REPRODUCTIVE BIOLOGY OF AMERICAN ROBINS IN NORTHERN MAINE

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ABSTRACT.—The nesting biology of the American Robin was studied in northern Maine forests during the summer of 1971. Robins arrived on the study tracts in early April and 78% of them nested within 5 m of a clearing. Robins nested higher in deciduous trees than in coniferous trees but this was probably a function of tree height. Of the nests in coniferous trees 65% were in an axillary position and 61% of the nests in deciduous trees were saddled on limbs. Egg-laying began on 10 May and ended on 6 July with the peak of laying occurring between 21 and 25 May. The mean clutch size of 38 nests was 3.2. Of the 34 nests built in coniferous trees 18% were successful, while 52% (N = 20) of the nests were successful in deciduous trees. Daily mortality rates of eggs and young in nests in conifers were 6.7% and 4.2% respectively. Daily mortality rates of eggs and young in nests in deciduous trees were 2.9% and 1.3%. Unknown predators were responsible for all nesting failures. The average number of young fledging per successful nest was 2.5, which put production near the lower limit that has been reported for population stability in robins.—*School of Forest Resources, University of Maine, Orono, Maine 04473, and Department of Entomology, University of Maine, Orono, Maine 04473. Present address of first author: Center of Environmental Sciences, Unity College, Unity, Maine 04988.* Accepted 30 June 1975.

ALTHOUGH several studies have been conducted of the nesting biology of the American Robin (*Turdus migratorius*) (e.g. Howell 1942, Klimstra and Stieglitz 1957, Graber et al. 1971, Martin 1973) none has been carried out at as high a latitude or in a semiwilderness as northern Maine. The data presented below were gathered in connection with an investigation of the effects of forest pesticide applications on the reproductive success in robins. No adverse effects of the treatments were found (Knupp 1974), and the data are a combination of observations from forests with no pesticide treatment history and from forests with past history of DDT treatment (Dimond et al. 1970).

METHODS

Four forested areas of northern Maine were chosen for study in 1971 on the basis of robin abundance and accessibility. The general shape of each study tract was a belt with a logging road providing the central axis. Most of the work was done within 100 m of these roads. The tracts ranged in length from 4.8 to 16 km. All were heavily forested with young second growth or mature trees and the cover types varied from purely deciduous to purely coniferous trees. Common deciduous trees were maples (*Acer* spp.), beech (*Fagus grandifolia*), ash (*Fraxinus* spp.), birch (*Betula* spp.), and aspen (*Populus* spp.), while balsam fir (*Abies balsamea*) and spruces (*Picea mariana*, *P. rubens*, *P. glauca*) made up most of the conifer growth. Numerous logging roads, gravel pits, and log landings provided an edge composed of birch, aspen, alder (*Alnus* spp.), and small conifers. Where roads cut through mature timber the edge effect was small. Water in the form of streams, spring seeps, roadside ditches, and mud puddles was abundant everywhere during the early summer and probably influenced the abundance of robins in a given area. Little human activity other than logging occurred in the region. Elevations ranged from approximately 180 to 360 m above sea level.

Nests were located by searching wherever robins congregated, and particularly where adult robins gave alarm calls or were seen carrying food or nesting materials. Nests along roadsides were often sighted from a slow-moving vehicle. This method permitted more ground to be covered but was biased in that it revealed only nests close to the road.

After the nests were found and the number of eggs or young counted, they were rechecked at 2- to 5-day intervals. Most nests were examined with a mirror affixed at right angles to a sectioned aluminum pole, which reduced the disturbance climbing the trees would have caused.

TABLE 1
POSITION OF ROBIN NESTS BY TREE TYPE

Nest site	Axil	Saddled	Crotch	Nest height	Nest height / tree height
Conifer	24 (65%)	13 (35%)	0	4.2 m	0.58
Deciduous	4 (17%)	14 (61%)	5 (22%)	6.9 m	0.56
Combined	28 (47%)	27 (45%)	5 (8%)	5.2 m	0.57

Nesting success was analyzed using the nest day as a unit of exposure (Mayfield 1961). Hatching dates were determined by aging the young and backdating.

Soon after nests became inactive, site description data were taken. Trees containing the nests were identified to species and the height of the nest above the ground and the total tree height were measured with a clinometer. General position of the nest in the tree was noted (e.g. axil, saddled on limb, in crotch) and the direction the nest faced in relation to the tree trunk was measured to the nearest 45 degrees. The distance to the nearest opening was also determined. We randomly sampled the trees and shrubs suitable for nesting within the habitat frequented by robins to determine if the birds differentially selected conifers for nest sites. Sample plots were 0.004 ha and the intensity of sampling was proportional to the nests located in each study tract.

RESULTS AND DISCUSSION

Nest site selection.—Of 60 robin nests found, 62% were in conifers although conifers comprised only 45% of the trees available for nesting. Those nests in coniferous trees averaged 4.2 m above the ground and those in deciduous trees averaged 6.9 m (Table 1). This difference is probably due to the average heights of the trees, 8.2 m and 12.6 m respectively, and the difference in life forms of the trees. The ratio of the nest height to the tree height was similar in each case, perhaps indicating that regardless of the tree type the best nest sites are near the center of the tree (Table 1).

Table 1 also summarizes the actual nest position within the tree. Regardless of tree type, 47% of the nests were in an axillary position and 45% were saddled on limbs. It is reasonable to assume early nesting robins would take advantage of the cover afforded close to the tree trunk or on conifer limbs, and that later nesters would receive protection from the foliage out on the limbs of deciduous trees. Our data showed robins nested 7 days earlier in conifers. We noted no strong preference for any compass direction.

Although this study was conducted in a forest habitat, robins nested close to openings. Extensive searches of closed canopy forest revealed no robin activity, and 78% of the nests were within 5 m of an opening of some sort. The openings fell into four general categories: roadsides, log landings, gravel pits, and small clearings within the forest. The vegetation in these clearings usually consisted of alders, small conifers, raspberries (*Rubus* spp.), and various grasses and forbs. Young (1955) stated that 60 of 79 nests were built in edge situations while Johnson (1969) found robin nests clumped around foraging sites. Distances from these feeding grounds ranged approximately 30 to 300 m and averaged 93 m. In the present study, nests seemed to be associated with wet sites such as large puddles, spring seeps, and streams, as well as clearings.

Chronology of nesting.—Temperature and snow depth data gathered within the study tracts showed the weather during the spring of 1971 to be typical for northern Maine. April averaged 2°C cooler while May was 2°C warmer than the 5-year average, 1968–72. Snow depth records, initiated in 1971, showed that snow levels in

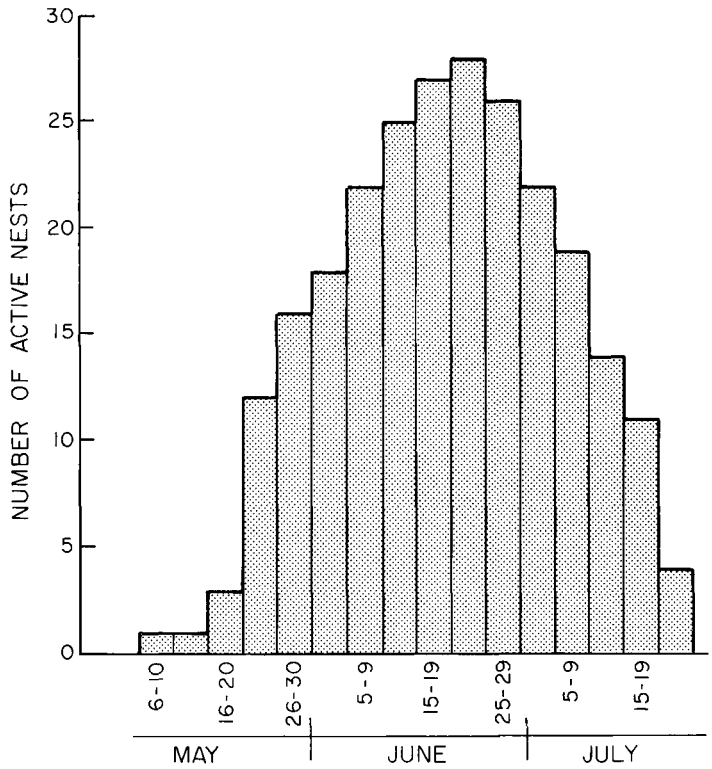

Fig. 1. Number of robin nests active throughout the breeding season in northern Maine (1971).

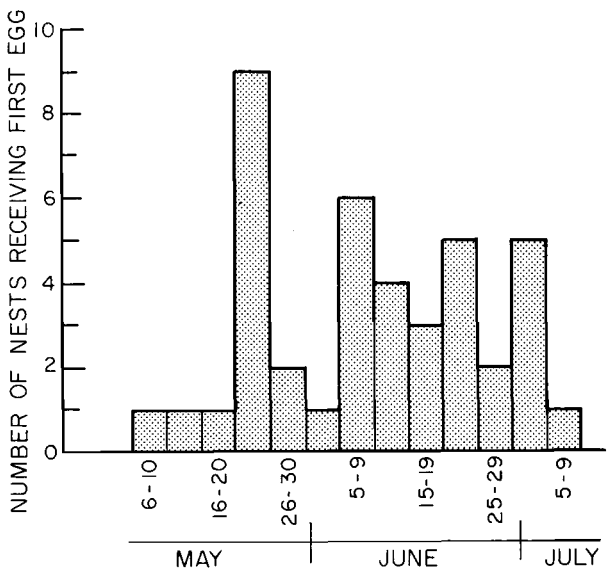

Fig. 2. Chronology of the initiation of egg-laying by robins in northern Maine (1971).

TABLE 2
RELATIONSHIP BETWEEN LATITUDE AND CLUTCH INITIATION BY ROBINS

Latitude	Source	First egg
37	Klimstra and Stieglitz 1957	1 April
40–42	Klimstra and Stieglitz 1957	15 March, 6 April, 9 April
40	Graber et al. 1971	20 March
42	Howell 1942	20 April
43	Howard 1967	12 April
43	Young 1955	8 April
42	Johnson 1969	20 April
45–46	Howard 1967	22 April
46	This study 1971	10 May

open hardwood stands in early May were 5 cm below the 4-year average, 1971-74, while those in the conifers were 11 cm lower.

Robins arrived on the study areas in 1971 in early April. A conservative estimate of breeding density based on limited counts of singing males, concentrated nest searches, and pair observations in the four study tracts was 10.6 ± 0.78(4) [mean ± SE (N)] pairs per 100 ha of occupied habitat. The first recorded egg was laid on 10 May and nests remained active until early August (Fig. 1). The latest calculated data of fledging from the observed nests was 5 August.

Dividing the nesting season into 5-day intervals showed that more eggs were laid between 21 and 25 May than during any other interval (Fig. 2). This represented first nestings. Three intervals later (5 to 9 June) a second peak remained fairly constant until 6 July when the last egg was laid. This extended peak probably represents both second broods and renesting attempts and accounts for the unimodal shape of the nest activity curve (Fig. 1). Johnson (1969) reported a similar situation in New York.

Table 2 shows that nesting by robins is retarded in the northern breeding ranges. Data for New York (Johnson 1969) showed the peak of nest activity was between 25 May and 1 June. In the present study the peak occurred between 20 and 24 June or about 1 month later than in New York. Unfortunately, Howard (1967) did not tell when nest activity peaked in the Maritimes, but she did state that the first eggs were laid several weeks earlier than we have recorded. This possibly is because of a more moderate climate in the Maritimes from oceanic influences not felt in northern interior Maine.

Nesting success.—The mean clutch size noted was 3.16 ± 0.12 (38). Nesting success varied with the type of tree in which the nest was located. Assuming a nest life of 29 days (3 days laying, 12.5 days incubation, 13.4 days nestling, Young 1955), nests built in deciduous trees had a success rate of 52% (20 nests) while those in conifers were 18% (34 nests) successful (Table 3). Had these success figures been derived by the more conventional method of dividing nests lost by nests found, they would have been 35 and 56% respectively. Mayfield (1961) stated that reported success rates based on the number of successful nests divided by the number of nests found are often greatly inflated because the nests found were already successful for a certain amount of time. He also pointed out that to compare success rates of various studies based on the number of nests found is misleading because no standard unit of time is associated with success. For these reasons we based our results on "exposure units."

Ricklefs (1969), using Howell's (1942) data, computed a daily mortality rate for robin eggs and nestlings of 2.8% and 0.8% respectively. These are lower than our overall rate of 5.1% for eggs and 2.8% for young (Table 3). Open nesting passerines in

TABLE 3
NESTING SUCCESS IN PERCENT BY TREE TYPE AND NEST STAGE FOR ROBINS IN NORTHERN MAINE, 1971[1]

	Deciduous (N = 20)		Coniferous (N = 34)		Combined	
	Total period	Daily	Total period	Daily	Total period	Daily
Egg[2]	62	97.1	33	93.3	53	94.9
Nestling	83	98.7	53	95.8	67	97.2
Total	52	97.9	18	94.7	35	96.3

[1] Nesting success was calculated using the method described by Mayfield (1961).
[2] Some of these may have hatched between visits, but this could not be determined and they are included as eggs.

the temperate region have an average nesting period of 26.5 days and an average daily nest mortality rate of 2.4% (Ricklefs 1969). Robin nests in the present study had 3.7% daily mortality.

Howell (1942), Kendeigh (1942), and Young (1955), and the present study indicated that mortality rates of eggs were higher than the mortality rates of nestlings. Even though the mortality rate of nestlings was lower, they were exposed to losses over a longer period of time, so that the actual losses were slightly greater than the daily mortality rate indicated.

Predation was the major mortality factor noted during the present study. In most instances the contents of the nest were missing, but the nest itself was not disturbed. Searching the immediate area revealed no signs of broken eggs or partially eaten young. One predator, a Raven (*Corvus corax*), was seen taking nestlings approximately 6 days old. The eggs of four other nests were picked open from the top but were not removed from the nest. House Wrens (*Troglodytes aedon*) destroy eggs in a similar manner but this species was not present in the study tract; Winter Wrens (*Troglodytes troglodytes*) were common residents and may have been responsible for the destruction.

Other possible predators in the area were red squirrels (*Tamiasciurus hudsonicus*), flying squirrels (*Glaucomys sabrinus*), chipmunks (*Tamias straitus*), Blue Jays (*Cyanocitta cristata*), Gray Jays (*Perisoreus canadensis*), Common Grackles (*Quiscalus quiscula*), and Common Crows (*Corvus brachyrhynchos*). Although not a predator, a moose (*Alces alces*) browsed a limb to within several inches of a nest and apparently made the young leave prematurely. We have no data indicating why nests in conifers received more predation than nests in deciduous trees, but many of the important predators are associated with northern coniferous forests and might be attracted to and spend more time searching in conifers for food.

Martin (1973) found that predators destroyed 49% of the robin nests under observation. She ascribed 76% of these losses to terrestrial predators but she only witnessed predation by a garter snake (*Thamnophis sirtalis*).

No cases of nest abandonment were noted during this study, nor was any parasitism by Brown-headed Cowbirds (*Molothrus ater*) seen although cowbirds were common.

Eight of 140 (6%) eggs failed to hatch. These eggs were significantly smaller in size than "fresh" eggs that were measured (Knupp 1974). Howell (1942) found that 7% of the eggs under observation failed to hatch at the end of the incubation period, which he attributed to infertility. The average weight of 18 robin eggs in Maine was 6.29 g, which compares closely with the 6.26 g (60 eggs) Howell (1942) reported.

The average number of young fledged per successful nest was 2.5 ± 0. 15 (38). Young (1955) estimated that a pair of robins produce 5.6 young per year. Farner (1945) suggested 5 and Henny (1972) cited a range of from 4.5 to 5.8 young produced per pair. These estimates were based on population stability.

In northern Maine the breeding season for robins is approximately 100 days long. This is ample time to raise two broods, even with several renesting attempts, but it is too short a period for raising three broods. Assuming that a 35% nest success would allow robins to raise two broods per year successfully at the most, then robin production within the study area was near the lower limit that has been previously proposed (Farner 1945, Henny 1972) for population stability.

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