

OCCURRENCE OF THE AMERICAN WOODCOCK IN OKLAHOMA

By

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PREFACE

No significant research on woodcock was conducted in Oklahoma before 1970. In the spring of that year a breeding population of woodcock was discovered on the Oklahoma State University (OSU) Ecology Preserve, Payne County. This breeding population was monitored yearly by Dr. John S. Barclay and his students. After a chick and brooding hen were discovered in the spring of 1973, a study was initiated to determine the ecology of woodcock in northcentral Oklahoma.

During the period of 1970 to 1974, Barclay collected all available records of woodcock sightings in Oklahoma. His past interest in woodcock, the discovery of a breeding population, the possibility of increased woodcock numbers in Oklahoma, and the general lack of knowledge of the species in the state led to the initiation of the present study in August, 1974.

The objectives of this study are: to determine the breeding status and range of woodcock in Oklahoma; to determine their seasonal abundance along with the chronology and distribution of migrations through the state; to locate and map areas and habitat preferred by them; to evaluate the present importance and potential they have to Oklahoma hunters; and to evaluate their population characteristics in the states on the western periphery of the species range.

The ensuing report was prepared using three manuscripts written in formats which would facilitate submission to scientific journals for

publication. These manuscripts are presented as chapters in the report and each is complete in itself without additional supporting materials.

The manuscript entitled "The status and distribution of American woodcock in Oklahoma" was written according to the style and format of the PROCEEDINGS OF THE OKLAHOMA ACADEMY OF SCIENCE. The manuscripts entitled "Woodcock as a gamebird in Oklahoma" and "Woodcock populations on the western periphery of their range" were written in the format of THE JOURNAL OF WILDLIFE MANAGEMENT.

The study was funded by the Research Program for Migratory Shore and Upland Game Birds, U. S. Fish and Wildlife Service, U. S. Department of the Interior. Equipment and vehicles used during the study were provided by the Oklahoma Cooperative Wildlife Research Unit.

We are grateful for the cooperation and assistance of all Oklahoma Department of Wildlife Conservation personnel involved in this study, in particular Lemuel Due and Darrel Musgrove. We thank Dr. James Lewis and Dr. Ted Silker for advice during the early stages of the project and for editorial comments on the final draft. Dr. George Sutton, University of Oklahoma professor emeritus, graciously contributed his woodcock records, time and valuable insights. We appreciate especially the many reports and other contribution from students, hunters, landowners and the general public.

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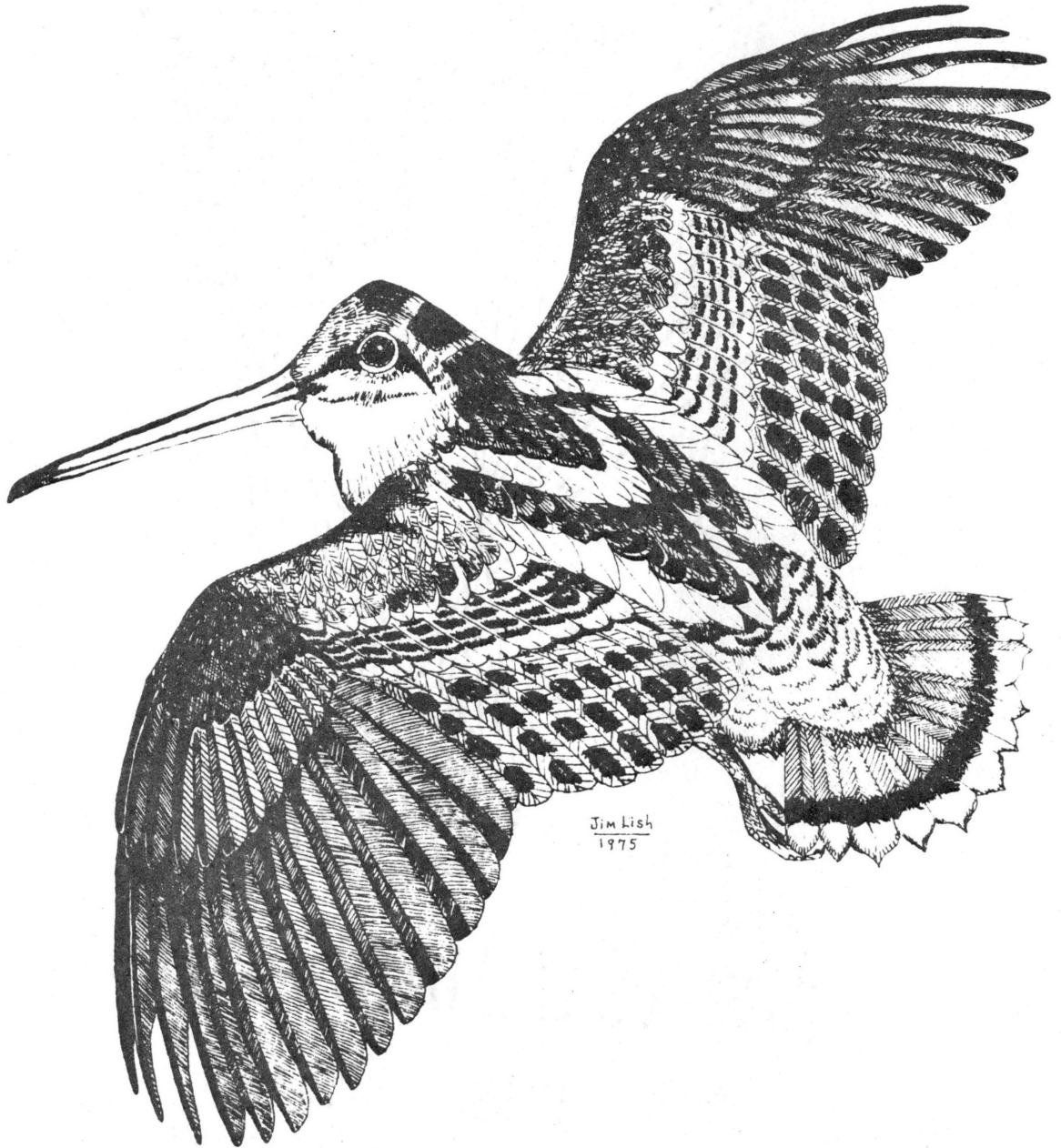
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Jim Lish
1975

CHAPTER I

THE STATUS AND DISTRIBUTION OF AMERICAN WOODCOCK IN OKLAHOMA

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The seasonal and spatial distribution of the American woodcock (Philohela minor) in Oklahoma were determined through field surveys and the collection of all known reports of woodcock sightings. Woodcock were reported in the state in all seasons and were most frequently sighted from 11 October to 10 January. The peak in fall migration occurred between 11 November and 10 December. Woodcock were found across the eastern two-thirds of the state but 75 percent of the observation reports during the study period came from east-central and southeastern Oklahoma. Spring roadside singing-ground surveys were conducted in 1975 and 1976. One hundred and forty-eight displaying woodcock were encountered by the surveyors. The peak number of displaying birds was observed during the second 10-day period in February. Woodcock were found displaying from January through late March. Personal observations, plus data reported via volunteer survey cards, indicated that a typical site used by woodcock in Oklahoma is a moist, brushy, bottomland with oak, elm, bluestem grasses, dogwood, and

broadleaf uniola present.

INTRODUCTION

The American woodcock (Philohela minor) has not until recently been considered a common bird in any part of Oklahoma. Nice (1) termed the bird a "rare transient" in eastern Oklahoma. Baumgartner and Howell (2) described woodcock as being rare fall visitants in Payne County, central Oklahoma. In a 1948 report, Fletcher and Temple (3) said woodcock "will never be an important gamebird in Oklahoma." They described the potential range for this bird as being the extreme eastern counties in the state. Sutton (4) described the woodcock as being a transient and summer visitant in eastern and central Oklahoma. Oklahoma has been excluded from most maps showing the distribution of breeding woodcock, and only the easternmost counties are included on maps showing the winter range of woodcock (5).

Woodcock sightings have been recorded in Oklahoma since 1913 (4), and the species has been documented in many counties, including some in the western part of the state. Sightings have increased over the past few years, and reports of nests have been confirmed. The increase in sightings statewide, the discovery of a Payne County breeding population in 1970, and capture for banding of a brood in 1972 (Barclay unpublished data) prompted further study of the American woodcock in Oklahoma.

The first funded project dealing with woodcock in the state was initiated in 1973 and concerned itself with the ecological relationships of the species in northcentral Oklahoma. The study focused on the

woodcock breeding population at the Oklahoma State University Ecology Preserve, Payne County, and involved analysis of breeding behavior and habitat use by woodcock (6).

A subsequent study was conducted in Oklahoma under the auspices of Oklahoma State University from June 1974-August 1976 to determine the status and potential of woodcock in Oklahoma. This paper deals with a portion of that study and concerns itself with the following objectives: 1) to determine the seasonal abundance and distribution of woodcock in Oklahoma; 2) to determine their breeding status and range in the state; and 3) to locate and map areas and habitat preferred by them.

METHODS

Seasonal abundance and distribution of woodcock in Oklahoma were determined through systematic field surveys and the collection of as many known sightings as possible. Woodcock observation reports in Oklahoma prior to 1970 were compiled by Sutton (4). Locations of sightings have been recorded since 1970 by Barclay (unpublished), Lambert and Barclay (6) and Smith (unpublished).

Past records of seasonal abundance and distribution were augmented by woodcock sightings collected during this study. A postage-paid, self-addressed "Woodcock Observation" postcard was sent to Oklahoma Department of Wildlife Conservation (ODWC) rangers, game biologists, and game management area managers, as well as U. S. Fish and Wildlife Service National Wildlife Refuge personnel and U. S. Army Corps of Engineers Project personnel. These postcards were also given to hunters and other persons known to have seen woodcock previously or known to frequent potential woodcock habitat. A woodcock observation form for

use by recipients was printed during the first year of the study in "The Scissortail", the news bulletin of the Oklahoma Ornithological Society. A news release was sent to newspapers asking persons seeing woodcock to report them to the authors. A note requesting woodcock sighting reports appeared in the November 1975 and January 1976 issues of "Outdoor Oklahoma", an ODWC publication.

Breeding

Singing-ground surveys, which enumerate "singing" males heard along predetermined routes, were used as an index to the size of breeding populations. These surveys were conducted in Oklahoma in springs of 1975 and 1976 to locate areas in the state containing displaying males, and to establish routes for future censusing. Surveys were conducted from late January through late March to coincide with the period when woodcock displayed in northcentral Oklahoma (6).

Singing-ground surveys were conducted in a manner similar to those conducted by the U. S. Fish and Wildlife Service (7). These surveys involved driving predetermined routes through probable breeding habitat in the morning and evening. Young forest stands near a creek bottom with redbud, cottonwood, sycamore or dogwood present generally constituted good sites for displaying woodcock when proximate to openings at least 10 m in diameter and containing some exposed soil (6). Routes were chosen that could be run in approximately 30 minutes and included 8 to 10 stops. Observers spent approximately 2 minutes at each stop, listening for the "peent" call and the wing twitter of the courtship flight. Observers started morning routes 45 minutes before sunrise, and evening routes 30 minutes after sunset. Accessible routes with good

potential for breeding woodcock were recorded and described for use in future singing-ground surveys (Appendix).

Some surveys were conducted by walking through areas containing potential display sites that were inaccessible by vehicle. This method proved successful where woodcock were known to have occurred previously and when the surveyor was familiar with the area. Surveyors recorded information on the number of birds, habitat characteristics and location.

Most survey routes in the spring of 1976 were in areas not surveyed in the spring of 1975 so that new displaying populations of woodcock could be located. Seven surveys were conducted in the same areas during both breeding seasons in order to provide data suitable for comparing population indices in the two years.

Habitat

Cooperators reporting woodcock on the observation cards were asked to mark the appropriate categories listed in reference to the habitat characteristics at the location of the sighting. They were also asked to list the two or three major plant species present where woodcock were seen. The habitat categories listed on the 1974-75 woodcock observation postcards were altered for the 1975-76 postcard survey because 5 of the 11 categories were found to provide little useful information. Six categories were added. The habitat section of 116 of the 157 returned woodcock observation postcards was correctly filled in and were used to describe sites frequented by woodcock in Oklahoma.

Woodcock sighting reports containing the location described by range, township and section, or by the distance from a known landmark,

were plotted on a map of Oklahoma. Vegetation maps were used to determine the general vegetation types of areas with the higher densities of woodcock sighting reports.

RESULTS AND DISCUSSION

Records of 483 woodcock were used to determine the seasonal distribution and relative abundance of woodcock in Oklahoma. Woodcock sighting reports collected by Sutton, Barclay, and Lambert prior to August 1974 accounted for 144 woodcock. The survey by the authors accounted for 114 woodcock observed September 1974 through May 1975 and 225 woodcock observed June 1974 through May 1976.

Seasonal distribution

Woodcock inhabited portions of Oklahoma throughout the year but were most frequently sighted 11 October-10 January (Figure 1). Migrating woodcock began arriving in Oklahoma in mid-October. The peak number of sightings occurred between 11 November and 10 December and appeared to be biased by the opening of the quail hunting season on 20 November. Apparent numbers of non-displaying woodcock remained low throughout the rest of the year and increased only slightly in April. This increase may have been due to young birds hatched in March because the peak number of spring migrants has been observed each year in mid-to-late February in northcentral Oklahoma (6). The peak in spring migration may also be shown in the numbers of displaying birds located (Figure 1).

The peak period for woodcock sightings prior to 1975 occurred earlier than in 1975 (Figure 2) and indicated a later than usual flight through Oklahoma that fall. Dr. William Marshall, University of

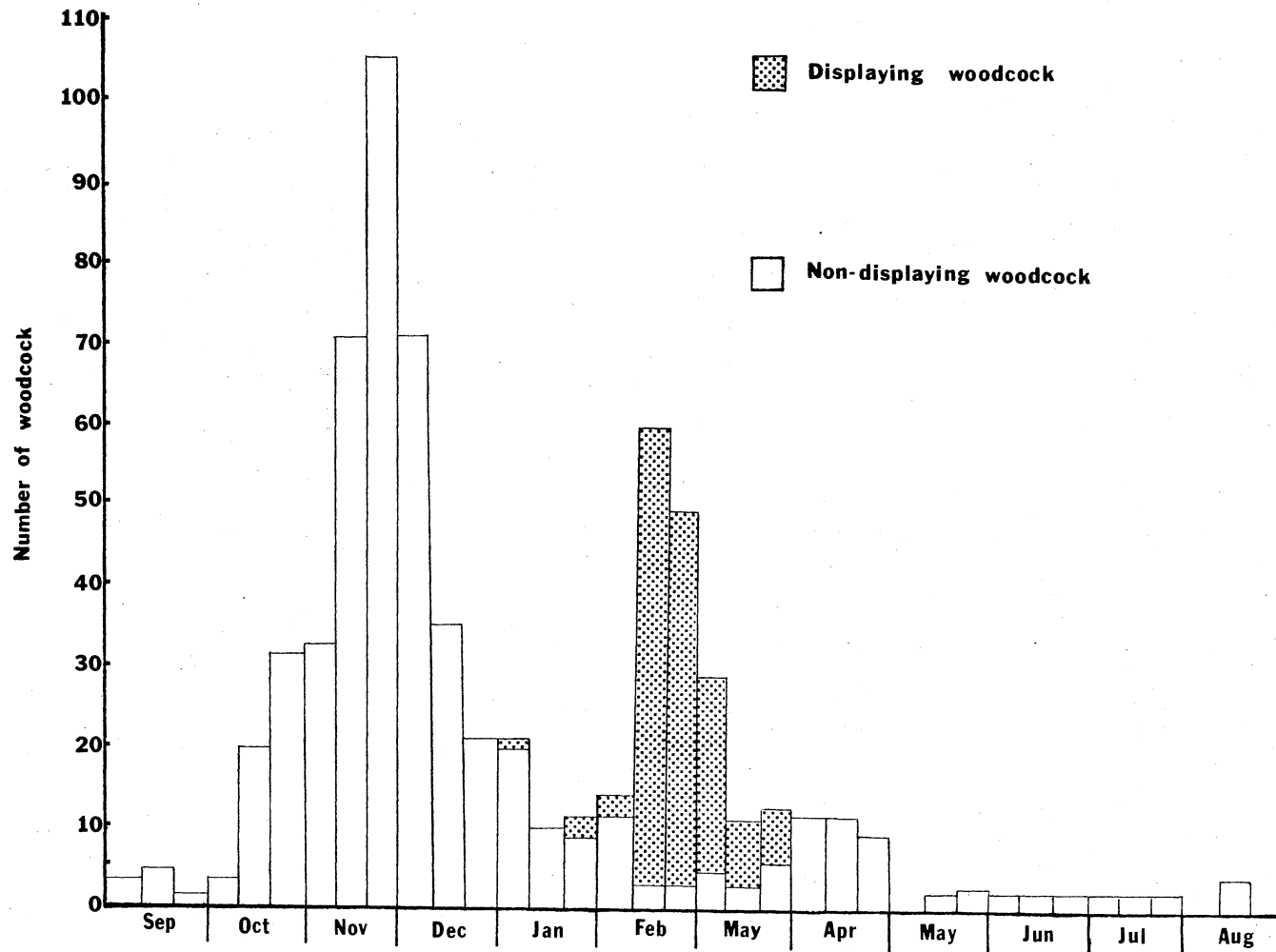


Figure 1. Distribution of woodcock sighted from Nov. 1913 to May 1976, excluding those on the OSU Ecology Preserve.

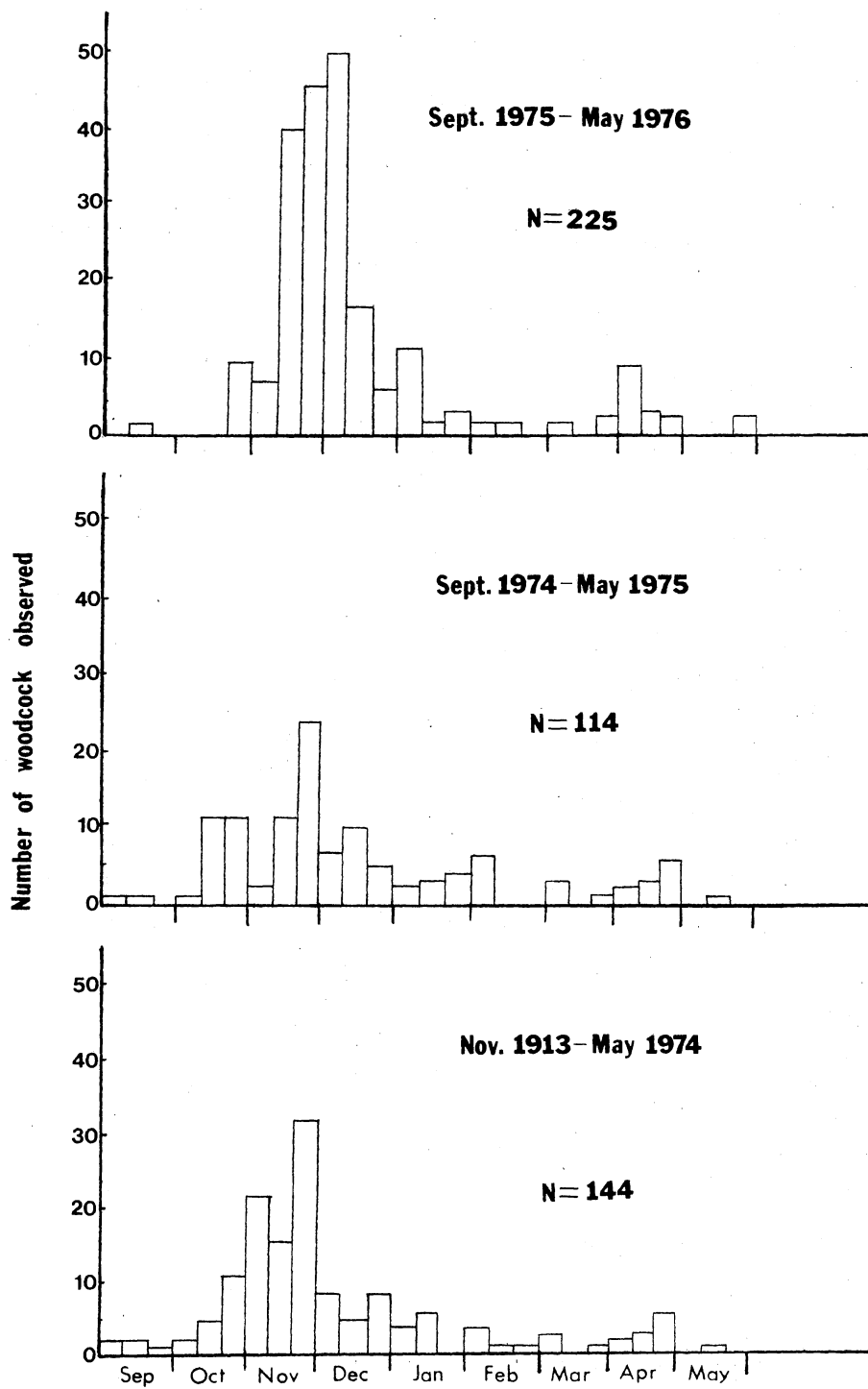


Figure 2. Distribution of non-displaying woodcock sighted during and prior to the study period.

Minnesota (pers. comm.) reported that there were woodcock in Minnesota through mid-November, 1975. This is apparently much later than in normal years when cold weather occurs earlier in the fall.

Spatial distribution

Woodcock have been reported across the state with the exception of the panhandle, but were not reported in the westernmost counties during the study (Figure 3). Although occasionally seen in the western counties, woodcock are most commonly found east of a line formed by Interstate Highway 35 (Figure 4). Over 73 percent of the woodcock reported in Oklahoma since 1973 were found in the two areas shown in Figure 5. Thirty-six percent (92 of 256) of the woodcock sighted were in the northern shaded area and 37 percent (94 of 256) were in the southern area. The northern area appears to represent a portion of the state drained by the Arkansas River. The southern region appears to represent an area drained by several rivers originating in the Ouachita Mountains. Reports of woodcock sightings have not come from that portion of the state between the two shaded regions since the beginning of the study.

Woodcock winter throughout eastern Oklahoma but are sighted most frequently in the southern portion of the state. Seventy-two percent (117 of 162) of the woodcock sighted before 1 December were in the northern half of the state, and more than two-thirds (112 of 166) of the woodcock sighted after 1 December were in southern Oklahoma. A Chi-square test revealed (Table 1) that the shift in sightings from north to south between fall and winter is highly significant ($P < 0.001$).

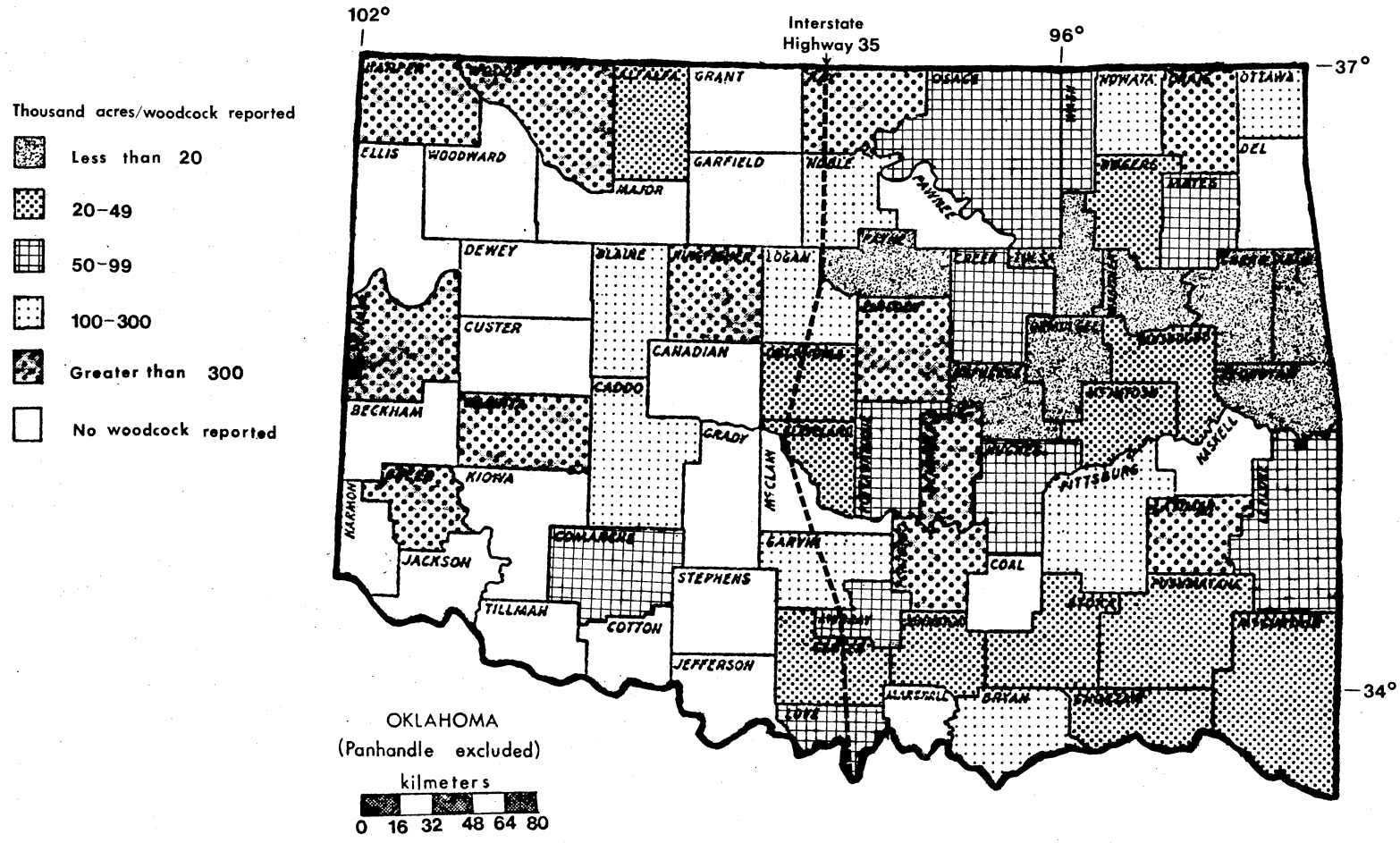


Figure 4. Relative distribution of 577 non-displaying woodcock sighted in Oklahoma from Nov. 1913 to May 1976.

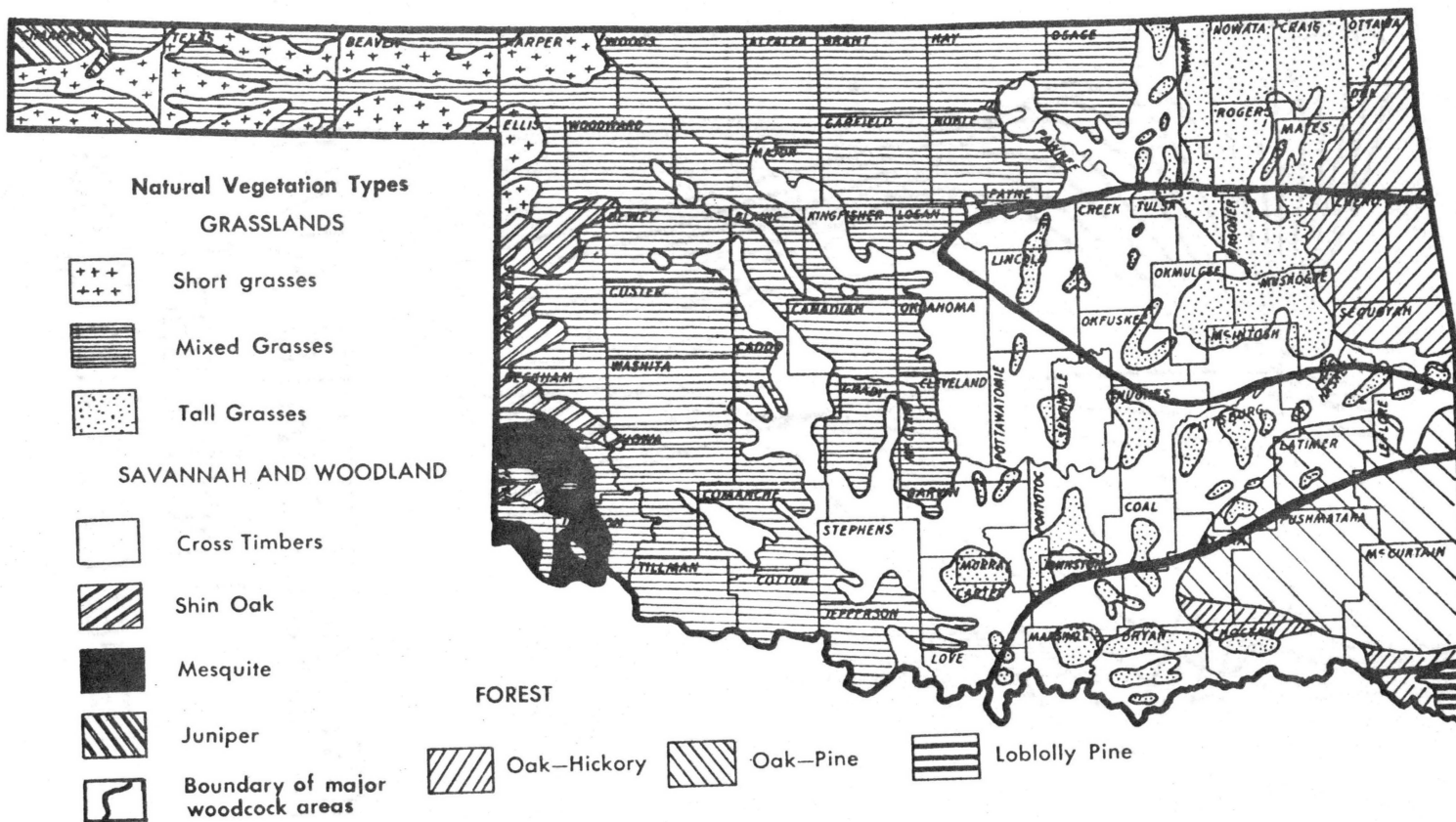


Figure 5. Oklahoma vegetation types and that portion of the state containing 73 percent of the woodcock sighting reports, Sept. 1974-May 1976 (adapted from Gray and Galloway 1959).

Table 1. Difference in north-south woodcock sightings from fall to winter.^a

	No. of woodcock				Total
	1 Sept.-30 Nov.		1 Dec.-1 Feb.		
	Observed	Expected	Observed	Expected	
Northern half of the state	117	84.5	54	86.5	171
Southern half of the state	45	77.5	112	79.5	157
Total	162		166		328

^aA Chi-square test shows the calculated $X^2 = 51.6$ with 1 df to be greater than the tabular value (10.83) at the 0.001 level; thus the difference in the north-south sightings during the two periods appears to be highly significant.

Populations of displaying woodcock were found scattered across the eastern one-half of the state. The distribution of the displaying birds approximates that of non-displaying woodcock except that displaying birds were found in a few counties where few non-displaying woodcock were reported. This apparent discrepancy might be the result of different habitat requirements for displaying and non-displaying woodcock, e.g. seasonal differences in soil moisture, vegetative cover, lack of display sites, or the result of the sampling techniques used.

Singing-ground surveys in 1975 and 1976 resulted in the location of 20 populations of displaying woodcock in 15 of the 24 counties surveyed (Figure 6). A total of 91 birds were located on 19 areas in the spring of 1976 compared to 57 displaying woodcock on 14 areas in the spring of 1975. An additional 7-12 breeding woodcock were closely observed each breeding season in Payne County.

Seven comparable routes from the two breeding seasons showed a decline in breeding birds from 33 in 1975 to 11 in 1976. Rainfall amounts during the two springs ranged from above normal in 1975 to below normal in 1976. The difference in rainfall amounts during the two breeding seasons is believed to have influenced selection of singing-ground sites by the woodcock.

The beginning of the breeding seasons was erratic and the exact date of initiation was not determined. Most display activity had begun by 1 February. One reliable report of a displaying bird was made in Johnston County, southern Oklahoma, in late November and two birds were observed displaying on the Ecology Preserve (Payne County) in north-central Oklahoma, on 26 December 1971. A woodcock was found displaying on 10 January 1975 in Haskell County and another was reported on 20

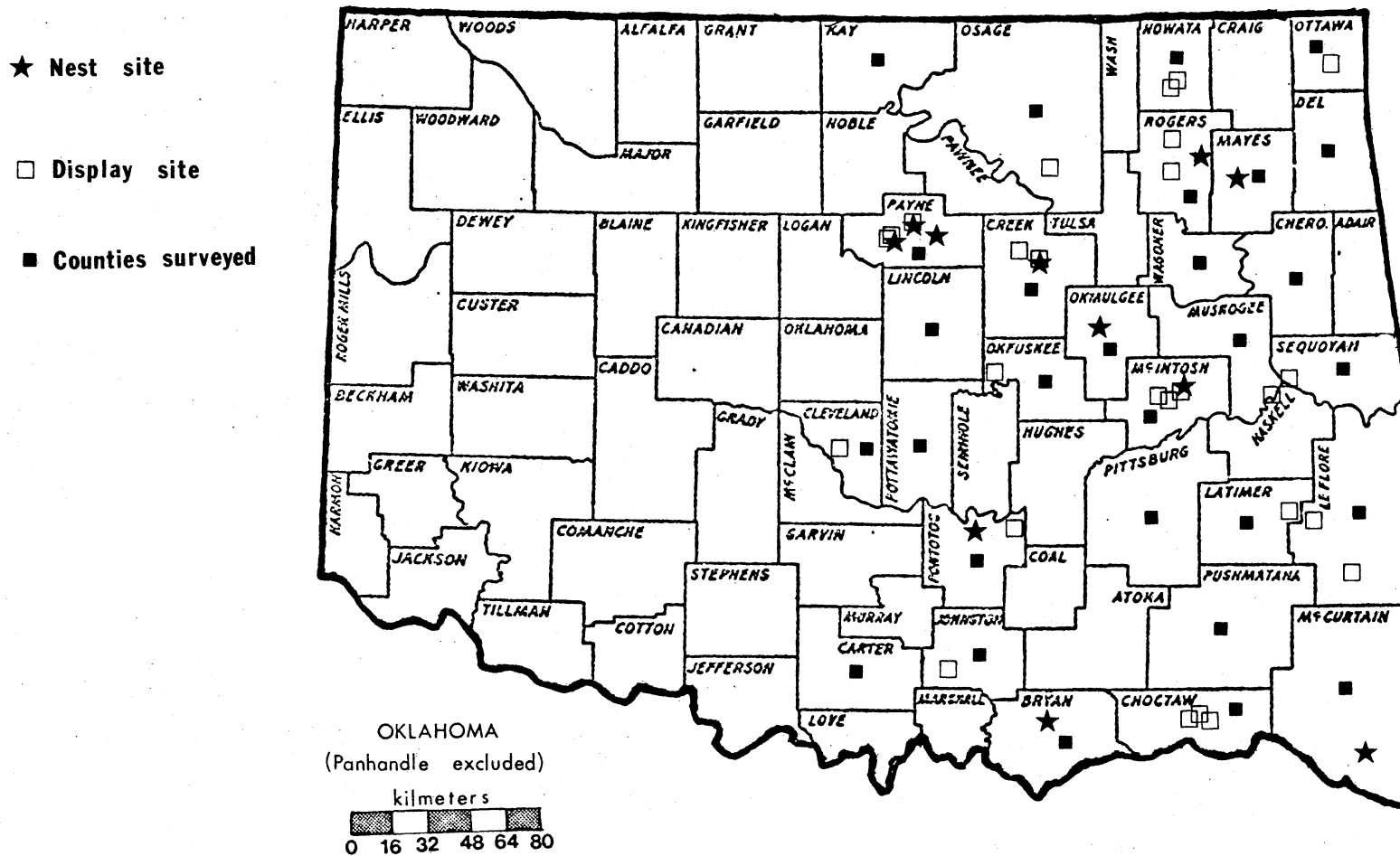


Figure 6. Approximate locations of woodcock display sites and nests and the counties in which singing-ground surveys were conducted in the springs of 1975 and 1976.

January 1976 in Rogers County. After the breeding seasons began, the woodcock became very active and the number of birds found displaying increased sharply (Figure 1). The time period in which the greatest number of displaying birds were located was the second 10-day period in February. The number of woodcock heard in each 10-day period declined from mid-February until the end of the breeding season. A resurgence of display activity by 1 to 3 birds in mid-to-late March has been observed in Payne County and is believed to represent re-nesting activities.

The ending of the breeding season occurred in mid-to-late March. Woodcock were found displaying in McIntosh County on 16 March 1975 but were not seen on 18 March of the same year. Woodcock displayed at a Creek County site on 17 and 25 March 1976, but were not seen after that date. Only one bird was found displaying in early April during the study period.

We believe the number of woodcock display sites located is quite low compared to the number actually existing in the state. There may be considerably more breeding activity taking place in Oklahoma because approximately 40 percent of the areas surveyed in 1975 and 35 percent of those surveyed in 1976 contained displaying birds. Woodcock were found at most sites surveyed whenever the sites contained good to excellent breeding habitat and weather conditions were favorable for courtship.

Nesting

Records of woodcock nests are scarce due to the lack of observers in woodcock habitat during the nesting season and to the difficulty of finding nests. A woodcock hen's tendency to remain on the nest until

an observer approaches to within 1-2 m makes finding the nest, by flushing the hen, difficult.

Eleven records of woodcock nests or broods have been confirmed in Oklahoma since 1944. Eight of the 11 reports have been recorded since Barclay began investigating woodcock in Oklahoma in 1970. Woodcock nests and broods have the same scattered distribution in eastern Oklahoma as do the displaying birds. Of the 11 nesting records, 3 have come from Payne County. The amount of potential nesting habitat appears to be much lower in Payne County than in many eastern Oklahoma counties, but woodcock habitat has been more intensively searched in the former.

The earliest recorded discovery of a woodcock nest in Oklahoma is 6 March and the latest is 10 April. Woodcock broods have been recorded from 10 March to 15 April. Earlier nesting is suspected in Oklahoma because, based on an incubation period of 21 days and 4 days for egg laying, the brood found on 10 March would have come from a nest containing eggs layed on or before 14 February. A brood possibly hatched after 15 April was discovered on 2 May 1954 at Devils Den State Park, Arkansas, 15 km east of the Oklahoma-Arkansas border.

Habitat

Results derived from the 116 "Woodcock Observation" postcards which contained useful habitat data are listed in Table 2. Woodcock were more frequently found on upland sites in 1974-75 than in 1975-76. Most woodcock reported in 1975-76 were located in bottomland sites with moist soil. Above average rainfall and frequent flooding were recorded in eastern Oklahoma in the fall of 1974 and below normal rainfall occurred in 1975. Flooded bottomlands and moist uplands may have caused greater

Table 2. Habitat characteristics recorded on 116 "Woodcock Observation" postcards 1 Sept. 1974-31 Aug. 1975 and 1 Sept. 1975-1 May 1976.

Category	Number of responses		Total
	1974-75	1975-76	
Upland site	28	12	40
Bottomland site	24	45	69
Ground moist	31	47	78
Ground dry	13	8	21
Brushy	28	34	62
Marshy	10	19	29
Wooded	a	34	
Grassy	a	19	
Cover dense	a	37	
Cover sparse	a	18	
Near a stream	a	37	
Near a pond or lake	a	25	
Tall grass	17	b	
Short grass	7	b	
Ground bare	4	b	
Ground cultivated	1	b	
Redbuds present	7	b	

^aCategory not included on the 1974-75 survey card.

^bCategory not included on the 1975-76 survey card.

utilization of upland sites in the fall of 1974 than in the fall of 1975 when upland sites were dry and bottomland sites were free of standing water.

Woodcock reported in 1975-76 were more frequently found: (1) in wooded areas rather than in grassy areas; (2) in dense cover rather than in sparse cover; and (3) near a stream rather than near a pond or lake. Woodcock reported in 1974-75 were more frequently seen in tall grass than in short grass. This difference could reflect greater woodcock utilization of areas ungrazed or lightly grazed than of areas heavily grazed by cattle.

The categories listed on both survey cards show general habitat characteristics of sites used by woodcock. The category most frequently checked by observers was "ground moist." This category was followed in frequency by "bottomland site" and "brushy."

Cooperators listed two or three major plant species at the location of the woodcock sighting on "Woodcock Observation" postcards. Oaks (Quercus spp.) were most frequently listed, followed in frequency by elm (Ulmus spp.), bluestem grass (Andropogon spp. and Schizachyrium scoparium) and greenbriar (Smilax spp.) (Table 3). Locations where woodcock were flushed by the author also frequently contained dogwood (Cornus spp.) and broadleaf uniola (Uniola latifolia).

The geographical area where 73 percent of the woodcock were sighted during the period of September 1974-May 1976 was outlined on a vegetation map of Oklahoma to show the major vegetation types occurring in areas with greater woodcock densities (Figure 5). The majority of woodcock sightings occurred east of that portion of the state composed of a mixed grass vegetation type. The cross timbers and tall grass

Table 3. Major plant species found at woodcock sighting locations; reported on "Woodcock Observation" postcards, September 1974-May 1976.

Species	Frequency
Oak	51
Unspecified (<u>Quercus</u> spp.)	28
Post oak (<u>Quercus stellata</u>)	13
Blackjack (<u>Quercus marilandica</u>)	19
Pin oak (<u>Quercus palustris</u>)	1
Elm	29
Unspecified (<u>Ulmus</u> spp.)	22
Winged-elm (<u>Ulmus alata</u>)	4
American (<u>Ulmus americana</u>)	3
Bluestem	25
Unspecified	12
Broomsedge (<u>Andropogon virginicus</u>)	7
Big bluestem (<u>Andropogon gerardi</u>)	3
Little bluestem (<u>Schizachyrium scoparium</u>)	3
Greenbriar (<u>Smilax</u> spp.)	24
Shortleaf pine (<u>Pinus echinata</u>)	11
Willow (<u>Salix nigra</u>)	10
Cottonwood (<u>Populus deltoides</u>)	10
Eastern red cedar (<u>Juniperus virginiana</u>)	8
Pecan (<u>Carya illinoensis</u>)	7
Grasses--unspecified	7
Hackberry (<u>Celtis</u> spp.)	6
Hickory (<u>Carya</u> spp.)	6
Buckbrush (<u>Symphoricarpos orbiculatus</u>)	5
Persimmon (<u>Diospyros</u> spp.)	5
Sumac (<u>Rhus</u> spp.)	4
Buttonbush (<u>Cephalanthus occidentalis</u>)	4
Ash (<u>Fraxinus</u> spp.)	4
Burmuda grass (<u>Cynodon dactylon</u>)	4
Osage orange (<u>Maclura</u> spp.)	3
Hawthorn (<u>Crataegus</u> spp.)	3
Sweet gum (<u>Liquidambar styraciflua</u>)	3
Rough-leaved dogwood (<u>Cornus drummondii</u>)	3
Indian grass (<u>Sorghastrum nutans</u>)	3
Johnson grass (<u>Sorghum halepense</u>)	3
Black locust (<u>Robinia pseudoacacia</u>)	2
Redbud (<u>Cercis canadensis</u>)	2
Sycamore (<u>Platanus occidentalis</u>)	2
Cattail (<u>Typha</u> spp.)	2
Lespedeza (<u>Lespedeza</u> spp.)	1
Panic grass (<u>Panicum</u> spp.)	1
Goldenrod (<u>Solidago</u> spp.)	1

Table 3 (Continued)

Species	Frequency
Blackgum (<u>Nyssa sylvatica</u>)	1
Tree sparkleberry (<u>Vaccinium arboreum</u>)	1
Trumpet creeper (<u>Campsis radicans</u>)	1
Wild millet (<u>Echinochloa crusgalli</u>)	1
Basswood (<u>Tilia spp.</u>)	1
Soybean (<u>Glycine max</u>)	1
Cypress (<u>Taxodium distichum</u>)	1
Sandplum (<u>Prunus angustifolia</u>)	1
Ragweed (<u>Ambrosia psyllostachia</u>)	1
American holly (<u>Ilex spp.</u>)	1
Peanut (<u>Arachis spp.</u>)	1

types occur in both of the high density areas with the oak-hickory type found in the northern region and the oak-pine type found in the southern region. Many of the woodcock sightings found in the western half of the state (Figure 1) were in the cross timbers vegetation type. Two surveys in the coastal plain loblolly pine area in extreme southeastern Oklahoma failed to produce woodcock.

The general vegetation type does not seem to be the dominating factor that controls habitat selection by woodcock. Several of the sighting reports have come from the oak-hickory vegetation type, yet no woodcock were reported in Ottawa or Delaware counties which are predominantly vegetated by this type. The same situation occurs in parts of the cross timbers, tall grass, and oak-pine vegetation types.

Most woodcock sighted in Oklahoma have been found near a stream or other wet area. Land use along streams appears to have a major impact on the vegetation characterizing the area. It has been our experience

that, along most streams in the state, woodcock are found only in the "pockets" of existing suitable habitat. Much of the remaining wooded riparian habitat has been either converted to cultivation or overgrazed by cattle. Heavy grazing of wooded areas by cattle may be responsible for more woodcock habitat destruction than any other factor.

CONCLUSIONS

Oklahoma is a western fringe state for woodcock wintering, migration and production. Migrant and breeding woodcock have been found to be more abundant in Oklahoma than previously recognized by most authorities. In addition to the greater number of woodcock reported in Oklahoma, there has been an increase in recent years in the number of sightings coming from areas other than the easternmost counties. Woodcock habitat in Oklahoma has been defined and may be increasing due to farm abandonment, control of fire, unused land purchased for speculative purposes, and land left idle after the construction of the many large reservoirs in the state.

Further study is needed in order to determine more specifically those factors which are limiting to woodcock in Oklahoma. Soil type and association, physiography, elevation, precipitation, land use, and plant species composition are all factors which should be documented in areas used and not used by woodcock so that potential habitat for the species can be mapped. This information could then be used in future management plans by state resource agencies.

Oklahoma may never produce the quantities of woodcock found in more central portions of the species range. However, the state could become a comparatively more important production area as good breeding habitat

in other states becomes limited, hunting pressure on woodcock increases, and if new and ongoing management programs by resource agencies in the state consider woodcock requirements in their programs. A possible westward expansion of woodcock, as seen in other states such as Texas (Keith Arnold, Texas A & M University, pers. comm.), combined with possible increasing habitat, might make Oklahoma a more important woodcock state in the future.

ACKNOWLEDGMENTS

The U. S. Fish and Wildlife Service, Accelerated Webless Migratory Research Program for Shore and Upland Game Birds, provided financial support for this study (Contract No. 14-16-008-878). Lemuel Due, Oklahoma Department of Wildlife Conservation (ODWC) provided assistance with the contract and data collection. Darrel Musgrove, ODWC, contacted law enforcement personnel for assistance in data collection. Special thanks is due all cooperators reporting woodcock sightings.

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CHAPTER II

WOODCOCK AS A GAMEBIRD IN OKLAHOMA

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Abstract: Eastern Oklahoma hunters were surveyed using a mail questionnaire in November and December, 1975 to determine their utilization of woodcock. A total of 4,200 questionnaires were mailed and 358 (9 percent) were returned. Eighty percent of the respondents claimed to be able to identify woodcock and 81 percent claimed to have seen woodcock in Oklahoma. Quail hunters accounted for 48 percent of the respondents who reported seeing woodcock while hunting and 75 percent of those hunters bagging woodcock. Those hunters seeing woodcock in the state averaged seeing 14.4 woodcock per year. Hunters claiming to have bagged woodcock (10 percent of the respondents) averaged 3.4 woodcock bagged per season. An Oklahoma Department of Wildlife Conservation statewide hunter questionnaire survey following the 1975-76 hunting season indicated that 0.6 percent of all Oklahoma hunters bagged an average of 2.2 woodcock during the hunting season. It was estimated that 2,000 to 3,000 woodcock are annually bagged in Oklahoma.

Data obtained from the U. S. Fish and Wildlife Service's annual waterfowl hunter survey have shown that few Oklahoma hunters bag woodcock (Clark 1972). Since 1970, when Oklahoma first reported woodcock wings returned to the Migratory Bird Research Center, Laurel, Maryland, the state has ranked very low in terms of the number of wings returned. However, studies by the authors since 1970 indicate wider distribution and greater numbers of both woodcock and woodcock harvested in the state than has been previously recognized.

The Oklahoma Department of Wildlife Conservation (ODWC) did not include woodcock in the list of species hunted on their annual hunter questionnaire survey prior to 1975, but a few woodcock were listed by hunters in the "other species hunted" category (Lemuel Due, Migratory Bird Supervisor, ODWC, pers. comm.). Reports from Oklahoma hunters prior to this study indicated that woodcock were often seen within eastern Oklahoma, but that the species was infrequently hunted or bagged. Those hunters who reported bagging woodcock stated that they were usually hunting quail, and infrequently hunting rabbits and other game species, when woodcock were encountered.

The status of some migratory gamebirds within a defined region is partially controlled by the hunting pressure placed on them in that region. Conversely, the amount of hunting pressure placed on a game animal in a defined region will normally be controlled by the status and abundance of the species in that region. Prior to our study, few data had been collected that could be used to determine the numerical status of woodcock in Oklahoma, or the hunting pressure woodcock receive from Oklahoma hunters. Such information is necessary so that management recommendations, including bag limits and hunting season dates, might be

made for the optimum use of woodcock in the state.

The status and distribution of woodcock in Oklahoma was determined and reported (Smith 1977). A hunter questionnaire developed and used to determine the present importance and the potential woodcock might have to Oklahoma hunters provided the basis for this paper.

The U. S. Fish and Wildlife Service, Accelerated Webless Migratory Bird Research Program provided financial support for this study. The Oklahoma Department of Wildlife Conservation provided hunting license receipts for hunters names and addresses. Dr. William Ward, O.S.U. Statistics Department, helped with the data analysis. We thank all persons who helped sort hunting license receipts. We especially thank all hunters responding to the mail survey.

MATERIALS AND METHODS

Eastern Oklahoma hunters were surveyed by use of a mail questionnaire in November and December, 1975 (Fig. 1). The survey was designed to yield information on knowledge and harvest of woodcock by hunters, and to delineate where hunters were seeing woodcock.

The eastern one-half of the state was chosen to be surveyed because previous surveys by the authors showed that woodcock are mainly confined to that portion of the state (Fig. 2). Hunters' names and addresses were randomly selected from hunting license receipts provided by the Oklahoma Department of Wildlife Conservation. The license receipts were stratified by counties in which the licenses were purchased. Budgetary restriction allowed only for the printing and mailing of 5,000 questionnaires. The percentage of the area of each survey county to the total area surveyed was determined and this

OKLAHOMA WOODCOCK SURVEY

Dear Hunter:

We are conducting a survey at Oklahoma State University, in cooperation with the Oklahoma Department of Wildlife Conservation, to find out more about one of Oklahoma's little known game birds, the American woodcock, and its importance to Oklahoma hunters. We need your help in determining how many hunters recognize woodcock, where in Oklahoma you see them, how many you see, and how important they are to you as a game bird.

Please fill out the survey, tear the card apart, and mail the survey portion. If you would be willing to further help us by reporting woodcock observations on business reply postcards we provide, please indicate so on the last question. Your help is most important to this study and the future of woodcock in Oklahoma.

Tear along dotted line

Did you recognize the bird pictured as being a woodcock?

Yes _____ No _____

Have you ever seen a woodcock in Oklahoma? Yes _____ No _____

If so, in what county(ies) do you most often see them? _____

Approximately how many do you see each year? _____

Are you usually hunting when you see woodcock? Yes _____ No _____

If so, what game species are you hunting? _____

Approximately how many woodcock do you bag each season? _____

If you knew where there were woodcock, would you hunt them?

Yes _____ No _____

Would you be willing to participate further in this study?

Yes _____ No _____

Fig. 1. Hunter questionnaire used in the 1975 survey.

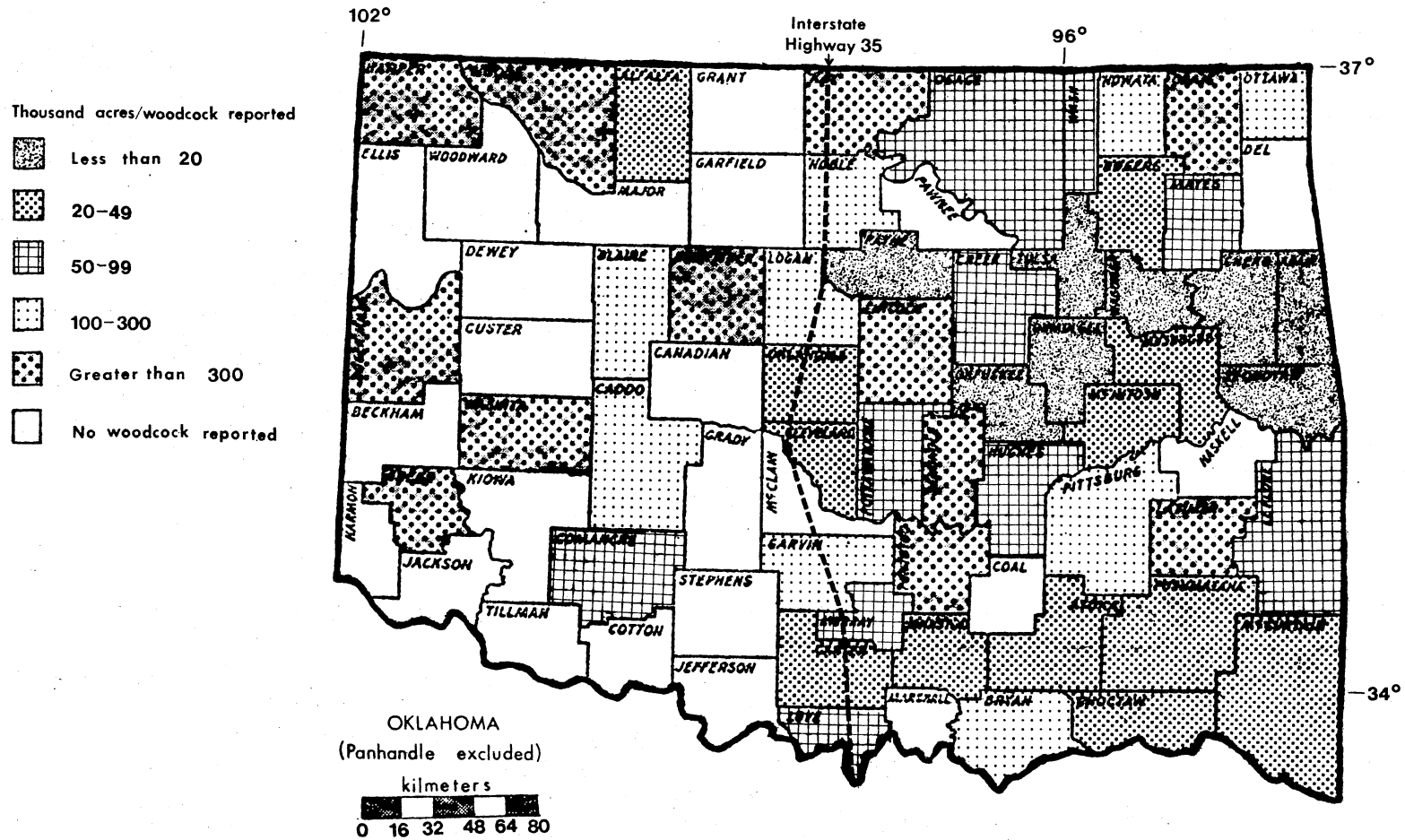


Fig. 2. Relative distribution of 577 non-displaying woodcock sighted in Oklahoma from Nov. 1913 to May 1976.

percentage was used to determine the number of the 5,000 questionnaires to be mailed in each county. The questionnaires were mailed to 4,200 hunters in 35 counties rather than the planned 5,000 questionnaires to 46 counties because hunting license receipts for the remaining 11 counties did not become available (Fig. 3). The survey included 3,700 questionnaires mailed third class and 500 mailed first class. The first class mailing was used to develop an estimate of the percentage of survey cards that were deliverable because third class mail is not returned to the sender when undeliverable. The number of first class cards returned provided only a minimum estimate of those questionnaires that were undeliverable because first class mail is forwarded with an address change whereas third class mail is discarded with a change of address.

The first objective of the survey was to determine the ability of Oklahoma hunters to identify woodcock. Our conversation with hunters prior to the survey often indicated that they were unable to distinguish between woodcock and snipe. Therefore illustrations of a woodcock in flight and at rest were included and hunters were asked whether or not they recognized the bird pictured as being a woodcock.

Respondents were asked whether or not they had seen woodcock in Oklahoma. Those seeing woodcock were provided space to record the counties where they most frequently encountered them. Hunters were requested to report the number of woodcock sighted per year and bagged per year. The resulting data were stratified by county in which respondents reported seeing woodcock to give the distribution and relative abundance of woodcock seen and bagged. The data were used to

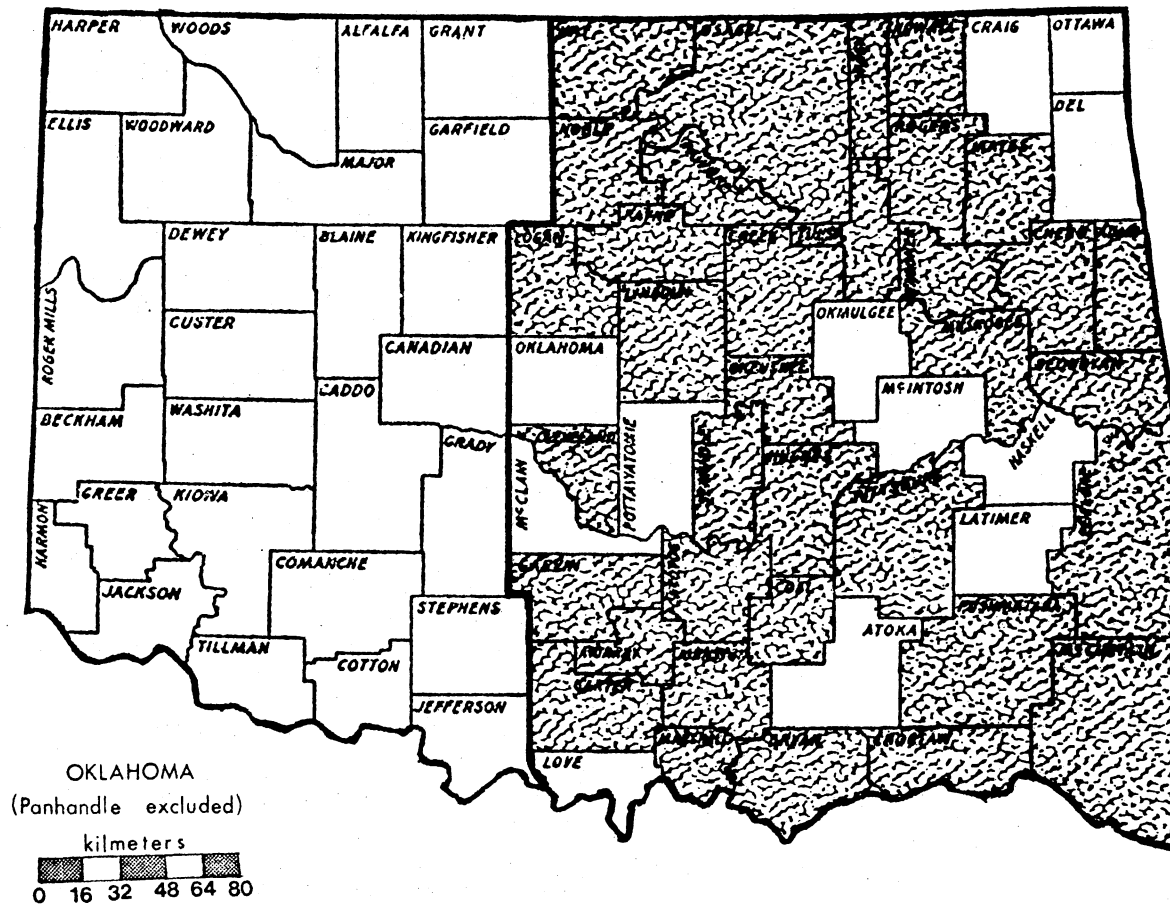


Fig. 3. Counties surveyed in the hunter questionnaire survey, 1975.

calculate index values such as the number of woodcock sighted per year per respondent and the number of woodcock bagged per respondent per year. The reports also provided information concerning the potential percentage of hunters hunting woodcock.

Hunters were asked if they were usually hunting when they saw woodcock and, if they were, what game species they were hunting. This information was used to determine the type of hunters seeing and bagging woodcock in Oklahoma. The information was also used in checking to see if hunters were misidentifying woodcock. It is probable that many of the persons reporting large numbers of woodcock sighted per year while hunting such species as waterfowl might actually be seeing common snipe or other shorebirds. Reports of woodcock observations by persons hunting quail, rabbits, or other species commonly found in or near woodcock habitat were thought to be more reliable.

The Oklahoma Department of Wildlife Conservation included woodcock for the first time on the list of species hunted on their annual hunter's questionnaire survey following the 1975-76 hunting season. The resulting information from the ODWC survey was compared to that received from the hunter questionnaire survey conducted by the authors.

RESULTS AND DISCUSSION

Approximately 9 percent (358) of the 4,200 questionnaires were returned (Table 1) and were used for determining woodcock-hunter relationships. It was estimated that 592 questionnaires would have been returned (14.1 percent of an estimated 3,814 delivered questionnaires) had all been mailed first class. The additional cost of \$370 to mail all questionnaires first class would have resulted in a 60 percent

increase in return, but the cost exceeded available funds.

Table 1. Hunter response to eastern Oklahoma woodcock questionnaire mailed in November and December, 1975.

Questionnaires	Mailing		Total
	1st class	3rd class	
No. sent	500	3,700	4,200
No. returned- useable	64	294	358
Percent-useable	12.8	7.9	8.5
No. returned- undeliverable	46	340 ^a	386 ^a
Percent- undeliverable	9.2	9.2 ^a	9.2
No. sent minus estimated no. undeliverable	454	3,360 ^a	3,796 ^a
Percent response (no. mailed minus no. undeliverable)	14.1	8.75 ^a	9.43 ^a

^a Approximate value because the number of undeliverable questionnaires mailed third class is greater than for those mailed first class as third class mail is not forwarded.

The ability of Oklahoma hunters to identify woodcock was tested by their ability to identify the woodcock illustrations. Eighty percent (285) of 356 hunters answered affirmatively when asked if they could identify the bird pictured as a woodcock. Six respondents commented that they had called the pictured bird a "killdeer", "jacksnipe" or

other names. The high percentage of hunters identifying woodcock should be viewed with caution when considering the results of a West Virginia survey. West Virginia officials found that when hunters reporting bagging woodcock on their mail questionnaire were shown six gamebird pictures, only 29 percent of the hunters could identify the picture of a woodcock (Ruckel 1969).

Respondents were asked whether or not they had seen woodcock in Oklahoma. Two hundred and forty-nine of the 350 persons (81 percent) responding to this question answered affirmatively. The hunters seeing woodcock in Oklahoma averaged 14.4 woodcock sighted per year (Table 2).

The mean number of woodcock seen/hunter/year was calculated for each of the counties in which woodcock were reported by hunters (Fig. 4). Most counties with the greater numbers of woodcock seen/hunter/year were located in the northern and southeastern portions of the area surveyed. The areas in the state with the greater densities of woodcock reported by hunters corresponds closely with the relative distribution map constructed by the authors from the compilation of all known woodcock sightings (Fig. 2). The greatest average reported number of woodcock/seen/hunter was 44.7 for Pushmataha County in southeastern Oklahoma.

Hunters seeing woodcock were asked if woodcock were observed while the respondent was hunting in Oklahoma. Two hundred and fourteen of 259 persons (83 percent) answered the question affirmatively, and averaged 14.5 woodcock sighted per year. Fourteen percent (37 of 261) stated that they had bagged woodcock, and listed an average of 3.4 woodcock per hunting season (Table 3).

Table 2. Relative number of woodcock seen per year by those hunters that reported seeing woodcock in Oklahoma.^a

Number of woodcock observed	Frequency (hunters)	Percent
0	10	3.9
1-5	101	39.0
6-10	65	25.1
11-15	27	10.4
16-20	18	7.0
21-25	8	3.1
> 25	<u>30</u>	<u>11.6</u>
Total	259	100.1

^aAverage of 14.4 woodcock per hunter.

Table 3. Relative number of woodcock bagged per season by those hunters that reported seeing woodcock in Oklahoma.^a

Number of woodcock bagged	Frequency (hunters)	Percent
0	224	85.8
1-2	19	7.3
3-5	10	3.8
6-10	6	2.3
> 10	<u>2</u>	<u>0.8</u>
Total	261	100.0

^aHunters bagging woodcock averaged 3.4/season.

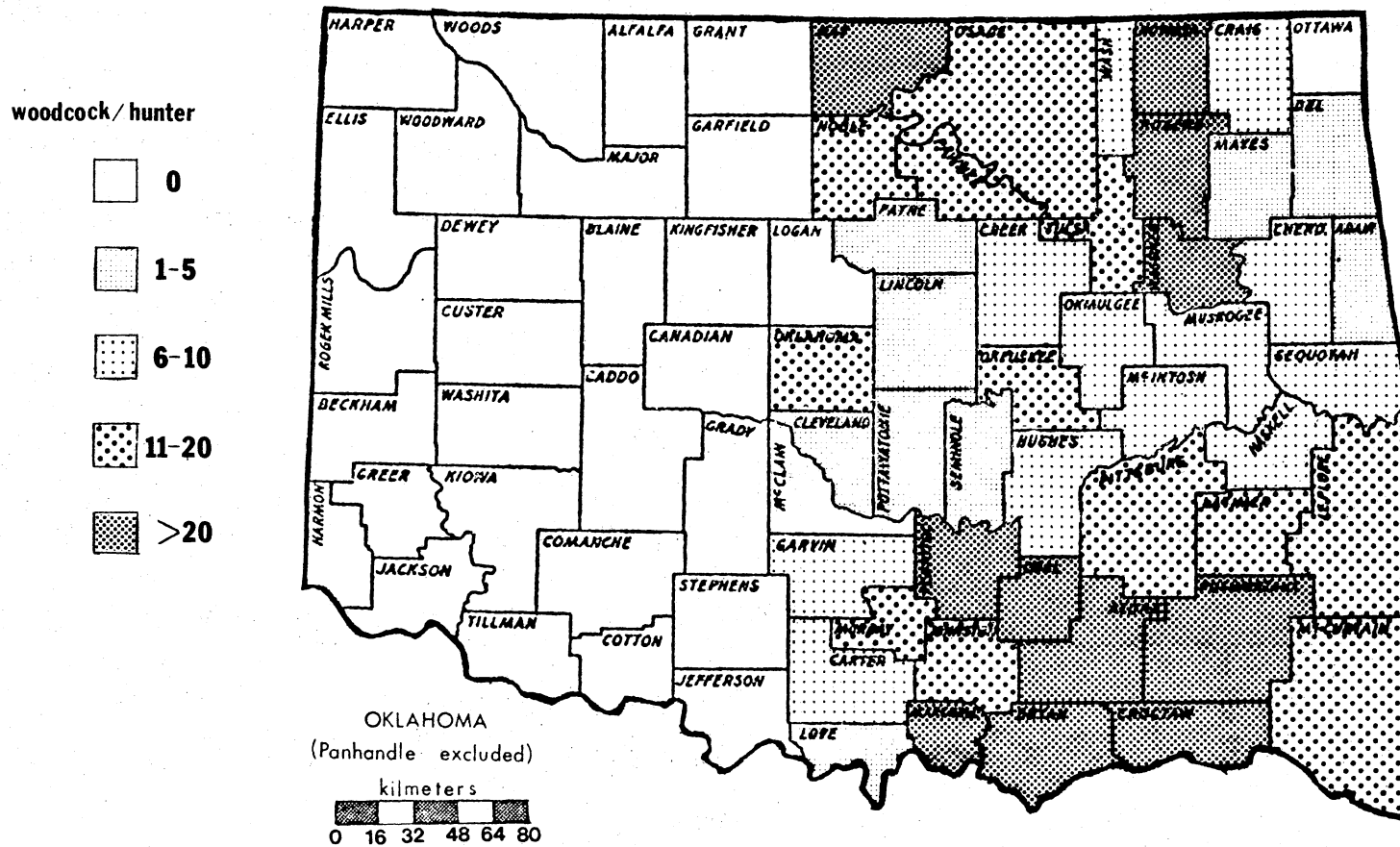


Fig. 4. Mean woodcock seen/hunter/year by the county in which woodcock were seen.

Respondents hunting other species when observations of woodcock were made were asked to list the species being sought. Quail hunters represented the largest group (48 percent) of these respondents (Table 4). Waterfowl hunters accounted for only 13 percent of those hunters seeing woodcock, but 19 percent of those made reports of greater than 25 woodcock sighted per year while only 37 percent were in the 1-5 woodcock sighted per year category. We cannot discount the waterfowl hunter reports but regard them with greater caution. The marginal woodcock habitat found in most areas utilized by hunters pursuing waterfowl and the disproportionate number of waterfowl hunters that report observing more than 25 woodcock/year suggests that they might have been misidentifying common snipe and other shorebirds. Hunters pursuing quail, deer, rabbits, and other species possibly might also have reported species other than woodcock as being woodcock in their sighting reports.

A large majority (75 percent) of those persons bagging woodcock reported that they were usually hunting quail when woodcock were encountered (Table 5). The high percentage of those hunting quail and opportunistically bagging woodcock is expected. The quail hunting season coincides with the woodcock hunting season in Oklahoma with both beginning 20 November and continuing until 16 January for woodcock and 1 February for quail. Personal observation has shown that hunters on the margin of quail habitat are often also on the edge of woodcock habitat. Woodcock normally remain motionless until a hunter comes to within a few meters of the bird's location. Dogs typically associated with quail hunting are likely to find and point woodcock (making

Table 4. Number of woodcock observed per year versus type of game hunted when woodcock were encountered.

Type of game hunted	Number of woodcock seen per year						Total	Percent
	1-5	6-10	11-15 (Number of responses)	16-20	21-25	> 25		
Quail	69	31	15	11	2	8	136	48.2
Waterfowl	14	12	1	2	2	7	38	13.5
Squirrel	26	7	-	-	-	3	36	12.8
Deer	17	4	3	1	-	-	25	8.9
Rabbit	13	2	3	2	1	1	24	8.5
Dove	3	4	2	2	1	1	13	4.6
Other	<u>5</u>	<u>3</u>	<u>-</u>	<u>1</u>	<u>-</u>	<u>1</u>	<u>10</u>	<u>3.5</u>
Total	149	63	24	19	6	21	282	100.0
Percent	52.8	22.3	8.5	6.7	2.1	7.5	99.9	

Table 5. Mean number of woodcock bagged per season, versus the type of game hunted when woodcock were observed.

Type of game being hunted when woodcock were observed ^a	Number of woodcock bagged/season				Total	Percent
	1-2	3-5 (Number of responses)	6-10	> 10		
Quail	19	9	4	1	33	75
Rabbit	-	2	1	1	4	9
Waterfowl	2	1	-	-	3	7
Deer	2	-	-	-	2	5
Woodcock	-	1	-	-	1	2
Squirrel	<u>1</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>1</u>	2
Total	24	13	5	2	44	100
Percent	55	30	11	4	100	

^aFor those persons seeing woodcock when hunting.

woodcock more easily detected) than would be the case for persons hunting rabbits, deer, squirrels or even quail without a dog.

Respondents were asked if they would hunt woodcock if they knew where they were located. Hunters not seeing woodcock in the state (61 percent) and hunters seeing woodcock (51 percent) reported that they would hunt woodcock if they knew where they were located (Table 6). The response to both categories indicated substantial interest in the species as a gamebird.

Lemuel Due (ODWC, pers. comm.) reported that there were 240,000 licensed hunters in Oklahoma in 1975. By using the ratio of the number of hunters in the survey counties to the total hunters in Oklahoma in 1969 (Ellis 1969), and to the total hunters in the state in 1975, it was calculated that there were 128,280 hunters in the survey counties in 1975. The survey results suggest that 81 percent of the hunters in the survey counties have seen woodcock and that 51 percent of these hunters would hunt woodcock if they knew where to find them. By applying the percentage of hunters seeing woodcock that would hunt them to the number of hunters in the surveyed counties, an estimate of 53,000 potential woodcock "hunters" is derived.

The Oklahoma Department of Wildlife Conservation included woodcock in its annual statewide hunter questionnaire survey for the first time following the 1975-76 hunting season. A 49 percent useable response (6,730 of 13,817 questionnaires) was obtained by the Department. Forty-two (0.6 percent) of those hunters returning questionnaires reported bagging 91 woodcock on 145 hunting trips (Lemuel Due, pers. comm.). The respondents bagging woodcock reported an average bag of 2.2 during the hunting season. Extrapolation of the statewide data would

Table 6. Respondents reporting they would/would not hunt woodcock if they knew where woodcock were located.

	Respondents would hunt		Respondents would not hunt		Respondents combined	
	No.	(%)	No.	(%)	No.	(%)
Respondents seeing woodcock	128	(51)	125	(49)	253	(74)
Respondents not seeing woodcock	53	(61)	34	(39)	87	(26)
Total	181	(53)	159	(47)	340	(100)

indicate that approximately 240,000 Oklahoma hunters bagged nearly 3,170 woodcock during the 1975-76 hunting season (Table 7).

Our survey indicated that 10 percent of the respondents bagged woodcock. Ten percent of the 128,280 hunters in the survey counties is 12,828 hunters. The respondents bagging woodcock averaged bagging 3.4 woodcock per season. If we assume that the 12,828 hunters in the survey counties bagged 3.4 per season, the result would be 43,615 woodcock bagged annually. This total presumably is a biased estimate because those persons bagging woodcock are more likely to respond to the questionnaire than those not bagging woodcock. The actual percentage of successful hunters is probably closer to the statewide percentage of 0.6 shown in the ODWC data than to the 10 percent shown in our data. We estimate that between one and two percent of the hunters in the survey counties bag woodcock. If our estimated percentages are correct, at the rate of 3.4 woodcock per season, the annual woodcock harvest would range from 4,360 to 8,720. The small sample of hunters bagging woodcock in both surveys should be kept in mind when considering the reliability of these data.

The previously mentioned Ruckel findings substantiate our feelings that all persons reporting that they had bagged woodcock had not actually bagged woodcock. The ODWC estimate is reduced to 920 and our estimates are reduced to 1,730-3,470 when the Ruckel correction factor is applied. Our interpretation of the different estimates is that the annual woodcock harvest in Oklahoma is from 2,000 to 3,000 birds.

These findings are in accordance with the woodcock harvest data collected in Missouri, a state bordering Oklahoma to the northeast. Missouri hunters recently have annually harvested approximately 15,000

Table 7. Woodcock harvest estimates from mail questionnaire survey data.

Survey	Area of coverage	No. of hunters (1975)	Hunters bagging woodcock		Mean no. woodcock bagged per hunter	Calculated number of woodcock bagged (N)	No. woodcock bagged using Ruckel factor (0.29 X N)
			Number	Percent			
ODWC ^a	Statewide	240,000	1,400	0.6	2.2	3,170	920
Authors'	Eastern Oklahoma survey counties	128,280	12,828	10	3.4	43,615	12,648
Authors' (adjusted)	Eastern Oklahoma survey counties	128,280	1,280-2,570	1-2	3.4	4,360-8,720	1,270-2,530

^aOklahoma Department of Wildlife Conservation.

woodcock and average approximately 2.4 to 3.0 woodcock per season (Kenneth Sadler, Missouri Department of Conservation, pers. comm.). Missouri's more easterly position and extensive woodcock habitat (compared to Oklahoma) would account for the larger harvest in Missouri.

CONCLUSIONS

Mail questionnaires were distributed to hunters in the eastern half of Oklahoma during November and December, 1975. Four thousand and two hundred questionnaires were mailed and 358 (9 percent) useable questionnaires were returned. Eighty percent (285 of 356) of the respondents claimed to be able to identify woodcock, and 81 percent (249 of 350) claimed to have seen woodcock in Oklahoma. Those hunters seeing woodcock in the state averaged seeing 14.4 woodcock per year. Hunters in the southeastern and northern portions of the area surveyed reported larger numbers of woodcock sighted per year. Those areas correspond closely to areas of higher woodcock densities found in a separate survey by the authors. Respondents that reported seeing woodcock while hunting accounted for 83 percent of those seeing woodcock. Hunters bagging woodcock (10 percent) averaged 3.4 woodcock per season. Quail hunters accounted for 48 percent of the respondents who reported seeing woodcock while hunting and 75 percent of those hunters bagging woodcock.

A hunter questionnaire survey by the Oklahoma Department of Wildlife Conservation indicated that 0.6 percent of the total Oklahoma hunters statewide bagged an average of 2.2 woodcock during the 1975-76 hunting season. Our average of 3.4 birds per woodcock hunter is in line with the statewide 2.2 value when considering the areas surveyed. Our estimate of the annual woodcock harvest in Oklahoma is from 2,000 to

3,000 birds.

Woodcock hunting is not and may never be a major recreational pastime in Oklahoma. However, the results of this study indicate that there are more woodcock seen and bagged by Oklahoma hunters than we previously anticipated. Several hunters indicated that they were not aware that there was an open season on woodcock in Oklahoma. An education effort on woodcock identification, the habitats frequented by them, the best methods for hunting, and the dates during which they are legal to hunt is needed. This effort should result in better use of the woodcock resource by Oklahoma hunters. Relatively inexpensive woodcock habitat management procedures, especially on public hunting areas and refuges, would probably assure greater availability of the species to the general public.

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CHAPTER III

WOODCOCK POPULATIONS ON THE WESTERN PERIPHERY OF THEIR RANGE

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Abstract: The woodcock is an increasingly important recreational resource throughout all parts of its range but has received little research attention in the westernmost states of the species' range. Data on woodcock population characteristics were collected from seven western woodcock states using mail questionnaires. Persons contacted included those within state wildlife agencies, universities, and state ornithological societies in North Dakota, South Dakota, Nebraska, Iowa, Kansas, Missouri and Texas. Additional information was obtained on the migration routes and wintering areas of woodcock breeding in Minnesota and Wisconsin. All survey states except Nebraska reported one or more breeding records for woodcock. The locations of breeding sites provided by cooperators in the survey states are considerably west of the western limit of the woodcock's breeding range as reported by Sheldon (1967). The earliest initiation dates for courtship activity in the survey states were in late January in Oklahoma and Texas. Nesting activity was shown to begin in mid-February in Oklahoma. North Dakota reported the earliest record for courtship activity in that state as being 24 April.

No nesting record was reported for North Dakota but South Dakota reported a nest that was probably initiated on 3 April. Migration dates reported by the survey states were compared to wing-collection data provided by the U. S. Fish and Wildlife Service to show migration chronology. Minnesota and Wisconsin officials reported that some woodcock produced in their states migrated through or wintered in the southern survey states. All survey states reported that woodcock were most common in the eastern portion of the states. Reports from Minnesota, Texas and Oklahoma indicated that woodcock may be more widespread to the west than previously recognized. Breeding records in states previously not known to contain breeding woodcock and a possible westward expansion of the species indicates potential for increased woodcock numbers on the western periphery of their range.

The woodcock has been a traditional gamebird in the northeastern United States. However, in recent years there has been an increase in woodcock hunting in other regions, particularly in the South (Pursglove and Doster 1970). The woodcock is an increasingly important recreational resource throughout all parts of its range (Clark 1971). An understanding of the relative abundance and distribution of the species, throughout its range, is necessary if management procedures are to be implemented that will provide for optimum use and protection of the resource.

Research on woodcock has been slow in developing and has concentrated on the species' principal breeding and wintering areas. Comparatively little information has been obtained in states on the western fringes of the range and in states along the migration routes

between major breeding and wintering areas. Lack of a hunting tradition and limited public awareness of woodcock in the Midwest may explain why little population data have been collected in this region.

A study was conducted at Oklahoma State University to determine the population status and management potential of woodcock in Oklahoma (Smith 1977). One of the objectives of that study was to compare the status of woodcock in Oklahoma with the status in other states on the western fringe of the species' range. The comparison was used to determine whether the information collected in Oklahoma was unique to the state or was consistent with woodcock population trends in other western states. This paper presents the results of that comparison in order to develop a broader understanding of the species' regional status, and to establish a basis for future research and management efforts.

Financial support for this study was provided by the U. S. Fish and Wildlife Service, Accelerated Research Program for Migratory Shore and Upland Game Birds. We wish to thank all persons responding to the questionnaire survey and those replying to letters asking for migration routes and wintering areas of woodcock nesting in their states.

METHODS AND MATERIALS

A mail survey was used to acquire information on woodcock breeding, migration and wintering distribution and chronology in states on the western edge of the breeding and wintering ranges. States shown in Fig. 1 were chosen to be surveyed because of their position on distribution maps by Sheldon (1967), and because much of the area surveyed lies outside the current reference area of surveys by the

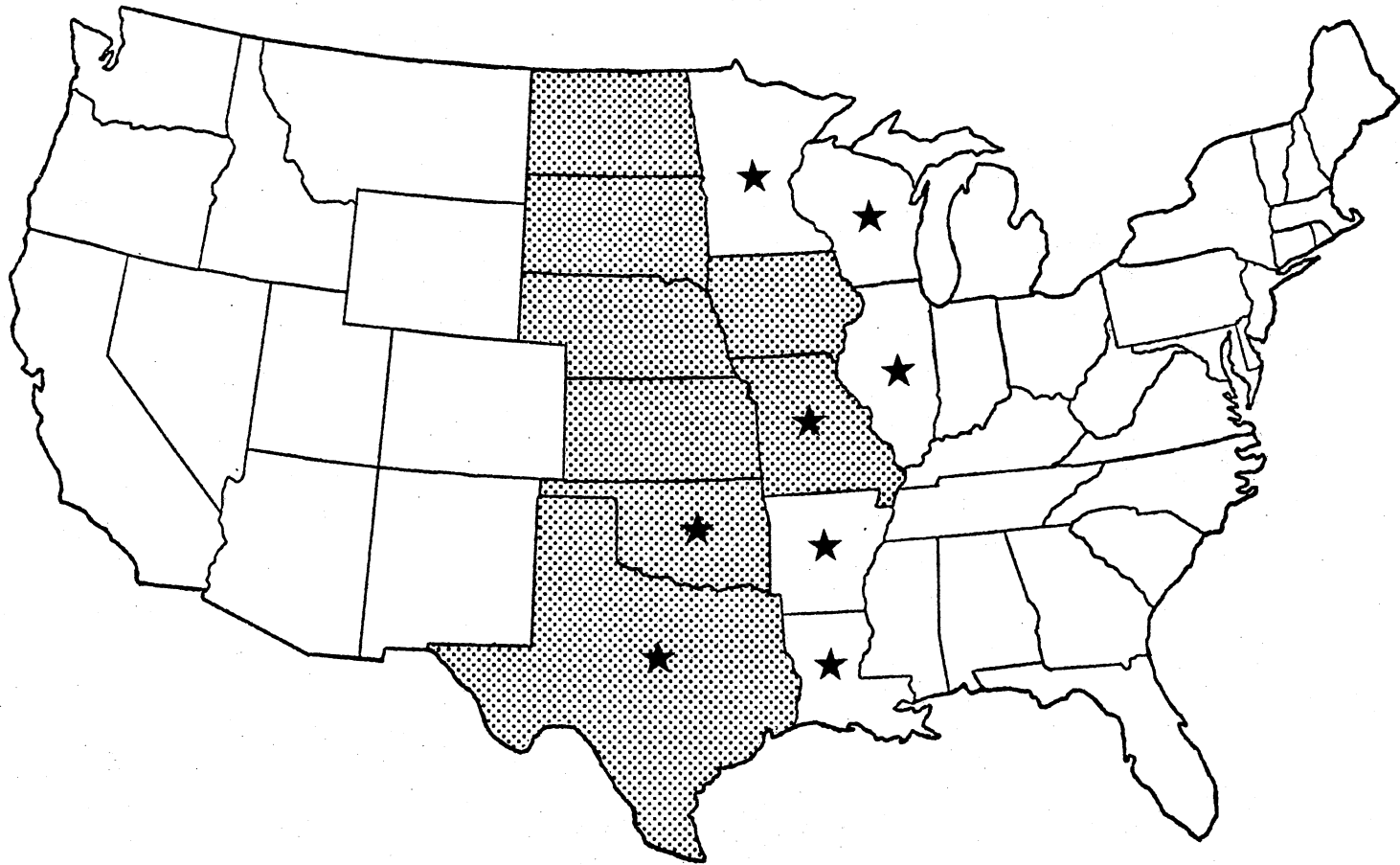


Fig. 1. States surveyed by Regional Survey questionnaire (shaded area) and states for which wing-collection data (U. S. Fish and Wildlife Service, Office of Migratory Bird Management) (★) were obtained.

U. S. Fish and Wildlife Service (USFWS) (Artmann 1975).

A survey form (Fig. 2) was designed and 23 questionnaires were mailed in April, 1976, to qualified individuals within seven states other than Oklahoma. Persons contacted included those within state wildlife agencies, universities, and state ornithological societies. Letters were also sent to Minnesota, Wisconsin and Michigan for information on the migration routes and wintering areas of woodcock breeding in their states. It was hypothesized that the above three states, known to have substantial breeding populations, may contribute migrant birds to western periphery states.

Woodcock wing-collection survey data were obtained from the Office of Migratory Bird Management, USFWS (Joe Artmann). These data showed, by 10-day periods, the dates in which woodcock were bagged during the hunting seasons of 1972-73 through 1974-75. Wing-collection data for states involved in our mail survey and adjacent states to the east were analyzed collectively to determine the woodcock migration and harvest phenology in each state.

RESULTS AND DISCUSSION

Twelve respondents from the seven survey states returned questionnaires. Minnesota and Wisconsin officials responded to letters asking for information concerning migration routes and wintering areas of woodcock produced in their states.

The results from the woodcock study in Oklahoma that were used in the comparison with other western states are: 1) eleven nests or broods were recorded, 2) nests and broods were restricted to the eastern half of the state, 3) woodcock were found displaying from late January to

REGIONAL WOODCOCK SURVEY

1. Do you have nesting records for woodcock in your state? Yes__ No__

Number of nests____, Approximate date of nesting activity:

Beginning_____, Peak_____, End_____.

2. Do you know of wintering woodcock records for your state?

Yes__ No__

3. When do woodcock migrate into or through your state?

	<u>Migration Dates</u>	
	Fall	Spring
Beginning	_____	_____
Peak	_____	_____
End	_____	_____

4. What portions of the state contain the greatest numbers of woodcock?

5. Have there been noticeable trends in woodcock numbers or geographical range? Yes__ No__ Not sure__

	Numbers	Range
Trends:		
Decreased	_____	_____
Unchanged	_____	_____
Increased	_____	_____

6. Did your state have a woodcock hunting season in 1975-76? Yes__ No__
Season dates _____

7. What is your most recent woodcock harvest estimate? _____

8. Use the space below for comments, additional information, or questions.

Fig. 2. Questionnaire used in the Regional Survey.

late March with the peak number observed during the second 10-day period in February, 4) nest record dates were from 6 March to 10 April, 5) woodcock were sighted in the state in all seasons and were most frequently reported during the period 11 October to 10 January, 6) the peak in fall migration occurred between 11 November and 10 December, 7) no peak in spring migration was established because few observers are afield during this period, resulting in few sighting reports, and 8) woodcock were most frequently found in the eastern half of the state and were considered uncommon in the western half of the state.

Incidence of Nesting

All survey states except Nebraska reported one or more records of breeding woodcock (Fig. 3). Respondents suggested that woodcock may be nesting in their states in greater abundance than their records indicate. Iowa reported 32 nest and brood records in 14 counties, mostly in the eastern portion of the state. A Missouri official reported approximately 15 nest records in the past three years, but did not include exact nest locations. A Texas respondent described woodcock nesting in Texas as rare and believes that nesting in that state may be directly related to moisture. An Arkansas official responding to a letter asking for nest records reported no records for the state. Woodcock nests and broods have been recorded in Arkansas by Pettingill (1936), Sutton (1967) and the authors. Sutton (1974:14) acknowledges that the ". . . species may breed much more widely than has been supposed" in Oklahoma.

The western boundary for the scattered breeding range of woodcock published by Sheldon (1967) is shown in Fig. 3. This boundary line is, on the average, 286 km east of the western limit of woodcock breeding range we propose. Distances between the two range limits is narrowest

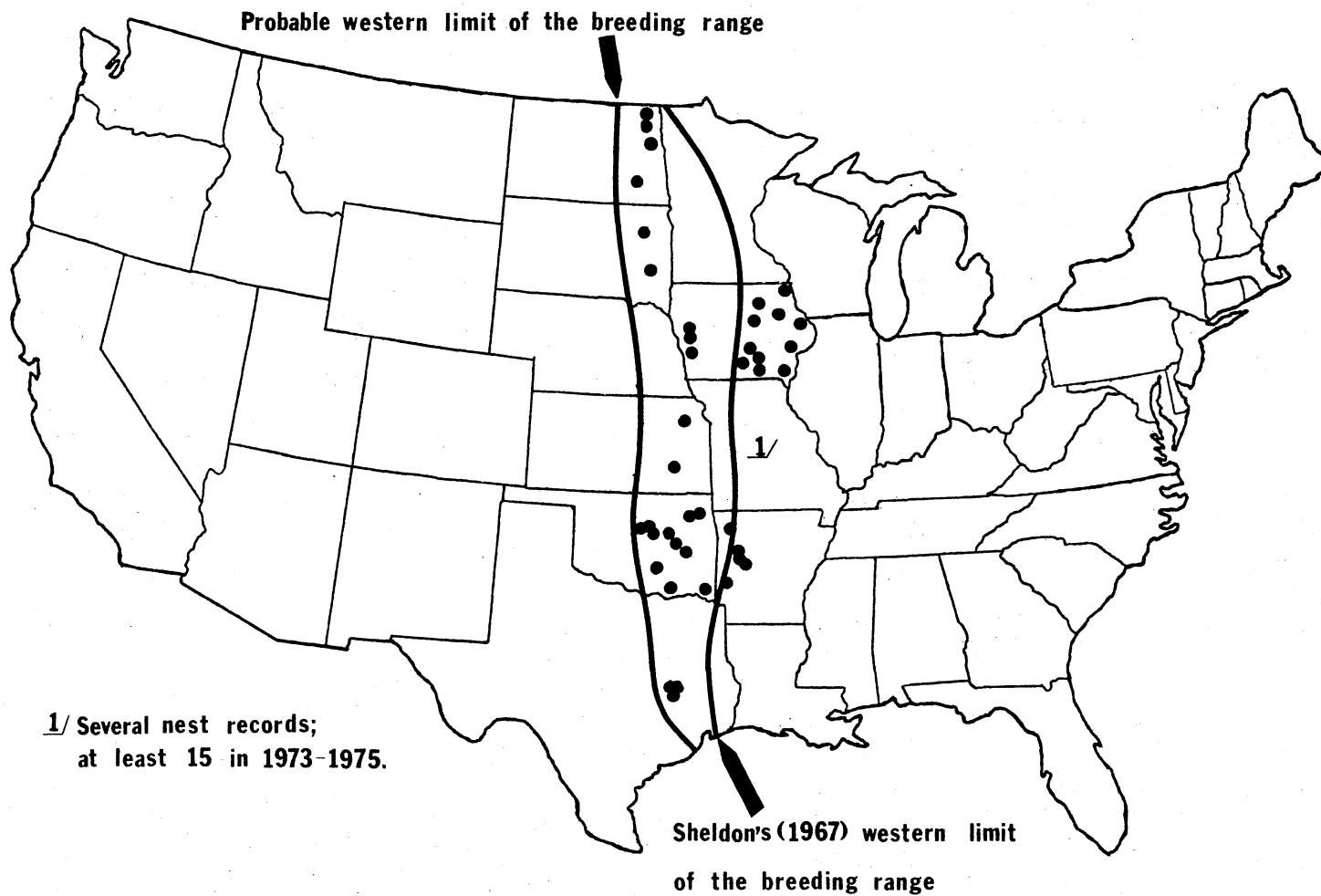


Fig. 3. Woodcock nest sites (courtship sites in North Dakota) in states on the western edge of the species breeding range and the western limits of the woodcock's breeding range proposed by Sheldon (1967) and the authors.

in Texas (176 km average) and widest in South Dakota (374 km average).

Breeding and Nesting Chronology

Records of both courtship activity and nests were not available from all states. These records were used in combination to show the breeding chronology from south to north.

A report from Texas indicated that male woodcock begin courtship activity in late January. No nesting dates were listed. This reported beginning date in Texas is comparable to the late January initiation of courtship activity in Oklahoma. The earliest nest record in Oklahoma was 6 March. Earlier nesting is suspected in Texas and Oklahoma because, based on an incubation period of 21 days and 4 days for egg laying, a brood found on 10 March in Oklahoma would have come from a nest containing eggs layed on or before 14 February.

The earliest date for a woodcock nest recorded in Kansas was 15 April and the latest brood sighting was 28 May. Courtship activity in Kansas probably begins in mid-February.

Iowa Conservation Commission personnel conducted an annual singing-ground survey from mid-April to mid-May. No dates were given for courtship activity or nesting in Iowa but woodcock probably began displaying before the mid-April survey initiation date. Breeding activity in Nebraska, if existing as we expect, probably occurs during nearly the same time period as in Iowa.

A nest located in South Dakota on 27 April hatched on 28 April. Since nesting activity for this brood probably began around 3 April, courtship activity in South Dakota must exist in late March. This is the only date given for a nest or brood in South Dakota so it was not

determined whether this was an early, late or normal hatching date.

No nests or broods were reported by the North Dakota Game and Fish Department, but displaying males were recorded from 24 April to 11 May. Woodcock nesting in South Dakota to the south and Minnesota to the east, plus the presence of displaying birds in the state, indicates that woodcock may nest in North Dakota. Woodcock possibly begin nesting in late April in North Dakota. Woodcock reported in North Dakota from 15 July to 27 July may have been birds that had nested in the state.

Timing of Migration and Harvest

Respondents from Iowa, Kansas, Missouri and Texas listed dates in which woodcock migrated through their states in the fall (Fig. 4). The Iowa report included only the initiation date. The Kansas report included only the ending date for woodcock migrations in the fall. The states that recorded beginning dates for the fall migration reported that it begins in mid-October and the states recording ending dates for the migration reported that it ends by mid-December. Respondents not reporting migration dates (North Dakota, South Dakota and Nebraska) reported that woodcock were believed to migrate through their states, but that the timing of the migration was unknown.

The timing of the woodcock harvest per state as reported in the U. S. Fish and Wildlife Service woodcock wing-collection survey (Artmann 1976) is shown in Fig. 4. The peak period for the woodcock harvest in a state was thought to be a possible indicator of the time period when the greatest numbers of migrant birds were found in the state.

Wing-collection data from Minnesota revealed that this state had the earliest peak in woodcock harvest of the states we examined while

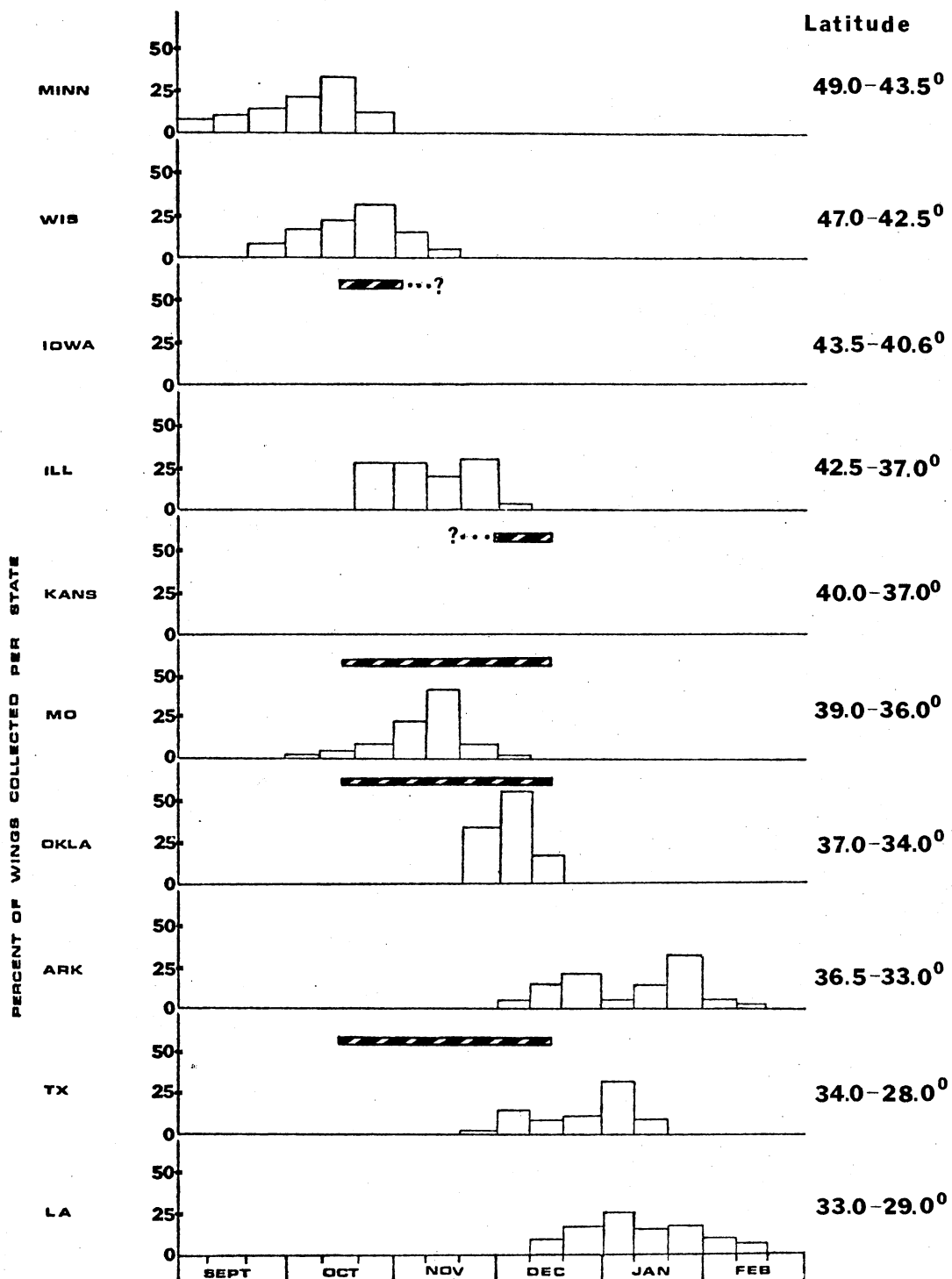


Fig. 4. Distribution of 1972-73 through 1974-75 woodcock wing collections by 10-day periods (Office of Migratory Bird Management, U. S. Fish and Wildlife Service) and migration periods (horizontal bars) reported on the Regional Survey questionnaire.

Arkansas and Louisiana had the latest peaks in harvest. States between Minnesota and Louisiana had harvest peaks that gradually advanced as the season progressed. The extended peak in woodcock harvest in Illinois occurred during the same time period as the migration dates reported for Iowa. The peak period for woodcock harvest in Missouri was centered in the migration period reported for that state. Oklahoma and Texas woodcock hunting seasons began after the mid-point of the migration period listed for those states. The peak period for the woodcock harvest in Texas occurred late in the state's reported migration period and extended past the end of the migration. This information indicates that a substantial portion of the harvest in Texas comes from birds wintering in the state. Arkansas and Louisiana hunters also appear to be harvesting mostly wintering birds.

Texas and Oklahoma were the only survey states that reported wintering woodcock. States not wintering woodcock, with the exception of Illinois, seem to have a peak in the number of birds bagged some time after the opening of the hunting season. The hunting season in Illinois begins later than in other states with similar latitudes (Ohio and Indiana). A large percentage of the Illinois woodcock are bagged during the first two 10-day periods of the hunting season.

Migration Routes

Minnesota and Wisconsin officials responded to requests for information concerning migration routes of woodcock nesting in their states. Larry Gregg, Wisconsin Department of Natural Resources, reported that many Wisconsin banded birds head nearly straight south in the fall and their migration route roughly coincides with the

Mississippi River. Band returns show that most Wisconsin-produced birds winter in Louisiana and Mississippi. Gregg reported that Texas is not a major wintering area for Wisconsin birds with only 10 percent of the band recoveries coming from Texas. Two direct recoveries of Wisconsin banded woodcock in Oklahoma indicates that some of the birds found in Oklahoma are produced in Wisconsin. William Marshall, University of Minnesota, reported that Iowa and Missouri recoveries of woodcock banded in Minnesota indicate the southern migration route and that recoveries from Louisiana and Mississippi indicate wintering areas. A male woodcock banded in Oklahoma in the spring of 1973 was bagged the following fall in Pine County, Minnesota, 1 to 2 km from the Wisconsin border.

Respondents to the regional survey, except Iowa and Missouri, listed the portions of their states containing breeding woodcock (Fig. 3) as being the same portions that contained the greatest numbers of non-breeding woodcock. Iowa and Missouri respondents reported that woodcock were found scattered across their states but were most abundant in eastern counties.

State Trends

Most respondents reported that they were not sure of the trends in woodcock range or numbers in their states because they had insufficient population data. However, Marshall (pers. comm. fall, 1975) reported an apparent westward expansion and greater numbers of woodcock in Minnesota in areas previously unrecognized as woodcock range. A Kansas respondent to the mail survey reported that woodcock seemed to be more numerous in the state and a Missouri respondent reported that he had, in

recent years, received more reports of singing and nesting woodcock than previously. A Texas respondent reported that woodcock seemed to be more widespread to the west. We feel that woodcock have been increasing in Oklahoma, particularly in central portions of the state where they were once considered to be quite rare.

CONCLUSIONS

The American woodcock is not regarded as an important gamebird in any of the states on the western fringe of its range. The numbers of breeding birds in most of these states appear to be low, but are probably more abundant than presently realized. Previous maps of the breeding distribution of woodcock have shown the western limit farther east than we propose. Woodcock may be extending their range westward. It is also likely that the limited past interest in and knowledge of woodcock has resulted in few woodcock nests being reported in the states surveyed. The scanty data available in the central United States is testimony to the lack of emphasis given to woodcock by researchers in these states. The states that have researched woodcock, Iowa and Oklahoma, have found the species to be in greater abundance than anticipated. There seems to be potential for greater utilization and management of woodcock in those states involved in the survey. A westward expansion, if occurring, could add a recreational resource previously unrecognized to those Central states on the western fringe of the woodcock's range. Further study of woodcock in these western states would appear to be warranted so that a more complete knowledge of breeding, migration, wintering, and habitat requirements might be obtained.

Future study of woodcock on the western fringe of their range may have importance in determining their population status and requirements in other portions of their range. Odum (1971:113) stated that "If we accept Andrewartha and Birch's (1953) contention that distribution and abundance are controlled by the same factors, then study at range margins should be doubly instructive." By studying the factors limiting woodcock on the western edge of their range, we may be able to better understand those factors limiting their abundance elsewhere. Annual monitoring of breeding populations in western fringe states could reveal important information not detected in areas where breeding populations are more abundant.

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APPENDIX

SINGING-GROUND SURVEY ROUTE DESCRIPTIONS

FOR THOSE TO BE USED AS BASE ROUTES

IN FUTURE CENSUSES

1. Heyburn Lake Feb. 9 - March 19, 1976 Creek Co. 6+ woodcock

The route begins in the middle of R9E, T17N, S14 in the Heyburn Lake Recreation Area. The first stop is at the location where the road leading into the northwest part of the recreation area is nearest the lake. The route proceeds north (N) to the blacktop road with stops at .25 mi intervals. At the blacktop road, the route proceeds west (W) past a fork in the road (going N) and on W to the point where the Public Hunting Area ends (2.8 mi). Stops should be made at .4 mi intervals. End route.

2. Hugo Lake Feb. 17, 1976 Choctaw County 12 woodcock

The route begins on the section road at the southeast corner of R19E, T6S, S6. Surveyors should proceed W, stopping at .3 mi intervals until State Highway (SH) 147 is reached. After a stop at this intersection, surveyors should proceed to the Virgil Point entrance (stop) and then enter the Public Use Area. This road should be followed 1 mi, stopping 3 times at .3 mi intervals. End route.

3. Hugo Lake Feb. 18, 1976 Choctaw County 10 woodcock

The survey route begins .3 mi south (S) of Apple at the SE corner of R16E, T5S, S9 at the intersection of 2 county roads. Surveyors should proceed S making 1 stop .3 mi from the intersection and another at the first road going W. Route then follows the road W as it bends to the NW, then N with stops at .3 mi intervals until the highway turns to the S. End route.

4. Sequoyah National Wildlife Refuge Feb. 12, 1976 Sequoyah Co.

4 woodcock

The survey route begins 200 m N of the Sequoyah NWR field headquarter's N gate. Surveyor should proceed N until the road turns W, and continue W for 2 mi. Stops should be made at .4 mi intervals. End route.

5. Hugo Lake Feb. 23, 1976 Choctaw County 5 woodcock

The route begins at the SW corner of R17E, T6S, S24 on SH 93. Surveyors should proceed N 1.5 mi, stopping at .3 mi intervals. They should then turn east (E) and go .75 mi, stopping at .25 mi intervals. End route.

6. Eufaula Lake. March 4, 1976 McIntosh County 13+ woodcock

The route begins at Camping Area #2, Fountainhead State Park. Surveyors should proceed W to SH 150 and follow the highway W and N to Brushy Hill. Stops should be made at .3 mi intervals. End route at Brushy Hill.

7. Lexington Public Hunting Area March 10, 1975 Cleveland Co.

4 woodcock

The route begins 200 m N of Dahlgren Lake, R1E, T7N, S21. Surveyors should proceed N, stopping at .25 mi intervals. A stop should be made at the location at which the road turns W. Surveyors should then proceed W, stopping at .3 mi intervals until the road turns N toward the entrance. End route.

8. Heburn Lake March 17, 1976 Creek County 3+ woodcock

The creek (Polecat Creek) below the Heyburn Lake dam can be surveyed on foot. Surveyors should begin at the point where the creek is

nearest to the road that parallels the dam. Surveyors should then proceed S along the side of the creek until the end of the display period. End route.

VITA

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