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POPULATION FLUCTUATIONS, SPATIAL DISTRIBUTION, AND FOOD HABITS OF ROUGH-LEGGED HAWKS IN ILLINOIS

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Relatively little has been published concerning most aspects of the winter ecology of the Rough-legged Hawk (*Buteo lagopus*). Craighead and Craighead (1956) made an extensive study of wintering raptors, including Rough-legged Hawks, in a township in southern Michigan. Weller (1964) noted winter habits of Rough-legged Hawks and Red-tailed Hawks (*B. jamaicensis*) in Iowa. Graber and Golden (1960) used the Illinois Christmas counts as an index of long-term hawk and owl population trends, including the Rough-legged Hawk. They found that the highest frequency of rough-legs occurred in the central third of Illinois, with the lowest being in the southern part of the state. Rough-legged Hawks were seen with increasing frequency in central Illinois from 1900 to 1920, and after this time there was a gradual decrease in sightings until about 1945. Annual fluctuations in population numbers occurred and in some years few, if any, rough-legs were observed. Graber and Golden concluded that a fairly consistent four-year cycle was indicated by the central Illinois counts, and Lack (1954:208) thought this to be the case over much of the range of the species.

In this paper I will present information concerning fluctuations in the number of Rough-legged Hawks in my study area in DeKalb County, Illinois during the winters of 1964-65 and 1965-66, spatial distribution of birds in the study area, and food habits of the species.

The study was conducted in a 43.1 square mile area located near the center of DeKalb County; the major part of this area is in Afton Township. The study area terrain varies from flat to gently rolling, as does the rest of the county. The elevation within the study area ranges from 770 to 920 feet, and the Cropsey moraine, constituting a watershed divide, crosses the area from southwest to northeast. As a result, the northwestern portion of the area is drained by the south branch of the Kishwaukee River, while the southeastern part is drained by tributaries of the Fox River (Kouba, 1965:12; 14).

Over 90 per cent of the soil is in agriculture and more than 80 per cent of the county is in cropland. While prairie grasses once covered about 92 per cent of DeKalb County, they are virtually non-existent in the county today (Kouba, 1965:36; 61). Although all townships in DeKalb County have some upland timber soil, the land in my study area has apparently been without virgin timber since at least 1850 (Randall, 1964:9).

POPULATION CENSUS

For each of the periodic censuses of Rough-legged Hawks, as well as other hawks and owls, I began at Location 1 (see Figures 1 and 2) and proceeded along the 50-mile survey route to Location 2, making 14 complete censuses during the 1964-65 winter period and 24 during the winter of 1965-66. All hawks that

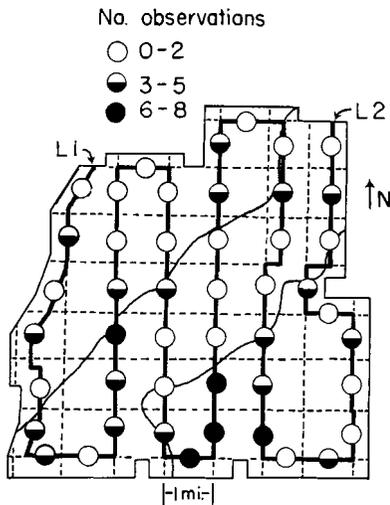


FIG. 1.

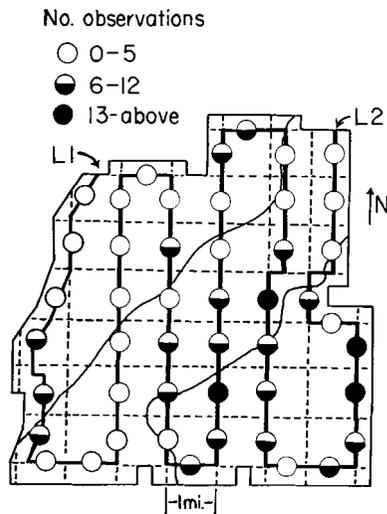


FIG. 2.

FIG. 1. The distribution of Rough-legged Hawk observations along the mile or "near mile" sections in the 1964-65 winter period. The irregular lines drawn from the lower left to the upper right indicate the approximate boundaries of the Cropsey moraine, as indicated by soil type. Location 1 (L1) is located on the northern edge of Section 9, Afton Township, DeKalb County, Illinois.

FIG. 2. The distribution of Rough-legged Hawk observations in the 1965-66 winter period.

were within one-third mile of the survey route, when first sighted, were included in the census totals. Therefore, approximately 33.3 square miles were covered on each census.

Observations were made with 7×35 binoculars and a $20 \times$ spotting scope. An average of 2.7 hours was required to complete a survey, with the average travel rate being 18.5 mph. Of the 38 completed surveys, 8 were made during the morning (see Tables 1 and 2). I made 25 censuses alone and 13 while accompanied by a second person. I attempted to make the surveys on days when the visibility was good.

Since most of the study area was flat or only slightly rolling and because there were only a few small groves of trees, it was possible to scan most of the area and thereby obtain an accurate count of the Rough-legged Hawks occurring within the census strips. To get some idea of the accuracy of the counts, two counts were made on 30 December, 1965; these yielded similar results for Rough-legged Hawks (nine rough-legs in the morning and ten in the afternoon).

In addition to censusing the Rough-legged Hawks, the numbers of Red-tailed Hawks, Marsh Hawks (*Circus cyaneus*), Sparrow Hawks (*Falco sparverius*), Snowy Owls (*Nyctea scandiaca*), and Short-eared Owls (*Asio flammeus*) were recorded (see Tables 1 and 2). The activity patterns of these other species varied and, with the exception of red-tails, only a rough estimation of these populations probably was acquired. This appeared to be particularly true for the Short-eared Owls. They were observed several times between census dates on which I did not see the species.

Except for the Red-tailed Hawk and possibly the Short-eared Owl, all of these species represented a relatively small part of the total winter raptor population in the study area. Thus, there was little possibility for competition between rough-legs and members of most of these other species for food during the two winters.

From 5 to 15 rough-legs (mean = 9.7) were observed during the 14 counts spaced throughout the 1964-65 winter period (Table 1 and Figure 3). It is apparent that Rough-legged Hawk numbers were relatively stable throughout the 1964-65 period. Although some rough-legs were observed in the study area during early November, 1964 (prior to initiation of my censuses), it is unlikely that many rough-legs passed through the area before the latter half of October.

The peak number of 15 rough-legs was observed on 10 December. Apparently a number of these individuals were transients since they were observed at locations where rough-legs were not found on any subsequent trip. A drop in numbers was noted on 19 December, followed by another increase. During the remainder of the winter only minor population fluctuations were observed, and these could easily have been caused by my failure to see a given bird on a particular survey. I recorded a definite population drop on the 6 March census, and five rough-legs were still in the area on 28 March. My general observations indicated that few birds were present in the study area much after this date.

During the 1965-66 winter season, 24 complete and 3 partial surveys were made (see Table 2 and Figure 3). The partial surveys made on 9 and 25 January were not completed since a rough-leg was captured on each of these days and taken back to the laboratory to be fitted with a radio transmitter. On 30 January the roads were impassable because of snowdrifts and I was not able to complete the survey.

The maximum number of rough-legs observed on the completed 1965-66 counts was 30, with the minimum being one individual (mean = 12.0). There was more fluctuation in numbers as well as more rough-legs during the winter of 1965-66. The census data for 1965-66 (as in 1964-65) indicate an initial increase in rough-leg numbers, followed by a decline and then another increase. The initial increase was apparently due to transient birds. Although census figures are lacking for the earlier part of the 1964-65 season, from general observations it appeared that the initial birds arrived somewhat earlier in 1965-66 than in 1964-65 and that the initial drop in numbers occurred near 24 November 1965, somewhat earlier than in the 1964-65 season.

A substantial increase in rough-leg numbers occurred on 11 January 1966, with a peak of 30 birds being reached by 20 January. A definite drop was noted on the

TABLE 1. NUMBER OF BIRDS SEEN DURING WINTER OF 1964-65 ALONG 50-MILE CENSUS ROUTE.

SPECIES							
Date	Rough-legged Hawk	Unidentified Buteo	Red-tailed Hawk	Marsh Hawk	Sparrow Hawk	Snowy Owl	Short-eared Owl
Nov. 14	6	5	5	2	-	-	-
19	12	2	4	-	1	-	-
Dec. 5 ^a	13	1	1	-	-	-	-
10	15	-	3	-	1	-	-
19	9	-	3	-	-	-	-
Jan. 9	11	-	-	-	-	2	-
21	14	-	1	-	-	-	-
Feb. 11	9	-	2	-	-	-	-
18	12	-	1	-	1	-	1
27 ^a	10	-	1	-	1	-	-
Mar. 6 ^a	6	-	1	1	2	-	-
12 ^a	8	-	-	-	-	-	-
21	5	-	-	-	-	-	-
28	6	-	-	-	1	-	-
Total	136	8	22	3	7	2	1

^a Morning census.

partial census of 30 January when only three birds were observed along 51 per cent of the survey route (with an estimated six present over the entire study route). Also, from my other field work in the area during this period, it was obvious that few birds were present. Apparently this rapid reduction in numbers was attributable to the local weather conditions. A relatively heavy snowfall occurred on 12 and 13 January 1966. Temperatures were below freezing for the remainder of January and some additional snow fell, resulting in an accumulation of 9.5 inches of ground snow near the end of the month. A cold front passed through northern Illinois on 27 January and winds associated with the front were predominately from the northwest. With the passage of the front, local temperatures dropped to a record daily low of -19°F on 29 January. The maximum for 28 and 29 January was -6°F , and on 30 January the temperature reached only 3°F . There was little exposed ground, many roadways were drifted, and it is likely that rough-legs had increased difficulty locating small mammals for food during this period.

While over nine inches of snow were present on the ground in the DeKalb area, there was much less to the south and east. On 29 January there was only one inch of ground snow at Ottawa, LaSalle County (approximately 55 miles SSW of DeKalb), five inches at Aurora, Kane County (30 miles SE), and five inches at

TABLE 2. NUMBER OF BIRDS SEEN DURING WINTER OF 1965-66 ALONG 50-MILE CENSUS ROUTE.

Date	SPECIES						
	Rough-legged Hawk	Unidentified Buteo	Red-tailed Hawk	Marsh Hawk	Sparrow Hawk	Snowy Owl	Short-eared Owl
Oct. 24	2	1	2	-	2	-	-
31	10	-	5	2	1	-	-
Nov. 6	6	-	7	1	-	-	-
14	13	1	7	-	-	-	-
18 ^a	11	2	3	-	1	-	-
24	5	1	1	1	-	-	3
Dec. 2 ^a	10	1	2	-	-	-	-
9 ^a	5	2	-	-	1	-	-
19	16	-	2	-	1	-	-
21	11	1	2	1	1	-	-
30 ^{a, b}	9	1	1	-	-	-	-
30 ^b	10	1	3	1	1	-	-
Jan. 9 ^c	14(10)	-	1	-	-	-	-
11	28	-	1	1	-	-	-
18	21	-	2	-	-	-	1
20	30	-	2	-	-	-	7
25 ^d	23(7)	-	-	-	-	-	-
30 ^e	6(3)	-	-	-	-	-	-
Feb. 1	11	-	-	-	-	-	-
5	24	1	1	-	-	-	1
12	13	1	-	2	-	-	-
19	5	-	-	-	-	-	-
24	13	-	-	1	-	-	-
27	15	-	1	-	-	-	-
Mar. 3	7	-	-	-	-	1	-
10	13	-	-	-	-	-	-
15	1	-	1	1	1	-	-
Total	309	13	44	11	9	1	12

^a Morning census.

^b Two surveys, one in morning and one in afternoon.

^c Number estimated from survey of first 73 per cent of census route. Number in () is actual count.

^d Number estimated from survey of first 31 per cent of census route.

^e Number estimated from survey of first 51 per cent of census route.

O'Hare Airport, Cook County, near Chicago (37 miles E) (U. S. Dept. of Commerce, 1966:9). Therefore, it is quite probable that the rough-legs from my study area moved with the front to the south or southeast and to locations better suited for feeding.

A fairly large number of rough-legs (24) was observed on 5 February, and after this date the number of birds sighted gradually dropped, with some fluctuation in numbers occurring from survey to survey (see Figure 3). Only one bird was seen on the last survey (15 March). A few birds were observed in the study area after this date, but it is unlikely that many were present. The last rough-leg recorded in the county was seen eight miles north of Dekalb on 21 April 1966.

It is apparent from Figure 3 that more rough-legs were present in the study area during the 1965-66 winter period than in 1964-65. I was unable to determine the reason for this difference. However, it is of interest that vole population indexes, taken by Daniel Q. Thompson (personal communication), at four locations in DeKalb County indicated that mean vole populations were significantly higher in the winter of 1965-66 than in 1964-65.

Craighead (1949:82), in his car censuses of the winter raptor populations in Superior Township, Washtenaw County, Michigan during the winter of 1941-42, observed the largest numbers of rough-legs (12 to 19) from 10 November to 7 December 1941 and found fewer birds present on censuses after the latter date.

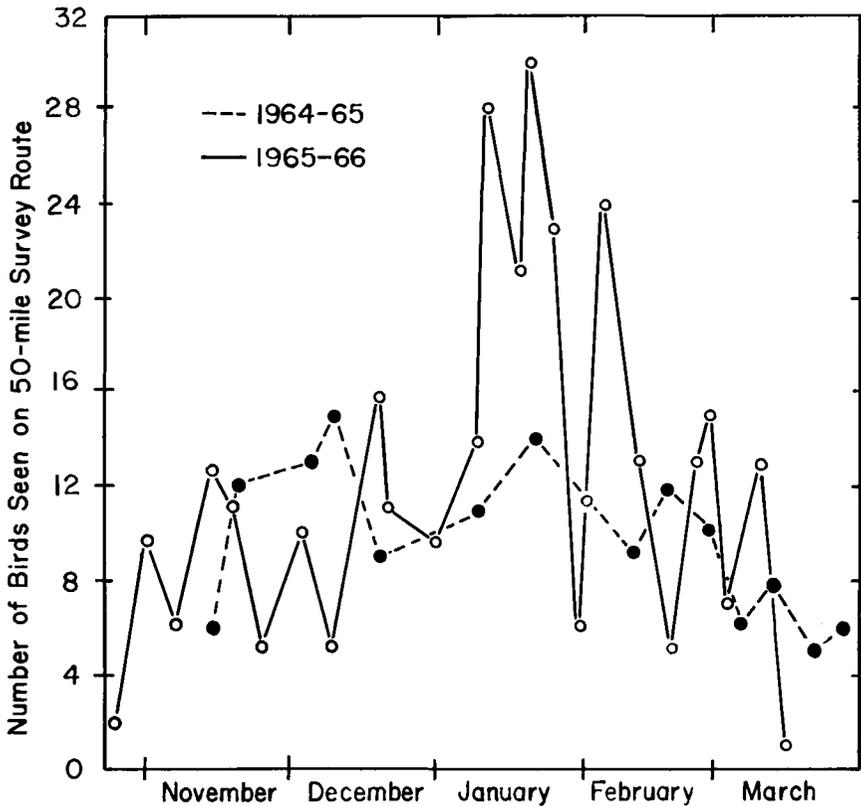


FIG. 3. The number of Rough-legged Hawks in the study area as determined by periodically censusing the birds along the 50-mile survey route. The area censused was approximately 33.3 square miles.

In the winter of 1947-48, when Craighead saw only six rough-legs, all of these birds were seen before 9 December 1947. It is likely that the higher numbers of Rough-legged Hawks recorded by Craighead during the first part of the season included some birds that were just passing through his study area, a situation similar to the one I encountered.

Concerning Red-tailed Hawks, in the 1964-65 winter the largest number was observed at the beginning of the study period (see Table 1), with a decrease in numbers occurring in December or early January. Apparently one or two birds remained in the study area most of the winter. During 1965-66 a very similar pattern was found (Table 2) and the largest numbers occurred in October and early November. Fewer individuals were observed in December and early January. For the remaining part of the winter there were only a few individuals observed. For both winters the drop in red-tail numbers corresponded approximately with increased ground snow and generally colder weather in the study area.

SPATIAL DISTRIBUTION

Rough-legged Hawks were not evenly distributed over the study area. Figures 1 and 2 show the total number of rough-legs seen within one-third mile of various mile or "near mile" sections of the survey route. Notably more birds were present in the southeastern portion of the study area in both winters. The relative percentage of land in various crop types was similar throughout the study area and, therefore, the distribution of crops did not appear to be a factor influencing distribution. Also, no apparent relation existed between rough-leg distribution and soil types. However, the area of higher concentrations, the southeastern portion, was approximately bordered by the Cropsey moraine, with the larger numbers of birds occurring in the area drained by the tributaries of the Fox River (Figures 1 and 2). In 1942 Craighead and Craighead (1956:44-45) found the distribution of all hawk species on their census strip was such that counts were directly proportional to the extent of land area covered, but in 1948 the hawks were localized.

FOOD HABITS

The food habits of Rough-legged Hawks were determined by analyzing regurgitated pellets and, to some extent, by observations of actual kills. I collected pellets at four communal roosting sites in DeKalb County, making one or two trips to each site between 26 January and 21 April 1967. A combined total of 134 pellets with a mean dry weight of 2.56 gm each was obtained from all locations. In addition, many small pieces of regurgitated material were found at each site and the total weight of these fragments was 260.38 gms. (Arbitrarily all pellet material weighing less than 1.50 gms was included in the group of fragments.) By weight the fragments were equal to approximately 102 whole pellets.

TABLE 3. PREY ITEMS FOUND IN ROUGH-LEGGED HAWK PELLETS.

Prey item	Number of prey present		
	Pellets	Fragments	Total ^a
<i>Peromyscus</i> sp.	75	34	109 (35.4)
<i>Microtus pennsylvanicus</i>	86	28	114 (37.0)
<i>Mus musculus</i>	31	14	45 (14.6)
<i>Blarina brevicauda</i>	4	5	9 (2.9)
<i>Sylvilagus floridanus</i>	3	1	4 (1.3)
Unidentified birds	17	6	23 (7.5)
Other	3 ^b	1 ^c	4 (1.3)
Total	219	89	308

^a Per cent of total sample given in parentheses.

^b Two *Peromyscus* or *Mus*, and one *Mustela vison*.

^c One beetle (Coleoptera).

After completely drying the pellets, they were broken apart and sorted under a binocular dissecting microscope. All bones were removed and placed into a small plastic bag for later identification. Small rodents were identified on the basis of tooth and skull characteristics, while larger animals were identified from the remains of hair and feathers. The weight of the bones present in the 134 pellets represented only 4.8 per cent of the total pellet weight, and even fewer bones were present in the fragments (3.7 per cent by weight). A total of 308 prey items was identified (av. for whole pellets = 1.67 prey items per pellet), with small rodents representing the largest percentage of the remains (Table 3).

From the bone fragments in the pellets it could not be determined whether the specimens of *Peromyscus* were *P. leucopus* or *P. maniculatus*. Both occur in northern Illinois (Hoffmeister and Mohr, 1957:158-163), with *P. leucopus* inhabiting the prairie and *P. maniculatus* more characteristic of the forests, brushlands, river bottoms, and forest edge. Judging from the preference of rough-legs for the more open areas, the majority of mice were probably *P. leucopus*.

Microtus pennsylvanicus inhabits damp, grassy areas and *Mus musculus* is almost always found around man-made dwellings. The rough-legs could have captured live eastern cottontails (*Sylvilagus floridanus*), but it seems more probable that they were eating previously killed rabbits. I observed rough-legs eating carrion rabbits on two occasions and numerous other writers have also referred to the species' habit of eating carrion (Cruikshank, 1939; Gullion, 1957; Butler, 1898; Weller, 1964; and others).

The birds represented in pellets were for the most part small passerines, but there was evidence of at least one Ring-necked Pheasant (*Phasianus colchicus*). In addition, on 5 December, 1966, Alfred D. Bjelland and I observed a Rough-legged Hawk as it made an unsuccessful pass at a female pheasant. Kopsischke (1965) made several observations of rough-legs attacking pheasants. However, this does not rule out the possibility that the pheasant represented in the pellet material was carrion. William E. Southern (personal communication) observed a rough-leg feeding on a road-kill pheasant during the 1964-65 winter period. I also saw a rough-leg capture and eat a Gray Partridge (*Perdix perdix*), and two rough-legs were captured with a bal-chatri trap using Coturnix Quail (*Coturnix coturnix*) for bait.

My information on food habits is in agreement with the findings of most other investigators for various parts of the species' range. Sladek (1960) found in Czechoslovakia that for the most part Rough-legged Hawks eat small rodents. Bergman (1961) reported that 85 per cent of 2,114 prey items identified for Fenno-Scandian rough-legs were small rodents, with about 11 per cent of the prey items being birds.

A much higher percentage of *Microtus* (87 per cent) was found by Craighead and Craighead (1956:134) in 66 pellets from Michigan, with only three per cent of the items being *Peromyscus* and less than two per cent birds. Weller (1964) analyzed 20 pellets from a winter roost in Iowa and found a predominance of small mammals.

It appears that the diet of wintering Rough-legged Hawks is similar throughout its range. The species consumes primarily small rodents, but will occasionally capture and feed on birds. Also rough-legs will utilize carrion for food.

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