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NESTING OF RED-WINGED BLACKBIRDS IN CATTAILS AND COMMON REED GRASS IN MENTOR MARSH[1]

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Abstract. During summer 1976, a study of habitat selection by the red-winged blackbird, *Agelaius phoeniceus*, was conducted. Mentor Marsh near Mentor, Ohio was chosen because of its unique geologic and botanical history. A swamp forest prior to 1959, the area is now a marsh composed of *Typha latifolia*, *T. angustifolia*, and *Phragmites australis*. Preferences of *A. phoeniceus* for each of these plants were investigated, and *T. latifolia* was significantly most chosen. Presumed advantages include rigidity, easy nest accessibility, and wide spacing to facilitate nest defense. Additional features of habitat selected such as available perches, proximity of open water, and edge effect were investigated. If rapid succession to monodominant stands of *P. australis* continues at the present rate, the nesting red-winged blackbird population may decrease sharply.

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During summer 1976, we attempted to determine if red-winged blackbirds (*Agelaius phoenicus*) chose a specific plant for nesting in Mentor Marsh. We also attempted to determine the advantages and disadvantages of nest construction in various plant types. Of additional interest was a prediction of future red-winged blackbird populations in the marsh, since succession was rapidly approaching a marsh composed of only common reed grass (*Phragmites australis*). Mentor Marsh is by no means an isolated environment, but due to its unique history of geologic formation and vegetation succession (Berstein 1977), a large area could be differentiated from surrounding available nesting habitat. Distinct patches of cattails (*Typha latifolia* and *Typha angustiofilia*) and *Phragmites* also could be distinguished within the marsh.

STUDY AREA AND METHODS

Located on the lake plains of north-central Lake County, Ohio, Mentor Marsh was originally an oxbow lake formed from the Grand River at some unknown time. A detailed account of the geologic and vegetational history of the marsh can be found in Bernstein (1977). Although the marsh was a swamp forest until 1959, a die-off of trees permitted replacement of the swamp forest by marsh plants, mainly broad-leaved cattail (*Typha latifolia*) and narrow-leaved cattail (*T. angustifolia*). Common reed grass (*Phragmites australis*), uncommon in the initial marsh stage, has since proliferated and is now present and still spreading in tall monodominant stands covering 75% of the marsh.

Three study areas were chosen. Study Area A (7 ha) was composed mainly of broad-leaved cattail, Study Area B (5 ha) contained mainly narrow-leaved cattail, and common reed grass was dominant in Study Area C (6 ha).

Observations of red-winged blackbird populations began on 3 March 1976. Spring migrant survey continued until mid-June, nesting survey through August, and fall migrants were observed until November. The majority of observations were made within four hours after sunrise, but evening observations also were made. About 125 man hours were spent in territory mapping and searching for nests. A grid system of color and number coded aluminum pie pans at 20 m intervals within each study area facilitated territorial mapping and nest location. Observations were made from elevated land, trees, and an observation platform on the marsh border, and from within the marsh. Mapping techniques, as described by Svensson (1970), were used. Nests were assigned numbers and were labeled with small tags tied beneath them.

Nest substrate, height above water or litter mat, dimensions and contents were recorded (table 1). Nest observations and/or territorial mapping were conducted every 3 to 4 days in each study area unless prevented by inclement weather. The time schedule of Meanley and Webb (1963), who suggested that females may abandon nests if stressed often, was followed. Each study area was censused an equal number of times at the same time of day.

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Although the total area of each of the study areas was known, each site had open bodies of water which were not potential nesting habitat. Since peripheries of non-vegetated areas also could be attractive to birds as edge, measurements of both their perimeter and area were made. Calculations were based on formulae and tables in Burington (1965) and by assuming the non-vegetated areas as approximate ellipses (not an unrealistic assumption).

Plant shoot density was measured by 2 sets of 2 one-m boards which were glued together at right angles and placed at the bases of plants. The number of shoots per square meter was obtained. This procedure was applied to to district stands of broad-leaved cattail in Study Area A, broad-leaved cattail in Study Area B, narrow-leaved cattail in Study Area B, and common reed grass in Study Area C. In addition, woody plants that could be used as perches were counted in each study area to determine whether their presence influenced nesting birds.

Data were analyzed using analysis of variance, and differences were computed with a two-tailed test of least significant difference.

RESULTS

The first migrant red-winged blackbirds were males, noted on 29 February, and pursuit of females was commonly observed from mid-April to mid-May. The first active nest was found on 23 May, and the last on 3 July. Most nests were discovered by 7 June. A combination of dead and new vegetation was used as support for 21 of the nests found, and only three of these nests were found tipped. No nests were found constructed strictly in vegetation of previous years.

Table 1 contains data pertaining to number of nests built, number of active nests, percentage of empty nests, number of eggs laid, and number of nests per hectare in each of the study areas. Nests in Study Area A contained from one to four eggs per nest. Seven juvenile birds were observed, but more may have fledged. One nest in Study Area A was built late in the summer after all other nests had fledged young; this occurrence may have been a case of renesting or, as suggested by Dolbeer (1976), may have been due to a new female entering the area. Study Area B had two nests with eggs. The first, with 4 eggs, was later observed with 4 young ready to fledge; the other nest contained 2 eggs which did not hatch. The three active nests of Study Area C contained a total of 8 eggs, but no young were observed. The average clutch size for active nests was 2.13.

Data pertaining to height of red-winged blackbird nests above water in each plant species are presented in table 2.

TABLE 1

Data from Study Areas in Mentor Marsh (1976).

Study Area	A	B	C
Nests Built	17	4	5
Active Nests	10	2	3
Empty Nests (%)	41	50	40
Eggs Laid	22	6	8
Active Nests/ha	1.4	0.4	0.5
Mean Area (m^2) Male Terr.	759±250**	1000±200	760±522
Harem Size	2.00±1.1	1.32±0.58	2.40±0.89
Mean Area (m^2) Open Water	834±308	1281±234	732±324
Area Open Water/100 m^2	1.19±0.44	2.56±0.47*	1.05±0.54
Mean Area (m^2) Available for Nesting	61018±3308	36208±2521*	52116±7051*
Av. Area/nest	3589±195	9052±1092*	10423±1410*
Av. (m) Edge Open Water	246±170	423±239	314±156
Edge (m) Open Water/100 m^2	0.35±0.23	0.35±0.48	0.88±0.26
No. Trees	281±26	115±18	150±20
Trees/100 m^2	0.31±0.37	0.24±0.35	0.25±0.33

*Significantly different ($P<0.05$).

**Number of observations (n=3) except Mean Area Male Terr. A=6, C=5 and Harem Size A=6 and C=5.

TABLE 2

Red-Winged Blackbird Nest Characteristics at Mentor Marsh (1976).

	Tl*	Ta	Pa	Or
Nest Ht. cm	53.9±9.8	71.1±22.0	99.2±26.2	106.7±15.1
Nest Dia. cm	10.7±0.7	10.3± 0.9	10.2± 0.0	11.6± 0.3
n	13	3	5	5
% Meas.	50.0	11.5	19.2	19.2

*Tl = *Typha latifolia*
Ta = *Typha angustifolia*
Pa = *Phragmites australis*
Or = *Osmunda regalis*

Height data are too few, however, to form conclusive correlations.

Since the majority of nests were constructed in Study Area A and 50% were built in broad-leaved cattail, data were statistically tested to determine if differences between study areas and/or vegetation existed that would relate to choice of nesting substrate (table 1–4). No significant differences were found among male territory or harem sizes. Physical characters of the study areas were tested; and although we found nothing in the literature concerning a direct effect of open bodies of water on choice of nesting habitat, we felt that this was worth testing as a possible factor in the bird's niche gestalt (James 1971). Differences were not significant. When average amounts of open water per study area were tested, significant differences existed between Study Area B and Study Areas A and C. This information, however, did not reveal evidence for choice of habitat since Study Area B and Study Area C had approximately the same number of nests.

To determine the extent that open water decreased potential nesting habitat, areas of open water were subtracted from the total area of each study site, and the resultant was called "area available for nesting." Study Area A had the greatest value and was significantly different from the other study sites. Without further analysis, it would appear that the reason for more nests in Study Area A was related to greater area available for nesting; however, when the area available for nesting was divided by the number of nests within each study area to determine average area utilized per nest, the data showed that the average area utilized per nest was least in Study Area A and that the differences were significant. Also significant was a greater density of nests in Study Area B than in Study Area C, suggesting, that something was attractive to nesting red-winged blackbirds in Study Area A that caused a greater density of nests, and that Study Area B was preferable to Study Area C.

TABLE 3

Density of Plant Shoots in Mentor Marsh (1976).

	n	$\bar{X}$±S.D.*
TLAN**	10	19.3±7.5
TLA	10	33.4±7.0
TLB	10	25.4±8.2
TAB	10	63.7±4.2
PC	8	71.5±7.5

*Number of shoots/m².
**TLAN = *T. latifolia*, Study Area A, used for nesting.
TLA = *T. latifolia*, Study Area A, not used for nesting.
TLB = *T. latifolia*, Study Area B.
TAB = *T. angustifolia*, Study Area B.
PC = *Phragmites australis*, Study Area C.

Edge effect (Beecher 1942, Nero 1956a, Weller and Spatcher 1963, Holm 1973) was tested by measuring perimeters of open bodies of water in each study area. Data for both the amount of edge and the average amount of edge showed no significant differences between the study areas. Nests were found at the edge of different vegetation types, and this factor or the differences in amount of edge of water were not important criteria for differences in number of nests per study area. Four of the five nests in Study Area C were, however, at the edge of the water even though similar habitat within the study area was not utilized

Trees that could be used as perches

TABLE 4
Difference in Densities of Plant Shoots, Mentor Marsh (1976).

Comparison	Significance
TLAN vs. TLA*	<0.001
TLAN vs. PC	<0.001
TLAN vs. TLB	n.s.
TLAN vs. TAB	<0.001
TAB vs. PC	n.s.
TAB vs. TLA	n.s.
TLA vs. PC	<0.001
TLB vs. TAB	<0.001
TLB vs. TLA	n.s.
TLB vs. PC	<0.001

*TLAN = *T. latifolia*, Study Area A, used for nesting.
TLA = *T. latifolia*, Study Area A, not used for nesting.
TLB = *T. latifolia*, Study Area B.
TAB = *T. angustifolia*, Study Area B.
PC = *Phragmites australis*, Study Area C.

counted, and Study Area A had significantly more trees than the other study areas. No significant difference existed in the number of trees between Study Areas B and C.

In searching for vegetational differences between study areas, we found that most of the nests were not only built in broad-leaved cattail, but broad-leaved cattail with low shoot density as in Study Area A. Data that pertained to density of plant shoots and vegetation used for nesting therefore were divided into five categories (table 3). Statistical results are recorded in table 4. Broad-leaved cattail in Study Area A that was used for nesting had the least density of shoots and significantly differed from all plant types except the broad-leaved cattail in Study Area B. Because of its intermediate density, broad-leaved cattail in Study Area B did not significantly differ in density from broad-leaved cattail in Study Area A that was not used for nesting. All broad-leaved cattail types by male red-winged blackbirds were differed significantly from narrow-leaved cattail and common reed grass, which did not differ significantly from each other. The areas with the least density of shoots contained the most nests.

DISCUSSION

Our data indicate that red-winged blackbirds in Mentor Marsh commenced nest building slightly later than in most northern North American localities (Allen 1914, Orians 1961, Meanley and Webb 1963, Nero 1956a). Cooler spring temperatures (lake effect due to proximity of Lake Erie) may have delayed nesting as a result of retardation of plant growth (Peet 1908) or directly as lower mean temperature (Smith 1943). We assume that new vegetation had ceased rapid growth before most nests were built since few nests built in a combination of old and new vegetation were found tipped as a result of differential plant growth. Allen (1914), Orians (1961), and Weller and Spatcher (1965) reported that first nests of red-winged blackbirds are usually built in the previous year's vegetation.

Our data are too few to make a correlation between nest height and nest success. Nest success was found to be related to nest height by Meanley and Webb (1963), Holcomb and Tweist (1968), Holm (1973), and Weatherhead and Robertson (1977). Francis (1971), however, suggested that this factor is not significant.

Goddard and Board (1967) found that nesting success was proportional to depth of water below the nest. Holm (1973) did not make measurements of water depth, but noticed that predation was least in an area of deepest water and sparsest vegetation. Weatherhead and Robertson's observations (1977) support Holm's conclusions. We did not make precise measurements of water depth but Study Area A, the area of greatest nest construction and most eggs laid, was also the area of deepest water and sparsest vegetation. We found no differences in nest diameters (table 2). It should be noted that Caccamise (1977), in a study involving marsh shrubs, found no differences in nest success between nests built in different plants.

It is assumed that greater density of nests indicates preferable habitat (Case and Hewitt 1963, Robertson 1972). An alternative explanation based on Weatherhead and Robertson's (1977) model would be that areas of nest density are due to recruitment of more females by an attractive male, implying that males of superior recruitment capability were all in Study Area A while less attractive males were found in the other study areas. This explanation seems unlikely but we have no data to indicate if the Weatherhead and Robertson model is applicable to this study.

Our data on the number of trees as perch sites are inconclusive. Nero (1956b) and Case and Hewitt (1963) reported that presence of a high perch could cause modification of red-winged blackbird territories so that a perch would be contained within the territory. A higher absolute number of perch sites therefore should make Study Area A more attractive to males, which should be the case despite lack of differences between the average number of trees. Presence of perch sites alone was not the total explanation for more nests in Study Area A, since the widely-spaced broad-leaved cattail used for nesting was distinct from denser stands of the same species not used for nesting. Orians (1961) found greater densities of red-winged blackbird nests and smaller territories in areas where cattails were not dense. Our data did not reveal smaller male territories. Wilson (1966) reported higher nesting success in yellow-headed blackbirds (*Xanthocephalus xanthocephalus*) where cattail stands were broken by patches of water, and Weller and Spatcher (1965) reported more red-winged blackbird nests in areas of marsh that had been opened by muskrat activity. Smith (1943), however, reported greatest red-winged blackbird success in dense stands of cattails as opposed to those that were less dense.

A possible reason for the choice of sparse vegetation by red-winged blackbirds may be that more open areas allow greater penetration of sunlight to the water which would increase aquatic productivity and attract congregations of some emerging insect larvae (Willson 1966). It may also be energetically and physically difficult for a female to travel to and from the nest if vegetation, such as common reed grass, is too dense.

Royal fern (*Osmunda regalis*), which grew near broad-leaved cattail, was also chosen for several nests although this selection may have been due to initial attraction to the cattail followed by construction of nests in a suitable nearby plant. Royal fern is a taller plant than broad-leaved cattail and was relatively sturdy providing an appropriate site for nest construction.

Assuming density of vegetation is important in selecting a nest site, our data indicated that broad-leaved cattail in Study Area B should have had similar densities of nests to broad-leaved cattail used for nesting in Study Area A. The fact that they did not may be related to lack of a proper niche gestalt (James 1971) because of proximity to remnant swamp forest or lack of enough perch sites in Study Area B.

Holm (1973) states in her study that cattails were preferred to bulrushes (*Scirpus* spp.) because they may have provided better support for nests, they may have been the only available nest support at the start of breeding, they provided better cover from wind and rain, and they may give better concealment from predators than *Scirpus*. Some of these factors may be applicable to our Mentor Marsh study. Support may be a factor in choice of broad-leaved rather than narrow-leaved cattail because of greater apparent flexibility of the latter. For a nest to be secure from waving in the wind when placed in narrow-leaved cattail, it probably must be positioned low in the plant, closer to water and potential predators. Data on nest heights (table 2) do not substantiate this assumption; however, heights above surface of nests built in narrow-leaved cattail were 58.4 and 96.5 cm. One nest was placed much higher than expected. Although this nest initially was found with two eggs, when checked five days later, no trace of the nest was present. Notes from our first observation state that the nest was poorly constructed, and intervening bad weather between observations may have been the cause of destruction. Broad-leaved cattail, in contrast, appears more rigid to a greater height and nests can probably be securely placed higher in the plant. Since common reed grass is obviously stiffer and harder to a greater height than either cattail, support at height can only be a partial factor. That only cattails are present at the beginning of spring is not the case, since dead plants of both cattail species and of common reed grass are present at this time. Presumed advantages of shelter and concealment apparently do not apply in the study areas since it would seem the denser narrow-leaved cattail and common reed grass would have been chosen instead of the less dense broad-leaved cattail.

We believe that factors concerning secure support of the nest at set height, presumed to be related to safety from predators, made widely spaced broad-leaved cattail the primary choice for a nesting substrate by red-winged blackbirds in Mentor Marsh. Easy access to the nest by the female may also be an advantage of this choice. Presence of sufficient numbers of perching sites may have been important in choice of habitat by males, although it cannot alone influence nest site selection since different densities of plant shoots were selected for within Study Area A. It is probable that few areas of the marsh will be free of common reed grass within a few years and that a sharp decrease in the nesting red-winged blackbird population within the marsh will accompany that proliferation.

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