nest support, 2) nest density, 3) breeding success, and 4) renesting.

a) Nest Support

All nests observed in this study were in cattails from the previous season. This is in contrast to the findings of Bernstein and McLean (1980) in Ohio where nests built in late May and early June were in new cattails, or a combination of old and new, but no nests were entirely in old cattails. Holcomb and Twiest (1968) suggested that Red-winged Blackbirds breed earlier in marshes than in uplands near Toledo, Ohio, because cattails are available for nesting before upland vegetation reaches sufficient height and strength to support nests. Goddard and Board (1967) found that nests in old cattails were more successful than nests in other vegetation in Oklahoma and that old cattails were the only nest platforms available early in the season. However, early nests have often been reported to be more successful than later nests, perhaps because older experienced females nest earlier than yearlings, and the results of Goddard and Board do not make it clear whether greater success in old cattails is due to the nest support or to other factors.

Joyner (1978) studied an upland nest site in Ontario and found that reed canary-grass from the previous year provided the nest support for all nests, though new vegetation provided cover to the nests. Joyner concluded that the consistent use of old reed canary-grass was due to its availability during the early portion of the nesting season. Robertson (1972) reported that old cattails were the most common material for marsh nest support in Connecticut, a combination of old and new cattails was nearly as common, and few nests were built entirely in new cattails. Brenner (1966) studied Red-winged Blackbirds in central Pennsylvania and found that old cattails were the primary nest support early in the season but were replaced by sedges in June.

The exclusive use of old cattails in this study is simply a matter of cattail phenology. Plants develop slower in cooler climates so while Red-winged Blackbirds nesting during May have new cattails available for nesting in more southerly latitudes, the new cattails are not tall and sturdy enough in New York and other northern sites during May. Some birds nest earlier in southern regions than in the north, but Meanley and Webb (1963) reported that the nesting season of the Red-winged Blackbird is virtually the same throughout its range in the eastern United States. Therefore, Red-winged Blackbirds nesting in May have only old cattails available in upstate New York but may use old or new cattails in milder climates.

Based on climate patterns, it is likely that old cattails are the general preference for support of marsh nests built in May in interior portions of New England, New York, and Pennsylvania, most of Michigan, Wisconsin, and Minnesota, and central and eastern portions of Canada.

b) Nest Density

The concentration of nests, seven in 370 m^2, is denser than reported in most studies of Red-winged Blackbirds. This concentration extrapolates to a density of 189 active nests per hectare of marsh vegetation. The spacings of only 1.8 m between nests 4 and 7 and 2.1 m between nests 2 and 3 are particularly interesting and indicate a great tolerance between the females on those nests.

Meanley and Webb (1963) reported 50 nests in a 0.61 ha (82/ha) tidal river habitat in Maryland. In a 6.4 ha upland habitat in Ohio, Dolbeer (1976) found 105 active nests in one year (16/ha) and 81 nests the next year (13/ha). Concentrations were dense around Oklahoma ponds examined by Goddard and Board (1967). At a 0.25 ha pond with only 0.012 ha of cattails, there were 9 nests to give a concentration of 741 nests per ha of cattails. Other nest concentrations reported by Goddard and Board were also over 100/ha in cattails surrounding ponds.

The nest concentrations reported in an Ohio marsh by Bernstein and McLean (1980) are more typical of others reported in the literature. They found that the density of active nests ranged from 0.4/ha to 1.4/ha in three marshes with areas of 5, 6, and 7 ha.

The high density of nests in this marsh is perplexing. Nesting habitat is not scarce in the immediate area and the marsh is near humans and domestic dogs and cats. The water is not unusually deep and most nests are within 6 m of dry land. The reason for the high density was not determined. It may have resulted from an abundant food supply or a cooperative effort by females to defend nests, as discussed below.

c) Breeding Success

Success rates for eggs and nestlings in this marsh are higher than reported elsewhere in the literature for Red-winged Blackbirds. Francis (1971) reviewed eight studies that reported success rates of 2712 active nests, mostly in marshes. Among those nests, 1136 (42%) were successful in fledging one bird. Among studies not reviewed by Francis, Caccamise (1977) studied 136 nests in New Jersey salt marshes and found 73% of eggs hatched, 62% of nestlings fledged, and 63% of nests were successful. Robertson (1972) reported a success rate of 53% among 738 marsh nests in Connecticut but only 34% among 162 upland nests. Weatherhead and Robertson (1977) reported 39% of 381 nests were successful in 10 marshes near Kingston, Ontario. Picman (1980) found only 23% of 399 nests in a British Columbia marsh were successful. Predation is generally reported as the major cause of losses in eggs and nestlings.

McGuire (1986) studied several dozen Red-winged Blackbird nests in central Alaska for two summers. He reported high hatch (90%) and fledging (93%) success rates and attributed this success to lack of predation, low interspecific competition, abundant food, and favorable weather during the nesting period. Nesting was more synchronous than reported in most studies.

Studies relating Red-winged Blackbird nest location to breeding success have concluded that success is greater with deeper water below the nest (Goddard and Board, 1967; Weatherhead and Robertson, 1977), lower nest placement (Goddard and Board, 1967; Weatherhead and Robertson, 1977), and higher nest placement (Meanley and Webb, 1963; Holcomb and Twiest, 1968). Francis (1971, 1973) subjected some of these conflicting conclusions to statistical analyses and found the reported differences in breeding success based on nest placement to be insignificant or masked by other factors. He concluded that nesting success is related to the mechanical sturdiness of vegetation and meteorological factors which may stress birds or destroy nests.

Crawford (1977) found that nests in which at least one nestling died were closer together (x = 12.4 m) than nests without mortality (x = 19.7 m). Similarly, the density of nests was greater around nests with mortality (28/ha) than around nests without mortality (20/ha). Weatherhead and Robertson (1977) found that nest success was positively correlated with "area per female," defined as the area of the marsh divided by number of nests. They studied ten marshes with areas of 600 m^2 to 16,000 m^2. Nest success ranged from 20% where area per female was less than 150 m^2 to 58% with areas over 600 m^2 per female. (The area per female in this study is only 53 m^2.)

Picman (1981), on the other hand, found that a high nesting density contributes to greater success in Red-winged Blackbird nests. He makes a good argument that a dense, clumped nesting pattern gives the opportunity for a cooperative nest defense against the predatory Marsh Wren in British Columbia. This argument can be extended logically to include a cooperative nest defense against other predatory birds, such as crows and Blue Jays, and against mammals, such as dogs and raccoons.

Wittenberger and Hunt (1985, p. 27-30) have proposed that swamping, mobbing, and vigilance affect the adaptive significance of coloniality in birds such as Red-winged Blackbirds. Swamping requires a large number of nesting birds to "swamp" the ability of predators to prey on the birds. Some prey is taken but the number of survivors increases as colony population increases. The population of Red-winged Blackbirds in this marsh is too small to swamp a population of predators. We expect, however, that mobbing and vigilance have increased the success rates in this small marsh. Mobbing is used by Red-winged Blackbirds to deter predators. This tactic is more effective in a small marsh with a dense population because recruitment for mobbing is easier. A dense nesting pattern in a small marsh also improves vigilance and allows early detection of predators with less time spent on vigilance per individual.

The dates in Table 1 indicate a synchrony of nesting. Incubation began within an 11-day period in the seven nests. In contrast, others have reported that most females in a male's territory are asynchronous (Nero, 1956). Orians (1961) observed that nesting is synchronous in California as it begins in April but becomes asynchronous through May as nests fail, second nests are started, and new females arrive.

Robertson (1972) found synchronous nesting in a Connecticut marsh. He reported that synchrony was more likely in a marsh habitat than in uplands since old cattails provide an abundance of sturdy nest sites early in the season when upland sites have little sturdy vegetation. Robertson concluded that dense nesting and synchrony of nesting provides an effective defense against predators.

Synchronous nesting strengthens the cooperative nest defense which is made possible by the dense nesting pattern. Red-winged Blackbirds with eggs or nestlings have a mutual interest in defending their nests. Synchronous nesting allows more efficient mobbing and vigilance against predators.

Finally, the weather may have significant impacts on nesting success through thermal stress on adults, eggs, or nestlings or by destruction of nests by wind or floods (Francis, 1971). The weather was favorable through the nesting period of 1 May - 11 June. Temperatures, measured 10 km west at Ithaca, averaged 13.9°C, 0.2°C above normal. Freezing weather occurred on several mornings but always with clear skies and light winds. Rain fell on 19 of 42 days giving a total of 72 mm, only 62% of the average. Moderate winds were noted on several days but no damage was caused to nests or the surrounding vegetation.

We propose that the high nest success rate observed in this marsh may be due to 1) sturdy, old cattails used as nest support, 2) a high density of nests which provides the opportunity for cooperative nest defense, 3) synchrony of nesting, and 4) favorable weather during the nesting period.

d) Renesting

Many studies on Red-winged Blackbirds report second and third nesting attempts through the summer. In most cases, the renesting is attributed to females with unsuccessful first nests (Dolbeer, 1976; Picman, 1981). No renesting was observed in this study. This is not surprising since all first nests were successful. An additional factor to inhibit second nests was the substantially lower water level in the marsh by late June which may have reduced the safety of the nests.

Conclusions

The results of this study have implications for the management of Red-winged Blackbird populations. Red-winged Blackbirds may be the most abundant native land bird in North America (Pettingill, 1970) and they are a nuisance in many areas. Bird damage to corn was surveyed in 24 states by Stone *et al.* (1972). New York was estimated to have damage to 41% of corn fields with a loss of 1.2 bu/acre, the highest of all states surveyed. Much of this damage is caused by Red-winged Blackbirds. Weatherhead *et al.* (1980) estimated blackbird damage to corn and grains in the St. Lawrence Valley runs into millions of dollars and Red-winged Blackbird populations are growing rapidly in that region.

A small marsh can produce a large number of fledgling Red-winged Blackbirds through dense nesting patterns and breeding synchrony if other conditions, such as vegetation and weather, are favorable. Most studies of marsh-nesting Red-winged Blackbirds focus on larger marshes where nest density and success are lower. An overall view of the ecology of Red-winged Blackbirds must consider very small nesting habitats because 1) social structure and nest success may be different than seen in larger marshes and 2) there are many very small marshes formed from excavation associated with building of homes or highways or the drainage of agricultural land. Even a very small marsh can produce a dense concentration of nests and a high breeding success, given the right combination of weather, phenology, and setting.

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