

Productivity of Red-winged Blackbirds in South Dakota

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ABSTRACT — The productivity of 138 red-winged blackbird territories in marshland and 96 in upland was determined from 1963-1966 in Brown County, South Dakota. Males in marshland attracted 1.7 times as many females as males in upland (2.91 vs. 1.75, $P < 0.05$) and females in marshland fledged 2.0 times as many young as females in upland (1.79 vs. 0.90, $P < 0.01$). Consequently, male territories in marshland produced 3.5 times as many fledglings as those in upland (5.22 vs. 1.51, $P < 0.01$). Based on these data, we estimate that the post-breeding (crop-damaging) red-wing population in North Dakota in 1982, the year that a state-wide census of male redwings was completed, was 11.5 million birds.

The red-winged blackbird (*Aegialius phoeniceus*) is the most numerous species in the large blackbird congregations damaging ripening field corn (*Zea mays*) in late summer and early fall in South Dakota (De Grazio et al. 1971). Hundreds of thousands of blackbirds assemble in late summer each year in the marshes formed by impoundments of the James River in Brown County, SD, and cause substantial losses in nearby cornfields (De Grazio 1964). Many of the birds causing these losses breed in North Dakota (Besser et al. 1984a). Censuses of a 77,000-km² area of the breeding range of these populations in the Dakotas showed that from 1 to 2 million redwing males held breeding territories in this area from 1965 through 1981 (Besser et al. 1984b). Production studies were necessary to determine the relationship between numbers of breeding males censused and the expected populations of males, females, and young redwings available to damage corn in late summer. With the reintroduction of sunflower (*Helianthus annuus*) as a major agricultural crop in the Dakotas in the 1970's and the severe blackbird damage taking place in that crop (DeHaven 1982), redwing production in the Dakotas also should be of interest to persons concerned with reducing this damage.

Despite the large number of nesting studies of red-wing blackbirds in other regions of North America, none has been conducted in the Drift Plains physiographic region (Fenneman 1938), which contains the largest acreage of prairie wetlands remaining in North America (Shaw and Fredine 1971). Brown County, South Dakota, lies wholly within the Drift Plains region and was the location of production studies of nesting red-winged blackbirds conducted from May to August during 1963 - 1966. Herein, we report the reproductive success of red-winged blackbirds in marshland and upland of Brown County.

METHODS

We selected male redwings for study in four of the most common nesting habitats of red-winged blackbirds in Brown County, two in marshland and two

in upland. Marshland habitats included (a) deep-water marshes bordering semi-permanent ponds or lakes and (b) shallow-water marshes in temporary ponds and in wet meadows (Stewart and Kantrud 1971). Upland habitats included (a) cultivated uplands, principally hay fields, and (b) uncultivated uplands, chiefly grazing lands or retired croplands.

Each of the four habitat types was characterized by rather distinctive vegetation affording nesting substrates for red-winged blackbird females. Broadleaf cattail (*Typha latifolia*), reed (*Phragmites communis*), and common three-square (*Scirpus americanus*) were the plants most frequently associated with deep-water marshes. Sedges (*Carex* spp.), docks (*Rumex* spp.), smartweed (*Polygonum punctata*), giant burreed (*Sparganium eurycarpum*), and prairie cordgrass (*Spartina spectinata*) were associated with shallow-water marshes and wet meadows. Alfalfa (*Medicago sativa*) was the dominant plant used by redwings in cultivated uplands, while brome grass (*Bromus* spp.), sweet clover (*Melilotus* spp.), and snowberry (*Symphoricarpos occidentalis*) were the commonest plants used in uncultivated uplands.

We attempted to obtain production data on 15 male redwings in each habitat type in each of the four years. In late April and early May each year, we selected the first 15 males encountered in each habitat type from roads in the vicinity of the Sand Lake National Wildlife Refuge, Columbia, Brown County, SD. Some of the males initially selected, particularly those in uncultivated uplands, did not succeed in attracting females, and subsequently moved to more productive habitats, in a manner reported by Besser and Brady (1984). Males that secured territories within the territories of males initially selected for study were added to the numbers originally selected for the more productive habitat types. Thus, the total number of males for habitat types varied from 58 to 72 for the four years (Table 1).

We visited redwing territories and nests two to three times weekly during the nesting season. Since a given habitat usually contained groups of male territories, all males and females were counted each visit. Because females were less conspicuous than males, especially when incubating, we sometimes used the count of active nests, if higher than the count of females, as the number of females present.

We located nests by observing females and searching territories for nests. A nest was marked by placing a numbered lath approximately 2 m from it. Upon initial location, we recorded the plant species to which the nest was attached. Condition and content of the nest was noted on each subsequent visit. A nest was considered active when the first redwing egg was laid. Ages of eggs and nestlings were determined by backdating. From nests found before complete clutches were laid, we determined that incubation by females in South Dakota began the day before the last egg of a clutch was laid, that most eggs hatched 10 days thereafter, but that the last egg did not hatch until the 11th day of incubation. For the modal clutch of four eggs, 24 days usually elapsed from the time the first egg was laid until the last nestling fledged, although in one instance this period was extended to 28 days when a nestling did not leave the nest until 14 days after hatching.

When a nest had lost eggs or nestlings since the last visit, the nest was checked for egg shell fragments or remains of nestlings, the condition of the supporting vegetation was determined, and the immediate vicinity of the nest was searched for predator sign in an attempt to ascertain the cause of loss. Allen (1914), Beer and Tibbitts (1950), and Case and Hewitt (1963) reported that young redwings will not leave the nest until they are nine days old. In our study, nestlings missing from the nest before they were nine days old were considered mortalities. Those in the nest when seven or eight days old, but missing on the next visit were considered to have fledged, if there was no evidence of mortality. Nestlings were banded when six to eight days of age.

Differences in the number of females attracted by males in marshland and upland, differences in the number of young fledged per female in marshland and upland, and differences in the number of young fledged from nests that were parasitized and not parasitized by brown-headed cowbirds (*Molothrus ater*) were subjected to a two-way analysis of variance (habitats and years) and the significance of differences determined by Scheffe's test (Snedecor and Cochran 1974).

RESULTS AND DISCUSSION

Number of Males, Females, and Active Nests

In four years, we located 546 females and 873 active nests on the territories of 234 males (Table 1). One-hundred thirty-eight (59.0%) of the males, 384 (70.1%) of the females, and 649 (74.3%) of the active nests were in marshland; the remainder were in uplands.

Table 1. Numbers of redwing males, females, and active nests in four habitats, Brown County, SD, 1963-66.

Habitat	Number		
	Males	Females	Active nests
Deep marsh	66	205	337
Shallow marsh	72	179	312
All marshland	138	384	649
Cultivated upland	58	95	113
Uncultivated upland	38	67	111
All upland	96	162	224
Total	234	546	873

Nesting Chronology

The first egg was laid on 12 May (1964) and the last nestling fledged 6 August (1966). Dates on which the first egg was laid in the other three years were 19 May (1965), 21 May (1963), and 22 May (1966). In 1965, the last nestling fledged on 3 August and in both 1963 and 1964 on 29 July. Thus, the total time that nests were active ranged from 70 to 79 days during the four years. The first egg was laid in 34.8% of the 873 active nests in May, 57.7% in June, and 7.4% in July.

Clutch Size

A total of 2963 redwing eggs was found in the 873 active nests, or 3.4 eggs per nest. However, predation on redwing eggs undoubtedly resulted in finding lower numbers than actually laid. The 706 nests that had three or more redwing eggs, presumably a minimal full clutch, contained a total of 2704 eggs, or 3.8 eggs per nest. Two nests contained clutches of six eggs, and 64 had five eggs. Four eggs were present in 452 (51.8%) of the active nests. Of 32 studies of redwing production that were reviewed, only two other six-egg clutches have been reported, one in California (Orians 1961) and one in Alaska (McGuire 1983); Rigby (1982) reported a seven-egg clutch from the New Brunswick Nest Record Card Program.

Fledging Success

Of the 2963 redwing eggs found, 811 (27.4%) resulted in fledglings (Table 2). Of the 2212 eggs in marshland, 682 (30.8%) produced fledglings, whereas of 751 eggs in upland, 129 (17.2%) resulted in fledglings (Table 2). Eggs in

Table 2. Percentage of redwing eggs resulting in fledglings in four habitats, Brown County, SD, 1963-1966.

Habit	No. eggs	No. nestlings	No. fledglings	Percentage fledglings/egg
Deep marsh	1137	630	418	36.8
Shallow marsh	1075	401	264	24.6
All marshland	2212	1031	682	30.8
Cultivated upland	365	107	45	12.3
Uncultivated upland	386	149	84	21.8
All upland	751	256	129	17.2
Total	2963	1287	811	27.4

nests in deep-water marshes produced the highest proportion of fledglings (36.8%), followed by eggs in nests in shallow-water marshes (24.6%), and uncultivated upland (21.8%), whereas only 12.3% of the eggs in nests in cultivated upland produced fledglings.

The number of young fledged per active nest was 0.93 (811/873), 1.05 in marshland and 0.58 in upland. The median number of fledgling redwings produced per active nest was 1.33 in 37 other studies of redwings in marshland and 1.12 in seven other upland studies. These comparative data show that the number of fledglings per active nest in our study was 21% less in marshland and 48% less in upland than the median for these habitats for other studies in North America.

Production by Habitats

Male redwings in marshland attracted 1.7 times as many females as males in upland (2.91 vs. 1.73, $P < 0.05$) and these females fledged 2.0 times as many young as females in upland (1.79 vs. 0.90, $P < 0.01$) (Table 3). Consequently, male territories in marshland produced 3.5 times as many fledgling as those in upland (5.22 vs. 1.51, $P < 0.01$).

In marshland, production per male territory in this study was third highest among eight North American studies where production per male was reported (Table 4). Production per male in marshes in South Dakota was exceeded in only two more northerly locales, British Columbia (Picman 1980) and Alaska (McGuire 1983). However, in upland, production per male was only 24.5% of that reported in Ohio (Dolbeer 1976), the only other study where production per male in upland was reported (Table 4).

Table 3. Production of red-wing fledglings in four habitats, Brown County, SD, 1963-1966.

Habitat	Females per male	Fledglings	
		Per female	Per male
Deep marsh	3.09	1.99	6.19
Shallow marsh	2.73	1.61	4.24
All marshland	2.91 ^a	1.79 ^b	5.22 ^b
Cultivated upland	1.60	0.52	0.80
Uncultivated upland	1.86	1.28	2.21
All upland	1.73 ^a	0.90 ^b	1.51 ^b
Mean	2.32	1.35	3.36

^aSignificant at the 5% error level.

^bSignificant at the 1% error level.

Table 4. Numbers of fledglings produced on territories of male and female redwings in eight marshland and two upland studies in North America.

State or province	Males	Females	Fledglings	Fledglings		Reference
				Per male	Per female	
Marshland						
British Columbia	34	142	215	6.32	1.51	Picman 1980
Alaska	40	79	244	6.10	3.08	McGuire 1983
South Dakota	138	384	682	5.05	1.78	This study
Quebec	96	272	473	4.93	1.74	Weatherhead & Robertson 1977
New York	42	92	178	4.24	1.93	Case and Hewitt 1963
Washington	101	298	318	3.15	1.07	Holm 1973
Minnesota	45	97 ^a	137	3.04	1.41 ^a	Moulton 1981
Pennsylvania	92	120	169	1.84	1.41	Brenner 1966
Upland						
Ohio	31	132 ^a	170	5.48	1.29 ^a	Dolbeer 1976
South Dakota	96	162	129	1.34	0.80	This study

^aBased on minimum number of females.

Production by Nesting Substrate

Redwing females attached nests to 36 genera of plants (Table 5). Twenty-seven nests had fences for additional support and eight nests were attached to two genera of plants. Broadleaf cattail was the most common plant chosen for nesting; 213 (25.6%) nests were attached to this substrate. Nesting females in cattail produced 1.13 fledglings per nest, whereas the average in all other substrates was only 0.88 fledglings per nest. Six other plant taxa were chosen by 5-10% of the females for nesting. Nesting females in common three-square, sedges, and reed produced above average numbers of fledglings per nest, whereas nesting females in docks, brome grass, and alfalfa produced below average numbers of fledglings per nest. Only 0.22 fledglings per nest were produced in 85 alfalfa nests, whereas the average in all other substrates was 1.01 fledglings per nest. Among less frequently used plants, common milkweed (*Asclepias syriaca*) was noteworthy in that seven nesting females in milkweed produced 23 fledglings.

Egg and Nestling Losses

We attributed 67.5% (1132 of 1676) of the loss of redwing eggs and 62.2% (296 of 476) of the loss of redwing nestlings to predation (Table 6). Predation losses accounted for 1428 (66.4%) of the 2152 eggs. Most predation only could be classified into unidentified predation by large mammals (nest support destroyed), unidentified avian predation (egg shells in the nest), or unidentified

Table 5. Redwing fledgling production in 39 nesting substrates, Brown County, SD, 1963-1966.

Substrate	No. nests	No. fledglings	No. fledglings/nest
Broadleaf cattail (<i>Typha latifolia</i>)	213	241	1.13
Common three-square (<i>Scirpus americanus</i>)	85	99	1.16
Alfalfa (<i>Medicago sativa</i>)	85	19	0.22
Dock (<i>Rumex</i> spp.)	72	54	0.75
Sedge (<i>Carex</i> spp.)	58	64	1.10
Bromegrass (<i>Bromus</i> spp.)	51	25	0.49
Reed (<i>Phragmites communis</i>)	46	77	1.67
Snowberry (<i>Symphoricarpos occidentalis</i>)	34	27	0.79
Giant burreed (<i>Sparganium eurycarpum</i>)	33	35	1.06
Cord grass (<i>Spartina pectinata</i>)	33	29	0.88
Sweet clover (<i>Melilotus</i> spp.)	32	24	0.75
Fence	27	21	0.78
Dotted smart weed (<i>Polygonum punctatum</i>)	21	20	0.95
Soft stem bulrush (<i>Scirpus validus</i>)	20	26	1.30
Reed canary grass (<i>Phalaris arundinacea</i>)	18	1	0.06
Willow (<i>Salix</i> spp.)	16	10	0.63
Wormwood (<i>Artemisia absinthum</i>)	13	9	0.69
Common milkweed (<i>Asclepias syriaca</i>)	7	23	3.29
Western wheatgrass (<i>Agropyron smithii</i>)	7	5	0.71
Rush (<i>Juncus</i> spp.)	6	13	2.17
Wild millet (<i>Echinochloa crusgalli</i>)	5	1	0.20
Wild barley (<i>Hordeum jubatum</i>)	5	0	0
Summer cypress (<i>Kochia scoparia</i>)	4	3	0.75
Green ash (<i>Fraxinus viridis</i>)	3	10	3.33
Honeysuckle (<i>Lonicera involucrata</i>)	3	3	1.00
Russian thistle (<i>Salsola kali</i>)	3	0	0
Common ragweed (<i>Ambrosia elatior</i>)	3	0	0
Mariagrass (<i>Glyceria</i> spp.)	2	4	2.00
Dasylleabane (<i>Erigeron ramosus</i>)	2	4	2.00
Broadleaf arrowhead (<i>Sagittaria latifolia</i>)	2	0	0
Hybrid cattail (<i>Typha glauca</i>)	2	0	0
Rice cutgrass (<i>Oryzopsis</i> spp.)	1	3	3.00
Prairie rose (<i>Rosa arkansana</i>)	1	0	0
Stinging nettle (<i>Urtica gracillis</i>)	1	0	0
Green needlegrass (<i>Stipa viridula</i>)	1	0	0
Johnson grass (<i>Sorghum halapense</i>)	1	0	0
Unidentified composite	1	0	0
Field thistle (<i>Cirsium arvense</i>)	1	0	0
	908	850	0.94

Table 6. Known and suspected causes of loss of redwing eggs and nestlings, Brown County, SD, 1963-1966.

Cause	Number eggs lost			Number nestlings lost			Total losses
	Marsh-lands	Uplands	Total	Marsh-lands	Uplands	Total	
Predation							
Raccoon (<i>Procyon lotor</i>)	50	0	50	4	0	4	54
Red fox (<i>Vulpes fulva</i>)	22	0	22	0	0	0	22
Unidentified large mammal	302	80	382	107	40	147	529
Total mammal	355	99	454	111	40	151	605
Marsh wren (<i>Cistothorus palustris</i>)	14	0	14	0	0	0	14
Common grackle (<i>Quiscalus quiscula</i>)	13	0	13	0	0	0	13
Unidentified avian	131	28	159	3	0	3	162
Total avian	158	28	186	3	0	3	189
Small mammal or snake	0	29	29	0	4	4	33
Unidentified predation	349	114	463	120	18	138	601
Totals	862	270	1132	234	62	296	1428
Attrition				68	18	84	84
Starvation	-	-	-	-	-	-	70
Failed to hatch	48	22	70	-	-	-	-
Abandoned—female killed	14	0	14	-	-	-	14
Drowned nestling	-	-	-	4	0	4	4
Dump egg	2	1	3	-	-	-	3
Dead in nest—cause unknown	-	-	-	3	0	3	3
Abandoned—cause unidentified	80	17	97	-	-	-	97
Totals	144	40	184	75	18	91	275
Farming activities							
Mowing	2	119	121	0	34	34	155
Cattle trampling	23	13	36	0	4	4	40
Insecticide use	0	0	0	7	0	7	7
Plowing	1	0	1	0	4	4	5
Tractor use	2	0	2	0	0	0	2
Totals	28	132	160	7	42	49	209
Weather							
Flood	46	7	53	10	0	10	63
Rainstorm	15	4	19	13	3	16	35
Wind	19	5	24	0	3	3	27
Totals	80	16	96	23	6	29	127
Avian interference							
Brown-headed cowbird	46	34	80	0	0	0	80
Unidentified large bird egg	0	1	1	0	0	0	1
Totals	46	35	81	0	0	0	81
Vegetation problem							
Tipped nest	13	0	13	9	1	10	23
Cut by muskrat	1	0	1	0	0	0	1
Totals	14	0	14	9	1	10	24
Interference by man							
Rock placed in nest	4	0	4	0	0	0	4
Female shot	0	2	2	0	0	0	2
Totals	4	0	6	0	0	0	6
Investigator disturbance	3	2	3	1	0	1	4
Grand total	1181	495	1676	349	127	476	2152

predation (no trace of nest contents). Predation by large mammals accounted for losses of 454 eggs and 151 nestlings (28.1% of all losses) and avian predation for 186 eggs and three nestlings (8.8% of all losses). Raccoons (*Procyon lotor*) and red foxes (*Vulpes fulva*) were probably responsible for much of the predation by large mammals and marsh wrens (*Cistothorus palustris*) and common grackles (*Quiscalus quiscula*) for much of the avian predation on eggs, but our evidence was largely circumstantial.

Normal attrition associated with clutch and brood reduction was the second largest cause of loss, accounting for 184 redwing eggs and 91 nestlings (12.8% of all losses) (Table 6). Ninety-seven eggs were abandoned for unknown reasons, 84 nestlings starved, 70 eggs failed to hatch, and 17 eggs and 7 nestlings were lost for other reasons.

Farming activities accounted for losses of 160 redwing eggs and 49 nestlings (9.7% of all losses), largely from mowing of hayfields (121 eggs and 34 nestlings; Table 6). Weather caused the loss of 96 redwing eggs and 29 nestlings (5.9% of all losses); avian interference, almost entirely from the substitution of brown-headed cowbird eggs, caused the loss of 81 eggs (3.8% of all losses); and vegetation problems, nearly all tipped nests, caused the loss of 13 eggs and 10 nestlings (1.1% of all losses; Table 6).

Cowbird Parasitism

Parasitism of redwing nests by brown-headed cowbirds was higher than reported in any other published study and lowered redwing production; 186 (21.3%) nests were parasitized by cowbirds. Redwings fledged nearly twice as many redwing nestlings from non-parasitized nests as those parasitized by cowbirds (1.03 vs. 0.56, $P < 0.05$). Parasitism by cowbirds was somewhat higher in nests in upland than marshland (29.0% vs. 18.6%, $P = 0.12$).

Of the 262 cowbird eggs laid in 186 nests (1.41/nest), 39 (14.9%) produced fledglings. If female cowbirds are capable of laying 25 eggs per season as indicated by Friedmann (1963), the eggs from a single cowbird would produce 3.72 fledglings if all were laid in redwing nests. This is nearly four times as many fledglings as produced by a female redwing in this study.

Extrapolation to Statewide Populations

No statewide surveys have been made of male redwing populations in South Dakota, but such a survey has recently been made in North Dakota (Besser 1985b). Estimates of the total number of breeding males in North Dakota in 1981-82 allow one to speculate on the size of North Dakota's post-breeding redwing population. Based on the South Dakota production data, the extrapolated estimate of the post-breeding redwing population in North Dakota in 1982 was 11.5 million (423.2/km²) (Table 7).

Table 7. Total redwing populations in late summer in North Dakota based on South Dakota production during 1963-66.

North Dakota (1981-82)	
Wetland breeders	
Breeding males ^a	971,174
Females ^b	2,826,116
Young of year ^c	5,058,748
Total	8,856,038
Upland breeders	
Breeding males ^d	558,829
Females ^e	961,484
Young of year ^f	865,426
Total	2,385,739
Total wetland & upland breeders	11,241,777
Non-breeding males ^g	293,814
Total red-wings	11,535,591
Per km ²	423.2

^a63.6% of all males in North Dakota (Besser 1985b).

^b2.91 times the number of breeding males.

^c1.79 times the number of females.

^d36.4% of all males in North Dakota (Besser 1985b).

^e1.73 times the number of breeding males.

^f0.90 times the number of females; mortality from fledging to full flight capability unknown but suspected to be substantial.

^g19.2% of all breeding males (Besser 1985a).

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