NESTING POPULATIONS OF RED-TAILED HAWKS AND GREAT HORNED OWLS IN CENTRAL OHIO

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Abstract

Nesting populations of Red-tailed Hawks (*Buteo jamaicensis*) and Great Horned Owls (*Bubo virginianus*) were studied from 1974 through 1976 on a 510-km² (197-sq.-mi.) area located in Delaware County, Ohio.

In 1976, 59 nesting pairs of Great Horned Owls, 6 non-nesting pairs, and 9 unpaired individuals were located, while 78 nesting pairs of Red-tailed Hawks, 7 non-nesting pairs, and 7 unpaired individuals were located. Density of Great Horned Owls was one nesting pair per 8.2 km² (3.16 sq. mi.) of usable habitat, and density of Red-tailed Hawks was one nesting pair per 6.2 km² (2.39 sq. mi.). The rate of nonbreeding for Great Horned Owls and Red-tailed Hawks was 15 percent and 12 percent, respectively. Productivity of Great Horned Owls averaged 2.0 eggs per observed clutch, 1.9 nestlings per hatched clutch, 1.7 fledglings per successful nest, and 1.2 young fledged per nesting attempt. Red-tailed Hawk productivity averaged 2.0 eggs per observed clutch, 2.12 nestlings per hatched clutch, 1.96 fledglings per successful nest, and 1.29 young fledged per nesting attempt. Nest failure rate for Great Horned Owls was 25 percent. Red-tailed Hawk nest failure rate was 34 percent, and nestling mortality was 19.7 percent. Causes of Red-tailed Hawk nest failures were largely undetermined although predation by Great Horned Owls was often suspected.

Introduction

Recent studies of Red-tailed Hawks (*Buteo jamaicensis*) and Great Horned Owls (*Bubo virginianus*) suggested that nesting densities of these raptors in Ohio were markedly lower than densities reported elsewhere (Shelton 1971, Cornman 1973, Misztal 1974). This study ranged from 1974 through 1976. Most of the information on population density and productivity of these birds, however, was obtained during the last year. Therefore, this report will focus on the results of that year.

Study Area and Methods

A 510-km² area was selected in Delaware County, Ohio (approximate coordinates, north latitude 40° 08′ and 40° 20′; west longitude 83° 10′ and 82° 96′; see figure 1). Topography in Delaware County is flat to gently rolling, and land is devoted largely to agriculture (67%) with small percentages of pasture (16%) and woodlots (9%). Three major drainages traverse the study area, two of which have reservoirs comprising a combined area of 17 km². Urban and residential development occupies approximately 8 percent of the county, where the city of Delaware covers approximately 26.4 km² of this land.

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Nesting Red-tailed Hawks (RTH) and Great Horned Owls (GHO) were located from foot surveys and road surveys during a period from early February through April. We considered a nest to be active if an adult raptor was observed on the nest or if signs of recent occupation were evident (i.e., eggs, eggshells, fresh nest lining, abundant whitewash, and fledglings). Individual or paired birds were listed as nonbreeding when repeated searches failed to reveal an active nest. Inasmuch as other investigators have reported high rates of abandonment of incubating raptors disturbed by climbers (Fitch et al. 1946, Luttich et al. 1971), we obtained clutch-size data without climbing by using a mirror and pole device (Parker 1972). It was necessary to climb only once to most nests, to determine hatching success and to weigh nestlings; this was usually done within three weeks after hatching. Age of nestlings was determined by comparing body weights of each nestling to known growth rates of five nestling RTHs and two GHOs measured on the study area in 1975 and 1976. Beyond this time, age was determined by the linear measurement of the 7th primary, and/or overall size and plumage development. Final reproductive outcome was determined by counting the four- to six-week-old nestlings from the ground with the aid of a mirror and pole device and binoculars.

Results and Discussion

Breeding chronology. Great Horned Owls: Of 53 nests occupied by GHOs in 1976, 31 (59%) were former RTH nests, 17 (32%) were tree hollows, and 5 (9%) were arboreal squirrel nests.

We visited 10 nests while hatching was in progress. Dates of first hatch ranged from 7 March to 21 March ($\bar{X}$: 13 March, 10 nests). In 16 other nests where nestling were aged by weight, hatch dates ranged from 15 February to 26 March ($\bar{X}$: 10 March). We used 34 days as an estimated incubation period (Austing and Holt 1966) and estimated laying occurred between 12 January and 21 February ($\bar{X}$: 5 February, 26 nests). No attempt was made to determine actual fledging dates, but newly fledged young were observed in the last week of March. Assuming the variable nestling period to average about 45 days (Hoffmeister and Setzer 1947), fledging dates ranged from the last week of March to the first week of May.

Red-tailed Hawks: Nest-building activities were observed on 27 January 1975 and on 4 February 1976. Both instances occurred on unseasonably warm, sunny days. Of 41 RTH territories active in 1975, 34 (83%) were reoccupied by RTHs in 1976. Pairs in the 34 reoccupied territories built new nests in 22 (65%) and reused former nest sites in 12 (35%) territories. Of the 29 nest sites in 1975 not reused by RTHs in 1976, 10 (34%) were occupied by GHOs, 9 (13%) were unused, and 10 (34%) had been destroyed, presumably by weather.

In 11 nests visited while hatching was in progress, date of first hatch in 1976 ranged from 11 April to 2 May ($\bar{X}$: 19 April). In 44 other nests where young were aged by weight, the hatch dates ranged from 9 April to 10 May ($\bar{X}$: 19 April). Our record of the first egg in a clutch hatching 34 days after it was first observed as a single egg agrees with the length of the incubation period observed by Hardy (1939). Assuming the incubation period to average 34 days, estimated laying dates at 55 nests ranged from 6 March to 6 April ($\bar{X}$: 16 March). Actual dates of fledging were generally not determined, but the nestling period averaged 42 days for nestlings weighed on a daily basis. If the nestling period is assumed to average 42 days, estimated fledging dates ranged from the last week of May through the last week of June.

Nesting Season Density. Great Horned Owl: In the study area in 1976, Great Horned

Owls numbered 59 nesting pairs, 6 non-nesting pairs, and 9 unpaired individuals, thus a total of 74 activity centers (figure 1). An owl density of one nesting pair per 8.2 km^2 was calculated for the 483.6 km^2 of usable habitat in the study area, excluding the land occupied by the city of Delaware. Great Horned Owls in our study area were distributed in considerably higher densities than those previously reported in Ohio (i.e., 82.9 and 171.7 km^2 per nesting pair reported by Cornman 1973 and Misztal 1974, respectively). Distances between the nearest adjacent owl nests average 2.0 km, with a minimum distance between active owl nests of 0.9 km. Nonbreeding in GHOs in the study area in 1976 was approximately 15 percent.

Red-tailed Hawk: The RTH population in 1976 consisted of 78 nesting pairs, 7 non-nesting pairs, and 7 unpaired individuals, yielding a total of 92 activity centers (figure 1). Red-tailed Hawk density on the usable habitat of the study area averaged one nesting pair per 6.2 km^2. Densities on selected 52-km^2 plots ranged from 10.4 km^2 per nesting pair in the sparsely wooded uplands to 3.4 km^2 per nesting pair along the heavily wooded river drainages. The average distribution of RTHs in the study area in 1976 was higher than those reported elsewhere in Ohio (i.e., 24.9, 43.0, and 50.0 km^2 per nesting pair reported by Cornman 1973, Misztal 1974, and Shelton 1971, respectively). Adjacent RTH nests were spaced an average distance of 1.5 km, with a minimum distance between active nests of 0.6 km. Nonbreeding in RTHs in the study area in 1976 was approximately 12 percent.

Productivity and Mortality. Great Horned Owl: Clutches in 19 Great Horned Owl nests ranged from 1 to 4 with a mean of 2.0, and broods in 32 nests ranged from 1 to 3 with a mean of 1.9 (table 1). We found that 8.8 percent of the eggs in 17 nests failed to hatch. Nestling mortality in 32 nests was approximately 13 percent. Great Horned Owl productivity in 42 nests where young were successfully fledged averaged 1.69 young per successful nest; but, when unsuccessful nesting attempts are included in the average, the net productivity is 1.27 young fledged per nesting attempt.

Of 56 Great Horned Owl nesting attempts with known outcome in 1976, 14 (25%) failed to fledge young. Many nest failures were believed to have occurred during incubation or shortly after the eggs hatched, judging from the lack of an accumulation of whitewash at the nest. Human disturbance was the probable cause of three nest failures, and predation by raccoons and wind damage each caused two nest failures.

Red-Tailed Hawk: The clutch and brood sizes of RTHs ranged from 1 to 3 with a mean clutch size in 38 nests of 2.0, and a mean brood size in 57 nests of 2.12 (table 1). (Average brood size is larger than average clutch size because of the low hatching success (16.7%) of single-egg clutches). In 26 nests for which clutch size and successful hatching are known, 4 had one addled egg each, a hatching failure rate of 7.3 percent. Nesting mortality rate in 56 nests was 19.7 percent, with loss of the entire brood accounting for 13 mortalities in 6 unsuccessful nests, and brood reductions accounting for 11 mortalities in 10 successful nests. The productivity in 50 successful nests averaged 1.96 young fledged per successful nest, but, when all nesting attempts are included, the net productivity averaged 1.29 per nesting attempt.

Because of low hatching success, single-egg clutches had a nesting success rate (16.7%) which was significantly (X^2, $P \leq 0.0001$) lower than that of 2-egg clutches (87.5%) or 3-egg clutches (86.7%). The final productivity of 2-egg and 3-egg clutches averaged 1.8 and 2.4 young fledged per successful nest, respectively. Brood reductions, occurring 10 times as frequently in broods of three (62%) as in broods of two (6%), suggest a higher

Table 1. Population and productivity statistics for Red-tailed Hawks and Great Horned Owls.

Researcher	Average density: km^2 per nesting pair	Average non-breeding rate %	Average clutch size	Average brood size	Average no. young fledged per nesting attempt	Average nest failure rate %	Hawk to owl nesting ratio
Red-tailed Hawk Studies							
Kirkley and Springer 1980 (Ohio)	6.2	12	2.0	2.12	1.29	34	1.3:1
Cornman 1973 (Ohio)	24.9	8.4	—	—	1.5	16	5:1
Craighead and (Michigan)	19.2	30	2.0	—	0.9	—	—
Craighead 1956 (Wyoming)	2.6	17	2.3	—	1.4	—	3:1
Fitch et al. 1946 (California)	1.3	—	2.0	2.2	0.9	46	—
Gates 1972 (Wisconsin)	10.6	—	—	—	1.1	35	10:1
Hagar 1957 (New York)	8.0	35	—	1.9	1.1	41	1.5:1
Johnson 1975 (Montana)	8.0	12	2.53	2.53	1.57	40	—
Luttich et al. 1971 (New York)	7.0	20	2.0	1.9	—	26	—
McInvaille and Keith 1974 (Canada)	7.5	16	2.1	2.0	0.92	—	1.3:1
Misztal 1974 (Ohio)	43.0	—	—	—	—	—	—
Orians and Kuhlman 1956 (Wisconsin)	7.3	10	—	1.9	1.4	26	2.3:1
Seidensticker and Reynolds 1971 (Montana)	—	—	2.9	2.6	0.9	50	3:1
Shelton 1971 (Ohio)	50.0	—	—	—	—	—	—
Wiley 1975 (California)	3.2	4.5	2.53	2.19	1.64	26.4	—
Great Horned Owl Studies							
Kirkley and Springer 1980 (Ohio)	8.2	15	2.0	1.9	1.27	25	
Baumgartner 1939 (Kansas)	1.3	—	—	—	—	—	
Boswell 1974 (Ohio)	—	—	2.0	1.45	1.18	36	
(Colorado)	—	—	2.66	1.85	1.69	8	
Cornman 1973 (Ohio)	82.9	—	—	—	—	—	
Craighead and (Michigan)	19.2	30	1.9	—	1.1	—	
Craighead 1956 (Wyoming)	7.8	0	2.2	—	2.0	—	
Hagar 1957 (New York)	12.2	27	—	1.8	1.5	11	
Houston 1975 (Canada)	5.2	(3–56)	—	—	—	6.5	
McInvaille and Keith 1974 (Canada)	22.0	(0–80)	2.37	2.2	1.8	—	
Misztal 1974 (Ohio)	171.7	—	—	—	—	—	
Orians and Kuhlman 1956 (Wisconsin)	14.5	30	—	1.82	1.46	16	
Seidensticker and Reynolds 1971 (Montana)	—	—	2.2	2.2	1.2	36	

degree of nestling competition in the larger broods. Fratricide may account for some of the brood reductions. In 1974, we observed from a blind a sibling fratricide sequence in which the largest of three RTH nestlings pecked both its nestmates to death. At one nest in 1976, we found evidence of sibling aggression where the smaller of two nestlings had parts of its head scarred and bare.

In 76 RTH nests with known outcome, 26 (34%) failed to fledge young. The causes of RTH nesting failures were often difficult to determine since the majority of the failures occurred during the incubation or early brood stages. Of the known causes of nest failure in 1976, human disturbance caused the desertion of three nests, wind and lightning each destroyed one nest, and predation by raccoons, crows, and GHOs (Springer and Kirkley 1978) accounted for the failures of one, two, and three nests, respectively.

Summary

Nesting populations of Red-tailed Hawks and Great Horned Owls were studied from 1974 to 1976 on a 510-km^2 area in Delaware County, Ohio. Population density and productivity of both raptors were similar to those values reported elsewhere in North America, but densities of these two raptors were considerably higher than those reported previously in Ohio.

In 1976, Great Horned Owls number 59 nesting pairs, 6 non-nesting pairs and 9 unpaired individuals, yielding an average density of 1 nesting pair per 8.2 km^2 of usable habitat and a nonbreeding rate of 15 percent. The estimated mean hatching date in 1976 was 10 March. Great Horned Owl productivity averaged 2.0 eggs per observed clutch, 1.9 nestlings per hatched clutch, 1.7 fledglings per successful nest, and 1.2 fledglings per nesting attempt. A hatching failure rate of 8.8 percent, a nestling mortality rate of 13 percent, and a nest failure rate of 25 percent were recorded for Great Horned Owls in 1976.

In 1976, Red-tailed Hawks numbered 78 nesting pairs, 7 non-nesting pairs, and 7 unpaired individuals, yielding an average density of one nesting pair per 6.2 km^2 and a nonbreeding rate of 12%. In 1976 the estimated mean hatching date was 19 April. Red-tailed Hawks produced an average of 2.0 eggs per observed clutch, 2.12 nestlings per hatched clutch, 1.96 fledglings per successful nest, and 1.29 fledglings per nesting attempt. A hatching failure rate of 7.3 percent, a nestling mortality rate of 19.7 percent, and a nest failure rate of 34 percent were also recorded for Red-tailed Hawks in 1976.

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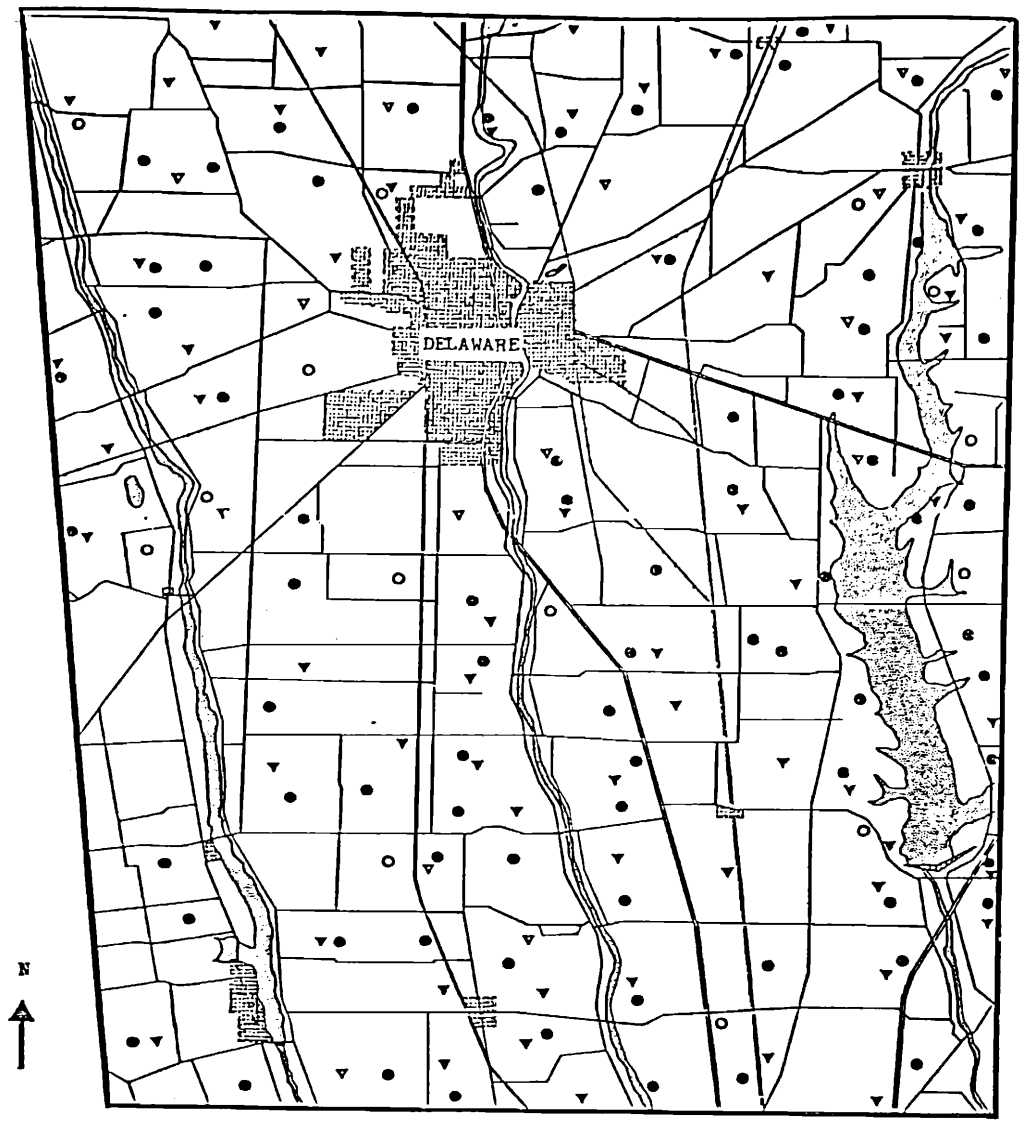

Figure 1. Distribution of Red-tailed Hawks and Great Horned Owls on the study area in 1976.