COMMUNAL ROOSTS OF WINTERING ROUGH-LEGGED HAWKS (*BUTEO LAGOPUS*)

GARY D. SCHNELL

WHILE studying various aspects of the winter habits of the Rough-legged Hawk (*Buteo lagopus*) in DeKalb County, Illinois, during the winters of 1964–65 and 1965–66 (Schnell, 1967a, 1967b, 1967c, 1968), late in the evenings I noted an absence of birds from perches often frequented during the day. Many Rough-legs from my general study area commonly utilized communal roosting sites.

Communal roosting has been reported for the Rough-legged Hawk in Cook County, Illinois (Freeman, 1952) and in Iowa (Weller, 1964), but few details are given. This paper presents some quantitative results, as well as a more detailed description of communal roosting by the Rough-legged Hawk.

STUDY AREA AND METHODS

This study was conducted in an approximately 120-square-mile area near the center of DeKalb County. The terrain varies from flat to gently rolling, with over 90 per cent of the soil in agriculture and more than 80 per cent of the county in cropland. While prairie grasses once covered about 92 per cent of DeKalb County, they are virtually gone today (Kouba, 1965: 36, 61). Although all townships in the 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). Thus the habitat is rather uniform, with lone trees and a few small groups of trees and groves scattered throughout.

I found communal roosting sites of Rough-legged Hawks in the study area at the following six localities: (1) Victor Township, Section 1, SW¼; (2) Squaw Grove Twp., Sec. 7, NE¼; (3) Pierce Twp., Sec. 29, SE¼; (4) Afton Twp., Sec. 29, NW¼; (5) Afton Twp., Sec. 8, NE¼; and (6) DeKalb Twp., Sec. 30, SE¼. All sites located were at least 2 miles apart. Other roosting sites almost certainly existed within the general area, though I was unable to find them in the time available.

Birds roosted at Site 1 in several parallel rows of Norway spruces (*Picea abies*) along the west side of the farmyard. Rough-legs utilized Norway spruces growing in a cemetery located near a church and several houses at Site 2. Site 3 consisted of a single row of Norway spruces very close to a house and the road. Site 4 was a farmyard where birds roosted in a row of tall deciduous trees along the road or in an arborvitae (*Thuja occidentalis*) in the farmyard. Site 5 was characterized by a few large deciduous trees scattered throughout a farmyard and by an absence of conifers. Site 6 was similar to Site 3, with a row of 40-foot Norway spruces along one side of a farmyard.

Observations were made on 28 evenings and 4 mornings, generally from an automobile parked some distance from the trees being used by the birds. Several evenings I was able to watch Rough-legs from a building only 50 feet from roosting trees at Site 1. Light intensity readings were made with a Weston Illumination Meter (Model 756) by holding the sensing surface upward and parallel with the ground to measure sky illumination. Below I have briefly summarized by evening observations at each

TABLE 1

NUMBER OF ROUGH-LEGGED HAWKS ROOSTING OR SEEN IN GENERAL AREA OF ROOST[1]

Date	Site	Number roosting	Additional number in area[2]
28 January 1965	1	4	1
1 January 1966	1	2	2
23 January 1966	1	6	–
24 January 1966	1	9	–
26 January 1966	1	3	1
27 January 1966	1	8	–
1 February 1966	1	6	–
19 February 1966	1	2	1
22 February 1966	1	6	–
10 March 1966	1	–	5
11 February 1965	2	1	–
29 December 1965	2	4	–
5 February 1966	2	6	–
6 February 1966	2	2	–
12 February 1966	2	1	–
23 December 1965	3	1	3
20 January 1966	3	–	6
3 March 1966	3	1	3
22 January 1966	4	10	–
23 January 1966	4	7 or 8	–
24 January 1966	4	15	–
6 February 1966	4	2	–
25 January 1966	5	–	6
30 January 1966	6	9	–

[1] Roosts were checked on the following dates when no birds were present: Site 2, 30 December 1965 and 26 February 1966; Site 4, 27 January and 5 February 1966; Site 6, 4 February 1966.

[2] These numbers indicate hawks that either entered a roosting site and were then disturbed, or were flying in the general area around the roost.

roost, analyzed data on the timing of roosting behavior at three sites, and given the morning observations at Site 1.

ROOSTING SITES

Table 1 summarizes the numbers of Rough-legs seen at various sites during the winters of 1964–65 and 1965–66. Various amounts of time were spent watching at each site, with Sites 1, 2, and 3 receiving the most attention. Following is a general description of Rough-legged Hawk behavior during the evening at Site 1. The series of events is generally similar to what occurred at other sites as well.

Some Rough-legs appeared in the general vicinity of the roost as early as 1 to 2 hours before sunset, but they usually left the area before returning to roost. Typically the "preroosting" and roosting behavior followed the pattern of coming and going described below. The first birds came near the roost about 15 minutes before sunset. These first Rough-

legs usually flew near the roosting trees and sometimes hovered over them. Occasionally one of the first arrivals landed briefly, only to take flight again and land some distance away or fly beyond my range of vision. Movements toward and away from the roost characteristically continued for 10 to 20 minutes, but by about sunset the birds that landed in the spruce trees usually remained there. Generally the Rough-legs approached the roost at low altitude (approximately 50 feet) and with a relatively rapid, steady, and direct flight pattern. This deliberate, steady flight was quite different from the hovering and planing flight often associated with this species when feeding or migrating. Of interest in this regard is Gurr's (1968) description of the approach to the roost of Australasian Harriers (*Circus approximans*) as "a strong, direct, purposeful flight very different from the slow quartering of a hunting bird."

Most Rough-legs arrived at the roost about 5 to 15 minutes after sunset when the sky illumination measured only a few footcandles (hereafter abbreviated ft-c), and these birds invariably landed directly without hovering. The birds usually spread out in the trees available at Site 1, but on several occasions I noted them perched very close to one another. Soon after arriving at the roost, many of the birds moved from one branch to another or flew from tree to tree within the roost. This activity diminished as the last birds entered the roost. Usually birds that landed near the top of a tree moved to a lower branch and worked their way into a thicker part of the tree before dark. This often made it difficult to spot birds in the roosts even a few minutes after they arrived. Birds in the roost preened occasionally, but I noted little other activity.

On some days the Rough-legs congregated at preliminary locations some distance away before coming into the roost. Before I began my observations at Site 1, the birds apparently used a group of deciduous trees ¼ mile east of the roost regularly for this purpose, where several residents told me of seeing the birds often. Similarly the hawks also used preliminary roosts at most of the other sites. Also on two evenings I found birds roosting individually near Site 1.

While the above typifies general roosting behavior, it seems worthwhile to present a specific example showing the hawks' arrival in relation to time and light intensity. Six birds used Site 2 on 5 February 1966. The first hawk was ½ mile north of the site at 16:37 (500 ft-c). It moved to within 100 yards of the roost at 17:15 (52 ft-c) and at 17:28 (7 ft-c) two other Rough-legs entered the roost, with the original bird following at 17:31 (6 ft-c). The fourth bird landed shortly thereafter, and a fifth and sixth Rough-leg arrived at 17:35 (5 ft-c). In the next few minutes several birds flew to nearby trees, but by 17:45 (0 ft-c) all six Rough-legs were roosting near the trunk in the upper third of a single spruce.

Timing of Roosting

In the winter of 1965–66 I recorded the exact times that 55 Rough-legs entered and remained at Sites 1, 2, and 3, and took light-intensity readings for all except the first six. None of the Rough-legs represented in these data seemed affected by my presence.

Statistical analysis of data on roosting time, roosting time in relation to sunset, and light intensity at roosting time indicated no discernible relationship of these variables to locality, to the color class of roosting birds (light, intermediate, and dark color classes; see Schnell, 1967a), or to the evening cloud cover (clear, partly cloudy, or overcast). This is not to imply that such relationships do not in fact exist, only that they cannot be demonstrated from the data at hand.

From late December to late February the absolute time of roosting became later and later, as did sunset (Figure 1), but the relationship between the two was not exactly one-to-one (see Figure 2). The significant negative regression of roosting time (in minutes after sunset) on observation date shows that Rough-legs tend to roost somewhat earlier in relation to sunset as the year progresses. While this is not entirely unexpected, it has not been demonstrated previously for Rough-legged Hawks. One would expect that when days were relatively short during the first portion of my study period, Rough-legs needed to hunt longer relative to day length to meet basic energy requirements. The data presented here should allow one to make a relatively close prediction of the average roosting time for Rough-legs on any given night within the extreme dates studied.

I found 43.66 per cent of variation in roosting time (in minutes after sunset) attributable to variation in date (Figure 2), but in a somewhat similar attempt to regress light intensity at roosting time on date, only 10.28 per cent of the variation in light intensity could be explained by date (nonsignificant regression). The average light intensity when birds entered a roost was 31.6 ft-c ($N = 49$, $s^2 = 1398.84$), and I was unable to show any difference in absolute light intensity at roosting on different dates. Because of the relatively large variance (s^2), no firm conclusions can be drawn without larger samples.

Morning Observations

I recorded movements of Rough-legged Hawks at Site 1 on the mornings of 2, 24, and 25 January and 2 February 1966. The hawks left the roost quickly early in the morning when the illumination was less than 4 ft-c, most departing before any light registered on the meter. Departure time became progressively earlier as the time of sunrise became earlier, but data were insufficient to determine whether the time of departure was constant in relation to sunrise. The average departure time of 15

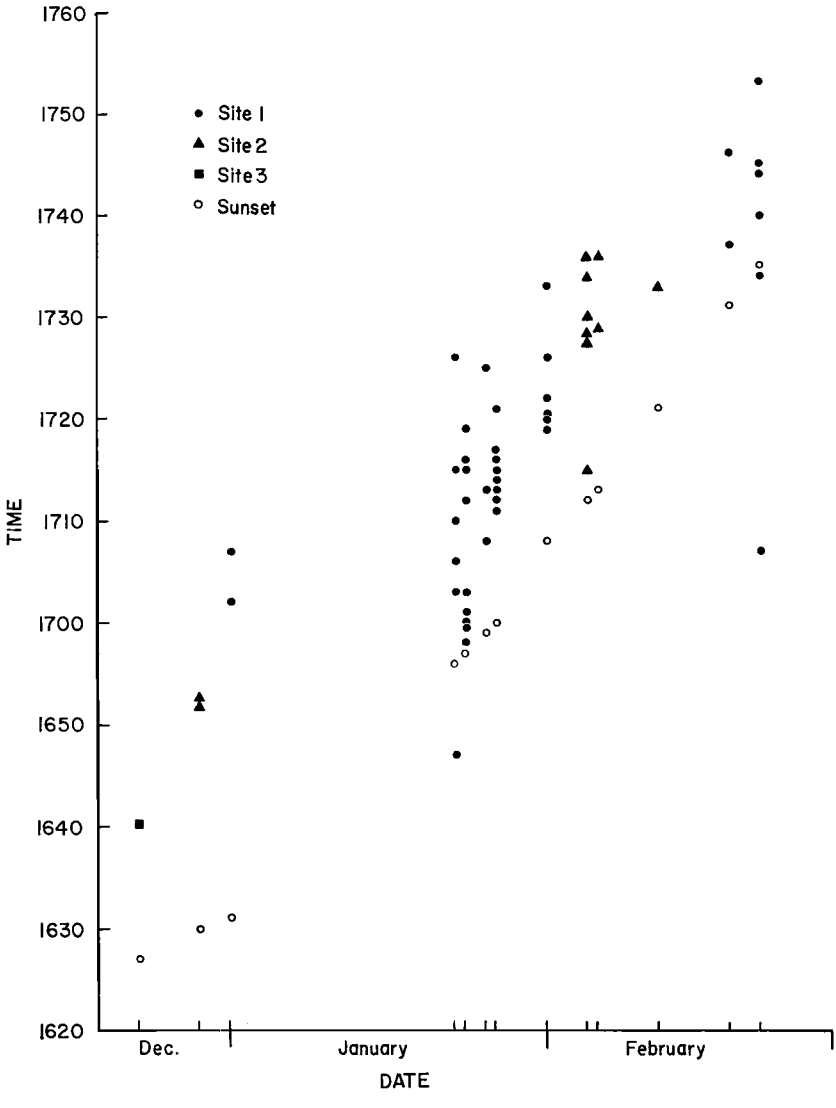

Figure 1. The time that Rough-legged Hawks entered and remained at a communal roost during the winter of 1965–66. Dates of observation are 23 and 29 December, 1, 23, 24, 26, and 27 January, and 1, 5, 6, 12, 19, and 22 February.

Rough-legs was 24.7 minutes before sunrise, with a range from 7 to 32 minutes ($s^2 = 59.64$). On the average birds may tend to leave the roost earlier than indicated by the mean. Eight Rough-legs that were known to enter the roost on nights before one of the above mentioned dates were

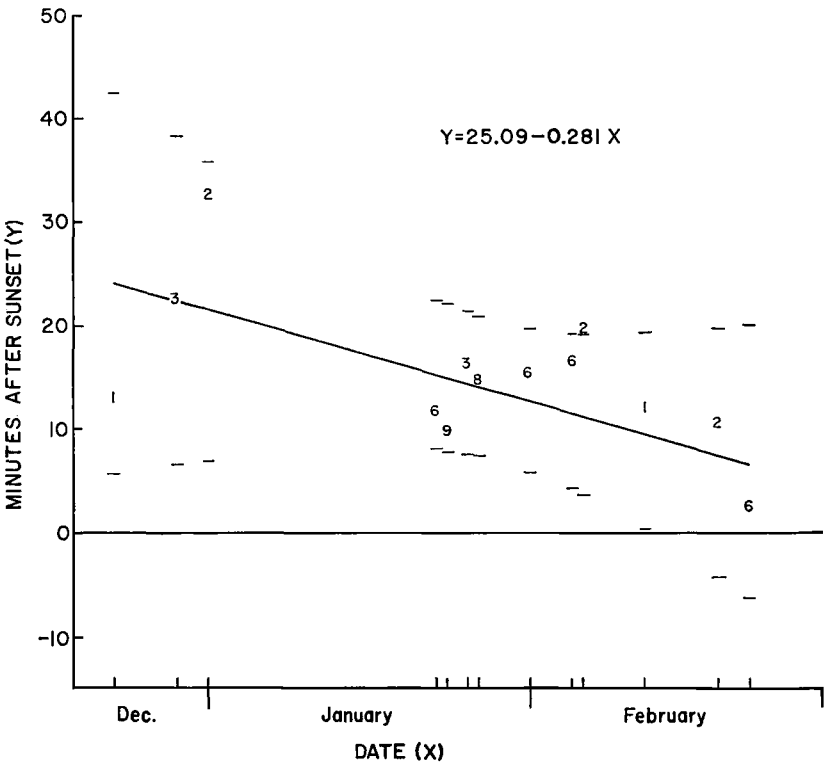

Figure 2. A statistically significant regression ($P < 0.05$) of roosting time (in minutes after sunset) against date of observation. For computation, 20 December 1965 was considered as Day 0. Numbers on graph indicate the number of records for each date and are placed at the mean value for that date. Small horizontal lines show the 95 per cent confidence limits for the parametric means corresponding to the dates for which data were available. The 95 per cent confidence limits for the slope are −0.7478 and 0.1851. Linear regression on date explains 43.66 per cent of the variation in roosting time. Observations are from three roosting sites as indicated in Figure 1. Calculating procedures and appropriate tests of significance are described in Sokal and Rohlf (1969).

not seen on the following morning. Possibly these birds left the roost somewhat earlier while it was too dark to see them, or they may have been flushed during the night.

Hawks leaving the roost appeared to take a definite course to some distant point, and it was the exceptional one that landed within my range of vision. They usually flew off at a height of about 50 feet, and most birds gave the impression they were headed for a predetermined location. Thus by about sunrise the birds had dispersed from the roost and were distributed throughout the surrounding area.

DISCUSSION

Some roosts (e.g. Site 1) appeared to be used almost every night and probably some are used winter after winter, while others might be used for only one or a few nights. Five of the six roosting sites contained Norway spruce or arborvitae, suggesting that the Rough-legs I studied preferred to roost in conifers. The five sites with conifers were all very similar in appearance, and apparently the Rough-legs used only tall trees. Two of the three roosts Weller (1964) studied were in pine and cedar windbreaks near farm houses, the third being in a clump of cottonwood trees (*Populus deltoides*) in an open field. The roost Freeman (1952) found was in a stand of five mature apple trees.

The number of Rough-legs using a single roost in my study varied greatly from night to night as well as from location to location, ranging from 1 to 15. Weller (1964) saw a maximum of three birds in any of the three roosts he watched, though he saw as many as eight in the vicinity of a roost. Freeman (1952) noted up to eight Rough-legs roosting on a given evening, but the number varied considerably. It would be of significance to determine the behavior of birds that do not congregate in a communal roost on a given night. What determines the number of birds that use a given roost, how far birds may fly to roost, how a roost is established, and why particular sites are chosen are as yet unanswered, but potentially answerable and extremely interesting questions. Because Rough-legs vary greatly in plumage coloration, I have good circumstantial evidence that particular birds returned to the same roost on different nights, but the extent to which this occurs cannot be determined without marking a number of individuals. Judging from information on the density of Rough-legged Hawks in the area (Schnell, 1967c) and the number of birds at a given roost, some birds must travel at least 2 to 3 miles to reach their nightly roost.

I had the impression that birds arrived relatively earlier at Site 2 than Site 1. If true, this would suggest an interesting consistency of behavior within certain groups of individuals. Unfortunately no roosting times for both sites on the same evenings are available, and data are too few, especially for Site 2, to test adequately for such a tendency.

It appeared to me that communal roosting by Rough-legs was not the result of a lack of other suitable sites, as evergreen windbreaks and cemeteries with tall conifers were scattered throughout the area. Wynne-Edwards (1962: 297–299) suggests that the practical result of birds roosting communally is to bring members of the population unit together and to stimulate adjustment of population density through emigration when economic and social pressures are sufficiently high. The present study sheds no light on the plausibility of this hypothesis, which in fact

is stated so vaguely it is difficult to determine what kinds of data are needed to support or refute it.

Probably Rough-legged Hawks often roost communally in other portions of the species' winter range, but because of the relatively short time the birds actually fly into roosting trees and the early hour they leave them, few records of this behavior have been reported. In fact, some of the late evening activity attributed to the species, which is often described as crepuscular (Fisher, 1893: 87; May, 1935: 59; and others), may represent movements to communal roosts. It would be of interest to learn whether Rough-legged Hawks behave differently at other localities within their winter range, as well as to determine how and when they start roosting in the late fall or early winter.

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SUMMARY

Communal roosting in Rough-legged Hawks was studied at six sites in northern Illinois during the winters of 1964–65 and 1965–66. Almost certainly other roosting sites existed within the 120-square-mile area, but were not found. Up to 15 Rough-legs used a given site on a single night. The six sites and observations at each are described.

The absolute roosting time on evenings from late December 1965 to late February 1966 became progressively later as the time of sunset became later, but a significant negative regression of roosting time (in minutes after sunset) on time of year indicated that the birds also tended to roost somewhat earlier in relation to sunset as the year progressed.

In the morning Rough-legged Hawks made a rapid exit from one roosting site studied, somewhat before sunrise and when light intensity was less than 4 ft-c. Five of six roosting sites had Norway spruce or arborvitae present, indicating a preference of the hawks for coniferous roosting trees. Communal roosting by Rough-legs was not a result of a paucity of suitable sites.

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Museum of Natural History, The University of Kansas, Lawrence, Kansas 66044. Present address: Convergent and Divergent Evolution IRP-IBP, P. O. Box 7366, Univ. Station, Austin, Texas 78712.