Wilson Bull., 93(1), 1981, pp. 119–121

Reproductive rate and renesting of Red-winged Blackbirds in Minnesota.—Red-winged Blackbirds (*Agelaius phoeniceus*) have an economic impact upon the industry of wild rice (*Zizania aquatica*) cultivation in northern Minnesota (Moulton, J. Wildl. Manage. 43:747–751, 1979). Red-wings nest in the marsh-like, emergent vegetation that borders the peripheral drainage ditches of the wild rice paddies. Very few Red-winged Blackbird studies have provided data on the number of young fledged per female, per territorial male, or per unit area; or on the extent and nature of renesting and movements of females during the nesting season (Dolbeer, Auk 93:343, 1976). The objectives of this study were: (1) to estimate the size and reproductive success of a population of Red-winged Blackbirds on a typical group of wild rice paddies; (2) to estimate fledging rates per male territory and per nesting female; and (3) to estimate the extent of renesting and movement by marked females during the nesting season in this habitat.

The study was conducted from late April to early August 1977 on commercial wild rice paddies (total area 53.2 ha) located 185 km north of Minneapolis, in Aitkin, Minnesota. Nest searching began in early May and continued through July. Active nests (1 or more eggs or nestlings) were checked daily. Prior to nesting, some birds were captured in large mist nets and in a large, walk-in decoy trap baited with oats and live blackbirds. Territorial males were captured in wire traps that used a live, adult male as a decoy (Bray et al., West. Bird Bander 50:4–7, 1975). Nesting females (with nestlings) were captured by placing small pieces of mist net around their nests. Each bird was marked with a USFWS band on 1 leg and a numbered, plasticized-nylon streamer, secured around the tarsus with an aluminum grommet (Arnold and Coon, Bird-Banding 42:49–50, 1971; DeHaven, West. Bird Bander 50:48–50, 1975), on the other leg. Birds were classed as either second-year (SY) or after-second-year (ASY) on the basis of plumage. Females were aged by color of marginal wing coverts (Payne, Univ. California Publ. Zool. 90:57, 1969). An error rate of from 18 (Dolbeer 1976) to 20% (Payne 1969) must be expected when using this technique.

Nesting chronology and success.—A total of 182 nests (154 active) was located and marked along the 9566 m of paddy ditches. Dominant plant species bordering the drainage ditches were broad-leaf cattail (*Typha latifolia*) and narrow-leaf cattail (*T. angustifolia*), sedges (*Carex* spp.), bulrushes (*Scirpus* spp.), various grasses (Gramineae) and some water plantain (*Alisma* spp.) and arrowhead (*Sagittaria* spp.). The first eggs were laid on 17 May and the

TABLE 1
NESTING AND FLEDGING RATES FOR 45 DEFINED MALE TERRITORIES AND FOR THE ENTIRE STUDY AREA

	Male territories	No. of active nests	Min. nesting females	Max. nesting females	Entire study area[a]
	45	120	97	115	53.2[c]
$\bar{x}$ nests or nesting females	—	2.67[b]	2.16[b]	2.56[b]	2.48[d]
$\bar{x}$ young fledged	2.55	0.95	1.2	1.0	2.6

[a] Undetermined number of territories.
[b] Per male territory.
[c] Ha.
[d] Nests per ha.

TABLE 2

NESTING PARAMETERS FOR 36 INDIVIDUALLY MARKED FEMALE RED-WINGED BLACKBIRDS

	Nesting females	Young fledged/ female	Females renesting	$\bar{x}$ days from end of first nest to start of next nest	Females attempting second brood on area	Renesting females that switched male territories	$\bar{x}$ distance (m) between successive nest-sites[b]
SY females	8 (22)[a]	1.5	2 (33)	7	0	0	—
ASY females	28 (78)	2.04	4 (17)	10	1 (6.6)	3 (75)	169
Total	36	1.93	6 (20)	9.6	1 (5.6)	3 (50)	169

[a] Parenthetical values are percent of total within category.
[b] For the 3 females that switched male territories.

last young fledged on 16 July—a nesting season of 61 days. The median dates for nest starts and fledging were 24 May and 18 June, respectively. The average clutch-size was 3.7 eggs (mode 4). A total of 137 young was fledged from 48 of 154 (31.2%) active nests. Predators, primarily raccoons (*Procyon lotor*), destroyed 99 nests (54.4%). About 80% of all egg mortality and over 50% of all nestling mortality was due to predation.

Territoriality of marked males.—Most males began territorial defense in late April. Of 5 ASY males captured in the walk-in decoy trap and tagged in early May, 2 later established territories on the area. Between 12 and 26 May, 30 ASY males were captured on-territory, in small decoy traps, and tagged. Seven marked males abandoned their territories and were not seen again. Table 1 gives nesting and fledging rates observed on 45 male territories (25 marked and 20 unmarked males). About 2.6 young were fledged per male territory, a low reproductive rate compared to most other studies (Dolbeer 1976). One ASY male abandoned its initial territory and established a second territory 1.4 km away. The first territory contained 1 nest which was depredated with 3 eggs in it on the night of 23–24 May. The second territory contained 1 nest in which the first egg was laid on 6 June and which fledged 3 young on 30 June. The nesting female on the first territory was not marked so it is not known whether or not it moved with the male. Two males in SY plumage successfully defended territories that attracted nesting females. One of the SY-male territories fledged 3 young.

Nesting and renesting by marked females.—Prior to the start of nesting in mid-May, 11 females (5 ASY and 6SY) were captured in large mist nets and marked. Of those, 4 remained on the study area and 3 (2 ASY and 1 SY) nested, but no nest was located for the other SY female. Between 2 and 21 June, 33 nesting females (26 ASY and 7 SY), with nestlings, were captured on their nests and marked. Of the 36 marked females that nested, 8 (22%) were classed as SY birds. The 36 marked females accounted for 42 nests (41 active) on the study area. One SY female built a second nest after the loss of its first nest, but did not lay a second clutch. Table 2 gives values for young fledged per marked female. Of 30 marked females that could have been observed renesting, 6 (20%) renested on the study area. Eighteen marked females successfully fledged young from nests started on or before 3 June. Only 1 marked female successfully produced a second brood on the study area. Three of 6 females that renested switched male territories, moving considerable distances in the process. The phenomenon of territory switching by individually marked, renesting, red-wing females was also observed by Dolbeer (1976) and Fankhauser (Bird-Banding 35:120, 1964). This study and that of Dolbeer (1976) suggest that this kind of movement may be common. Renesting and second-nest values (Table 2) represent minimum estimates since females that left the study area may have renested elsewhere. Four cases of renesting where clutch-sizes were known for both initial and subsequent nests were observed. In all cases, the females involved were ASY and laid initial clutches of 4 eggs. Only 1 female laid 4 eggs in its second clutch; the other 3 females each laid only 3 eggs in their second clutches.

Acknowledgments.—I thank the C. K. Blandin Foundation and Wild Rice Growers' Association, Inc. for financial support; K. C. Carr and R. S. Wetzel (USFWS) for field support; H. Jacobson for permission to study the rice paddies; and M. W. Weller (University of Minnesota) for reviewing the manuscript. This paper is No. 10401, Scientific Journal Series, University of Minnesota Agricultural Experiment Station, St. Paul, Project 17-92.—DANIEL W. MOULTON, *Dept. Entomology, Fisheries and Wildlife, Univ. of Minnesota, St. Paul, Minnesota 55108.* (Present address: *70 Edgewood Dr., Central Valley, New York 10917.*) *Accepted 1 Nov. 1979.*

Wilson Bull., 93(1), 1981, pp. 121–124

Migration speeds of three waterfowl species.—To better understand the physical nature of bird migration and its energy requirements, it is important to evaluate the speed at which various species fly, and how speed may be affected by environmental factors. This paper reports on ground and air speed of migrating flocks of Canada Geese (*Branta canadensis interior*), Lesser Snow Geese (*Anser c. caerulescens*) and Mallards (*Anas platyrhynchos*).

In 1966, we began recording ground speeds of migrating waterfowl in central Illinois. By late 1978, we had obtained 160 records, all but 3 from a car driven for 1.5–24 km parallel to the birds' flight. The 3 additional records were obtained from mapping the course and time interval of migrating birds observed from a light aircraft. Migrating flocks of Canada Geese composed 79% of the records, Lesser Snow Geese 16% and Mallards 5% (Table 1).

At the time the waterfowl were observed, the wind direction and velocity were estimated. Direction data were more reliable than velocity estimates, which were based on radio reports and local clues (flag, foliage, smoke and the like). Most flocks were between 100 and 365 m above the ground. At those altitudes, wind direction was approximately the same as at ground level, but average wind velocity was probably higher. The wind force striking the migrating flocks was vectored on the basis of cosine of the angle of wind to migration track × wind velocity.

Table 1 shows the ground speed of the migrants, the vectored air velocity assisting or impeding their passage, the calculated air speed that resulted from the deletion of the wind force and the statistical significance of the results. Data for the Canada Goose were separated into fall and spring periods to determine whether the stronger winds in the spring or the proximity of the wintering grounds were factors affecting the air speed of these geese.

A comparison of ground speed to the vectored wind speed shows that migrating Canada Geese adjusted their flight speed within certain constraints to compensate for wind velocity. Although the ground speeds of Canada and Snow geese flying into the wind were reduced, their effort (as measured by air speed) averaged 13.1 km/h; more when they flew against the wind than when they flew with it. The F value derived from an analysis of variance demonstrated a highly significant relationship between wind speed and the air speed of Canada Geese ($F = 18.5$, $P < 0.01$ for fall and 20.7, $P < 0.01$ for spring), but no statistically significant difference in the Snow Goose ($F = 3.6$, NS). (The small sample measured in the opposed-wind category appears responsible.)