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HAWKS AND OWLS: Population Trends From Illinois Christmas Counts

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Fig. 1.—Saw-whet owl. Smallest owl (7-9 inches) in eastern North America. Because it seeks dense cover in daytime, the saw-whet owl was reported relatively infrequently even in northern Illinois, where the population is probably highest in the state.

HAWKS AND OWLS:

Population Trends From Illinois Christmas Counts

RICHARD R. GRABER AND JACK S. GOLDEN

In 1900 the Audubon Societies, parent organizations of the National Audubon Society, inaugurated the Christmas bird census. This census was introduced and briefly outlined in the societies' official organ, *Bird-Lore* magazine (Chapman 1900:192), and two or possibly three aims were suggested. The first stated purpose was that the Christmas census would serve as a harmless "hunt" or entertainment for the participants. The second, in the words of the article, was that it would "also constitute, in a measure, a census of Christmas bird-life." A third purpose was implied, that is, conservation of wildlife.

The Christmas census or count that has been repeated annually for more than half a century has constituted a numerical record of winter bird life, but opinions of its value as a census vary greatly. Stewart (1954) reviewed some of these opinions and suggested methods for eliminating several major variables in the Christmas census. Hickey (1955) urged that the Christmas census be considered a sport and implied that it should be largely disregarded as a scientific tool.

Though major faunal changes are a part of our written history, there is no record of winter bird life in the United States comparable to that provided by the Christmas census. Filled with variables as these censuses are and have been, few persons would deny that they are better than a complete void, and ornithologists will go on making attempts to analyze the census data. The present study is such an attempt, and its purpose is twofold: (1) to summarize the hawk and owl data contained in the published counts from 1903 to 1955 for Illinois, and (2) to uncover any general trends in winter hawk and owl populations in Illinois.

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The manuscript was edited and the booklet designed by Diana R. Braverman of the Illinois Natural History Survey editorial staff.

The cover photograph of a red-tailed hawk and all other photographs were taken by William E. Clark, Illinois Natural History Survey photographer. Only the saw-whet owl was photographed in the wild.

METHODS USED IN INTERPRETING CENSUS DATA

Data for each species of hawk and owl and each locality in Illinois were tabulated from *Bird-Lore* (1903-1940), *Audubon Magazine* (1941-1946), *Audubon Field Notes* (1947-1956), and *The Audubon Bulletin*, the last the quarterly publication of the Illinois Audubon Society (1933-1956). The earliest censuses (1900-1902) were so short and sketchy that they were not used in this study.

To eliminate bias introduced by censuses that were made at feeding stations or in urban situations where raptors were not likely to be seen, only the 527 counts recording at least one bird of prey were included. (As used here, "count" refers to the record for one locality in one Christmas census.) The figures for frequency of occurrence given in text and histograms were derived from these counts.

In attempting to determine trends of raptor populations in the 1903-1955 census period, we used only part of the 527 counts. For determination of long-term trends in density, it was necessary to have as nearly complete a record as possible and still to eliminate, without bias, the largest variables, such as the total number of observers participating at each census locality and the number of observers in each individual census party. Thus, the graphs showing annual fluctuations of raptor populations during the period 1903-1955 are based on the 277 counts in each of which no more than 10 persons took part and no individual census party consisted of more than four persons.

Data from counts in northern, central, and southern zones of Illinois were treated separately. These divisions of the state, figs. 3 and 4, are the same as those used by Smith & Parmalee (1955:2). Each census locality is preceded by the name of its county; counties in each zone are listed in alphabetical order.

Census localities in northern Illinois were: Bureau (Ohio, Princeton); Cook (Arlington Heights, Blue Island, Chicago, Des Plaines, Elk Grove Forest Preserve, Evanston, La Grange, Orland Park, Palos Park, Park Ridge, River Forest, southeastern Cook County, Stick-



Fig. 2.—Sparrow hawk (female). Smallest (9-10½ inches) of the Illinois hawks. The sparrow hawk was reported commonly throughout the state, but it was especially abundant in southern Illinois in winter.

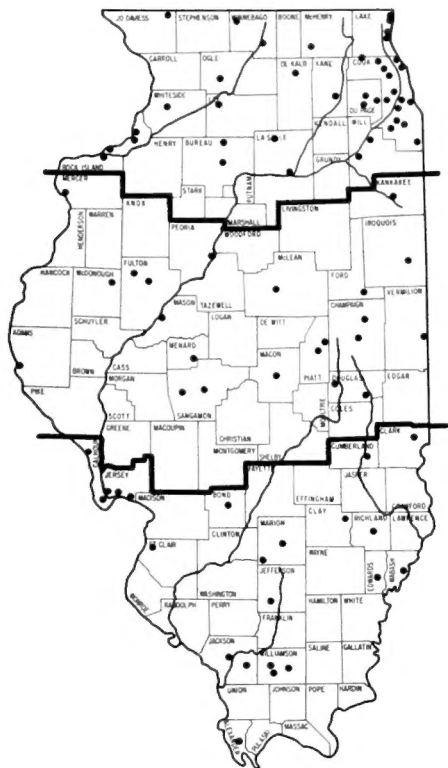


Fig. 3.—Localities from which raptors were reported on Christmas counts in northern, central, and southern Illinois, 1903-1955.

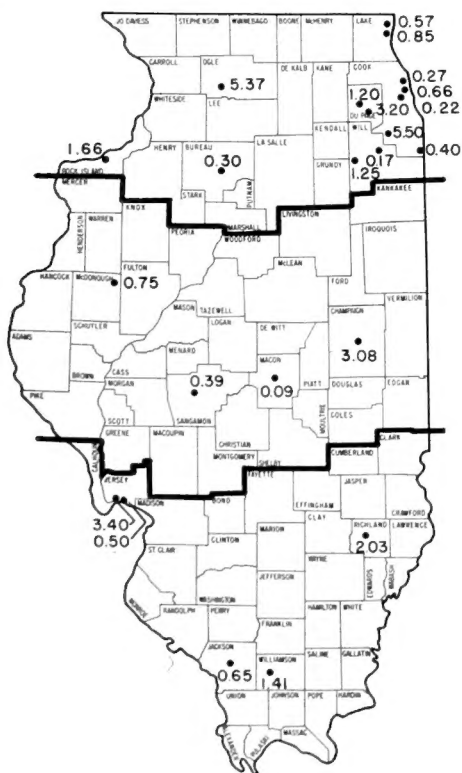


Fig. 4.—Average numbers of raptors reported per census-party-hour on some of the Christmas counts in 1953. Local variation is evident in several localities.

ney, Summit, Winnetka); De Kalb (Kingston); Du Page (Glen Ellyn, Hinsdale, Lisle); Jo Daviess (Warren); Kane (Batavia); Lake (Barrington, Beach, Lake Bluff, Waukegan, Zion); La Salle (Earlville, Ottawa); Lee (Dixon); McHenry (Marengo); Ogle (White Pines Forest State Park); Rock Island (Moline, Port Byron, Rock Island, Zuma Township); Whiteside (Morrison); Will (Channahon, Joliet); and Winnebago (Durand, Rockford).

In central Illinois the census localities were: Adams (Quincy); Champaign (Champaign-Urbana, Rantoul); Douglas (Atwood, Hindsboro); Ford (Paxton); Fulton (Babylon, Fiatt); Iroquois (Milford); Kankakee (Kankakee); Macon (Decatur); Mason (Havana); McDonough (Bushnell); McLean (Bloomington); Menard (Athens); Mercer (western Mercer County); Peoria (Peoria); Piatt (Monticello, White Heath); Sangamon (Berlin, Springfield); and Vermilion (Danville).

In southern Illinois the following census localities were represented: Alexander (Horseshoe Lake Conservation Area); Bond (Greenville); Calhoun (Brussels, Michael); Clark (Marshall); Clay (Ingraham); Cumberland (Greenup); Edwards (Albion); Jackson (Carbondale, Murphysboro); Jefferson (Waltonville); Jersey (Elsah, Grafton, Pere Marquette State Park); Marion (Centralia, Salem); Richland (Bird Haven Sanctuary); St. Clair (East St. Louis); Wabash (Mount Carmel); and Williamson (Carterville, Crab Orchard National Wildlife Refuge, Marion).

Statistical treatment of the Christmas census data, with their inherently high variability, was limited to simple methods. Calculations for frequency of occurrence for each 5-year period in the record were made for each species. (One or more individuals of a species reported from a census locality constituted an occurrence.) Computations of birds per mile, birds per observer-hour, and birds per party-hour were made for each of the relatively common species of raptors and for all species of raptors combined. The graphs for each species of raptor were plotted for only that region of the state which reported high frequency for the species.

Variables Affecting Census Results

Interpretation of quantitative data contained in the Christmas censuses is difficult because of the many variables involved. Stewart (1954:192) suggested that quantitative data be used to show general trends only. The major variables are those of locality, habitat, weather, number and competence of observers, time spent in the field, period of day spent in the field, methods of travel, and conspicuousness of birds. It was impossible to eliminate all of even the major vari-

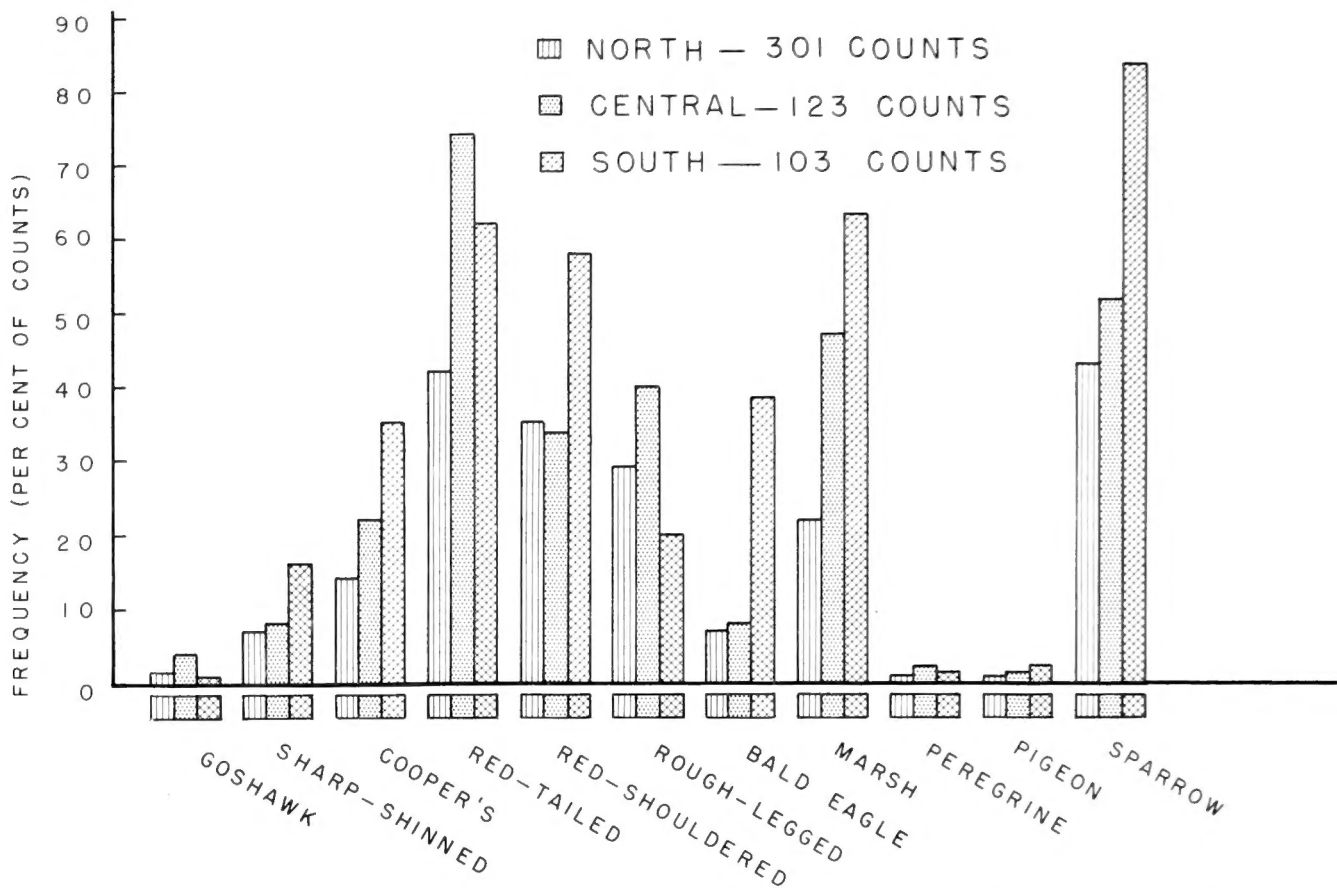


Fig. 5.—Frequency of occurrence of the relatively common species of hawks reported on Christmas counts in northern, central, and southern Illinois, 1903-1955.

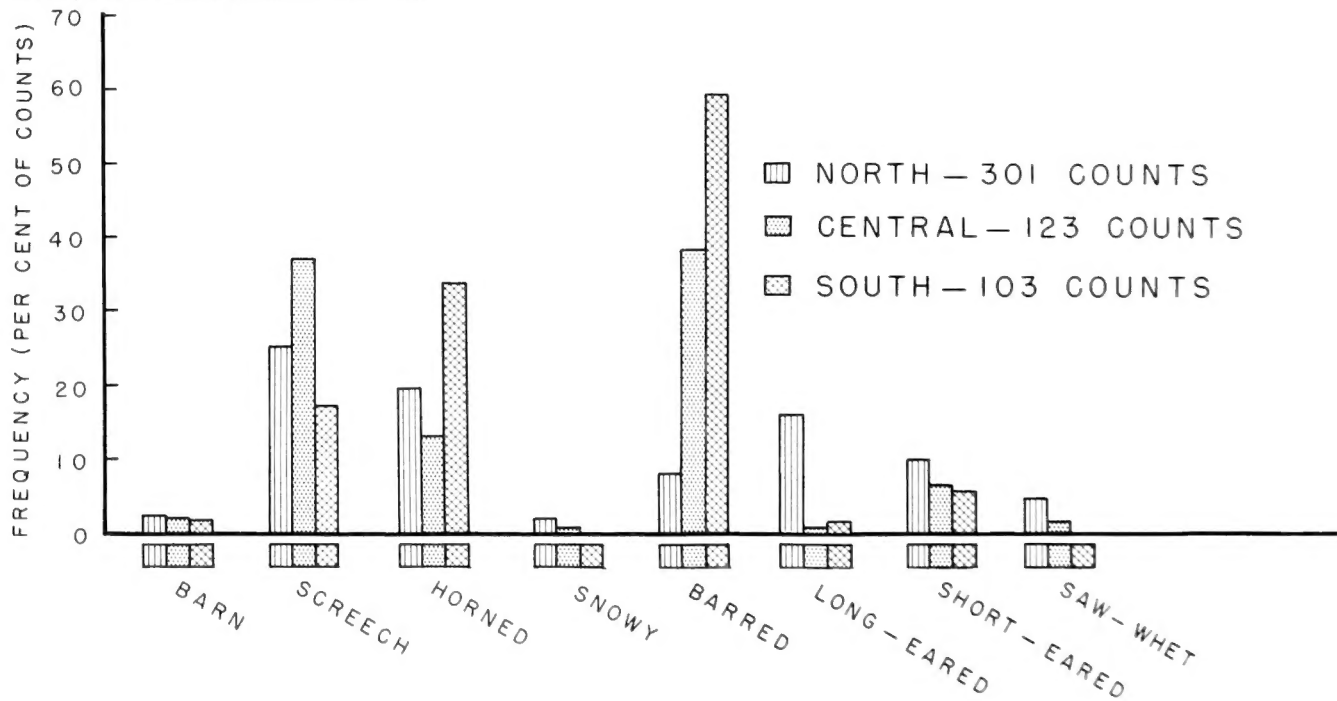


Fig. 6.—Frequency of occurrence of the relatively common species of owls reported on Christmas counts in northern, central, and southern Illinois, 1903-1955.

ables and still have a relatively complete and continuous record; however, most of the variables were present throughout the census period considered here and were probably not operating in any one direction to produce undue bias.

The Habitat Variable.—From the earliest censuses, observers recorded a variety of data on the census localities, such as hour of starting and returning, character of the weather, direction and force of the wind, and temperature. Not until the early 1940's did census takers begin providing information on the kinds of habitat covered. This deficiency in basic data would be a serious deterrent to an evaluation of the trends in raptor populations were it not for the fact that central and northern Illinois have relatively uniform terrain. Cultivated land constitutes over 90 per cent of the habitat in these regions, and most of the censuses were taken in counties with less than 9 per cent of the land in woods (King & Winters 1952:22).

In the consideration of numerical changes in raptor populations, emphasis is placed on data from the regions of the state which have been under heavy cultivation throughout the period 1903-1955. In northern and central Illinois, the observer was never far from cultivated farm land, and most of the birds of prey reported on counts were probably seen in or from this general kind of habitat.

In southern Illinois, the part of the state with the most land in forest, birds reported were seen in a greater diversity of habitat than in northern and central

Illinois. Woodland species of raptors would be expected to appear more frequently in southern Illinois than in the other zones.

The Locality Variable.—Census reports showed that raptors were not uniformly distributed throughout Illinois, table 1. Census localities in southern Illinois averaged higher numbers of raptors than those in the central and northern zones. For the period 1949-1955, larger numbers of raptors (an average of 2.54 birds per party-hour) were reported for Grafton than for any other Illinois locality. The large number at Grafton was brought about in part by winter concentrations of bald eagles along the Mississippi and Illinois rivers in recent years. Similarly, Moline, situated on the Mississippi River in the north, has had large numbers of eagles and of other raptors in recent years.

Through the years a given locality, in relation to other localities, has tended to show a consistent rank with regard to the density of its raptor populations. In central Illinois, Urbana regularly has reported higher raptor numbers than Springfield. Rockford consistently has reported the highest raptor numbers in northern Illinois. Variation in reported numbers from different localities in a relatively small geographic area is shown in the records of Chicago, River Forest, south-eastern Cook County, and Joliet, table 1.

Though certain localities, such as Springfield and Urbana in central Illinois, have had fairly long records of Christmas counts, no single locality has provided a complete record of counts from 1900 to 1955. In analyzing the general trends of hawk and owl populations, it

Table 1.—Number of raptors per census-party-hour recorded on Christmas counts at different localities in northern, central, and southern Illinois, 1946-1955.

Year	Number of Raptors Recorded Per Census-Party-Hour										
	Northern						Central		Southern		
	Moline	Rockford	Chicago	River Forest	South-eastern Cook Co.	Joliet	Springfield	Urbana	Bird Haven	Grafton	Murphysboro
1946	0.75	1.25	0.14	....	....	....	0.40	0.69	1.14	....	0.33
1947	0.50	2.00	0.14	....	....	....	0.32	0.50	1.75	....	....
1948	....	2.39	0.30	0.40	0.13	1.26	0.24	0.88	2.00	....	1.95
1949	....	4.38	0.36	0.12	0.30	0.47	0.37	1.22	1.53	0.58	1.00
1950	....	1.62	0.46	0.12	0.47	0.50	....	1.00	0.83	3.35	0.83
1951	2.13	0.49	0.36	0.22	0.33	0.10	0.27	1.25	2.94	2.41	1.29
1952	0.50	1.20	....	0.44	0.11	0.18	0.44	5.69	2.47	3.27	1.40
1953	1.66	....	....	0.22	0.40	0.17	0.52	0.83	2.04	3.41	0.66
1954	....	1.00	0.18	0.25	0.14	0.37	0.35	0.66	2.38	2.73	0.86
1955	....	2.04	0.37	0.35	0.83	....	0.65	1.01	2.92	2.00	0.80

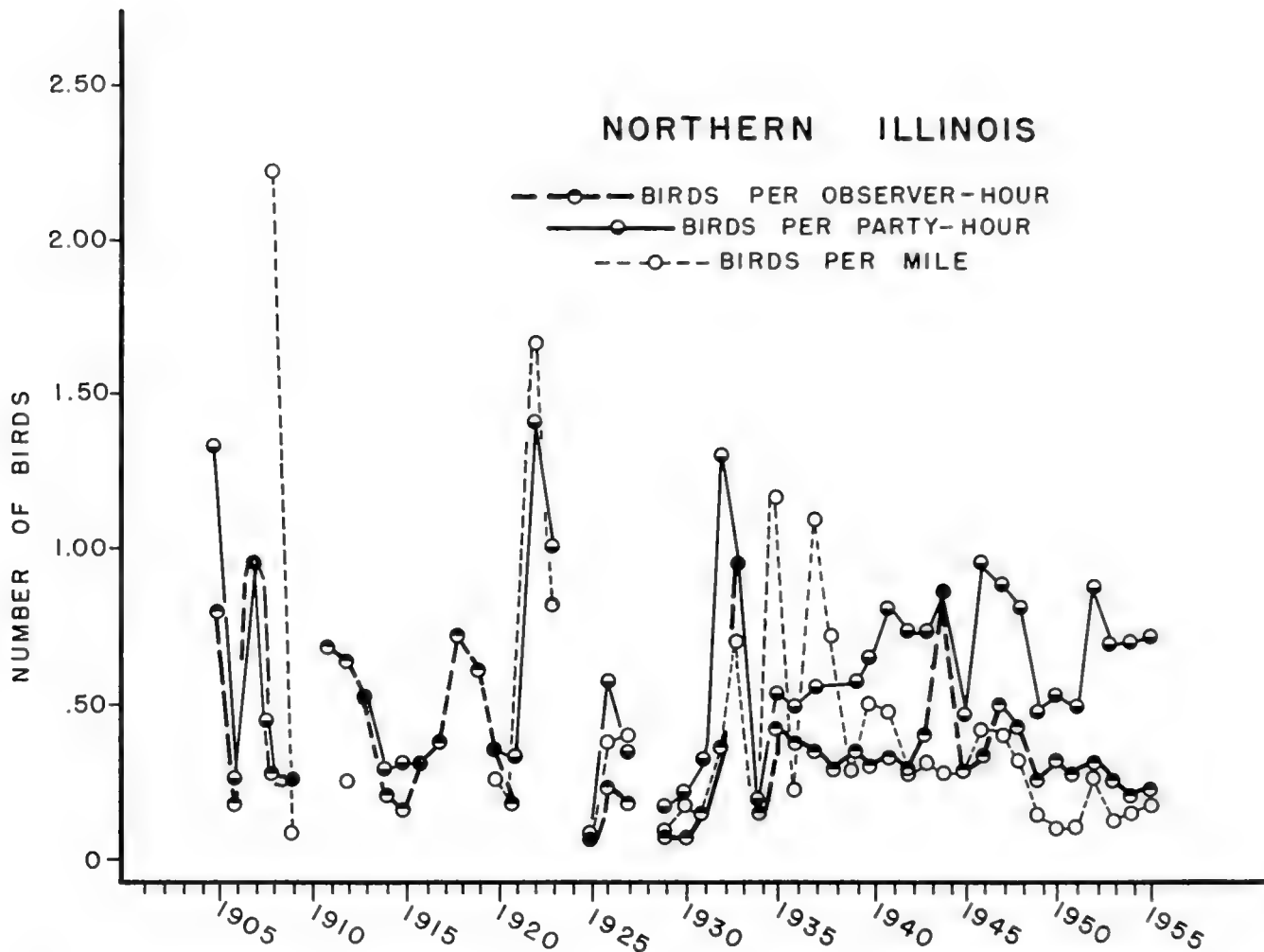


Fig. 7.—Average numbers of raptors reported on Christmas counts in northern Illinois, 1905-1955, expressed as birds per observer-hour, birds per party-hour, and birds per mile.

was necessary to use data from a number of localities in each section of the state.

Analysis of Frequency of Occurrence

Probably the simplest quantitative treatment of Christmas census data is the analysis of frequency of occurrence of each species, the percentage of the total number of counts in which the species was reported. The frequencies of occurrence for the species of raptors recorded in the period 1903-1955 in southern Illinois were based on 103 counts and in 1905-1955 in central and northern Illinois on 123 and 301 counts respectively, figs. 5 and 6.

If the Christmas census has any value in making determinations of relative abundance of species of raptors from early to later years, it should become apparent from an analysis of frequency of occurrence and density, the latter determined by number of birds per observer-hour, birds per party-hour, and birds per mile.

Knowing that the southern region of the state is more heavily forested than the central and northern, we would expect higher frequencies there for such woodland birds as the red-shouldered hawk and the barred owl and lower frequencies for such prairie-loving species as the short-eared owl and the rough-legged hawk. These relative frequencies appeared as expected, figs. 5 and 6.

In winter certain raptors tended to concentrate at latitudes farther south than in summer, regardless of habitat, as though responsive to the temperature cline. The Cooper's hawk, marsh hawk, and sparrow hawk occurred with increasing frequency from north to south. Conversely, the snowy owl and the saw-whet owl occurred with decreasing frequency from north to south.

Frequencies reported for the sparrow hawk and some other species tended to increase in later years, but these apparent increases do not necessarily indicate real increases in raptor populations. The increases reported in later years probably resulted largely from

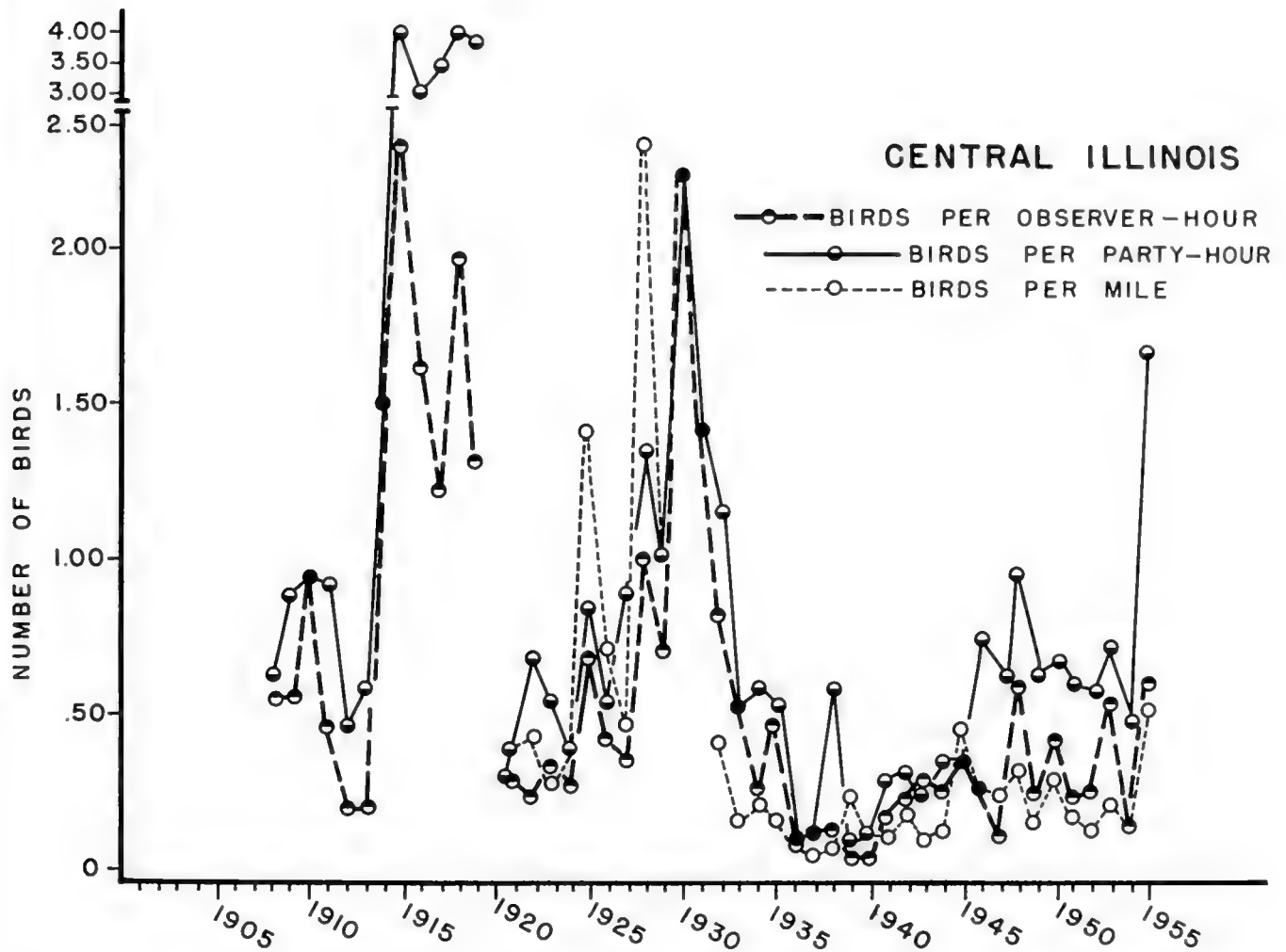


Fig. 8.—Average numbers of raptors reported on Christmas counts in central Illinois, 1905-1955, expressed as birds per observer-hour, birds per party-hour, and birds per mile.

three changes in the Christmas census methods: (1) attempts by observers to "better" the records of previous years; (2) increases in the number of observers; (3) wider coverage of the census locality areas through the use of automobiles.

CHANGES IN RAPTOR POPULATIONS

Although there is considerable fluctuation from year to year, a general decline in winter populations of raptors is apparent from early to later years. Peaks representing years of high population are lower in later years. There are considerable gaps in the record for southern Illinois, particularly in the early years, so that no definite trend showed there, but the population trend of raptors in northern and central Illinois shows the same general decline when expressed by three different units of measure—birds per observer-hour, birds per party-hour, and birds per party-mile traveled, figs. 7 and 8.

Stewart (1954:187) stated that, as a unit of measure for the Christmas census data, number of birds found per mile of travel was more meaningful than number found per hour of observation. As mileage was not given on all of the early counts this record is incomplete.

Eifrig (1939:5) and Nice (1945:9-10) both pointed out a decline in hawk populations in Illinois. If there has been a decline in hawks, has it been general for all raptors and all species? If all raptor populations have declined, what has caused the decrease?

To answer the first question, we must look at the data on those individual species for which the record is most nearly complete.

For the sparrow hawk, frequency and density have been highest in southern Illinois, figs. 10 and 11. Although the record was incomplete for early years, the highest density peaks came in those years, with the peak in the late 1920's lower, and peaks in the 1940's and 1950's lower still. No definite trend is evident for



Fig. 9.—Golden eagle. Comparable in size to the bald eagle. The golden eagle was reported only twice on Christmas counts, both times in southern Illinois.

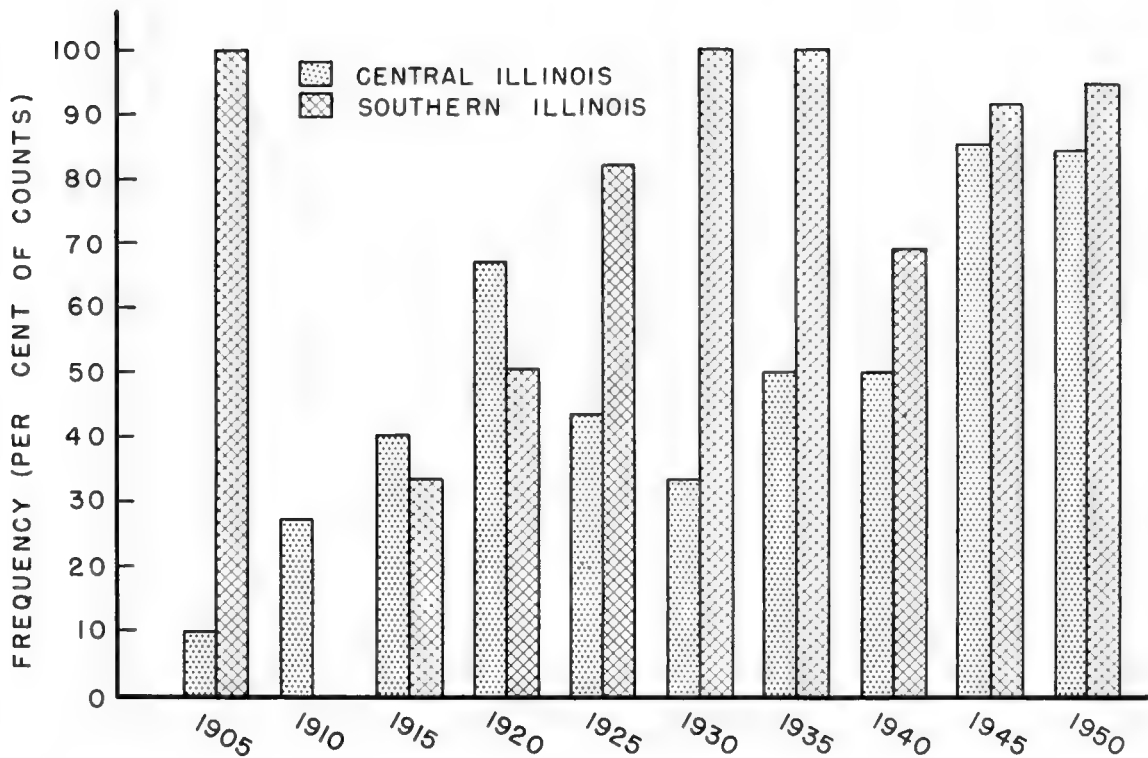


Fig. 10.—Frequency of occurrence of the sparrow hawk in central and southern Illinois calculated for 5-year periods beginning in 1905 and ending in 1954. The year indicates the beginning of the 5-year period.

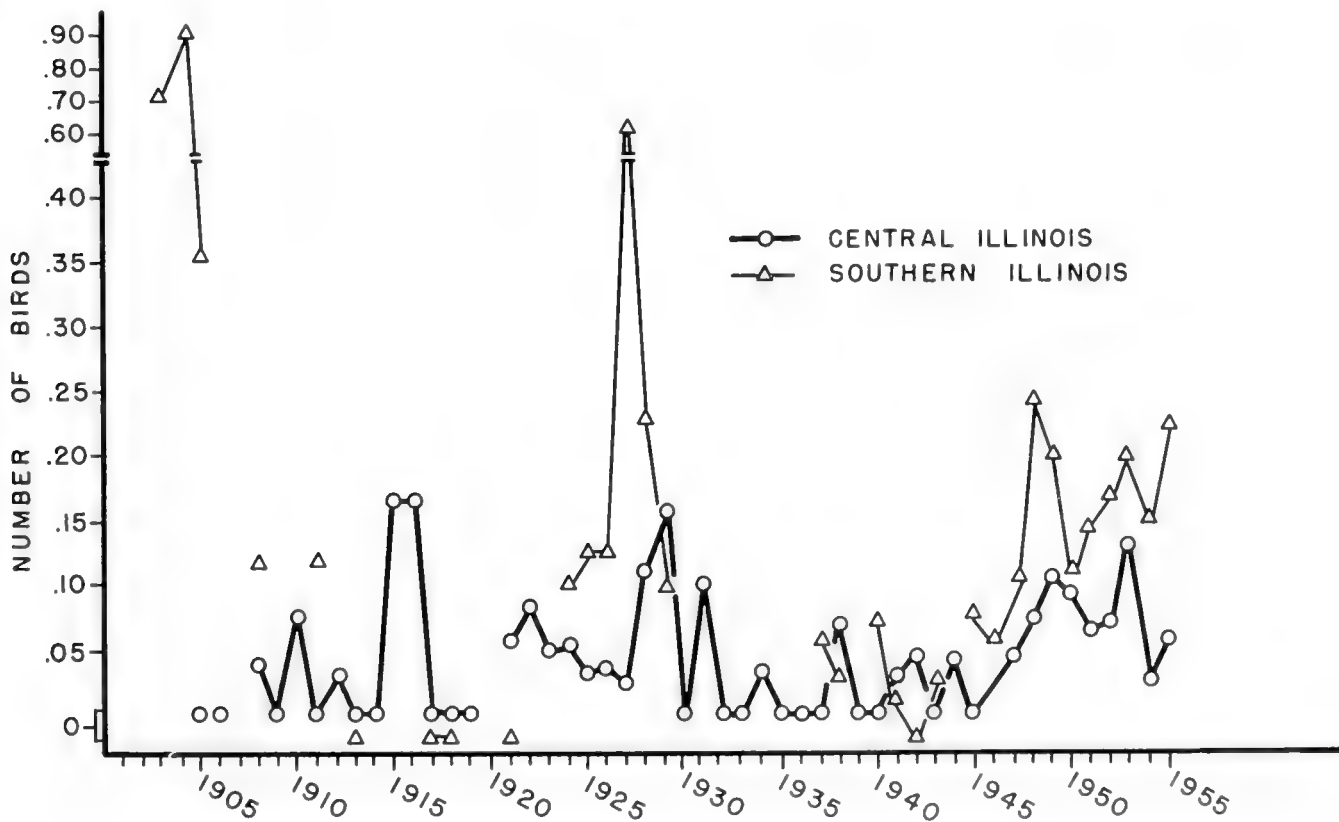


Fig. 11.—Average numbers of sparrow hawks reported per observer-hour in central and southern Illinois, 1903-1955.



Fig. 12.—Bald eagle (immature). About 3 feet in length when mature. In Illinois, the bald eagle was found principally along the major rivers, especially along the Mississippi River.

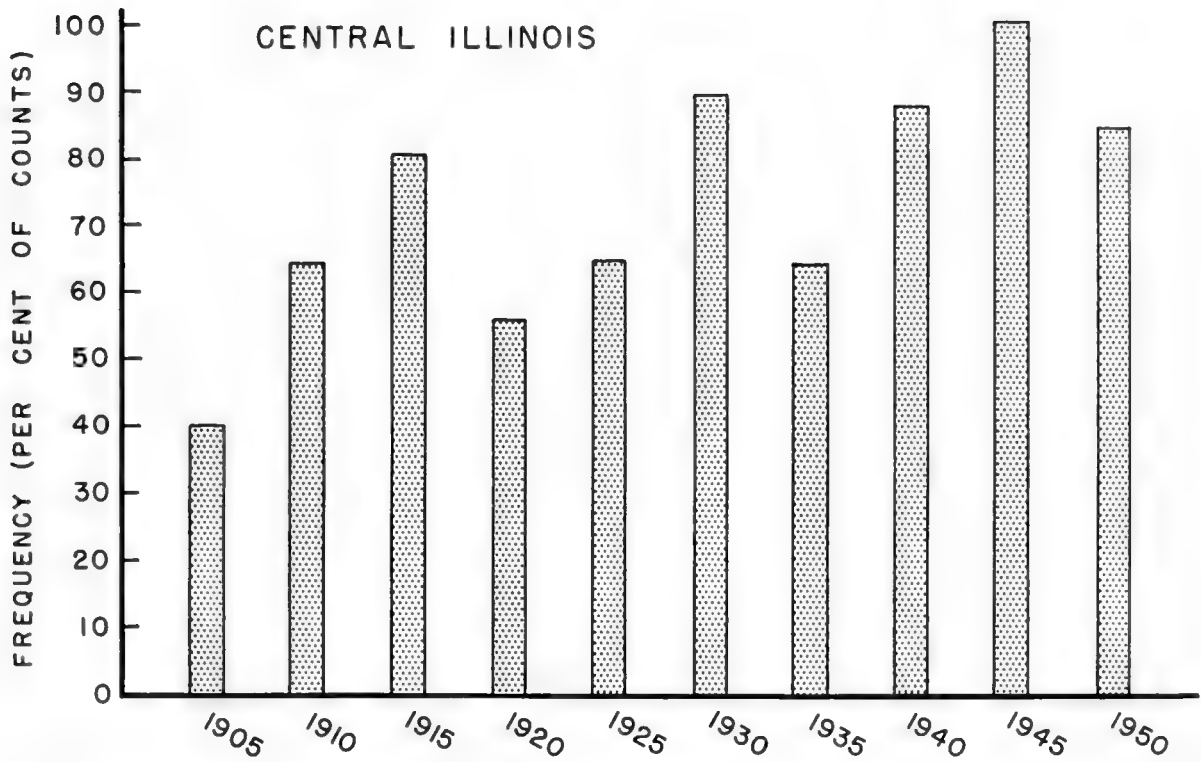


Fig. 13.—Frequency of occurrence of the red-tailed hawk in central Illinois calculated for 5-year periods beginning in 1905 and ending in 1954. The year indicates the beginning of the 5-year period.

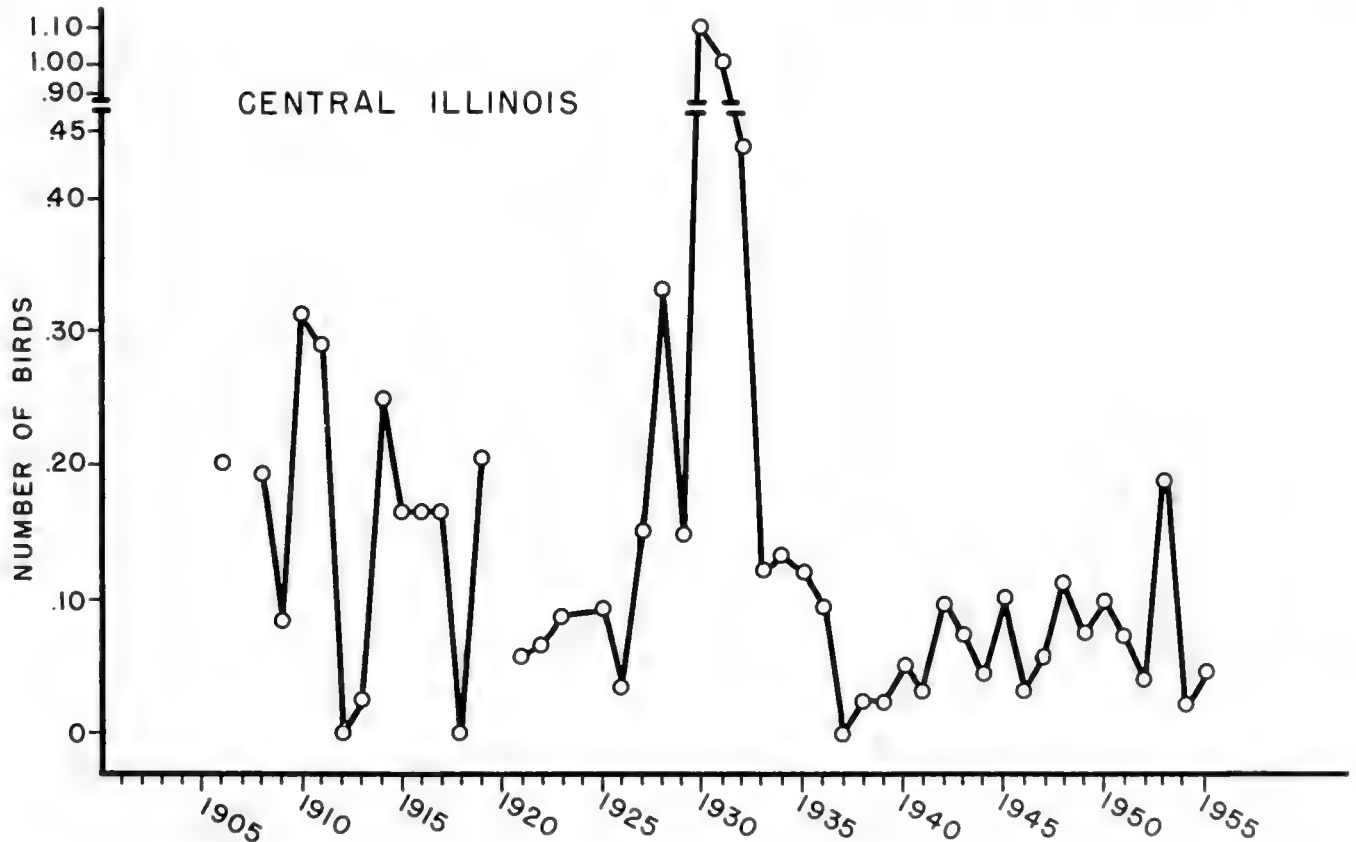


Fig. 14.—Average numbers of red-tailed hawks reported per observer-hour in central Illinois, 1905-1955.

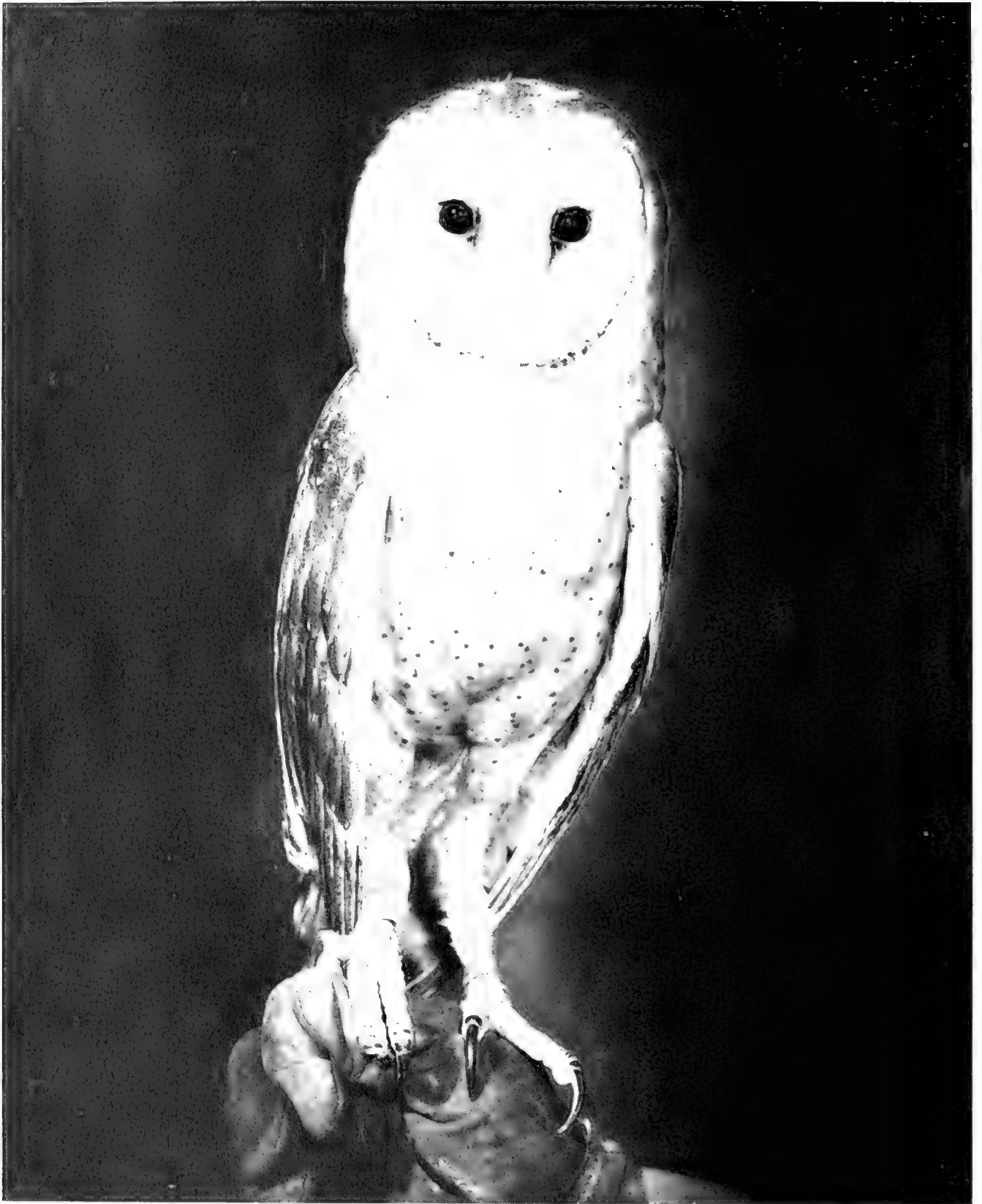


Fig. 15.- Barn owl. A cosmopolitan species; individuals 15-18 inches long. The barn owl was reported with about the same frequency throughout the state.

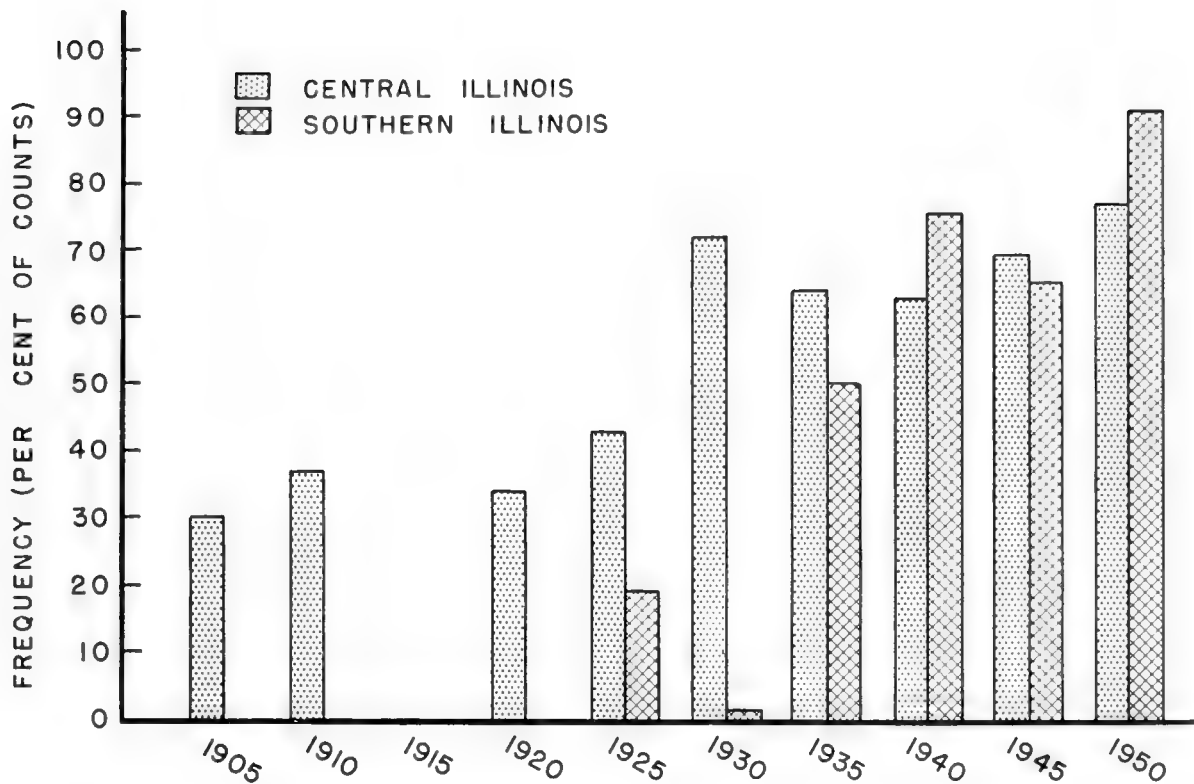


Fig. 16.—Frequency of occurrence of the marsh hawk in central and southern Illinois calculated for 5-year periods beginning in 1905 and ending in 1954. The year indicates the beginning of the 5-year period.

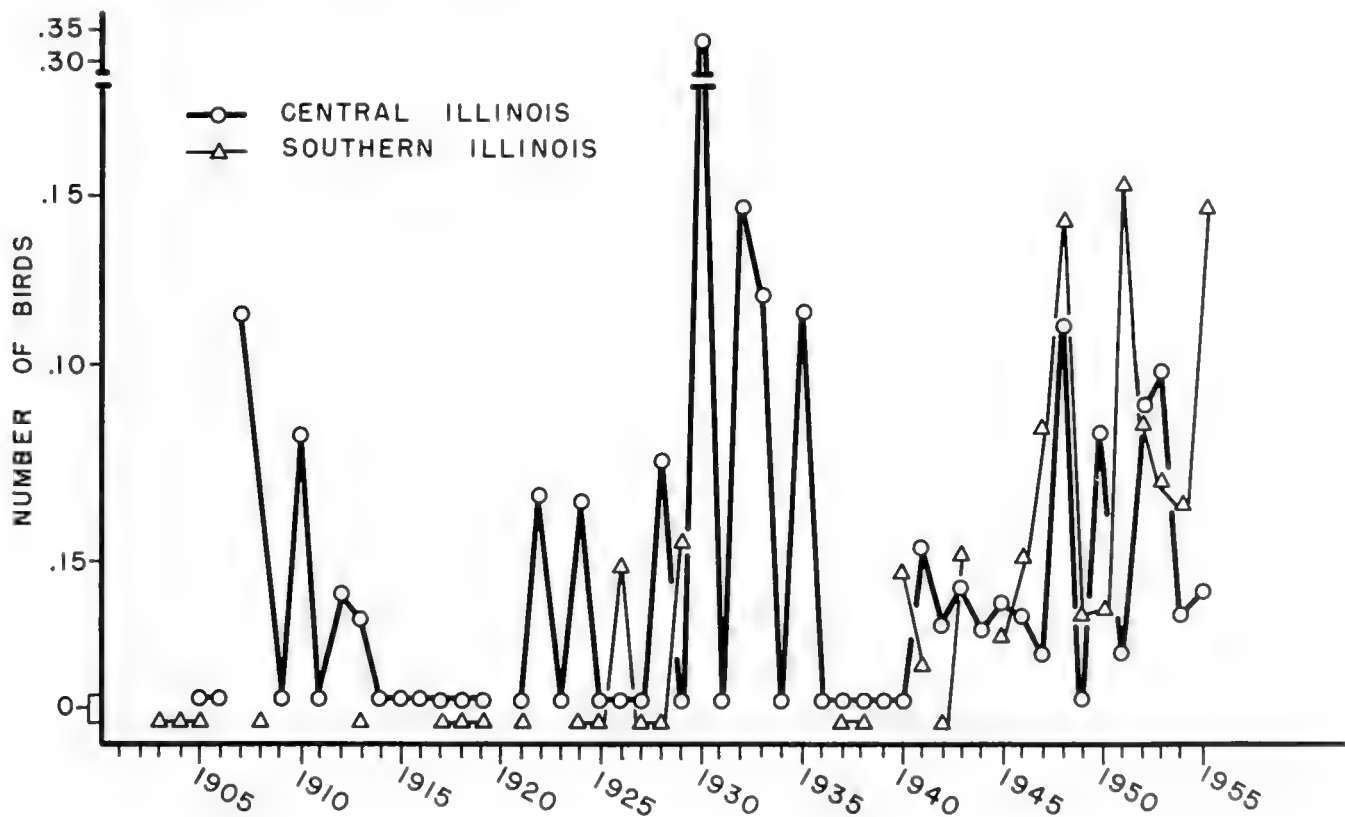


Fig. 17.—Average numbers of marsh hawks reported per observer-hour in central and southern Illinois, 1903-1955.

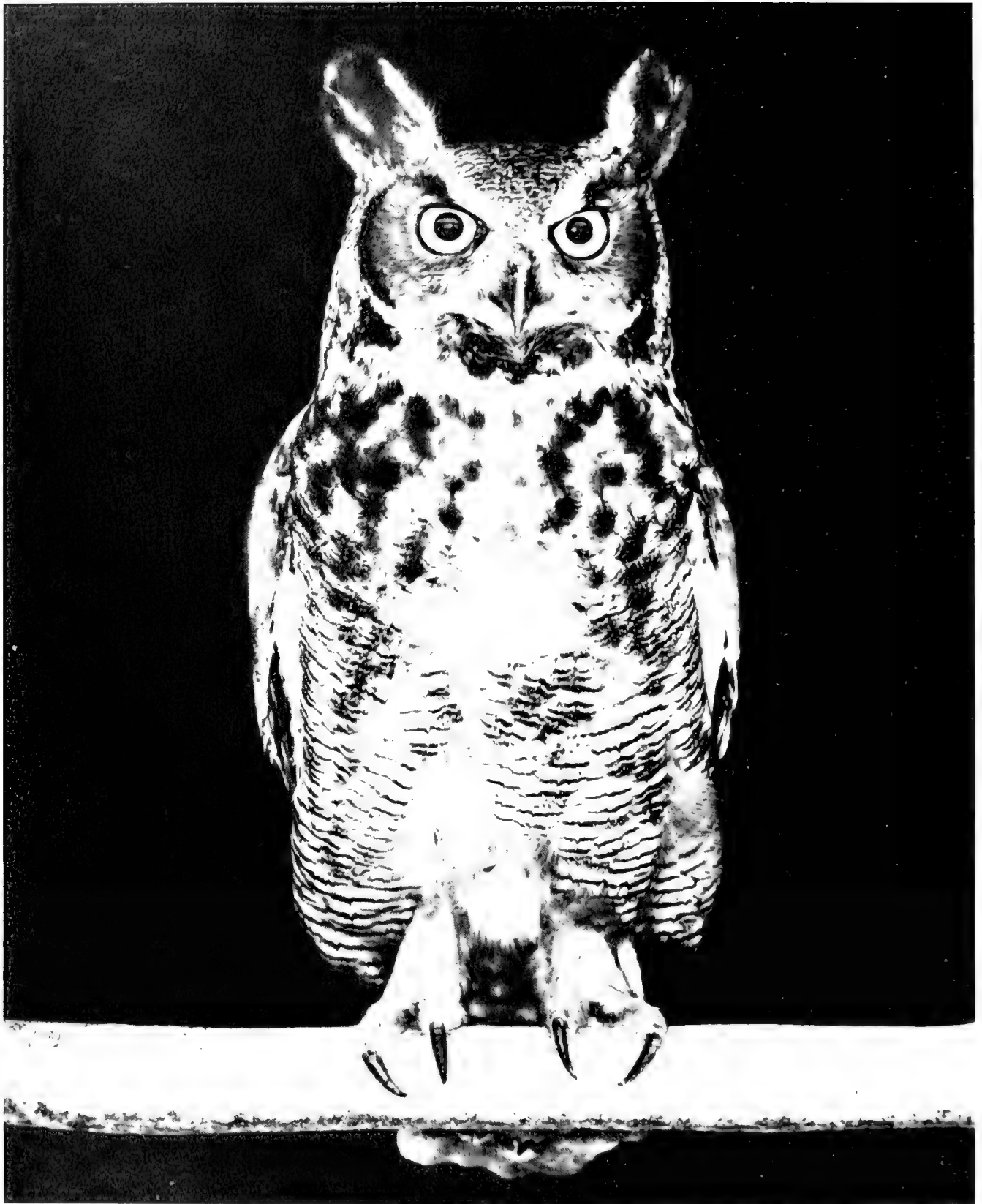


Fig. 18. — Great horned owl. Largest (18-25 inches) of the four species of "horned" or "eared" owls which occur in Illinois. Although the great horned owl occurs throughout the state, it was reported with greatest frequency in southern Illinois.

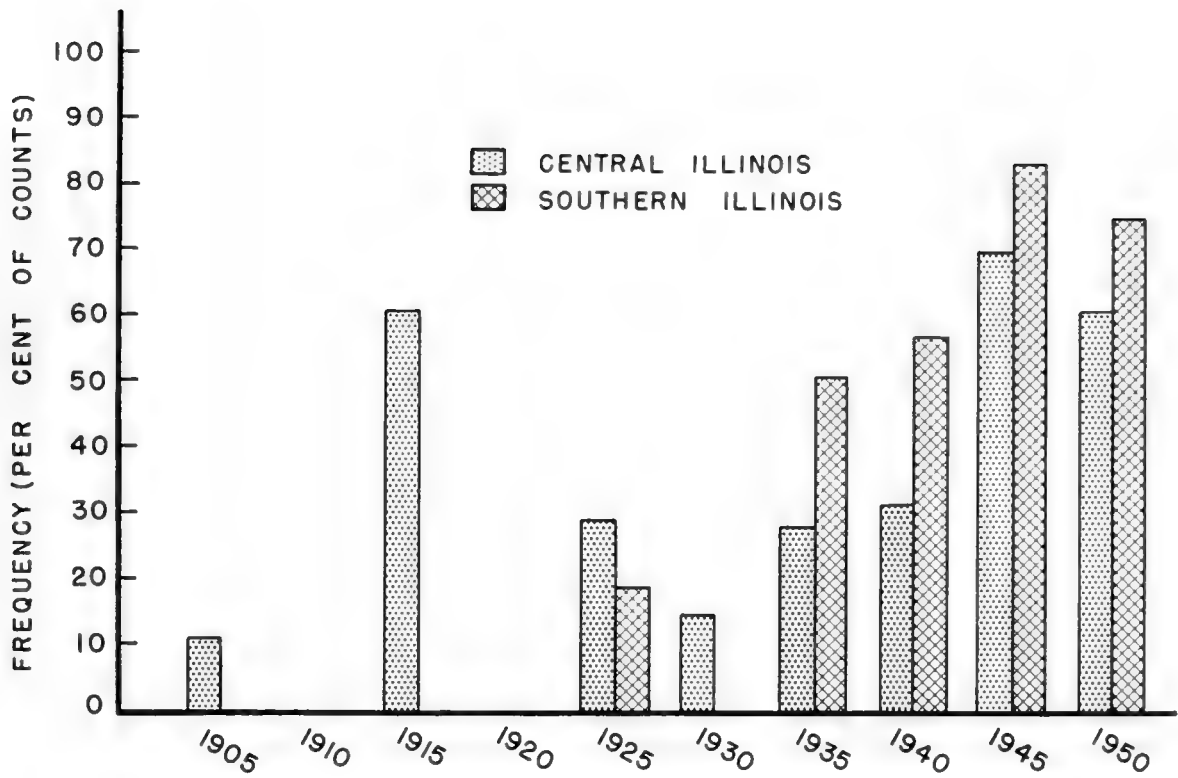


Fig. 19.—Frequency of occurrence of the red-shouldered hawk in central and southern Illinois calculated for 5-year periods beginning in 1905 and ending in 1954. The year indicates the beginning of the 5-year period.

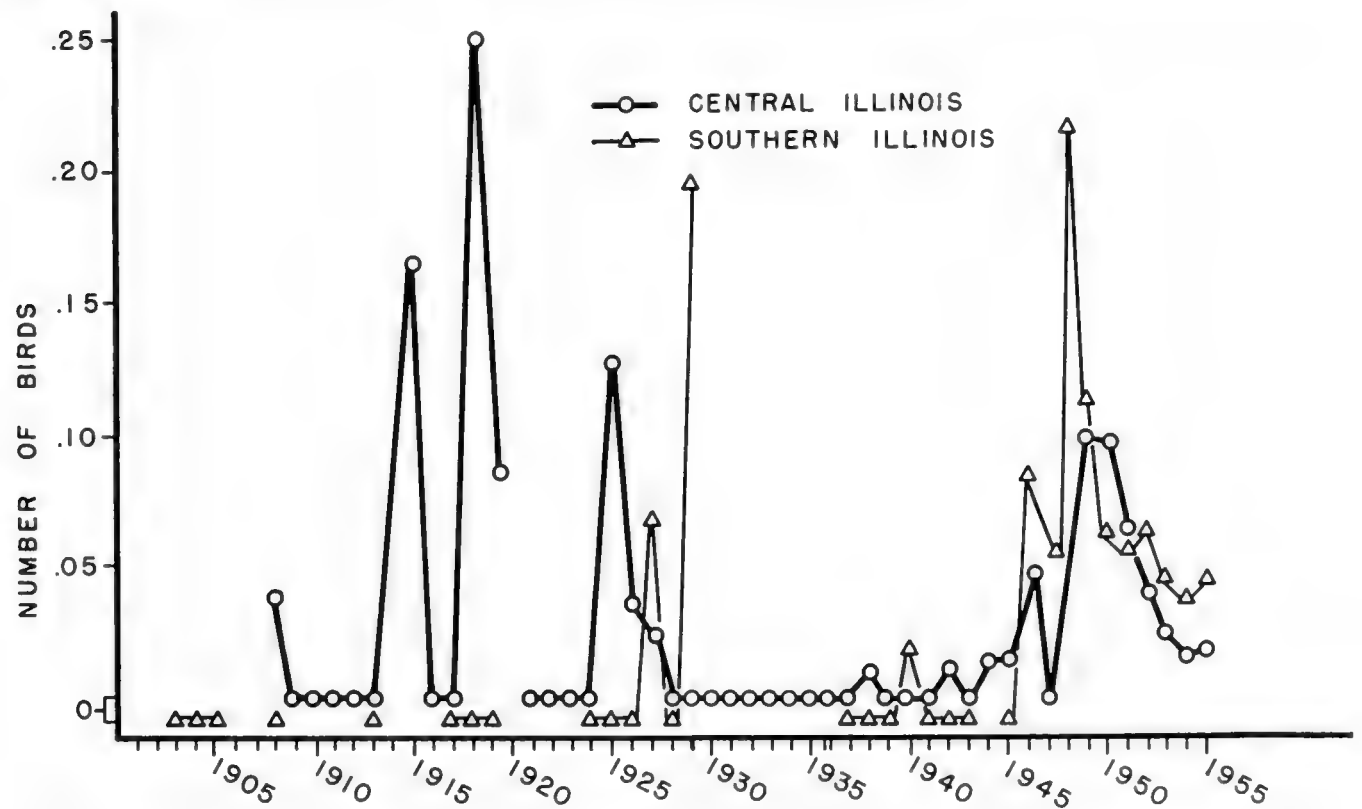


Fig. 20.—Average numbers of red-shouldered hawks reported per observer-hour in central and southern Illinois, 1903-1955.

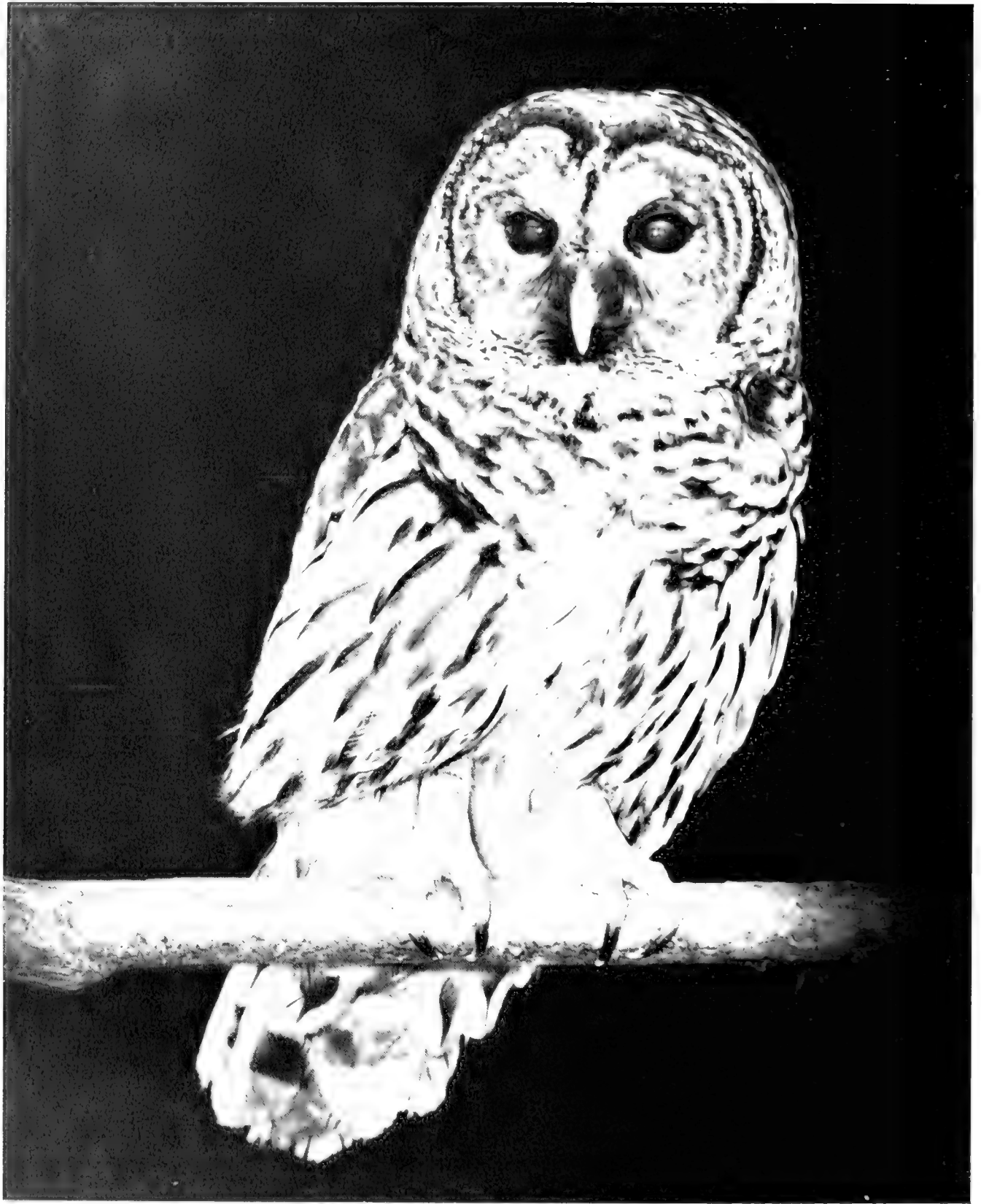


Fig. 21.—Barred owl. Approaches the size of the great horned owl. The barred owl was the most frequently reported owl on Christmas counts in Illinois and, like the great horned owl, was seen with greatest frequency in southern Illinois.

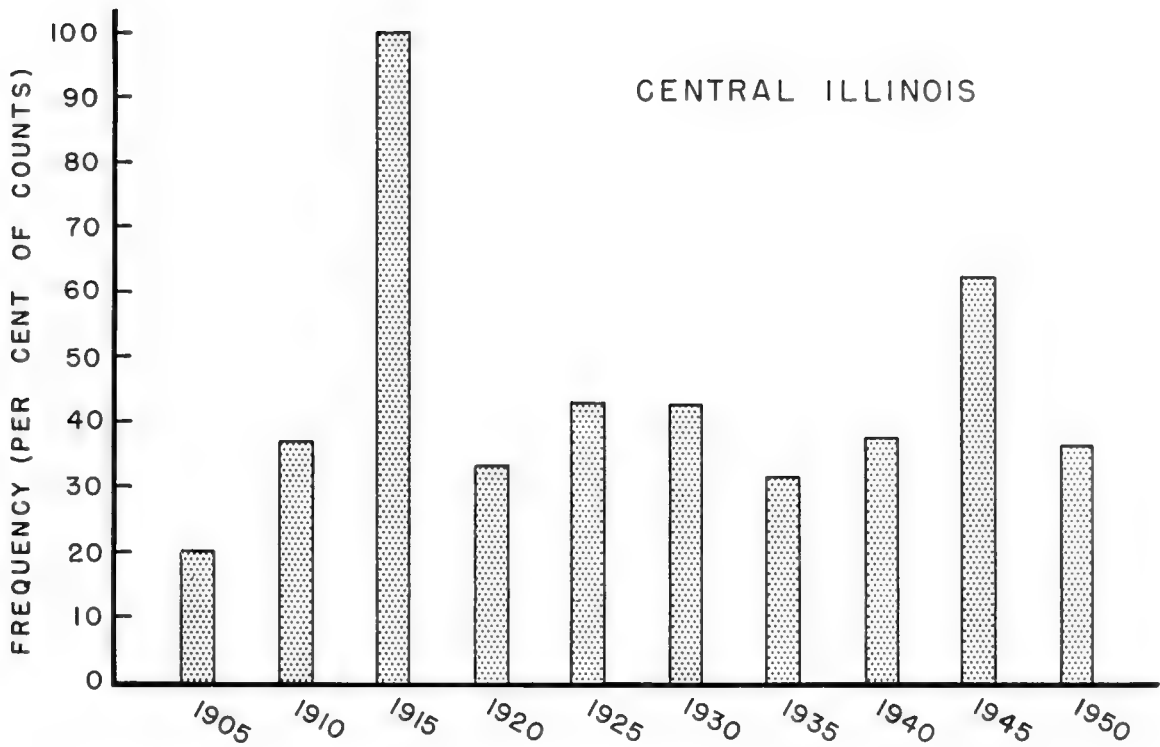


Fig. 22.—Frequency of occurrence of the rough-legged hawk in central Illinois calculated for 5-year periods beginning in 1905 and ending in 1954. The year indicates the beginning of the 5-year period.

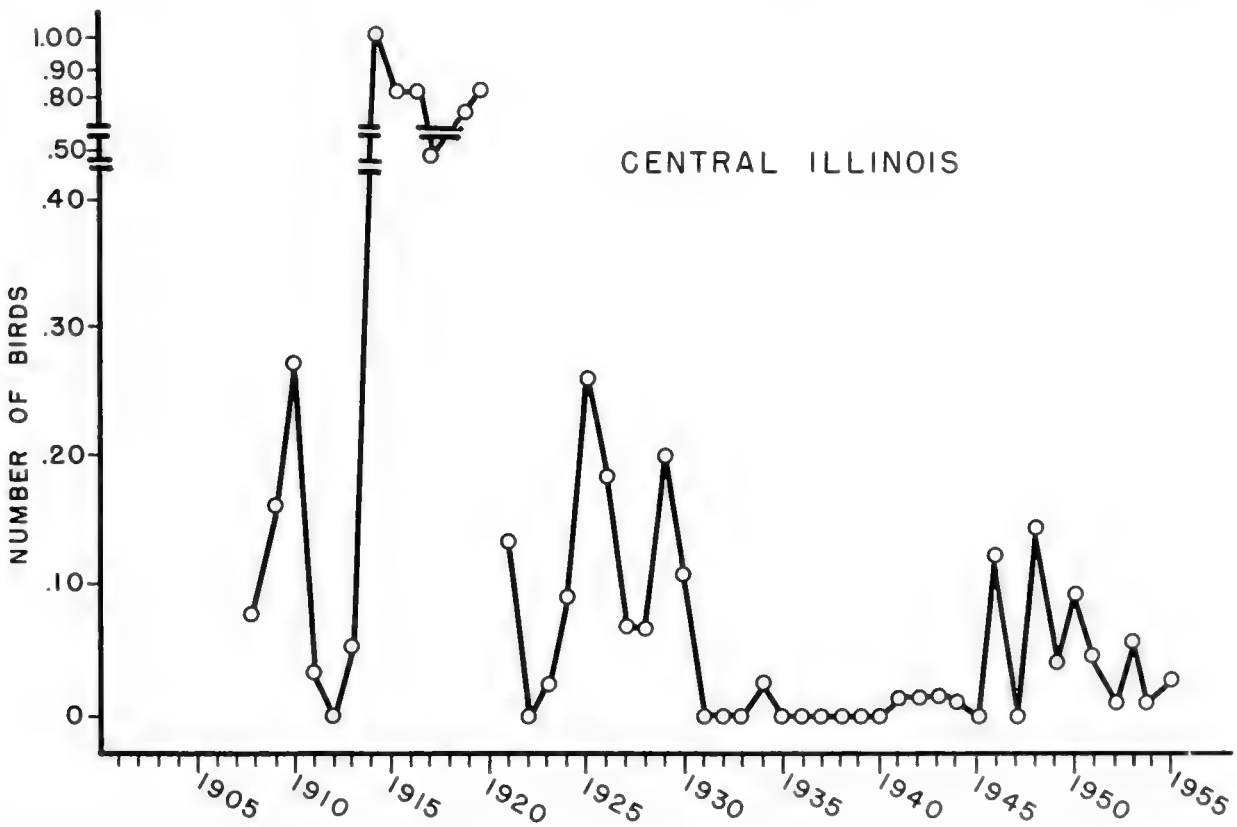


Fig. 23.—Average numbers of rough-legged hawks reported per observer-hour in central Illinois, 1908-1955.

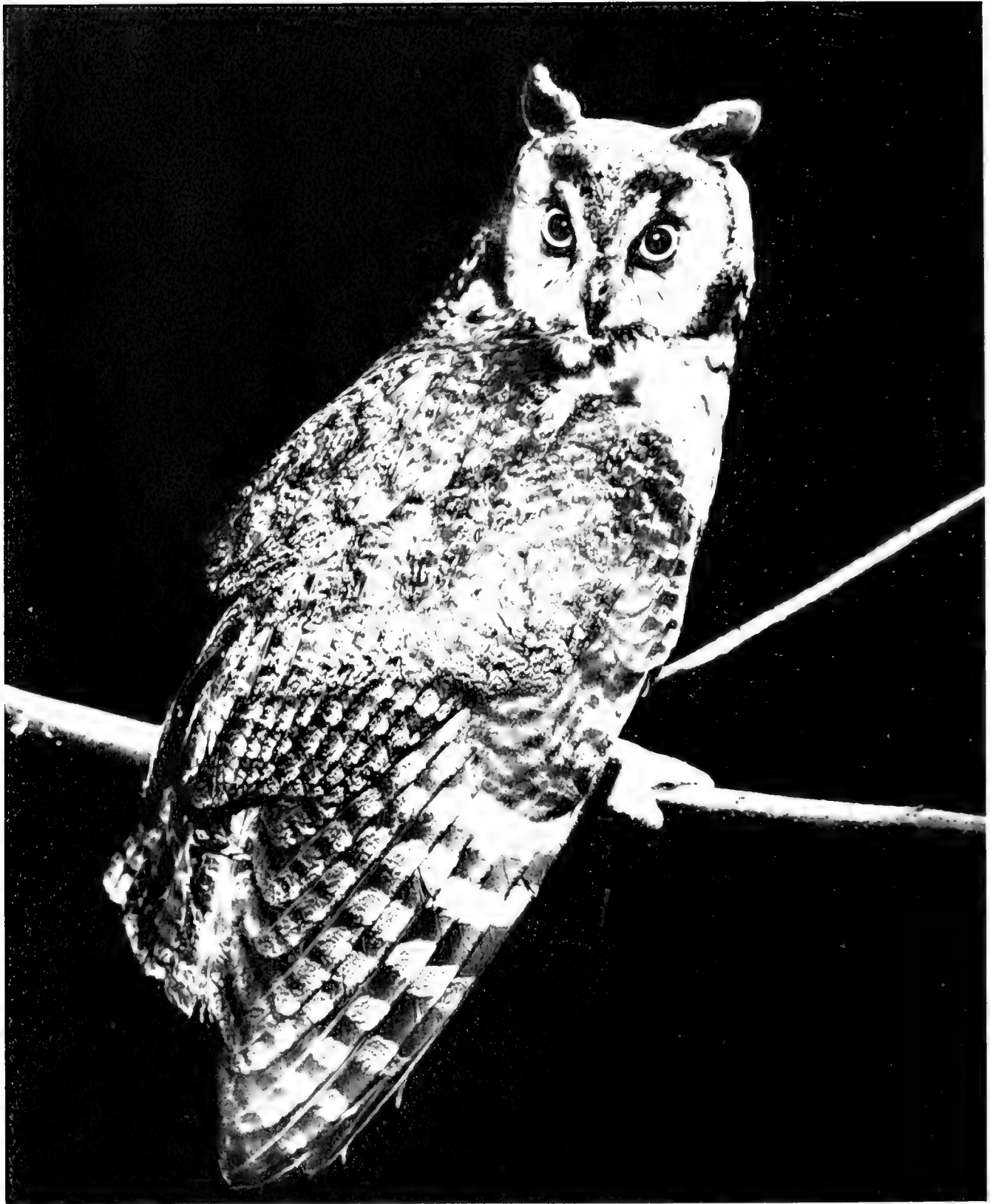


Fig. 24. - Long-eared owl. Smaller (13-16 inches) than the great horned owl. The long-eared owl was reported with greatest frequency in northern Illinois. Long-eared owls favor evergreen plantations for winter roosting sites; several owls may roost close together.

central Illinois, where the winter sparrow hawk population has always been relatively low.

The record for the red-tailed hawk is fairly uniform except for a high density peak in central Illinois in the early 1930's, figs. 13 and 14. Again the pattern of peaks is higher in early years than in later years.

The record for the marsh hawk shows no consistent declining trend in central and southern Illinois, figs. 16 and 17. However, for later years there is a suggestion of decline in central Illinois and of increase in the southern region.

Like that for the marsh hawk, the census record for the red-shouldered hawk shows no consistent declining trend in the state, figs. 19 and 20. In the record for central Illinois, high density peaks occurred in early years (before 1930); in southern Illinois, red-shouldered hawks have increased in recent years.

The rough-legged hawk was seen in central Illinois with increasing frequency from 1900 to about 1920, after which the frequency tended to fall until about 1945-1950, fig. 22. The density of rough-legged hawk populations tended to follow the pattern of frequency; the population has decreased decidedly from 1900 to recent years, fig. 23.

Both early and late in the period, numbers of rough-legged hawks fell to zero in some years; it is the peaks that best show the decline. A 3- to 5-year cycle has been suggested by Wallace (1955:218) for both old and new world rough-legged hawks. The relatively complete record for central Illinois shows a fairly consistent 4-year cycle. In the 1930's rough-legged hawk numbers fell so low that annual fluctuations did not show. This level continued until the mid-1940's, when the numbers increased somewhat.

Though the record for the barred owl is very incomplete and has the largest gaps in the early years, the population trend shows the familiar pattern, the population being higher in early years and lower in later years. Records for other species of owls are even less complete, and their population trends were not evaluated.

Although winter populations of raptors as a group have generally decreased, the decrease is not reflected in each species of raptor.

The decrease in hawk populations has been attributed by Nice (1945:10) to both shooting of hawks and destruction of habitat. The effect of habitat destruction is difficult to evaluate because there are not sufficient statistical data on the extent of habitat change in Illinois. Also, the total effect of a change in habitat on any one species of raptor is virtually unknown. A given change may be detrimental to one species and beneficial to another. Before we can evaluate the effect of habi-

tat change, we need more precise information both on the ecology of all species of raptors and on the kind and amount of habitat change.

The effect of shooting would be most apparent among the less wary species and those species that are most frequently encountered. The rough-legged hawk, a relatively lethargic species, has suffered the most severe decrease in numbers of any of the species here considered. The red-tailed hawk and the sparrow hawk also have declined in numbers, and they are the species which have been reported with greatest frequency.

Returns from raptors banded in other states help to point out man's role in the population decline. Cooke (1941:151) said, "It is probably a safe estimate that nine-tenths of the recoveries [banded birds of prey] represent birds killed." Lincoln (1936) presented evidence that 75 per cent of the band recoveries for eastern species of raptors represented birds killed by man. Even for a species as rigidly protected as the bald eagle the proportion of banded birds killed by man is high—60 per cent as figured from data published by Broley (1947:7). These figures are difficult to evaluate. They are biased on one hand because the most likely source of band returns are birds taken by shooting or trapping and on the other because many bands probably go unreported.

Since 1900 the laws concerning protection of hawks and owls in Illinois have changed greatly. Until 1919 there was no explicit protection for any species of hawk. In 1919 most raptors gained legal protection, except the accipiters, duck hawk, pigeon hawk, and great horned owl. These were left unprotected until 1959, when the Illinois legislature passed a law protecting all species of hawks and owls. A few other states (Connecticut, Indiana, and Michigan, for example) give complete protection to hawks and owls, but most states continue to permit the killing of certain species of birds of prey—usually the accipiters and the great horned owl. Such limited protective laws for raptors are only partially effective; they ultimately depend upon the shooter's ability to identify the different species of raptors, and field identification of birds in this group is difficult for the untrained observer.

Christmas census data from Illinois show that observers encountered the protected species seven times as often as the species that were unprotected; consequently, it is the former group that is likely to suffer at the hands of the shooter as long as any species goes unprotected. During the period 1919-1959, when Illinois had protective regulations covering only some species of hawks and owls, the protected species declined in numbers in spite of legal protection.

SPECIES RECORDED ON CHRISTMAS COUNTS

Although the winter records for many of the species of raptors are too incomplete to show definite population trends, data for these species are of interest to students of Illinois birds and are summarized in the following annotated list. In general, the annotations are very brief, but a few species, such as the bald eagle and the broad-winged hawk, are discussed in some detail. The commonest Illinois raptors, which have been discussed in the previous section, are included with summary statements. No attempt was made to evaluate the authenticity of the records; they are reported here as they appeared in the published counts.

Turkey vulture, *Cathartes aura*. Recorded at three localities: 1 each at Mount Carmel, 1903, and Murphysboro, 1954; 3 at Urbana, 1955.

Black vulture, *Coragyps atratus*. Recorded at two localities: 6 at Horseshoe Lake, Alexander County, 1949; 2 at Murphysboro, 1954.

Goshawk, *Accipiter gentilis*. The least common of the accipiters recorded on the Illinois Christmas counts; reported with greatest frequency in the central and least in the southern zones. Largest number recorded on a locality count: 5 at Havana, 1949.

Sharp-shinned hawk, *Accipiter striatus*. Recorded irregularly in each zone throughout the census period but with highest frequency in the southern. Largest number reported on a locality count: 13 at Grafton, 1949.

Cooper's hawk, *Accipiter cooperii*. Recorded throughout the census period and the state with increasing frequency from north to south. Largest numbers reported on locality counts: 3 at several localities; 7 at Grafton, 1940.

Red-tailed hawk, *Buteo jamaicensis*, cover photograph. The red-tailed hawk and the sparrow hawk were the two raptors most frequently reported on Illinois Christmas censuses. Largest numbers of red-tailed hawks reported on locality counts: 65 at Urbana, 1952; 47 at Grafton, 1950; 35 at Moline, 1955.

Sight records of oddly plumaged red-tailed hawks are always open to question, because of the extreme variability of the species. Western subspecies of the red-tailed hawk have been reported only rarely. A black individual was seen at Michael, 1947, and a bird identified as a western red-tail at Rockford, 1949.

The Krider's hawk, another subspecies, has been reported seven times: 1 at Glen Ellyn, 1943; 1 at Michael, 1951; 2 at Grafton, 1951; 1 at Lisle, 1953; 1 at Moline, 1954 and 1955; 1 at Waukegan, 1956.

Harlan's hawk, *Buteo harlani*. Two records: 1 at Grafton, 1950, and 1 at East St. Louis, 1951.

Red-shouldered hawk, *Buteo lineatus*. The fourth most frequently encountered hawk in the locality counts, recorded with highest frequency in the southern zone. Largest numbers reported on single counts: 15 at Bird Haven, 1954; 13 at Decatur, 1954; 12 at Moline, 1955.

Broad-winged hawk, *Buteo platypterus*. Astonishing numbers of the broad-winged hawk have been reported on Christmas censuses: 1.0 per cent of northern, 5.7 per cent of central, and 4.2 per cent of southern zone censuses; the reports were somewhat less frequent in early years than in later years.

Though it breeds in Illinois, the broad-winged hawk is one of the most strongly migratory of falconiform birds, usually wintering in South America. The Christmas census records for this species may contain errors of identification; the broad-winged hawk has a conspicuously banded tail, as does the adult red-shouldered hawk, and it is possible that the bulk of the broad-winged hawk records actually refer to the red-shouldered hawk. Winter records of the broad-winged hawk should be backed up by collected specimens when possible until the status of the species is firmly established.

Swainson's hawk, *Buteo swainsoni*. Two records of this western species, both in 1953: 1 each at Arlington Heights and White Pines Forest State Park.

Rough-legged hawk, *Buteo lagopus*. Recorded with highest frequency in central Illinois, lowest in the southern zone. Dark individuals recorded only rarely. Largest numbers recorded on individual counts: 28 at Rockford, 1955; 20 at Rantoul, 1919.

Golden eagle, *Aquila chrysaetos*, fig. 9. Recorded at two localities: 1 each at Horseshoe Lake, Alexander County, 1949, and Grafton, 1950.

Bald eagle, *Haliaeetus leucocephalus*, fig. 12. Nearly all of the bald eagle records are from localities near large rivers, especially the Mississippi. Frank C. Bellrose of the Illinois Natural History Survey stated in 1957 that bald eagles were increasing in number. This distinctive species was given protection in 1940; before 1935 bald eagles were rarely reported on Illinois counts. The frequency for the period 1903-1935 for this species was 0.016 per cent of the counts in northern Illinois and 0.036 per cent in central Illinois; none were reported from southern Illinois. In the decade 1945-1955, frequency of occurrence for the bald eagle rose to 5 per cent of the counts (north), 2 per cent (central), and 27 per cent (south). That this rise in frequency was not solely a matter of more extensive coverage in later years is indicated by analyzing the Christmas counts from Rock Island, Moline, and Port Byron. Between 1906 and 1952, raptors were reported on 34 censuses from

these localities. On the 21 counts made in the period 1906-1936 not one eagle was reported, but on the 13 counts made in the period 1936-1952 eagles were reported in increasing numbers in 77 per cent of these counts.

Published Christmas census reports from the Iowa localities of Bettendorf, Davenport, and Dubuque also showed the same trend. The Bettendorf censuses, made by one man, covered 5 years (1917 and 1920-1923 inclusive). Only one eagle was reported in this period.

The Davenport census covered 12 years (1943-1955, except 1953); bald eagles were reported in 10 of these (83 per cent frequency). Bald eagles were largely responsible for three of the four peaks in raptor populations during this period.

The Dubuque censuses, which covered 16 years (1939-1955, except 1942), indicate that the increase in eagle populations began in the 1940's. Bald eagles were not reported in 1939 or 1940; for the remaining 14 years, they were reported on 71 per cent of these counts. Of four raptor peaks indicated in Dubuque censuses in the period 1944-1955, three were due to increases in numbers of bald eagles.

Largest numbers reported on single Illinois counts: 63 at Grafton, 1950; 46 at Moline, 1953.

Marsh hawk, *Circus cyaneus*. The third most frequently encountered raptor in the Christmas census in Illinois, the frequency increasing from north to south. There is no indication of radical change in marsh hawk populations during the entire census period. Largest numbers reported on single counts: 22 at Grafton, 1953; 22 at Bird Haven, 1951; 15 at Michael, 1944.

Osprey, *Pandion haliaetus*. Recorded at three localities: 1 at Murphysboro, 1948; 1 at White Pines Forest State Park, 1953; 2 at Moline, 1955.

Gyr Falcon, *Falco rusticolus*. Recorded at one locality: 1 at Arlington Heights, 1953.

Peregrine falcon, *Falco peregrinus*. Single birds reported seven times in the Illinois Christmas census: Springfield, 1934 and 1936; Havana, 1949; Chicago, 1949; Moline, 1953; White Pines Forest State Park, 1953; and Grafton, 1954.

Pigeon hawk, *Falco columbarius*. Reported from eight localities: 1 each at Urbana, 1905; Ohio, 1922; Springfield, 1939; Grafton, 1939; Chicago, 1952; Arlington Heights, 1953; Lisle, 1955; and 3 at Grafton, 1941.

Sparrow hawk, *Falco sparverius*, fig. 2. This species and the red-tailed hawk were the raptors most frequently reported in the Illinois Christmas census. Frequency for the sparrow hawk increased from north to south. Largest number recorded on a count: 42 at Grafton, 1950.

Barn owl, *Tyto alba*, fig. 15. The barn owl has been

reported with slightly decreasing frequency from north to south. Largest number on single counts: 2 at several localities.

Screech owl, *Otus asio*. The screech owl has been recorded in central, northern, and southern Illinois, in order of decreasing frequency. The figures may indicate merely that this species is most easily detected in the least heavily forested areas. The screech owl was the second most frequently reported owl, the barred owl first. Largest numbers reported on single counts: 6 at Michael, 1947; 7 at Paxton, 1928.

Great horned owl, *Bubo virginianus*, fig. 18. The third most frequently reported owl, the great horned owl was reported most often in the more heavily wooded southern part of Illinois. Largest numbers recorded on single counts: 6 at Michael, 1947; 5 at Rockford, 1949.

Snowy owl, *Nyctea scandiaca*. This northern species was reported from six localities: 1 at Lisle, 1937; 4 in the Chicago area, 1949; 1 each at Waukegan and Havana, 1949; Moline, 1954; White Pines Forest State Park, 1955.

Barred owl, *Strix varia*, fig. 21. This species was the most commonly recorded owl, with frequency increasing from north to south. In northern Illinois, the barred owl seemed to be less common than either the screech owl or the great horned owl. Though southern Illinois offers the most suitable habitat for both great horned and barred owls, the great horned owl appears to be more successful in the northern and the barred owl more successful in the central part of the state. Largest numbers of barred owls reported on single counts: 8 at Moline, 1955; 7 at Murphysboro, 1951; 7 at Moline, 1953.

Great gray owl, *Strix nebulosa*. Only one record of the great gray owl: 2 at Moline, 1946.

Long-eared owl, *Asio otus*, fig. 24. Reported in northern, southern, and central Illinois, in order of decreasing frequency, this species was seen with about the same frequency as the short-eared owl. Largest number reported on a count: 37 at Lisle, 1955.

Short-eared owl, *Asio flammeus*. Reported with decreasing frequency from north to south. Largest number reported on a count: 38 at Rockford, 1950.

Saw-whet owl, *Aegolius acadicus*, fig. 1. Reported on 13 counts: 12 from northern and 1 from central Illinois. Largest number reported on a count: 2 at several localities.

SUMMARY

1.—Data on hawks and owls in Illinois, as reported in the Christmas counts sponsored by the National Audubon Society and its parent organizations, were ana-

lyzed to determine population trends for the years 1903-1955.

2.—Even though most of northern and central Illinois offered fairly uniform habitat of cultivated farm land with relatively little forest, the distribution of raptors was not uniform, and raptor populations varied considerably even within relatively small areas. Highest concentrations of raptors were in the southern part of the state. Through the years a given locality, in relation to other localities, has tended to show a consistent rank with regard to the density of its raptor populations, as reported in the Christmas counts.

3.—Analysis of frequency of occurrence for all species of raptors recorded on Christmas counts in the period 1903-1955 was based on 527 censuses—103 in southern, 123 in central, and 301 in northern Illinois. This analysis shows the expected higher frequency of prairie-inhabiting species of raptors in central and northern Illinois and of woodland species in southern Illinois. Regardless of habitat, certain species, such as the sparrow hawk and the marsh hawk, were seen with increasing frequency from north to south, as though responsive to the temperature cline.

4.—The combined data for all raptor species show that there has been a marked and consistent decline in winter raptor populations during the period 1903-1955. Peaks representing years of high population are lower in later years. Trends in raptor populations were de-

duced from birds per observer-hour, birds per party-hour, and birds per mile.

5.—The records of individual species show that the rough-legged hawk has suffered the severest decline in numbers; the red-tailed hawk, the sparrow hawk, and the barred owl also have decreased. Marsh hawk and red-shouldered hawk populations have not changed appreciably. The bald eagle has been increasing in numbers since the early 1940's, but this is the only species for which a notable increase was shown. The records for many species are too incomplete to evaluate.

6.—Because the decline in raptor populations is shown particularly among the less wary species and those species that are most likely to be encountered by man, it is suggested that man may be directly responsible for the decline. This view is corroborated by the fact that many raptor band returns are from birds that were trapped or shot and also by the indication that a notably lethargic species, the rough-legged hawk, has suffered the severest population decline.

7.—The species of raptors—*Buteo* spp., *Circus* spp., and *Falco sparverius*—that have been protected by law since 1919 were seen at least seven times as frequently on Illinois Christmas counts as the previously unprotected accipiters and the great horned owl.

8.—A briefly annotated list summarizes the winter records of the species of raptors reported from Illinois on Christmas counts in the period 1903-1955.

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