Click Here for Table of Contents

PROCEEDINGS

of the

FIRST NATIONAL WILD TURKEY MANAGEMENT SYMPOSIUM

SPONSORED BY

THE SOUTHEASTERN SECTION OF THE WILDLIFE SOCIETY

through its

FOREST GAME COMMITTEE

SYMPOSIUM ARRANGEMENTS
BY THE TURKEY SUBCOMMITTEE

Don H. Strode and Fred Hardy, Chairmen
R. Wayne Bailey Eugene Knoder
Samuel P. Shaw

Peabody Hotel
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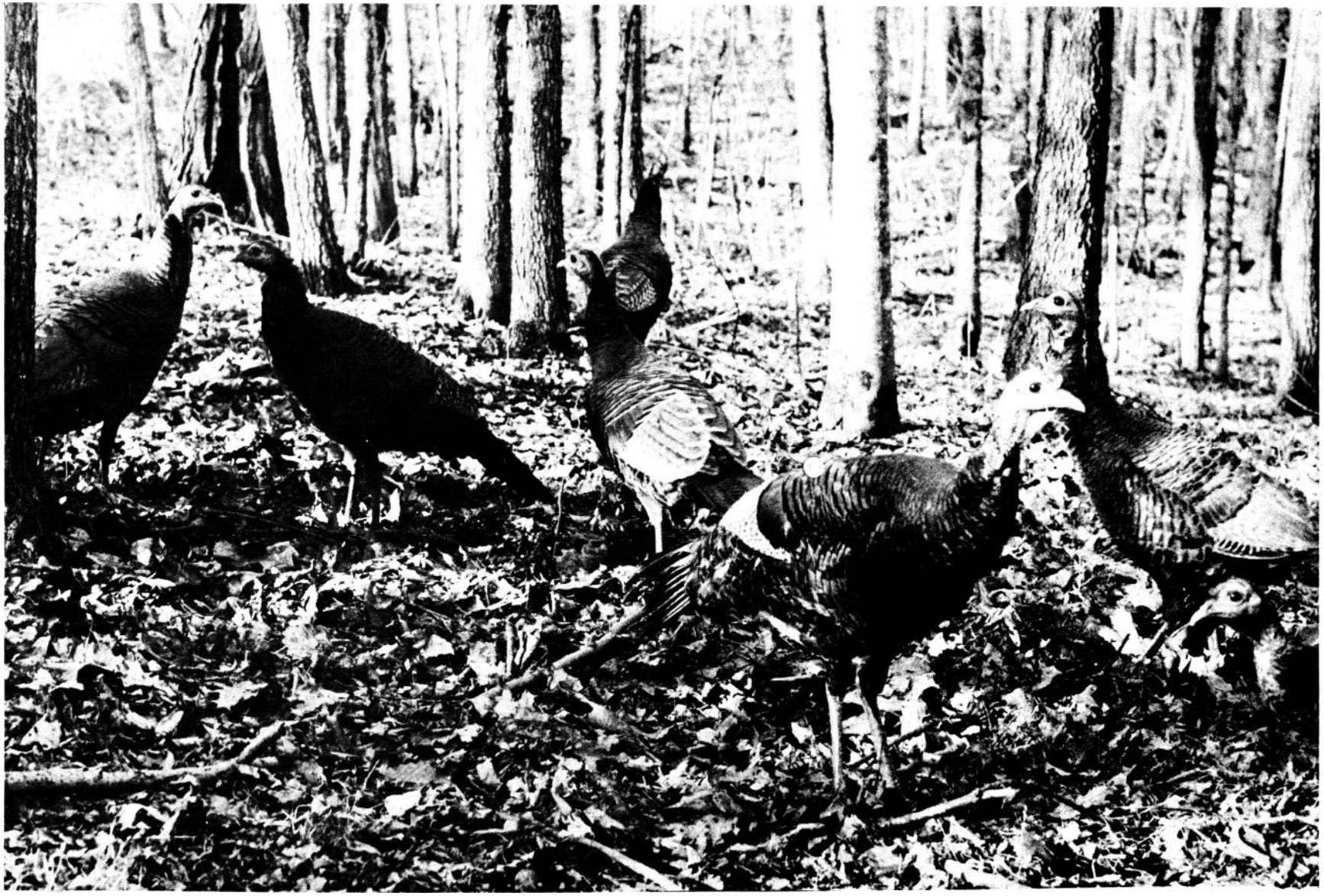

...Photo by Wayne Bailey

Wild turkeys (Meleagris gallopavo silvestris Vieillot) in native oak-hickory range in the mountains of West Virginia

INTRODUCTION TO THE SYMPOSIUM

C. W. Watson
U. S. Fish and Wildlife Service
Chairman, Forest Game Committee

In behalf of our Forest Game Research Committee and particularly expressing the sentiments of our hard-working Turkey Sub-committee, I welcome you to this meeting. We are glad to see you. We appreciate your coming here to take part in our discussions. We hope that this first turkey meeting will lead to actions which will benefit us all in better management of that premier game animal - the wild turkey.

And now let me briefly describe the activities of the Forest Game Research Committee for those of you who may be unacquainted with it. The Committee was set up by the Southeastern Section of the Wildlife Society. It has been active about four years. It is a loosely-organized committee of about 25 members representing state fish and game departments, the U.S. Forest Service, the Soil Conservation Service, the timber industry, the universities, the Wildlife Management Institute, the U.S. Fish and Wildlife Service, etc., in this region. This region involves 12 states. However, as in the case of this turkey meeting, we welcome the interest of all states. We work through small sub-committees organized for action on specific problems.

Our first such sub-committee promoted the Cooperative Deer Disease project in which eleven of our states contract with the University of Georgia to do research in this field.

However, our main interest has been in studies of timber management as it affects forest game, particularly deer, squirrels, and turkeys. Several studies of a fundamental character have been set up. In these the chief problems at the moment appear to be the censusing of game animals and the evaluation of forage resources, especially deer browse analysis. Both the Southern and the Southeastern Forest Experiment Stations are cooperating in these programs.

And now let us turn to the activity which is to us here the most important of all - the wild turkey problems. This meeting is really the consequence of the high interest of a group which makes up our Turkey Sub-committee - Don Strode, Chairman; Wayne Bailey (W. Va.); Fred Hardy (Ky.); Gene Knoder (Ohio); and Sam Shaw (Forest Service). This group formed a tight little action committee, which, because of location, could convene frequently. They worked hard and did a good job. We all felt that the wild turkey deserved special consideration. Also, we felt that this meeting should embrace all turkey workers regardless of regional bounds.

CONTENTS

RANGE MANAGEMENT

POPULATION DYNAMICS AND SPECIES BIOLOGY

RESEARCH NEEDS

FRIDAY--FEBRUARY 13

Program Chairman For The Day: R. WAYNE BAILEY
Conservation Commission of West Virginia

STATUS AND DISTRIBUTION

Session Chairman: HENRY S. MOSBY
Wildlife Unit, Virginia Polytechnic Institute

GENERAL STATUS OF THE WILD TURKEY AND ITS MANAGEMENT IN THE UNITED STATES, 1958

Henry S. Mosby
Wildlife Unit, Biology Dept.
Virginia Polytechnic Institute
Blacksburg, Virginia[1]

About a decade ago, Walker (1949) and Mosby (1949) summarized the status of the wild turkey in the United States; pertinent literature up to 1949 is cited in these two papers. In the period between 1948 and 1958, rather dramatic changes have occurred in the status of America's largest game bird throughout much of the United States. Perhaps the most important changes have been the reestablishment of the wild turkey as a hunting species in several states within its ancestral range and its successful introduction--including its establishment as hunting species--in some states beyond its historical range. These developments have focused attention upon the management possibilities of the wild turkey as a sporting species in areas where twenty years ago it was thought that the bird was doomed to extirpation. This Symposium affords concrete evidence of such interest in the potentialities of this species. So far as the writer is aware, this is the first nation-wide symposium which has been concerned with the status, problems and management of a single game species.

The purpose of this paper is to outline the general status of the wild turkey and its management throughout the United States. It is hoped that this presentation will serve as a general introduction for later papers and discussions of this Symposium.

In order to secure the reconnaissance information here presented, a questionnaire was sent to selected individuals in each of the 48 states and

[1] Release No. 59-6 of the Virginia Cooperative Wildlife Research Unit, Virginia Commission of Game and Inland Fisheries, Virginia Polytechnic Institute, Wildlife Management Institute and Fish and Wildlife Service (U.S.D.I.), cooperating.

usable data were received from 46 of these states.[2] The writer is well aware of the inadequacies and fallacies of "mail order research"; however, it is thought that the information obtained from these questionnaires is adequate for a general introduction to the major problems and management opportunities of the wild turkey throughout the United States. It is recognized that questionnaires are subject to wide interpretation and the writer, not the correspondents, must assume responsibility for the analysis presented here. Fortunately, more complete information will be presented for several states in papers and discussions immediately following this presentation.

DISTRIBUTION AND ABUNDANCE

Figure 1 presents the general distribution and relative abundance of the five races of wild turkey in the United States as of 1958. It is regrettable that data were not available for Oklahoma and North Dakota. It is obvious from this map that the distribution and relative abundance of the wild turkey is shown on a county basis for some states and on a survey basis for other states. Despite this handicap, a comparison of the information in Figure 1 with similar data collected in 1937 (Mosby, 1937) and again in 1948 (Walker, 1949 and Mosby, 1949)reveals several definite changes for the better in the last two decades. Among the more outstanding improvements are: (1) the northern expansion of the Eastern Wild Turkey in northern Pennsylvania and its reintroduction--as a huntable species--in New York; (2) the increase in occupied habitat and in numbers of both the Eastern and Florida Wild Turkey in the Gulf States; (3) the northern expansion of intermedia in Texas (4) the outstanding gains registered by merriami in New Mexico, Arizona and Colorado and (5) the establishment of merriami beyond its ancestral range in South Dakota, Wyoming and Montana, The writer made no effort to assemble information on the probable causes of these improvements as these points will be discussed in later papers presented at this Symposium.

Table 1 lists the information available regarding the estimated wild turkey population present in each of the 37 states now supporting a stock of this bird. In addition, this table presents the 1958 hunting harvest taken in 20 states having a legal hunting season and the general trend of hunting harvest in each of these states. It is of interest to note that the hunting harvest is reported to be increasing in 11 states, static in 6 states, decreasing in 1 state and undetermined in the remaining 2 states. Of course, 17 of the states reporting a wild turkey population did not have a legal hunting season in 1958.

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[2] It is a real pleasure to acknowledge indebtedness to the following individuals for the information presented: Ala., Jr. R. Davis; Ari., R. A. Jantzen; Ark., H. E. Alexander; Calif., Ben Glading; Cole., M. L. Burget; Conn., A. L. Lamson; Del., J. L. Harnec; Fla., E. B. Chamberlain; Ga., G. C. Moore; Idaho, L. I. Mohler; Ill., J. C. Calhoun; Ind., J. M. Allen; Iowa, Paul Leaverton, Kan., Dave Coleman; Ky., F. C. Hardy; La., J. D., Newsom; Maine, W. R. DeGarmo; Md., E. A., Vaughn; Mass., W. G. Sheldon; Mich., Vie Janson; Minn., D. H. Leden; Miss., B. C. Johnson; Mo., J. B. Lewis; Mont., R. L. Eng; Neb., Phil Agee; Nev., J. C. Greenley; N.H., H. R. Siegler; N.J., L. G. MacNsmara; N. M., Levon Lee; N. Y., Charles Mason; N. C., D. J. Hankla; Ohio, Eugene Knoder; Ore., I. D. Luman; Penn., H. A. Roberts; R. I., T. J. Wright; S. C., H. L. Holbrook; S. D, Wendell Bever; Tenn., Harold Warvel; Texas, E. A. Walker and staff; Utah, C. M. Greenhalgh; Vermont, G. W. Davis; Va., Jack Gwynn; Wash., Raleigh Moreland; W. Va., Wayne Bailey; Wise., J. R. Smith and Wyoming, Robert Gustafson.

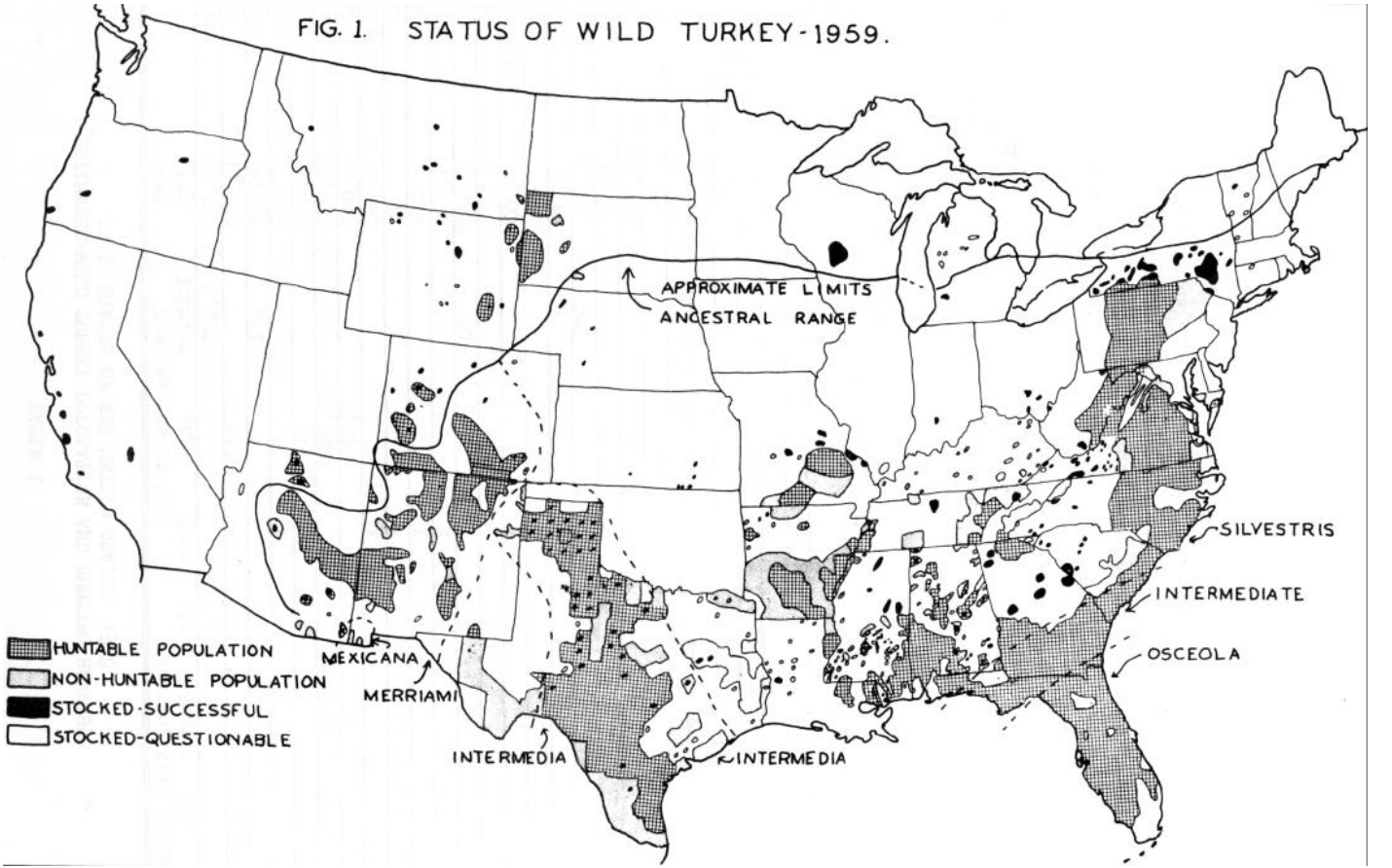
FIG. 1. STATUS OF WILD TURKEY - 1959.
APPROXIMATE LIMITS
ANCESTRAL RANGE
SILVESTRIS
INTERMEDIATE
OSCEOLA
HUNTABLE POPULATION
NON-HUNTABLE POPULATION
STOCKED-SUCCESSFUL
STOCKED-QUESTIONABLE
MEXICANA
MERRIAMI
INTERMEDIA
INTERMEDIA

TABLE 1

ESTIMATED WILD TURKEY POPULATION AND HUNTING HARVEST
IN 37 STATES OF THE UNITED STATES, 1958

	Est. Pop.	Hunting Season Kill			Hunting Kill Status			
		Gobbler	Any	None	Inc.	Static	Dec.	Undet.
Alabama	54,760	5,122			X			
Arizona	18,000		727				X	
Arkansas	4,000	461			X			
California	2,000			X				
Colorado	8,000		343		X			
Florida	50,000		17,100			X		
Georgia	40,000		5,000			X		
Illinois	400			X				
Indiana	75			X				
Kansas	114			X				
Kentucky	1,500			X				
Louisiana	2,000#	80				X		
Maryland	2,000		511		X			
Massachusetts	200			X				
Michigan	800			X				
Minnesota	75			X				
Mississippi	20,000	974			X			
Missouri	4,000			X				
Montana	2,000		90					X
Nebraska	400			X				
New Mexico	25,000		1,800		X			
New York	2,500			X				
North Carolina	15,000	3,294						X
North Dakota	7,875*			?				
Ohio	200			X				
Oregon	200			X				
Pennsylvania	40,000		16,156			X		
South Carolina	18,000	3,000				X		
South Dakota	5,000		550		X			
Tennessee	2,500	77			X			
Texas	100,000	7,500			X			
Utah	200			X				
Vermont	10			X				
Virginia	20,000		2,060			X		
West Virginia	10,000		1,173		X			
Wisconsin	1,000			X				
Wyoming	10,000		393		X			
Total	467,809 37 states	20,508 8 states	45,903 12 states	17 states	11 states	6 states	1 state	2 states

Estimate by H. S. Mosby, based on Bick (1947).
* From Fish and Wildlife Service (1958) for year 1956.

RECENT CHANGES IN STATUS OF THE EASTERN AND FLORIDA WILD TURKEY

Table 2 summarizes data on the Eastern and Florida Wild Turkeys collected in the late 1940's with similar information for the year 1956. The most outstanding fact indicated in this table is the 127 per cent increase in the over-all population during this time--from an estimated population of 129,373 in the late 1940's to 293,937 turkeys in 1956. During the same period of time the harvest increased from 24,194 to 48,034, an increase of 98 per cent. States reporting the most outstanding gains are Alabama, Georgia, Mississippi and Pennsylvania, followed closely by Florida and South Carolina. Unfortunately, the turkey decreased in numbers in Arkansas, Missouri and Virginia during this decade.

STATUS OF RESTOCKING PROGRAMS

In recent years, considerable attention has been devoted anew to wild turkey stocking, using both captivity-reared and wild trapped stock. Same states have attained almost phenomenal success but other stocking endeavors have been less fruitful. Thirty-one states report current, immediate past or immediate future plans for a turkey stocking program. Table 3 gives the type, objective and results of these programs as reported by the 31 states. In general, the objective of the stocking program in most states is to establish or reestablish the turkey in unoccupied habitat. Four states use stocking to augment the hunting harvest and three use this technique to bolster a declining population. Table 4 presents further details on these stocking programs, including the approximate number of turkeys used annually in each state. It is the writer's interpretation of the data shown in Tables 3 and 4 that the use of wild-trapped stock has generally resulted in a more successful stocking program and that the use of captivity-reared stock has been less productive of results. A number of correspondents have expressed the same view--many of them with strong conviction.

STATUS OF HUNTING REGULATIONS

The influence of hunting regulations on the welfare of the wild turkey is a controversial subject; it will be more thoroughly discussed in a later paper at this Symposium. Twenty states have a wild turkey hunting season in 1958; eight states permit the taking of gobblers only and twelve states authorize the taking of any sex or age turkey. Table 5 gives the estimated population, estimated hunting harvest and the percentage of the population removed by hunting in these 20 states. In the eight "gobbler only" states, the 1956 population estimate was 216,260 turkeys, the harvest was 17,696 birds with an 8.2 per cent removal. In the 12 "any turkey" states, the estimated population was about the same (230,000) but the harvest was 45,903 turkeys, on an average of 20 per cent harvest. It is of interest to note that the turkey kill in each of two "any turkey" states (Florida and Pennsylvania) was approximately equal to the total kill of all eight of the "gobbler only" states.

STATUS OF STATE WILD TURKEY RESEARCH-MANAGEMENT PROGRAMS

Few, if any, states have land management programs devoted entirely to encouraging the wild turkey. Most land management programs are normally "shotgun" programs designed to benefit all forest game species present on the area. Similarly, comparatively few states have full-time personnel working exelusively on the wild turkey. Generally, personnel assignments include more

TABLE 2

CHANGE IN STATUS OF EASTERN AND FLORIDA WILD TURKEYS
IN THE DECADE PRIOR TO 1956

	Year	Status in 1940's* Estimated pop.	kill	Status in 1956** Estimated pop.	kill	Per cent increase/decrease of population
Alabama	1941	13,487	3,200	50,963	5,122	+277
Arizona						
Arkansas	1948	10,000	NOS#	9,000	314	- 10
Florida	1948	26,854	3,800	50,000	16,000	+ 86
Georgia	1948	5,000	1,000	24,000	3,000	+380
Illinois				400	NOS	
Indiana				75	NOS	
Kansas				114	NOS	
Kentucky	1947	1,000	NOS			
Louisiana	1946	1,500	400	2,000##	75	+ 32
Maryland	1947	90	25	7,500	750	?
Massachusetts	-			200	NOS	
Michigan				800	NOS	
Minnesota				75	NOS	
Mississippi	1943	4,840	NOS	15,000	1,000	+209
Missouri	1947	3,289	NOS	3,100	NOS	- 6
New York				2,500	NOS	
North Carolina	1948	10,000	3,000	15,000	2,500	+ 50
Ohio				200	--	
Oklahoma	1945	225	NOS	No data		
Oregon						
Pennsylvania	1948	12,000	3,772	70,000	14,481	+483
Rhode Island						
South Carolina	1948	10,000	2,500	18,000	1,000	+ 80
Tennessee	1947	5,000	NOS	7,500	75	+ 50
Texas	1945	100	NOS	No Eastern Turkeys		-100
Vermont				10	NOS	
Virginia	1948	20,000	6,067	6,000	2,470	- 70
West Virginia	1945	5,988	430	10,500	1,247	+ 75
Wisconsin				1,000	NOS	
Total		129,373	24,194	293,937	48,034	+127

* Data from Mosby (1949:348).
** Data from Fish and Wildlife Service (1958).
# NOS - No open season.
Estimate by HSM.

TABLE 3

TYPE, OBJECTIVE AND RESULTS OF WILD TURKEY STOCKING PROGRAMS IN THE UNITED STATES, 1958

	Type of stock used		Objective of stocking			Status	
	Reared	Trapped	Rees-tablish	Increase kill	Bolster pop.	Succ.	Ques.-undet.
Alabama	X	X	X			X	
Arkansas	X	X				T*	R*
Colorado		X	X			X	
Connecticut	X		X				X
Florida		X	X	X		X	
Georgia	X	X	X			T	R
Illinois	X		X				X
Kentucky	X	X	X			T	R
Louisiana		X	X				X
Maryland	X	X	X	X		X	
Minnesota	X		X				X
Mississippi		X	X			X	
Missouri		X	X			X	
Montana		X	X			X	
Nevada		X**	X				
New York	X		X			X	
North Carolina		X				X	
Ohio	X	X	X			X	
Oklahoma	X	X	X			X	
Pennsylvania	X	X	X	X	X		X
Rhode Island	X		X				X
South Carolina		X	X			X	
South Dakota		X	X			X	
Tennessee		X	X		X	X	
Texas		X	X	X		X	X
Utah		X	X			X	
Virginia	X	X	X		X	X	X
Washington		X#					
West Virginia	X##	X	X			T	
Wisconsin	(X)		X		Under Investigation		
Wyoming		X	X			X	

* T indicates trapped stock; R indicates captivity reared.
** Plan to secure turkeys from Arizona in 1959.
# Game farm produced turkeys used only in 1958.
Plan importation of wild trapped birds from New Mexico.

TABLE 4

STATUS OF WILD TURKEY STOCKING PROGRAMS
IN 39 STATES OF UNITED STATES, 1958

	Type of stock used		Approximate No. used annually		Comments
	Trapped	Reared	Trapped	Reared	
Alabama	X	X	30	1,100	
Arizona	(X)*				Trading turkeys with Utah and Nevada
Arkansas	X	X	80	700	
California					Previous stocking being investigated
Colorado	X		123		
Connecticut		X		30	
Florida	X		200		
Georgia	X	X	40	750	Only trapped showing success
Illinois	(X)	X		1,000	Wild turkeys to be used 1959
Indiana	X				From our stock in future
Kentucky	X	X	40	600	Propagation discontinued 1958
Louisiana	X		6		
Maryland	X	X	-	1,500	Occasional wild gobblers trapped
Massachusetts	(X)				Plan trapping soon
Michigan		(X)			Stocking under observation
Minnesota		X		40	Stocked 1957
Mississippi	X		90		
Missouri	X		32		
Montana	X		150		
Nevada	(X)			25	Wild turkeys from Arizona
New Mexico	(X)				Stocking completed
New York	X	X	50	550	
North Carolina	X		52		
Ohio	X	X	15		Game farm stock abandoned
Pennsylvania	X	X	27	5,000	
Rhode Island		X		40	Stocked 1958
South Carolina	X		65		
South Dakota	X		130		
Tennessee	X		17		
Texas	X		312		intermedia only
Utah	X		10		
Virginia	X	X	5	1,200	Plan trapping 50 annually
Washington	(X)				Anticipated from New Mexico
West Virginia	X	(X)	9	?	Game farm stock used 1958 only
Wisconsin		(X)			Currently being investigated
Wyoming	X		80		Trap intermittently
Total	24 plus 6 recent programs	13 plus 3 recent programs	1,533	12,535	

*(X) indicates program has been used recently or have definite plans for use in immediate future.

TABLE 5

ANNUAL WILD TURKEY KILL BY TYPE OF HUNTING RESTRICTION, 1956[1]

	Gobbler only season			Any turkey season		
	Est. Pop.	Kill	% killed	Est. POP.	Kill	% killed
Alabama	54,760	2,315	4.2			
Arizona				18,000	727	4.0
Arkansas	4,000	461	11.5			
Colorado				8,000	343	4.3
Florida				50,000	17,100	34.2
Georgia	2,000#	75		40,000	5,000*	12.5
Louisiana			3.6			
Maryland	20,000	974	4.9	2,000	511	25.5
Mississippi						
Montana				2,000	90	4.5
New Mexico	15,000	3,294		25,000	1,800	7.2
North Carolina			22.0			
Pennsylvania	18,000	3,000	16.7	40,000	16,156	40.4
South Carolina						
South Dakota	2,500			5,000	550	11.0
Tennessee		77	3.1			
Texas	100,000	7,500	7.5			
Virginia				20,000	2,060	10.3
West Virginia				10,000	1,173	11.7
Wyoming				10,000	393	3.9
Total	216,260	17,696	8.2	230,000	45,903	20.0

[1] Data from Fish and Wildlife Service (1958).
* Gobblers only in northern Georgia.
# Author estimate (based on Bick (1947)).

TABLE 6

PERSONNEL ASSIGNMENT AND FINANCIAL SUPPORT OF WILD TURKEY PROGRAM IN THE UNITED STATES, 1958
States not listed report no official wild turkey research-management program

	No. of personnel Full time	Part time	Division of program % Research	% Mgmt./Dev.	Est. cost of turkey program
Alabama		3	30	70	50,000
Arizona		12	50	50	6,000
Arkansas		3	10	90	25,000
California		1	--	--	neg.
Colorado	3		50	50	13,000
Florida		3	50	50	5,000
Illinois		2	25	75	1,000
Kentucky		6	20	80	20,000
Louisiana			0	100	1,500
Maryland		3		90	18,000
Michigan		2	95	5	2,000
Minnesota		1	25	75	200
Mississippi		2	20	80	30,305
Missouri	2		25	75	60,000
Montana		?	10	90	2,000
New Mexico		4	0	100	2,500
New York		4	90	10	15,000
North Carolina		1	0	100	2,000
Ohio		5	90	10	4,000
Oklahoma	1*	2	50	50	3,500
Pennsylvania	1		10	90	?
South Carolina		3	5	95	14,000
South Dakota		2	50	50	1,100
Tennessee		2	0	100	1,000
Texas		3	10	90	14,430
Virginia		2	2	98	23,000
Washington		1	0	10	neg.
West Virginia		14	25	75	50,000
Wisconsin		3	35	65	5,000
Wyoming		1	85	15	8,400
Total/Average	7	85	36% 24 states	66% 29 states	377,935

* Graduate student on turkey research program.

than one wildlife species. Table 6 indicates the personnel assignment and financial support of the wild turkey management program in 30 states with an official wild turkey program. It will be noted that 7 individuals are assigned full-time and 85 individuals have part-time assignments in these 30 programs. In all 30 states, the time assignment is about 36 per cent devoted to research and 66 per cent to management. These 30 states report that $377,935 was allotted to the wild turkey research, stocking and habitat improvement projects in the United States in 1958.

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THE PRESENT STATUS OF THE WILD TURKEY IN NEW MEXICO

Levon Lee
New Mexico Department of Game and Fish

Of the three species of the wild turkey present in New Mexico at this time, the Merriam is by far the most important. It occupies approximately nine-tenths of the turkey range, the other one-tenth being shared by the Rio Grande and the Mexican turkeys. There is little sharing of a common range among these subspecies, although it does occur to a very limited extent between the Merriam and the Rio Grande in the northeastern quarter of New Mexico. The Merriam is the largest of our wild turkeys, followed by the Mexican strain which is slightly larger than the Rio Grande.

The Merriam turkey was long thought to be the only subspecies present in the state. Considerable evidence exists, however, that the Rio Grande strain was present up to about 50 or 75 years ago in the northeastern stream courses along the New Mexico-Oklahoma and New Mexico-Texas boundaries. The turkeys were exterminated in the days of the squatters and small landholders in the rolling plains district of this country. These small holdings have since been absorbed by large cattle ranches.

About 1951, rumors began to come in from the ranchers in the area that some of them had sandhill turkeys, as they call them. "Sandhill" is the word since this country is largely a sandy, grassy land with trees found only along watercourses or around ranch headquarters. Big bluestem is the dominant grass in the sandhills. Scrub oak and mesquite comprise the bulk of the woody vegetation. Along the streams there are cottonwoods, hackberry and willow.

The Rio Grande turkeys have steadily increased their range here in New Mexico and continue to progress along a wider front each year. Ranchers welcome them enthusiastically and protect and foster their increase in every way possible. Practically no domestic turkeys are raised in this area and, provided climate remains suitable, the Rio Grande turkey will remain a permanent resident of this state.

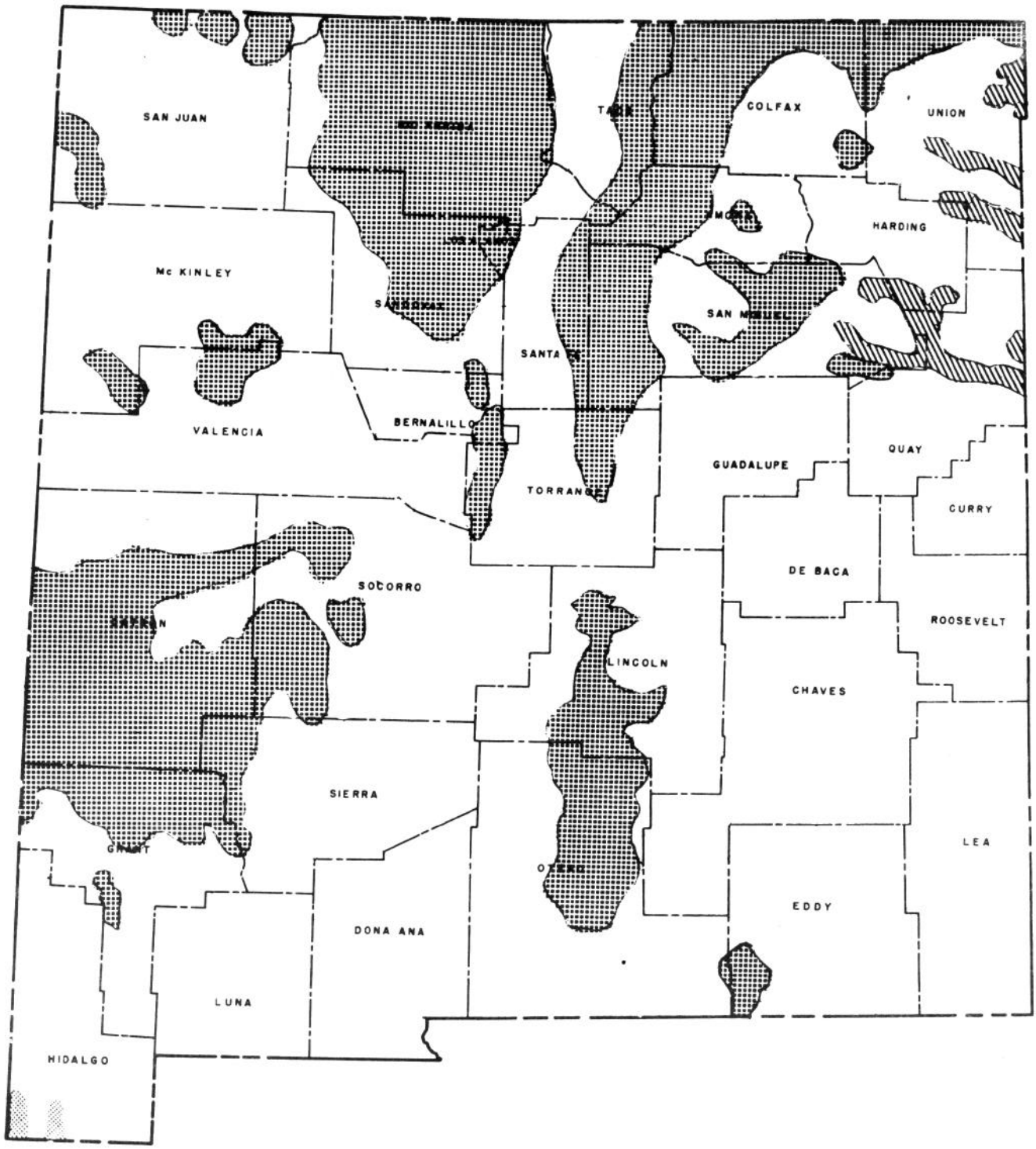
The other turkey, our rarest one, is the Mexican turkey, native to the Sierra Madre of Mexico and the extreme southwestern corner of New Mexico. Apparently the only records of the Mexican turkey in the United States are from the Animas and Peloncillo Mountains, the most recent record being a hen collected in May of 1957.

The capture of this bird was in itself a strange occurrence. A rancher, Mr. Laddie Pendleton, whose headquarters are three airline miles north of the Mexican boundary fence, had a domestic tom turkey, the sole domestic turkey he possessed. During May of 1957 he noticed that a wild hen had showed up at his place and attempted to mate with the domestic tom. Mr. Pendleton was able to capture this hen against a net fence, although she was in perfect physical condition and in no way incapable of flying or running. Mr. Pendleton made this collection at the request of the New Mexico Department of Game and Fish.

The bird was brought alive to Santa Fe whereupon the writer, among others, found it was almost certainly referrable to the Mexican strain known as Gould's turkey. The bird was electrocuted and the specimen was sent to Dr. A. Starker Leopold of the University of California with the request that he compare it with known skins of mexicana and confirm the identification. This he did and the skin is now part of the collection of the University of California.

The U. S. Fish and Wildlife Service was informed of this record of the Mexican strain in New Mexico. Mr. John W. Aldrich, chief of that service's Section of Distribution of Birds and Mammals, wrote to the New Mexico game department as follows:

"Meleagris gallopavo mexicana was described by J. Z. Gould (1856) in the Proc. of the Zool. Soc. of London, vol. 24, pp. 61-63. Since this original description may not be readily available to you I am enclosing a copy of the description of this subspecies which we prepared some years ago for a monograph on the wild turkey which has not yet been published. It should be noted that this Gould's turkey, although having the characters of white feather tipping is distinct from the Mexican turkey of central Mexico, which although also having the white feather tipped character is smaller and somewhat different in color of body plumage. This northern Sierra Madre race is large like the Merriam's turkey. It would be interesting to know just how extensive a range the Gould's turkey does occupy in southwestern New Mexico and southeastern Arizona."



DISTRIBUTION OF WILD TURKEY IN NEW MEXICO - 1959

Meleagris gallopavo merriami

Meleagris gallopavo intermedia

Meleagris gallopavo mexicana

For those interested in this description of the Gould's turkey, it is reproduced at the end of this paper.

The area in which the Mexican turkey is found is comprised of two north-south mountain ranges. The most easterly of them, the Animas, is a group of granitic upthrusts surrounded by desert plains and connected on the south by a low pass with the Espuelas Range of the Sierra Madre of Mexico. The vegetation in the high valleys and canyons is largely characterized by mixed conifers and hardwoods, the hardwoods being a bewildering variety of oaks with Quercus grisea and arizonica as the dominant species. The higher ridges of the range, which attains the modest elevation of 8,519 feet, are covered principally with Pinus leiophylla, the Chihuahuan pine, with smaller patches of Douglas fir, Pseudotsuga taxifolia, white fir, Abies concolor, and Arizona cypress, Cupressus arizonica. There are no permanent streams on the mountain, although waterholes in the canyon bottoms and numerous springs provide water. There are also quite a few stock-waterings in the form of either open tanks or windmills.

This mountain has an understory of dense growth of madroño, Arbutus arizonica. In many places the growth is so rank that it is impenetrable to all except the smallest animals. Mule deer, Sonoran fantail deer, black bear and javelina are abundant in both the Animas and the Peloncillos.

The Peloncillo Mountains, which parallel the Animas on the west, are significantly different from the Animas in topography and, in many cases, also in plant life. They are of a faulted limestone in deep-bedded layers and are not so steep or precipitous as the slopes of the Animas. The highest portion of the Peloncillos is quite low, reaching only to 6,715 feet. The vegetation here is of mixed stands of hardwoods, chiefly oaks and sycamores, along the stream courses and mixed stands of Chihuahuan pine and Apache pine, Pinus apacheca, higher up.

There are several small permanent streams, although their flow is usually small except in times of heavy rains. Plenty of surface water is available for the turkeys present in these mountains. Other game species here are the black bear, mule deer, Sonoran fantail deer, javelina, Arizona gray squirrel, and a number of upland species such as Mearns', scaled and Gambel's quail, band-tailed pigeons, and among the doves, the mourning, white-winged, ground and Inca doves.

The western portion of the Peloncillos extends into Arizona. It is possible that further investigation will find the Mexican turkey present also in southeastern Arizona.

The Merriam turkey, which is found throughout most of New Mexico, occurs in many varying types of habitat. All of the areas, however, are characterized by ponderosa pine, with two exceptions. In fact, except for these two cases, the Merriam turkey range could be said to be confined to the ponderosa pine belt in the various mountain ranges. The two exceptions are the Guadalupe Mountains lying in the extreme southeastern part of the state and extending into Texas, and the Chuska Mountains in the northwestern corner where turkeys do at times inhabit the piñon-juniper belt on the lower elevations of the mountains. In a few other ranges turkeys may travel through a piñon-juniper area, but they usually move on through to the preferred ponderosa belt.

Piñon, Pinus edulis and stroboformis, provides an of the great sources of food for turkeys as well as for other game. It also constitutes an important food for man. Unfortunately, the piñon does not fruit every year. Large crops occur on the average of once in every seven years, and fair crops about every three to five years.

From the central part of the state southward is found the alligator-bark juniper, Juniperus pachyphloea, which is an important reservoir of food for all species of game, particularly turkeys. Pine mast, juniper berries, grass heads and various wild berries such as kinnikinnick, Arctostaphylos uva-ursi, form the major diet of the Merriam turkey in this state. As much as three-fourths of a quart of the pannicles Of grama grass have been taken from a mature Merriam gobbler. These tall grasses, when not overgrazed, provide the ace-in-the-hole for turkeys during periods of intense cold or heavy snowfall. The tall grasses sometimes extend above the snow and allow the Merriam to winter at high elevations and under extreme weather conditions. The Merriam has a considerable vertical migration, being found in the summer clear to timberline in the northern mountains.

Although census methods are inadequate, the number of turkeys now present in New Mexico is estimated to be from 25,000 to somewhat in excess of 30,000. At present, turkeys are on the increase and are gradually becoming more numerous on all suitable ranges, though they are subject to cyclic declines.

Through trapping of wild stock, restoration of turkeys has been accomplished in all mountains from which they had been exterminated. No pen-raised stock has ever been used in restoration measures in New Mexico. Our efforts have rather been towards the capture of wild stock by the pole trap, cannon net or drop net. Over 500 wild-trapped turkeys have been taken by these means and distributed, either to other states through exchanges or to suitable areas within New Mexico. Turkey flocks now present in Wyoming, South Dakota, North Dakota and Texas are derived, at least in part, from turkeys provided from New Mexico through exchanges.

We know nothing of the diet of the Mexican turkey since no food habits studies have been conducted on this subspecies, insofar as known. We have a very sparse knowledge of the diet of the Rio Grande turkey in northeastern New Mexico. They have been seen to feed on the heads of tall bunch grasses but, other than that, we know very little about their diet. Hackberries, wild grapes, sumac and mesquite beans are found along the watercourses which they inhabit and it is likely that they take considerable quantities of these food items.

Predation on turkeys in New Mexico is chiefly by the golden eagle, the coyote and the bobcat. The bobcat is known to seek a turkey dinner avidly, but there is no substantial evidence that bobcats constitute a critically limiting factor upon the wild turkey. Coyotes have been seen to attack and kill turkeys and to seize and swallow young birds unable to fly. Again, however, there is no evidence that they critically limit turkey numbers. Although golden eagles have been seen killing turkeys, predation from this source evidently does not seriously affect turkey populations.

The average kill during the hunting seasons runs about 2,000 birds. Considering the fact that New Mexico's turkey population exceeds 25,000, this is certainly a modest harvest of a bird with the reproductive capacity of the wild turkey. The Rio Grande turkey lives largely on privately owned

land and is subject to but limited hunting, usually only by the landowner and his invited guests. The rest of the turkey range is primarily forest, BLM or state-leased land with the principal range being on forest land where, of course, unlimited numbers of public hunters may seek turkey.

Turkeys are classified by law as big game in New Mexico and they may be taken only with a big game license which also allows the taking of deer and bear. Turkeys may be taken with either shotgun or full-patched bullets. There has been only one season held on the Mexican turkey for many years and very few of them were taken. The two mountain ranges they inhabit are remote and largely inaccessible. On the other hand, there has been no general closed season on Merriam's turkeys since the first World War. Turkeys are maintaining their numbers throughout their range and there appears reason to believe that New Mexico can look forward to many years of hunting of this fine game species.

GOULD TURKEY
Meleagris gallopavo mexicana Gould

Meleagris mexicana Gould (1856: 61). Mexico [= Bolanos, Jalisco, Mexico (see Nelson 1900: 122)]. Type in British Museum.

Adult Male

(From a specimen taken El Salto, Durango.)

Similar to Meleagris gallopavo silvestris, but paler, and, as in osceola, and intermedia, more highly glossed with greenish and reddish golden reflections, less purplish bronzy.

Lower back and rump with reddish and greenish-golden metallic reflections as silvestris osceola rather than bluish black, as in gallopavo and merriami.

Tips of tail feathers and upper tail-coverts very light, almost pure white.

Secondaries as in merriami, with darker bars and mottling, broader white margins, less rusty and higher metallic gloss.

Tail feathers more dusky and less evenly barred, more marbled and speckled as in gallopavo.

Size large, particularly the legs, which are especially long.

Measurements (5 specimens from Chihuahua and Durango).--Wing, 513-545 (Average 528.2) mm.; tail, 380-437 (412.2); culmen from cere, 38.41. (39.7); tarsus, 170-182 (173.8); middle toe without claw, 84-93.5 (87.7); length of spur, 13.5-17.5 (16.1); greatest diameter of spur, 11-13 (12).

Adult Female

(Chiefly from a July specimen taken at El Salto, Durango.)

Similar to Meleagris gallopavo silvestris, but differs chiefly in the generally lighter and more grayish or olivaceous, less purplish bronzy,

coloration and whitish tips to body and tail feathers and upper and under tail-coverts.

This is the palest of the races, even exceeding intermedia in this respect and differing chiefly from that race in the much lighter tips of tail and coverts.

Body feathers and wing-coverts with concealed portions clove brown as in silvestris rather than fuscous black as in gallopavo and merriami.

Tips of tail feathers and upper tail-coverts very light, almost pure white.

Brown barring and mottling of tail feathers and upper tail-coverts paler than in silvestrisand metallic spot on black area of lateral rectrices distinct.

Secondaries broadly edged with white, but practically lacking in rusty coloration and metallic gloss; dark bars pale.

Measurements (7 specimens from Chihuahua and Durango).--Wing, 402-436 (419.6); tail, 318-362 (334.9); culmen from cere, 33.5-35 (34.4); tarsus, 132-139.5 (134.5); middle toe without claw, 68-73 (70.1).

Distribution.--In mountain pine forests of the Sierra Madre Occidental. North to: southwestern New Mexico (San Luis Mountains on the Mexican boundary), southward along the east slopes of the Sierra Madre in Chihuahua (Colonia Garcia), Durango (El Salto) and Zacatecas (Fresnillo and Valparaiso Mountains) to northern Jalisco (Bolaños).

Remarks.--Although no specimens have been seen from the east slopes of the Sierra Madre between northeastern Chihuahua and southern Durango, because of the similarity of the birds of those two areas, it is probable that the Gould Turkey occupied an unbroken range there from the northern border of Mexico south to Jalisco. Specimens of this race have not been seen from definitely within the borders of the United States, but there is an adult male in the U. S. National Museum collection taken by Mearns in the San Luis Mountains on the boundary line between Mexico and New Mexico. From this it is logical to presume that the Gould Turkey formerly ranged northward in the continuous mountain range which crosses the border into southwestern New Mexico. According to Ligon, the original turkey stock has been entirely eliminated from this area, as well as from southeastern Arizona, so that the race probably does not now enter the United States.

I follow Nelson (1900: 122) in applying the name mexicana to the northwestern Mexican race, rather than relegating it to the synonymy of gallopavo. Not only do I believe the conclusions of Nelson, relative to the probable origin of Gould's type, to be sound, but also from the description given by Gould 1856: the type must have been a very large bird. In fact the measurements which he gives fit the Sierra Madre race perfectly and are too large for gallopavo. Furthermore, Gould mentions "the center of the back is black with green, purplish and red reflections", another character of the northern as distinct from the southern, Mexican population.

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SUMMARY OF 1958 MICHIGAN TURKEY POPULATIONS

Vic Jansen
Michigan Department of Conservation

Prospects for the reestablishment of wild turkeys in Michigan continues to be encouraging. Turkeys can now be found in parts of at least 8 counties, including Allegan, Lake, Newaygo, Ogemaw, Roscommon, Gladwin, Clare, and Alcona. Best populations and prospects for continued survival are for the turkey flocks located in the Allegan State Forest. In the Allegan State Forest the peak summer population is estimated to be close to 500 turkeys or 2.1 birds per square mile of inhabited range. Since 1954 the flock has sustained rather constant annual losses of more than 50 percent of peak summer populations.

Little intensive work has been done with turkeys in the northern counties and estimates there are difficult to make. In the Lake-Newaygo areas, 9 flocks accounted for a total of 116 turkeys. There are no doubt a few other flocks present.

I would estimate 150 turkeys (peak summer population) to be in the Roscommon, Clare, Ogemaw, Alcona areas. Most of these birds are to be found in Ogemaw and Clare Counties.

STATUS OF TURKEY IN MONTANA

Robert L. Eng
Montana Game and Fish Department

This condensed history of our program is as follows: Two plants were made, one into each of two areas in the state during the winter of 1954-55. These consisted of 13 and 18 wild-trapped birds from Colorado and Wyoming, respectively. The 13 birds apparently experienced poor reproductive success the first year, but have since increased favorably to where they are dispersed over a l0-15 mile area around the base of the mountains. The 18 birds experienced favorable reproductive success and increased to approximate numbers of 65, 175 and 700 during the next three years.

The remaining areas are inhabited by birds transplanted from Area 2. Reproduction has been observed in all of the transplanted flocks. Contrary to some reports, reproduction has been accomplished in flocks in which only juvenile (1 year) toms were present.

A season was held in Area 2 (one-half of the area inhabited by turkeys was closed) for three days in the fall of 1958. The approximate population in the fall of 1957 was 700. One turkey of either sex was the season limit. This area was completely enclosed by checking stations and approximately 500 hunters harvested 100 birds. All types of guns were legal, although over 70% of the birds were killed with shotguns. Juveniles, adult males, and adult females made up 70, 20, and 10 per cent of the kill, respectively.

The available data indicates that the birds distribute themselves quite readily over the available habitat prior to building to excessive numbers in any one area. This information is being followed in determining the extent of transplanting needed in any one area. Transplants have distributed over a 25 mile area within two breeding seasons.

The present plan in this state is to continue a transplanting program into uninhabited areas. These areas are largely found in somewhat isolated spots throughout the eastern two-thirds of the state. Briefly, the areas planted are areas of ponderosa pine with light annual precipitation (and resulting snow cover). In addition, we have attempted to plant areas with occasional grain fields scattered throughout or adjacent to the timber. The stubble has been observed to be heavily used during certain winters and perhaps substitutes for the lack of mast sources in this country.

DISCUSSION

DR. MOSBY: The Montana transplant, I think, has been extremely interesting as has been the reestablishment of the Merriam's turkey in South Dakota where they have had a rather extensive season.

Mr. Powell, of Florida, is going to make brief comments on the general status of the turkey in Florida. He will also have a paper on the restoration efforts, but at this time we would like to have him briefly tell us something of the status of the turkey in Florida.

MR. POWELL (Florida): Gentlemen, we have in Florida what we consider a rather high population of turkeys.

In the 1957-58 hunting season we harvested,, state-wide, 20,200 birds. That is based on our free mailing system that was set up by Mr. Scott Overton, who is now with the North Carolina Institute, that Dr. Watson was talking about.

Approximately ten percent of the kill is taken on our management areas. We have three management areas in Florida.

We have three main things that we are working on in Florida -- one is restoration attempts, and, two, is improvement of habitat and, third, is trying to count turkeys, which we really can't do.

Our two limiting factors seem to be the inability to count turkeys and spring rainfall, which is the controlling factor on most of the turkey population in Florida.

Now, this is strictly an off-the-cuff talk, so if anyone has any questions on Florida turkeys, I will be glad to try to answer them.

As regard to change in status, we have -- at least I have nothing available anything as far back as twenty years. Our records going back ten years show an increase from 15,000 harvest to 20,000 harvest. This has gone down as low as 10,000 in the years in between, and it is directly re-

lated to heavy spring rainfall the previous spring for the reduction in kill of that particular year.

Our restocking methods are, as Dr. Mosby pointed out, completely wild trapped birds. We trap between 200 and 300 birds every year and restock all of the state, generally within our management areas or areas open to public hunting. We had some areas on the West Coast -- Hardee, Manatee, Sarasota and DeSoto Counties which were almost completely devoid of turkeys about five years ago, and with the release of approximately 160 or 165 birds we had a huntable population within three years. A lot of it was due to cooperation with the local people. In those counties we do have a limited hunting season and permit only one bird. The remainder of the state allows three birds a year of any sex. We do have a spring gobbler season in the northern part of the state, that is in addition to the general state-wide fall hunting season, which runs from the middle of November to the middle of January. I do not have the statewide kill figures for '58-'59, but it will be, we are sure, somewhat reduced from the 20,200 kill of '57-'58, due to the bad hatching conditions that we had in the spring of 1958.

In general, that summarizes the status.

MR. SNYDER (Arizona): I was interested in what you said about habitat. I wondered what particular types of habitat manipulation you use in Florida.

MR. POWELL: Most of our habitat manipulation is confined to the state wildlife management areas and is primarily devoted to food -- Pensacola tuber, corn, mixed peas, that is about 90 percent of our habitat work. Just on areas that are marginal turkey country, we are just trying to raise the carrying capacity.

MR. LEWIS (Missouri): What size are your management areas?

MR. POWELL: We have three million acres in managed areas. Our prime turkey country is in Glade County; that is where I do most of the trapping. The closed area consists of 125,000 acres, and right beside it is the managed hunt area, which is composed of 100,000 acres. Those are our largest areas in South Florida that we consider good turkey areas.

MR. HARTMAN (Wisconsin): You said these areas are 100,000 acres. Are they wilderness areas or sparsely settled?

MR. POWELL: They are sparsely settled. In Glade County, this is heavily grazed. It's palmetto flat land interspersed with live oak and cabbage palm.

MR. HARTMAN: How many people live in these areas? Are they fairly well scattered throughout them?

MR. POWELL: No. In the 125,000 acre closed area where we do the trapping, there wouldn't be over 15 or 20 people living within the whole area.

MR. HARTMAN: Fifteen or twenty people or families?

MR. POWELL: People.

MR. HARTMAN: And what is the minimum sized area that you work with?

MR. POWELL: Our smallest management area is Okeechobee, just north of Lake Okeechobee, which is 16,000 acres.

WISCONSIN'S WILD TURKEY PROJECT

George F. Hartman
Wisconsin Conservation Department

Wisconsin's initial stocking of wild turkeys was made in 1887, six years after the last wild bird was reported for the state. That year a Mr. Gordon purchased two pairs of wild turkeys from a source in the Indian Territory and released them in the farm woods near Lake Koshkonong. In 1890 the estimates of their number varied from 23 of pure stock to more than 200 birds of wild and domestic stock. This planting disappeared within the next few years.

In the mid-thirties the Wisconsin Conservation Department purchased game farm birds (southwestern stock) and made a series of releases in the Baraboo hills country, the Wisconsin River bottoms in the southern part of the state and a few isolated releases were made as far north as the oak lands of Chippewa and Barron counties. Most of these plants were total and rapid failures but a small flock, progeny of the releases of the thirties, remains today. The birds are semi-domesticated, coming into a farm yard to feed each day.

Early in 1954, Roger Latham of Pennsylvania was brought to Wisconsin to evaluate the possibility of turkey stocking. His final recommendation was for us to make our initial stocking on our Meadow Valley wildlife management unit - a 60,000 acre area which adjoins the 40,000 acre Necedah National Waterfowl Refuge. These units lie in the heart of old Glacial Lake, Wisconsin, which is characterized by scrub oak and jack pine timber, sand and peat soils, extensive brush and sedge marshes, defunct drainage ditches, rolling timbered dunes, and an occasional sandstone ridge. It contains the highest deer population in the state and because it is the ecatone of the Appalachian forest, the Canadian forest and the tall grass prairie, a very good variety of wildlife food species is present. It is south of the state's snow belt and ground cover food species are usually available through the winter months. The area is primarily being managed for waterfowl, deer, ruffed and sharptail grouse. These practices include the winter feeding of sharptails, the establishment of approximately 300 acres of food patches for waterfowl, yearly and fairly intensive law enforcement. The food patch program on the adjoining refuge is comparative to ours. Almost all of these practices benefit our turkey program.

The best of our potential turkey range totals about two million acres, almost all of which lies within the basin of the old glacial lake.

In 1954, 69 adult turkeys, spent-breeders, were released during the first week of July. Stan Plis, our resident game manager, made fairly in-

tensive follow-up studies on these birds. He found three predator kills and one sick bird was captured. It died in captivity the following winter.

The following summer and fall (1955) at least six broods were discovered. This gave us the encouragement to purchase 217 in 1956 which were released in the same general area. In 1956 only six broods of wild birds were discovered but as our personnel spent little time on the birds and as there were few visitors in the area that summer, we considered even these six reports to be encouraging. During the November rifle season hunters reported seeing the birds over a ten township area.

During the fall and winter of 1956-57 six birds were found dead in the woods and along roads. Two of these birds were killed by poachers. The turkeys wintered very well during the winter of 1956-57. While the winter was generally mild, sub-zero temperatures were recorded on 32 days with a low of -32^{0} being registered. During this winter we fed a minimum of 77 birds at our feeding food patches and feeding stations and many birds were located in areas where they had to exist entirely on natural feeds.

Wild brood observations in 1957 were encouraging. With few people using the area that summer, 18 broods were reported and the minimum number of young totaled 74.

In 1957 we released 443 young birds that were hatched and reared at our State Game Farm from eggs procured from Pennsylvania. These birds were released generally along the perimeter of the initial release area.

In 1958 we observed a minimum of 34 broods totaling 240 young. While most broods were reported in the vicinity of the release sites, birds were seen 30 miles from the nearest point of release.

This winter should give us the test the birds need. We have already had over 40 days of sub-zero temperature readings. Our acorn crop was almost a complete failure. Present snow depths, however, are moderate and the snow condition is good. In spite of the absence of acorns, turkeys are using our food patches and feeding stations only to a moderate degree (90 to 100 birds).

The next year or two should show us if the birds will take. We realize that our selected area is approximately 100 miles north of the original turkey range in the state but we think that the alteration of the habitat in this area by man during the last hundred years along with our intensive game management will permit us to maintain a turkey population. Whether this population will offer us harvestable birds remains to be seen.

CENTRAL WISCONSIN TURKEY STOCKING

Year	Number Released		Broods Observed		No. of
	Adults	Young	No. of Broods	Min. No. of Young	Known Losses
1954	69	-			3
1955	-	-	6	22	1
1956	158	59	6	26	9
1957	17	443	18	74	18
1958	-	-	34	240	7
1959	-	-			1

DISCUSSION

MR. CALHOUN (Illinois): How would you compare the behavior of that bird in the field?

MR. HARTMAN: Some of the birds are very wild; whereas others are quite stupid. We have noticed that, and we get a terrific deer hunting pressure up there. Our hunting pressure is about 30 to 40 hunters per square mile, and I think they take care of a few of the stupid birds, at least, and maybe actually those people are doing us a favor by doing that. I don't know.

DR. MOSBY: Does anyone else care to make a comment about the status of the bird in their respective state?

MR. ELLIS (Oklahoma): I notice there is considerable vacuity of information from Oklahoma. I wonder if that is one of the states that didn't reply?

DR. MOSBY: They replied, but I couldn't decipher their legend on the map and returned it to them and didn't hear again.

MR. ELLIS: Would you like for me to fill in some?

DR. MOSBY: If you would, please. Would you come forward?

MR. ELLIS: I am doing a study of turkeys out there, and it kind of embarrassed me to see all these blanks up there (indicating map). I will run over a few notes I just jotted down.

In 1925 Oklahoma was practically out of the turkey business. It was estimated by the game people at that time there was probably a thousand turkeys in McCurtain County, and maybe a remnant flock or two in the west but nothing to be excited about.

I think that about 1937 -- some of you people from Texas correct me if this is wrong -- that the Texas Department began transplanting Rio Grande turkey in the Texas Panhandle, right west of Oklahoma. Along about 1951 some of these birds began to drift into Oklahoma, just a dribble, and this incited some people in the department to get concerned about the turkey because those drifters did quite well, and so about 1955 the department started transplanting some of these birds -- this is the Rio Grande turkey -- and since that time about 1,200 birds have been transplanted, around 400 a year for the years that they were transplanted, and these have been put out very sparsely. Sometimes a transplant would only include three birds, two hens and a gobbler, and the success was phenomenal with some of those transplants. Apparently there was a great vacuity there in turkey habitat, so that today we have approximately 7,000 turkeys in the western one-third of Oklahoma. The density is high enough that the department is considering a season for 1959.

We have -- this is a pretty rough guess -- we have approximately 1,500 eastern turkeys in the southern part of the state. Apparently poaching is pretty hard on the turkeys and keeps them pretty low.

The department is now spending several thousand dollars a year on the transplanting program. Other than that we have no management program in effect as yet. Hybridism is somewhat of a problem. We get some hybridism. I think maybe a season will help that.

MR. SCHORGER (Wisconsin): Isn't it probable that the Rio Grande turkey, as reported by Lee in Northeastern New Mexico, came from these transplants?

DR. MOSBY: You mean from the Texas transplants?

MR. SCHORGER: Yes, that spread into Oklahoma.

DR. MOSBY: I would like to have examined that more closely and found out from them, but there is a section at least in extreme Western Texas which supposedly was not within the range of the Rio Grande turkey that I presume the turkey to be re-established there by transplant. Mr. Glazener from Texas can answer that probably.

MR. GLAZENER (Texas): I happen to know of transplant of Rio Grande turkeys made in Dallam County in the vicinity of Vega not far from the New Mexico line, and we had records up to the time that I left, the Game and Fish Commission, that some of those birds had drifted westward. Part of that was based on band recoveries. One hen there was found dead at the age of about ten years, and she was very near the New Mexico line. It is conceivable, and I think quite probable, that other turkeys released north of there in Dallam County also moved westward into New Mexico. Many of these birds that are going down the stream on the east originated from live trapped wild birds on the Clear Fork of the Brazos River north of Albany, and that particular strain has been used almost exclusively for transplanting in the Texas Panhandle and across the northern portion of the state.

DR. MOSBY: Mr. Gwynn of Virginia.

MR. GWYNN (Virginia): I have been working with turkeys in Virginia for almost three years. Breaking down our state into climatological regions, we

find that our best area is the central mountain area which is composed of almost all Allegheny Range counties. Our turkey population in this section has been on the increase approximately since World War II. This year (1958) we had a kill of 783 birds of either sex, which was the all-time high for that area. This is surprising, because as far as winter weather is concerned we had last winter some of our worst winter conditions. Wayne Bailey, I think, will bear me out on that in the paper that he presents.

In our bag checks of a sample of 129 birds in two counties, Bath County and Highland County, for every adult female checked by the hunter, 8.2 juveniles were also checked. The past record was in 1953, when McDowell was working in Virginia, and he found, I think, a one to five ratio and the season preceding this one I think we had a 1 to 1.8 ratio, less than one to two. We, of course, believe that we had a tremendous spring hatch in 1958. In our northern counties, Shenandoah and Frederick, which are also in the Allegheny Range, but more accessible than our northern tier counties, south of Washington, D.C., our turkey harvests have been more or less stable. You would be interested to know that our turkey checking has been required by state law since 1951. Before that we had the wardens estimate the turkey harvest. I haven't done a whole lot of that. The wardens' estimates could be fairly accurate or they might not be. In our western Piedmont, which is a string of counties south of our northern areas, the turkey population has been decreasing, based on the turkey harvest, since 1951. In our eastern Piedmont, which is our main range, the harvest has been increasing slightly, although in the last couple of years it has been going down. In the Tidewater it has been increasing slightly also but not much to speak of. Our bag limit is two birds in the east. We usually draw a line on the Blue Ridge Mountains and east of that we had a season from the middle of November to the middle of January, two months. This year we reduced it to one month, from the middle of December to the middle of January.

In the western area we have a month-long season from the middle of November to the middle of December. We are going to recommend that our season be increased west of Blue Ridge to a full two months' season and also increase in bag limit up to two birds per hunter, if he is able to do that.

INVENTORY AND HARVEST

Session Chairman: HENRY S. MOSBY

TURKEY HEN-POULT RATIOS AS AN INDEX TO REPRODUCTIVE TRENDS[1]

Richard DeArment
Texas Game and Fish Commission

Prior to 1954 little was known about the reproductive trends of the Rio Grande wild turkey (Meleagris gallopavo intermedia) in the Texas Panhandle. In the fall of 1954, Texas Game and Fish Commission biologists initiated hen-poult counts on three watersheds in order to determine reproduction for that year, and to establish a basis for future trends.

At present, five consecutive years of hen-poult data have been assembled by the Commission. Not only has it helped to determine reasonable turkey hunting regulations, but also has contributed the following information: (1) the reproductive index or hen-poult ratio for local areas, single watersheds, and combined watersheds; (2) knowledge of turkey poult size classes; (3) the status of turkey populations on different ranges or watersheds; (4) some factors affecting reproduction.

The range of the Rio Grande turkey in the Panhandle of Texas is unique when compared to that of the Eastern turkey. It is found only along the timbered watercourses; as a result, its numbers are concentrated and easy to observe. Winter concentrations numbering 150 birds per flock are not uncommon. On occasions 300 birds have been seen. This situation facilitates turkey research, especially hen-poult counts.

METHODS

The Study Areas

Three study areas, located in Hemphill and Wheeler Counties in the eastern Panhandle, totaling approximately 70 miles along the Canadian River, Washita River and Sweetwater Creek, were selected because of their heavy turkey populations. These areas are located in the 21-inch rainfall belt in the rolling plains. The vegetation in the study areas is typically mixed grass with an interspersion of shrubs. The timber along the watercourses consists primarily of cottonwood (Populus deltoides). The soil varies from tightland to sandyland. The primary land use practice on the watersheds of the Canadian and Washita Rivers, in Hemphill County, is ranching. As a result, practically all of the bottomland is in native meadows and/or pastures. Sweetwater Creek watershed is interspersed with ranches and farms; however, the majority of bottomland is in native grass or alfalfa meadows. Turkeys are found only on the ranches in the study areas.

1 A contribution from Pittman-Robertson Project, Texas W-45-R-(4,5,6,7, & 8), Job 2.

Hen-Poult Counts

In the fall of each year, biologists take a random sample of the hen-poult population on each watershed, usually visiting the same ranches. The count is made during late August and early September, approximately two weeks are involved. The counts are timed so that the majority of nesting has been completed and the meadows have been cut. As a result, broods are easier to find.

The counts are made at the roost sites, early in the morning and late in the afternoon. Hens with poults, in fact all turkeys, usually prefer roosting on or near meadows. All hens, including the so-called "dry hens" (without young) and all poults are counted. It might be added, at this season "dry hens" congregate into flocks and are segregated from brood flocks; consequently the size of the "dry hen" flocks, in any given area, appears to be a good indication of nesting success. The poults are classified into the following size categories: one-quarter, one-half, three-quarters, and full grown.

When the count is completed, data is grouped according to ranches, watersheds, and combined watersheds. It is compared to that of the previous year and/or years in order to determine the trend. All data referring to poult size (with one exception) have been omitted from this paper for the sake of brevity.

RESULTS

The hen-poult ratio for the combined study areas, over a five-year period (1954-1958), was 1:2 (Table 1). This ratio resulted from counting a total of 1,347 hens and 3,114 poults.

Breaking the data down to individual watersheds, the hen-poult ratios were as follows: Canadian River, 1:2, based on 654 hens and 1,199 poults; Washita River, 1:2, based on 442 hens and 963 poults; and Sweetwater Creek, 1:4, based on 251 hens and 952 poults. The 1:4 ratio of Sweetwater Creek is significantly higher than that of the other two watersheds.

On a yearly basis the hen-poult ratios were as follows (Table 2): In 1954 it was 1:5, based on 152 hens and 691 poults; in 1955 it was 1:3, based on 205 hens and 556 poults; in 1956 it was l:l, based on 423 hens and 623 poults; in 1957 it was 1:2, based on 284 hens and 511 poults; and in 1958 it was 1:3, based on 283 hens and 733 poults. The year having the greatest reproductive success was 1954. The poorest year was 1956. Reproductive success steadily decreased from 1954 to 1956, then began to steadily increase through 1958.

In the final breakdown of the data, on an annual basis for each watershed, it is significant to note that Sweetwater Creek had a consistently higher hen-poult ratio than either of the other watersheds, with one exception (Table 2).

DISCUSSION

Rainfall appears to be one of the major factors affecting the fluctuation in turkey reproduction over the five-year study period. The decline,

TABLE 1

FIVE-YEAR TREND IN HEN-POULT RATIOS FROM THREE TEXAS PANHANDLE WATERSHEDS

Year	Hens	Poults	Hen-Poult Ratio
1954	152	691	1:5 (5.54)
1955	205	556	1:3 (2.71)
1956	423	623	1:l (1.47)
1957	284	511	1:2 (1.79)
1958	283	733	1:3 (2.55)
Totals	1,347	3,114	1:2

TABLE 2

ANNUAL HEN-POULT RATIOS FOR THREE WATERSHEDS IN THE TEXAS PANHANDLE

Watershed	Year	Hens	Poults	Hen-Poult Ratio
Canadian River	1954	69	251	1:4 (3.64)
	1955	138	282	1:2 (2.04)
	1956	187	245	1:1 (1.31)
	1957	93	129	1:1 (1.38)
	1958	167	292	1:l (1.74)
	Totals	654	1,199	1:2 (1.83)
Washita River	1954	41	246	1:6 (6.00)
	1955	44	132	1:3 (3.00)
	1956	168	212	1:1 (1.26)
	1957	127	198	1:2 (1.55)
	1958	62	175	1:3 (2.82)
	Totals	442	963	1:2 (2.17)
Sweetwater Creek	1954	42	194	1:5 (4.61)
	1955	23	142	1:6 (6.17)
	1956	68	166	1:2 (2.44)
	1957	64	184	1:3 (2.87)
	1958	54	266	1:5 (4.92)
	Totals	251	952	1:4 (3.79)
Grand	Totals	1,347	3,114	1:2 (2.31)

low, and rise in turkey reproductive success in the Panhandle over this period parallels a similar trend in precipitation (Table 3). In 1956, when the hen-poult ratio was lowest, precipitation was also down - local weather stations had record lows.

On the basis of individual watersheds, the yearly hen-poult ratios for the Canadian and Washita Rivers paralleled the annual rainfall recorded at the local station in Canadian and the more distant station at Amarillo. Hen-poult records for Sweetwater Creek likewise corresponded to the annual trend in rainfall at the local station in Wheeler, 1957 was the lone exception. However, in May of that year a devastating flood raged over the Sweetwater Creek bottomlands, wiping out all nests and poults, and causing a later than normal hatch. This was evidenced during the fall count when 85 per cent of the poults counted were less than one-half grown - 59 per cent of these were one-quarter grown or less. During the following year, which had no floods, only 18 per cent was half grown or under (only 4 per cent was one-quarter grown) and the remaining 82 per cent was three-quarters grown.

During the five-year period, except 1955, Sweetwater Creek had higher hen-poult ratios than either of the other watersheds. The following factors appear responsible for these higher reproductive indices: slightly higher rainfall; more favorable physical characteristics of the watershed - less flooding; and unstable turkey population resulting from constant poaching - more difficult to stop because of the interspersion of ranches and farms throughout the watershed.

TABLE 3

ANNUAL RAINFALL RECORDS FOR STATIONS
NEAR TURKEY STUDY AREAS

Station	1954	1955	1956	1957	1958
Amarillo	13.89	13.71	9.94	21.24	23.29
Canadian	13.00	16.82	9.64	27.11	29.45
Wheeler	12.20	28.25	16.50	31.67	24.62

SUMMARY

Five years (1954-1958) of hen-poult data were accumulated as the result of counting the Rio Grande turkey on three watersheds in the Texas Panhandle.

The five-year hen-poult ratio or reproductive index was 1:2. This was based on 1,347 hens and 3,114 poults. The annual indices were as follows:

1954 - 1:5
1955 - 1:3
1956 - 1:l
1957 - 1:2
1958 - 1:3

The Sweetwater Creek watershed had a higher reproductive index (1:4) than the Canadian and Washita Rivers watersheds (1:2).

Rainfall appeared to be an important factor in determining reproductive success. Annual rainfall trends closely paralleled the trends in hen-poult ratios for the five-year study period.

The higher hen-poult ratios for the Sweetwater Creek watershed appeared to be caused by the following factors:

1. Slightly heavier rainfall.
2. Less flooding.
3. Unstable population caused by poaching.

ASPECTS OF HARVEST AND HUNTING PRESSURE IN PENNSYLVANIA'S WILD TURKEY RANGE

Harvey A. Roberts
Pennsylvania Game Commission

Within the last 25 years the wild turkey in Pennsylvania has expanded its range from the 2,000,000 acre oak-pine forests of the Appalachian Physiographic Province, or Southcentral Range, to include the birch-beech-maple forests of the Appalachian Plateau Physiographic Province in the north-central portion of the state. Today this game bird occupies over 13,000,000 acres of range confined mainly to the central third of the Commonwealth.

In essence, three tools of management appear to be partially responsible for the phenomenal growth and spread of the wild turkey population. They are rigid law enforcement, maintenance of numerous small refuges and the introduction of quality farm-reared breeding stock. However, a complex of other factors has played a part in the establishment of a turkey population now estimated to number 40,000 birds.

As part of this complex, harvest and hunting pressure cannot be disregarded; and, as they relate to Pennsylvania, a discussion must be prefaced with the statement that the Commonwealth holds a unique position among states managing wild turkey populations. This signal status stems from the fact that the Game Commission annually produces and releases more farm-reared stock than any other state in the country.

The year 1905 witnessed the first attempt at expanding turkey management beyond law enforcement efforts; however, it was not until 1929 that the game farm program, as we know it today, came into being. At present the State Wild Turkey Farm produces approximately 6,000 birds per year. Half of these turkeys are released in the late winter as breeding stock and the remainder as gun-fodder prior to the hunting season. The spring and fall liberations are largely confined to the southcentral and marginal turkey ranges. Very little of this stock is released in the northcentral range where the native turkey population is self-sustaining.

Since 1953, Game Protectors estimates show that Pennsylvania turkey hunters have bagged an average of 15,399 birds per year. The largest estimated kill took place in 1955 when 17,944 birds were harvested; the smallest kill, which involved 12,957 turkeys, occurred in 1958.

The trend established by these harvest estimates revealed that the newly occupied northcentral range surpassed the long-established south-central range in the production of turkeys during the 1949 hunting season. Since that time the kill in the northcentral range has averaged 76 per cent of the total harvest for the two regions.

While hunting pressure data have been obtained in other states by (1) road checks whereon all traffic is halted and each hunter interviewed; (2) count of hunters vehicles in pre-selected areas at pre-selected times; and (3) mandatory registration at checking stations, the car-tag questionnaire appears best Suited to conditions in Pennsylvania.

The 1958 wild turkey season (October 25 - November 22) marked the fifth consecutive year that this method was employed to sample hunting effort in various portions of the turkey range. Because of the variation in the number of days surveyed for the six study areas, it seemed advisable to limit a comparison of hunting pressure to three key days. As employed in Table 1, these units of time are (1) first day, (2) a Saturday or holiday, and (3) a mid-week or minimum effort day. By applying the data for these three key periods to the total number of corresponding days, a seasonal average or index was developed.

Since 1954, range-wide hunting effort has averaged 1 hunter per 1,096 acres of range. On the average, each hunter spent 4.25 hours afield. For the southcentral and northcentral ranges, the hunter per acres of range ratios were 1:422 and 1:505, respectively.

While the "hunter index" appears to be quite similar for the two regions, it should be noted that the ridge and valley topography of the southcentral range lends itself to complete saturation by hunters. The vastness of the northcentral range precludes any such large-scale penetration.

There is a wide variance in hunting pressure from season to season, as witnessed by the findings for 1957 and 1958. Without question, economic conditions, weather conditions, etc., are reflected in pressure and harvest of turkeys; moreover, staggered opening dates for small-game species also show up in hunting effort. The 1957 turkey season, which began one week in advance of the pheasant-rabbit season, was 31 days in length. The 1958 turkey season was 25 days in length and ran concurrently with all other small-game hunting.

As a partial result, 1958 first day effort in the combined southcentral study areas was only 33.48 per cent of that recorded for the corresponding period, 1957: 68.85 per cent of last season's first day pressure was experienced in the combined northcentral study areas. State-wide, first day hunting pressure in the turkey range was only 46.79 per cent of that recorded for 1957.

It has been observed in many states that the small-game kill is very high for the first few days of the season. Based on range-wide data, these observations can also be applied to wild turkeys. Kill data for Pennsylvania were broken down into six or seven categories, depending on the length

of the turkey season. First day, second day, end of first week (7 days), end of second week, etc., were the units of time used. Table 2 shows that, state-wide, 48.28 per cent of the total turkey kill occurred on the first day of the season and by the end of the second day 51.85 per cent of the harvest had taken place.

Of particular interest was the distribution of the kill during the first week of the 1957 season. The first and second day kills of 53.12 per cent and 65.82 per cent of the total season kill can be largely attributed to the fact that the turkey-grouse-squirrel season preceded the rabbit-ring-neck season by one week. In 1958, when all small-game became legal prey on October 25, the first and second day kills fell to 32.17 per cent and 40.13 per cent of the total, respectively.

Accessibility and distance from urban centers, was also reflected in the distribution of the turkey harvest in the northcentral and southcentral ranges. By the end of the second week, 1958, 66.66 per cent of the total kill had taken place in the northcentral portion of the state; during the same period 85.71 per cent of the kill had occurred in the heavily hunted southcentral range.

Range-wide (1954-1957), 3.6 per cent of the turkey hunters were successful. Hunter success during the 1958 season averaged 3.66 per cent.

As noted previously, farm-reared turkeys are liberated, spring and fall, in those portions of the range supporting the smallest "native" populations and experiencing the greatest gunning pressure. From a total of 2,779 turkeys stocked during the period September 20 - October 22, 1958, in five of the Commissions' six field divisions, 659 birds or 23.71 per cent were marked with metal bands. An 11.38 per cent band return was realized from these releases of 18 to 22 week-old birds. The 1957 return from a smaller release in four divisions was 17.50 per cent.

It comes as no surprise that the timing of the fall liberations has a definite bearing on harvest and band returns. The return of bands was greatest from turkeys liberated not more than two weeks before the gunning season. On the other hand, poorest returns were realized from birds stocked five or more weeks in advance of the season.

With the exception of one bird that was killed by an automobile in July, there were no bands returned from 18 farm-reared turkeys released early in January, 1958, in the Perry County study area. Two hunting season returns were recorded for 28 trapped and transferred wild birds liberated in February. At this writing, the trapped and transferred turkeys appear to constitute the major portion of the surviving stock in the Perry County area.

Admittedly, more data will be needed before definite conclusions can be drawn regarding the role of farm-reared, fall-liberated stock; however, on the basis of information gathered thus far, some light has been shed on the subject. The 1958 hunting season study in western Perry County revealed that 66.66 per cent of the harvest was made up of fall-liberated birds. Trapped and transferred stock, released in mid-winter, constituted 6.66 per cent of the total kill and "native" birds made up the remaining 26.66 per cent. Spring-released farm-reared breeding stock did not appear in the fall harvest.

The total kill in western Perry County was approximately 80 turkeys or about 75 per cent of the pre-hunting season population. Inasmuch as Perry

TABLE 1

HUNTING PRESSURE - NORTHCENTRAL AND SOUTHCENTRAL RANGES

Range	Year	Day[1]	Number Hunters	Total Hours	Average Hours	Acres per Hunter
Southcentral	1954	1	122	468.5	3.84	251.47
		2	52	258.0	4.96	590.00
		3	30	153.5	5.11	1,022.66
Season	Index		996	4884.0	4.90	769.07
	1955	1	84	339.5	4.04	365.23
		2	76	360.0	4.73	403.68
		3	20	63.0	3.15	1,534.00
Season	Index		956	3930.5	4.11	802.30
	1956	1	332	1300.0	3.91	92.40
		2	72	264.0	3.66	426.11
		3	21	73.0	3.47	1,460.95
Season	Index		1319	4827.0	3.65	721.06
	1957	1	327	1212.0	3:70	93.82
		2	63	263.0	4.17	485.39
		3	13	45.0	3.46	2,360.00
Season	Index		1067	4088.0	4.76	891.35
1958		1	76	251.5	3.30	403.68
		2	69	232.0	3.36	444.63
		3	21	57.0	2.71	1,460.95
Season	Index		868	2669.5	3.07	883.64
Northcentral	1954	1	75	395.0	6.06	1,141.02
		2		26.5	5.26	593.33
		3	7		3.78	6,357.14
Season	Index		683	3452.0	5.05	1,775.25
	* 1955	1	4	10.0	2.50	5,000.00
		2	23	133.5	5.80	869.56
		3	3	11.0	3.66	6,666.66
Season	Index		216	1131.5	5.22	2,314.81
	19%	1	216	1115.0	5.16	206.01
		2	68	290.5	5.00	767.24
		3	14	57.0	4.07	
Season	Index		944	3946.5	4.18	3,178.57
	1957	1	228	1021.0	4.47	1,461.32 195.17
		2	45	223.0	4.95	988.88
		3	8	32.0	4.00	5,562.50
Season	Index		727	3318.0	4.56	1,897.52
	1958	1	157	795 .0	5.06	283.43
		2	69	339.5	4.92	644.92
		3	28	134.0	4.78	1,589.28
Season	Index		1075	5244.0	4.87	1,034.88

(1) 1 - 1st day
2 - Saturday or Holiday
3 - Mid-week day

* Only Clinton - Lycoming Area Surveyed.

TABLE 2

WILD TURKEY HARVEST EXPRESSED AS CUMULATIVE PERCENTAGES

	First Day		Second Day		First Week		Second Week		Third Week		Fourth Week		Fifth Week	
	'57[1]	'58[2]	'57	'58	'57	'58	'57	'58	'57	'58	'57	'58	'57	'58
Northcentral	44	27	46	32	55	51	69	67	78	82	89	l00	l	
Southcentral	48	41	61	62	80	76	86	86	95	95	100	100		
Northeast	55	32	59	36	66	55	80	86	83	95	93	100	l00	
Southeast	65	54	68	60	93	69	98	83	99	91	l00	l00		
Northwest	72	28	75	34	82	66	85	75	89	92	l00	l00		
Southwest	70	37	76	48	85	72	90	90	90	99	l00	l00		
State-wide	53	32	57	40	69	61	79	78	84	90	93	l00	l00	
All Data State-wide			48		52		69		78		87		93	

(1) 1957 Season 31 days long; started 1 week in advance of ringneck-rabbit season.
(2) 1958 season 25 days long; all small-game legal same day.

County is representative of the southcentral range, it can be assumed that fall-liberated stock makes up a large portion of the kill in other southcentral counties. Conversely, in some of the northcentral areas where marked birds were stocked prior to the hunting season, banded birds constituted less than 1 per cent of the total harvest. There were no band returns from some other areas.

Pennsylvania, in general, affords some of the best turkey hunting in the country. The turkey population in the northcentral range is self-sufficient and the addition of fall-liberated, farm-reared stock adds little to the annual harvest. However, fall releases in the heavily hunted, easily accessible southcentral range appears to add appreciably to the annual kill. In some cases, these liberations tend to ease the pressure on the resident turkeys. In light of the fact that the harvest in the southcentral range removes upwards of 75 per cent of the pre-hunting season population, the stocking program appears justified.

At present, the hunting in the southcentral and marginal ranges can be classified as put-and-take. As steps toward the alleviation of this condition, the creation of additional nesting and escape areas, the judicious use of farm-reared stock and a reduction in the length of the gunning season are recommended.

DR. MOSBY: You will recall that the two aspects that we are addressing ourselves to in this particular session are inventory and harvest. In the short time that remains to us I suggest that we take up these topics individually, that is first inventory methods, and, then a discussion on harvest.

The State of Arkansas has an intensive method of trying to make an inventory. Kentucky counts the winter flocks. Florida is conducting gobbler counts, and West Virginia has been using the re-trap method of arriving at an estimate of the population on a given area. Missouri and Virginia in the past have used the multiple interview method of trying to locate the flocks and plotting them on the map. Mr. DeArment indicated that they were using brood count data as a method of keeping their finger on the status of the turkey. So, you can see there are a number of inventory techniques that have been employed.

MR. BAILEY: I would like to ask Mr. DeArment, from Texas, about what he would term saturated populations on the refuge area. You mentioned that poaching had limited population increase on some areas, and I presume that in your refuge areas you don't have that.

MR. DeARMENT: In our range country we have a saturated population, but in our refuge we keep trapping turkeys off, so we keep the density down.

MR. BAILEY: What do you consider a saturated population there?

MR. DeARMENT: It's all on the bottomland areas, and we have never figured a saturation. All we know is as long as the turkeys are increasing in any particular range, we know we are not saturated. On some ranches that are isolated we can tell when we have a saturated population because the turkeys start moving off to other areas; whereas they keep increasing until they reach that. It's just a matter of counts.

Incidentally, we started aerial counts last spring and we found in our country they are very reliable. We can see them very well from the air and get counts that way. I am sorry I can't answer your question on a per acre basis what a saturated population would be in that range land.

DR. MOSBY: We found out that Texas is now using the aerial method of counting. They are in a fortunate position, I think, in being able to see the majority of the individuals in that open country and can, therefore, get a much more accurate count than those of us who have to work surrounded by brush.

MR. ALEXANDER (Arkansas): I want to ask one question of Roberts from Pennsylvania and that is whether or not they are making an effort to inventory the reproduction of the pen reared stock?

MR. ROBERTS: I will have to answer your question by making a statement first -- it has only been within very recent years that the powers-that-be have seen fit to permit us to band any of this stock. As a result, inventory on that basis is very difficult when you turn farm bred birds out with established populations. This spring we did get permission to band about two thousand of our farm reared breeding stock that has been released within the last few weeks. We banded them with metal bands and also colored plastic bands and during the summer the game protectors make brood counts during the

course of their other duties, and we hope to come up with some figure on the basis of a banding program this year. I can't give you any more answer than that.

MR. GWYNN: This hasn't been developed too far. I thought you might be interested in it. West Virginia and Virginia have been using a gobbler count on roughly a ten-mile route. There are lots of pros and cons on a system like that, but I feel that it is better than no data at all. In Virginia we have set up a three-minute gobbler counting interval at stations. Our maximum count last year, which is the first year we have run counts, was 17 gobbling gobblers on a ten-mile route. That was in Eastern Virginia.

MR. BATEMAN (Louisiana): Do the yearling gobblers gobble as readily as the older gobblers, you think?

MR. GWYNN: We are assuming that they don't gobble at all.

DR. MOSBY: I presume that the group is anxious to pass on to the next discussion relative to harvesting.

As we pointed out earlier, there are two general methods used -- one permitting the taking of any turkey -- and normally that calls for a fall season, and the other system is the taking of gobblers only, and that normally involves a spring season. You will recall there were eight states having the gobbler only season and there were twelve states having the any turkey season.

Now, we have representatives from states having these two types of hunting regulations, and if there are any comments or questions the floor is now open to matters relating to harvesting, either the legislative control of harvesting or measuring the harvesting.

MR. KING (Wisconsin): I am interested in the states that may have a controlled harvest on a relatively small area. It sounded like Florida might have something that I am interested in.

DR. MOSBY: Your question then would be what are the mechanics of controlling the harvest on a specific and comparatively small area, 15,000 acres or less?

MR. KING: Right.

MR. POWELL: If I understand your question, sir, we have not as rigid a control as we would like because we don't feel that we can count the turkeys yet. On areas such as Fisheating Creek and our better areas, we would like to reach a point where we could inventory the birds so that we could set the kill before the season is open. In other words, say you can kill 300 birds this year, and then when that is reached, close the area. We do that on quail, but we just don't have firm enough ground to stand on yet to census the turkeys. Now, our management areas are open for a period of time and the kill is not regulated to numbers of birds taken other than what can be taken in that specific period.

MR. KING: But you do control the number of hunters on that?

MR. POWELL: No, sir, we do not. On a few areas there are some controls that come into being but not through limited hunters. We employ a limited hunter on the Collier Area for goose hunting, but on the turkey range we do not restrict the number of hunters.

MR. KING: I thought you mentioned a mailing system.

MR. POWELL: On a state-wide basis we have a mailing system after the season is over. It was set up by Mr. Overton, as I mentioned. It consists of three separate mailings that follow one another. We get our state-wide kill from that. Of course, our management area kill is operated on a checking area basis and all the kill that is taken out of the area is checked through these stations, but it doesn't as such, control the kill. Dr. Mosby mentioned that in Florida we are employing a gobbler count. We are, but in addition to that we are also employing everything else we can lay our hands on -- feeder observation, general sight records and our trapping data. We lay most of our strength in the trapping data in that we have the bird in hand and it is easily identifiable as an adult, sub-adult, hen or gobbler.

DR. MOSEY: There are several other states employing systems for the control of the kill. In Virginia in the past, although it is not currently being employed, on state forests where they anticipated rather high hunting pressure some restriction has been experienced on a permit basis. This system did not limit the total number of hunters but it was thought that checking through a station and purchasing the permit would tend to limit hunters to a certain degree. Some of the western states are, as I understand it, operating under a permit system for the taking of turkeys comparable to that employed for the taking of deer. You have to purchase a special license.

Is there anyone from Colorado, Arizona or New Mexico that would care to comment there?

MR. JANTZEN (Arizona): We have a system of management units, whereby we set the number of permits available for each management unit for turkey, and then we issue those on a lottery basis by drawing. The license itself is a turkey tag which is available to any of the license dealers throughout the state, but the permit to purchase that tag, which is valid for only a specified unit, is issued from the Phoenix office.

While I am on my feet, I would like to address a question to the gentleman from Florida.

You mentioned that you use a hunter questionnaire for some of your kill data.

MR. POWELL: Yes, that is correct.

MR. JANTZEN: We are trying to get into that in Arizona, and get away from our hunter report card that we used to have, and I would like to know what sample size you figure you need for fairly accurate estimates of a statewide kill?

MR. POWELL: Well, I am getting a little out of my territory. I wish Scott Overton were here. I am not a statistician. We take all the copies of the state hunting licenses and the copies are assembled for all the licenses sold that year in the state. We then pick out a random sample, which is statistically sound, and make the first mailing. We get back a certain percentage answer to the first mailing, and again pick out, from what is left, another sample; this second mailing is followed by another mailing. As far as the total percentage of hunters sampled, I just can't answer that question.

MR. JANTZEN: You don't send out a reply to all those that did not reply? You just make a sample?.

MR. POWELL: A sample of the non-respondents, that's correct.

MR. JANTZEN: Do you send out this questionnaire to estimate the kill on all species, state-wide?

MR. POWELL: That is right. That is for deer, quail, turkey and so forth.

I might make a few comments regarding the any turkey kill as opposed to gobbler only harvest. We have found that in good turkey habitat we can kill up to 60 percent of the population, and if all things are as they should be, of course they aren't always -- in other words, good food supply, and the factor that I mentioned earlier, the spring rainfall is as it should be, the birds will go back to their original population by the next fall. Using approximately 15,000 records, mainly feeder observation records, we find that we have a 40-60 sex ratio or 60 hens and 40 gobblers out of every hundred. The hens are about 70 percent sub-adult and 30 percent adult, and we can tell pretty close what kind of hatch we had last spring by the banding, from the percent of hens and gobblers, sub-adults and adult birds that we take.

Now; in determining whether or not to hunt gobblers only or hens and gobblers, I will read a paragraph here --

"In considering whether or not to permit hunting of gobblers only, it is first assumed that all hunters are honest and will not shoot a turkey unless they are absolutely sure it is a gobbler. It is also assumed that most hunters are not sure of the sex of a sub-adult gobbler, therefore, a few hunters wouldn't shoot sub-adult gobblers for fear that they may be hens. The first assumption has to be fairly accurate or the law would not be effective anyway. The second assumption is not unreasonable for a majority of the hunters.

We may assume that an honest hunter who is not absolutely sure of the difference between a young gobbler and a hen and is not allowed to shoot hens is at a definite disadvantage for two reasons -- the first is that he cannot shoot 60 percent of the turkey population, which is hens. The second reason is that of the remaining 40 percent, he can be sure of only 73 percent as being gobblers. Of every hundred turkeys seen, 60 will be hens, and 10 will be young gobblers and 30 adult gobblers; thus there are 70 out of the hundred he can't or won't shoot. There are probably cases where this is justified, but in most cases it is not."

Now, we have a good native population of birds on the areas that we kill most of our turkeys. If we could control spring rainfall, we could really be in business because we don't feel that we have any serious limiting factors other than the hatch in the spring.

Now, while I am here I would like to ask the gentleman from Texas --

You mentioned, sir, that you had a flood one year, I believe, and that the poults were very young late in the fall. From that do you mean that the hens re-nested?

MR. DeARMENT: Yes.

MR. POWELL: Unfortunately, we don't find that the case in Florida turkeys. Once the nest has been destroyed in the spring they are done for the year, consequently if we have bad rainfall in May and June, our turkey population takes a beating. Of course, we haven't come up with any good ideas on how to control spring rainfall yet. (Laughter.) But that seems to be the limiting factor.

MR. BAILEY: Before you sit down, I would like to ask one more question -

Winter before last I happened to be on the Collier Hunting Area which you mentioned a while ago as being one of the better hunting areas in Florida and talked with some of the men working there, just check station operators and people like that. I was interested in the fact that the kill data they had indicated that your kill per square mile was roughly one turkey, as I recall. That was rather striking to me because that is roughly what our kill averages on the better areas in West Virginia year after year. Some of the other data you have with regard to sex ratio and the number of immatures per adult hen and so on are very similar to that of West Virginia. I would like to hear any comments you have on the kill per square mile.

MR. POWELL: I have no figures on the turkey kill per square mile. The Collier Area contains 360,000 acres, but it isn't all turkey range. A lot of it is excellent deer range but not excellent turkey range. We have killed as high as 518 turkeys in one season off these 360,000 acres, but as I say it is not all turkey range, and I don't have it divided down. There again on the Collier Area I would like to point out in 1954-55 we had very bad rainfall in the spring of '54 and a bad hatch. That fall they only killed 179 turkeys on the Collier Area, the pressure being about equal for '55-'56 but we had an excellent hatch the following spring and the kill jumped up to almost 500 birds for just about the same number of man days hunting.

DR. DUSTMAN (Ohio): On a good healthy turkey range what is the justification for a gobbler season? Under what conditions would you wish to have a gobbler season in a healthy population of turkeys?

DR. MOSBY: Well, we have a representative from Alabama, and they have had the gobbler season for a number of years. Would you like to answer, Mr. Davis?

MR. DAVIS (Alabama): If I may, I would like to make a comment or two prior to this.

The gentleman from Florida said their sex ratio was 40-60, the 60 being hens. We don't have the sample that he has and our method of determining sex ratio depends solely on observation, but our sex ratio came out 134 gobblers per 100 hens. As I will point out later in a paper, only about one-third of the hens are producing broods, but it only takes one gobbler to fertilize this brood. So we are supporting over a period of years, a good many gobblers that aren't contributing either to reproduction or to recreation. If you only have one-third of your hens that are supporting your population, if you go in there and reduce this population, you can in my opinion hurt your population.

DR. MOSBY: In Virginia, about the productivity of turkeys, Mr. Gwynn has referred to the fact that the adult hen-poult ratio has been used as a measure

of productivity. There is also one intereating fact brought to light in a study made by Bob McDowell in Virginia several years ago and that was this -- that only about one hen in six is successful in rearing. At least that was true in the year of '54.

That was based on these facts: The brood count was one hen to approximately seven young, but in the kill the hen and young ratio was approximately one to one in Central Virginia. If those figures are representative, it will mean that only one out of six or seven hens was successful in bringing off a brood. That has some relation, I think, to an any turkey season. My contention has been that if your turkeys are not producing, then we need not be too much concerned with the harvest other than eliminating any of it, but if they are producing, turkeys have the potential of producing at almost a 600 percent rate of increase and the 300 percent is quite often attainable. If we harvest ten percent, which appears to be, from the Florida figures, approximately the proportion that would be harvested in a gobbler only season, I think we may want to think of those figures in the discussion of a gobbler versus any turkey season.

MR. POWELL: I know nothing about turkeys outside of Florida and very little about them there, but from our numbers, and we are fortunate in having records on a large number of turkeys, and separating the hens into adults and sub-adults shows that about 70 percent are sub-adults and 30 percent are adults. Of the adults approximately 15 percent to 25 percent can be expected to be two-year birds. This indicates that the hatch of any given year will drop from 70 percent hens to 15 percent to 25 percent for the second year, or that 75 percent of the sub-adult hens are lost between the first and second year. Areas that were trapped and most of the areas from which sight records were taken were closed to hunting. Therefore, this cannot be a hunting or poaching loss. The most logical explanation of this loss is that it is a nesting mortality since the hens are probably more vulnerable at this time than at any other.

That is somewhat of a supposition, but our figures seem to bear that out.

MR. GWYNN: I am going to ask Mr. Powell how he knew that the two-year old hens were actually two-year old hens.

ME?. POWELL: We are able to determine birds of the year by the outer primaries. They lose these in late February and March. They are hatched in May and June, and the following February and March they assume their adult primary feathers. From banding records (we have banded 1,400 to 1,500 birds) and we have about an eight to ten percent return. We find that, in a lot of cases, not until well after the second or into the third year hens will develop a button at the spur. This, however, is a figure that is hard to put your finger on. We certainly have found out from the banding record that the length of the beard has nothing to do with the age of the bird. I have had birds less than two years old with eight-inch beards. I have also had birds two years old with only one to two-inch beards. I think probably a lot of that is due to habitat, but we feel, as I stated, of the adults, which comprise 30 percent of the population, 15 to 25 percent are second year birds. I don't believe that is too little a figure from our studies. I am sure I didn't answer your question but did I clear it up at all?

MR. GWYNN: You did it from banding returns?

MR. POWELL: That's right, mostly from banding returns. We have had the opportunity to band a large number of birds.

MR. GLAZENER: I wonder if I might raise this question -- I don't know to whom to address it, but anyone from a state where there is a gobbler only season.

Do you have biological data to support an any turkey season but are prevented from having that arrangement because of legislative restrictions which you have not been able to overcome?

DR. MOSBY: That question was asked in the questionnaire and in 46 replies was rather adroitly circumvented. I don't know that there is anyone here who feels that they are among friends and will not be in jeopardy if they answered. When we get to the question of legislation, most of them have been a little circumspect in their remarks and perhaps rightly so. I don't think it need to be so at this particular group, however. I don't know whether you could appoint a volunteer or not.

MR. DAVIS: So far as I know, Alabama has never sought to change its law on that.

DR. MOSBY: You may be interested in a little reminiscing that goes back about twenty years. We went through the fourteen southeastern states and two things interested me a great deal -- every state had the only remaining pure strain of wild turkey, and the second was that every state had tried a gobbler only season. Those states that were in the most severe straits, particularly East Texas, Louisiana, Mississippi, stated that if they were able to re-establish the turkey as a hunting species, they would not go back to the gobbler law. All of them had had it including Virginia. Others having the gobbler law, or having had a season that extended into the gobbler season, presumably still have the gobbler law as a hangover, either rightfully or wrongfully, from the past. Don't misunderstand me. I am very much interested in your question. My only thought is to harvest as much of the turkey population as it will biologically stand, be it one percent or fifty percent. But in many cases I think perhaps we may be doing things merely because they have been done that way rather than for any good reason.

MR. CALHOUN: I would like to ask some of the fellows that have a gobbler only season what their opinion is of hen loss during the gobbler season.

MR. DAVIS: I don't have any figures on the loss of hens during the season. The majority of loss would come in Alabama during the fall season. Our season runs 71 days, 51 being in the fall and early winter, and 20 days in the spring. There is a loss, but it would be, in my opinion, minor.

DR. MOSBY: I have been asked to announce that as a courtesy of the National Audubon Society there is a group of reproductions of Audubons of turkey and other publications which are available free. We will encourage you to take one if you have need for same.

RESTORATION EFFORTS AND METHODS .

Session Chairman: EDWARD L. KOZICKY
Olin Mathieson Chemical Corporation

TURKEY RESTORATION EFFORTS IN THE OZARK REGION OF ARKANSAS

John R. Preston
University of Arkansas
Arkansas Game and Fish Commission

INTRODUCTION

The Arkansas Ozarks originally supported a large turkey population, but during the past 35 years turkeys have become increasingly scarce due to timber cutting and other land-use practices. Recent favorable changes in the environment, resulting mainly from the exodus of human populations and the development of the Ozark National Forest, have made it desirable to attempt reintroductions into parts of the formerly occupied range.

During 1940 and 1941 the Arkansas Game and Fish Commission released several hundred pen-raised turkeys in scattered locations throughout the Ozarks in an attempt to re-establish wild turkeys in parts of this area. In a few years it became apparent that these efforts, for all practical purposes, had failed. In 1950 the Commission began a new series of turkey restockings, this time, using turkeys trapped from native populations in southern Arkansas. This new program produced encouraging results and plans were made to continue it by increasing trapping efforts and selecting additional release sites. In 1957 the Commission renewed the pen-raised turkey restocking program and began raising turkeys of the Pennsylvania strain for later release.

As a phase of the Cooperative Game and Fish Commission-University of Arkansas research program a turkey investigation project designed to evaluate the success of both types of turkey releases was established and work began in December 1957.

METHODS

Investigations were conducted on four study areas stocked with native turkeys and on six areas containing pen-raised turkeys (Tables 1 and 2). In those areas containing native turkeys the primary goals were to locate flock concentrations, determine the dispersal limits of the populations, and to obtain an estimate of the number of turkeys present. In addition to these objectives, survival, reproductive potentials, and the behavior patterns of the populations received special attention in the pen-raised turkey study areas.

Two principle methods have been used in collecting turkey population data. Approximately seventy-five per cent of all the time allotted to field investigations has been devoted to the personal interviews of local residents and U.S. Forest Service and Game and Fish Commission employees who live near, work in, or periodically visit the study areas. The remaining time has been spent in

TABLE 1

WILD-TRAPPED TURKEY RELEASES IN FOUR STUDY AREAS

Name and Location of Study Areas	Date of Release	Number of Turkeys Released Male	Female
Black Mountain Area in the White Rock District of the Ozark National Forest, 14 Miles North of Ozark, Ark.	January 1950	3	5
	March 1951	3	6
	March 1953	3	4
	February 1953	10	3
	Total	19	18
Devils Den Area in the Boston Mountain District of the Ozark National Forest, 20 Miles South of Fayetteville, Ark.	December 1955	2	0
	January 1956	1	4
	March 1957	3	5
	Total	6	9
Wedington Area in the Boston Mountain District of the Ozark National Forest, 14 Miles West of Fayetteville, Ark.	October 1955	3	5
	February 1956	0	6
	Total	3	11
McIlroy Area in Northern Madison County 12 Miles North of Huntsville, Ark.	February 1958	14	21
	Total	14	21
	Combined Total	42	59

TABLE 2

PEN-RAISED TURKEY RELEASES IN SIX STUDY AREAS

Name and Location of Study Areas	Date of Release	Number of Turkeys Released Male	Female
Fort Chaffee-Sebastian Co. Near Fort Smith, Ark.	March 11, 1958	12	20
Ozone-Johnson Co. Near Ozone, Ark.	March 17, 1958	3	5
Pour-Off Mountain-Carroll Co. Near Carrollton, Ark.	March 11, 1958	3	5
Boat Mountain-Newton & Boone Co. Line Near Bellfonte, Ark.	March 12, 1958	3	5
Gather Community-Newton & Boone County Line	March 12, 1958	3	5
Koen Forest-Newton Co. . Near Jasper, Ark,	March 11, 1958	6	10
	Combined Total	30	50

making on-the-spot field checks, often in the company of rural residents or other interested persons, in an effort to document sight records, and to verify reports.

RESULTS

Wild-trapped Turkey Releases

Nineteen male and eighteen female turkeys were released in the White Rock District of the Ozark National Forest between January 1950 and February 1953. As a result several flocks are now well established, the heaviest concentrations remaining in the vicinity of the original release sites. Also, turkeys in smaller numbers have dispersed far into surrounding areas. A compilation of interviews from the periphery of the area of known dispersal indicates that wild turkeys now occupy parts of an area twenty miles wide from north to south and approximately twenty-six miles wide from northeast to southwest (Figure 1).

Six male and nine female turkeys were released in the Boston Mountain District of the Ozark National Forest between December 1955 and March 1957. Since that time reproduction has occurred and turkeys have spread into surrounding areas, with the heaviest concentration located in an area extending six miles south of the original release sites (Figure 2). It is apparent that populations now occupy parts of an area approximately twelve miles in diameter, extending to within three miles of the Oklahoma state line to the

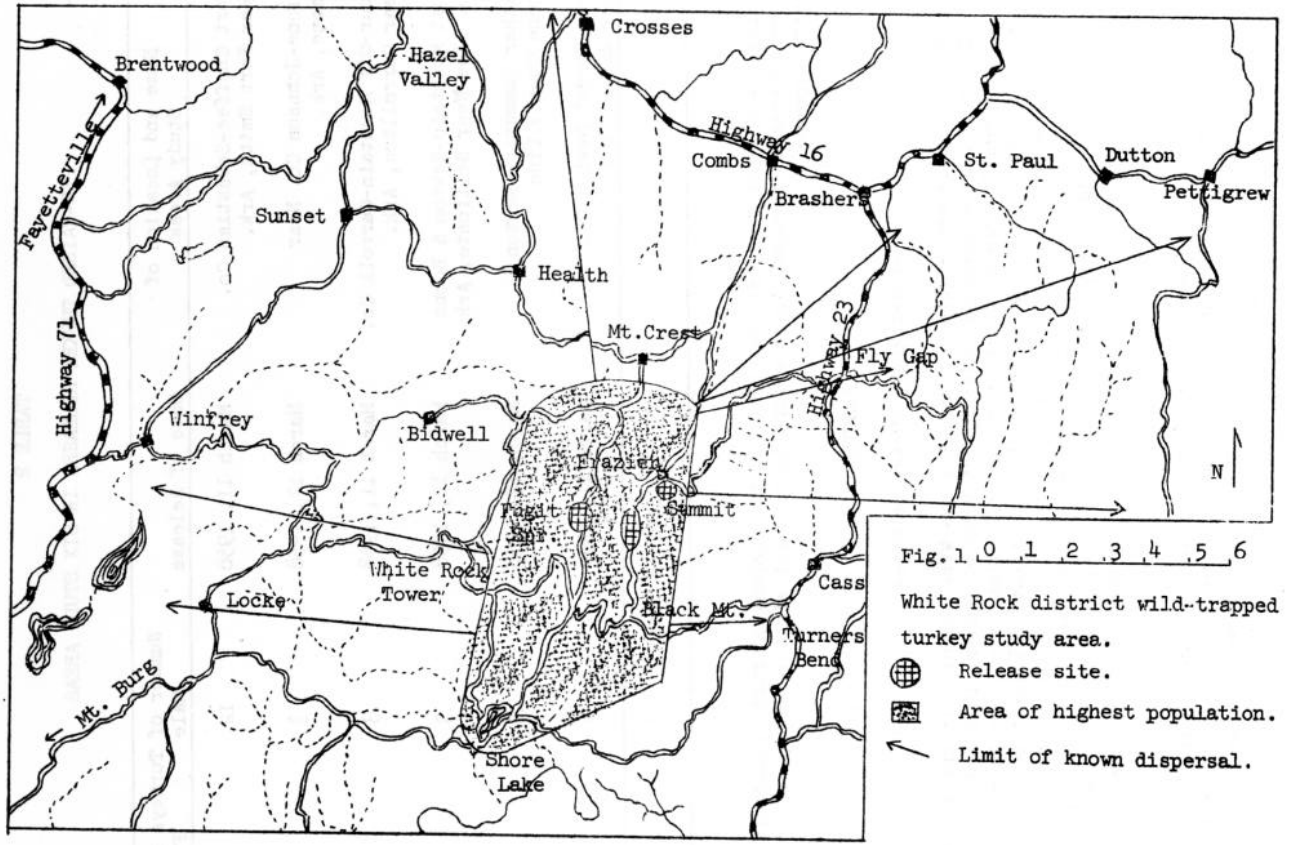
Crosses
Brentwood
Hazel Valley
Highway 16
Combs
St. Paul
Dutton
Pettigrew
Brashers
Fayetteville
Sunset
Health
Mt.Crest
Highway 23
Fly Gap
Highway 71
Winfrey
Bidwell
Frazier
Summit
N
White Rock Tower
Locke
Cass
Black Mt.
Turners Bend
Mt. Burg
Shore Lake
0 1 2 3 4 5 6
White Rock district wild-trapped turkey study area.
Release site.
Area of highest population.
Limit of known dispersal.

Fig. 1

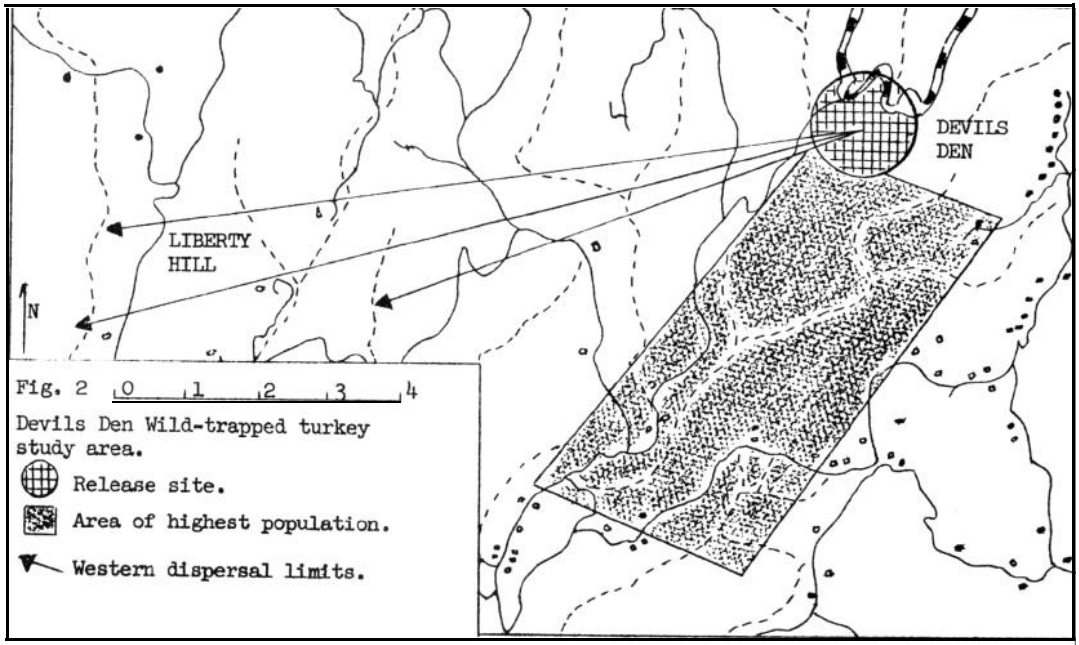

Fig. 2 Devils Den Wild-trapped turkey study area.

west and eastward to within seven miles of the known western dispersal limit of the White Rock District study area.

The introduction of three male and eleven female turkeys in the Wedington study area during the fall and winter of 1955-56 has produced less impressive results. Reproduction has occurred each season following the release but no great increase in numbers is evident. During the fall of 1957 a flock of twenty turkeys was reported in the vicinity of the release site. No other reports of such a large flock have been received since that time. Field investigations have indicated that turkeys in smaller groups have been ranging over most of this 18,000 acre area. The sighting of a turkey flock composed of ten birds was recently reported approximately two miles southeast of the release site.

During January and February of 1958 twentv-one female and fourteen male turkeys were released on the McIlroy study area in northern Madison County. Investigations conducted during the summer and fall following the release revealed that reproduction occurred during the spring and a large number of turkeys remained in the vicinity of the release sites. Also, reports have been received of turkey sighting six miles southwest, five and one-half miles south, and five miles southeast of the release sites.

Pen-raised Turkey Releases

During March 1958, ten-month old, pen-raised turkeys of the Pennsylvania strain were released in eight potential study areas in northwest Arkansas. Six of these areas (Table 3), which received a combined total of eighty turkeys, were studied during the ten-month period since the release.

TABLE 3

STATUS OF THE PEN-RAISED TURKEYS IN FIVE STUDY AREAS IN SEPTEMBER 1958

Study Area	Number Turkeys Released		Number Turkeys Still Present		Number Known To Be Dead	Number Not Accounted For
	Male	Female	Male	Female		
Fort Chaffee	12	20	6	12	11	3
Ozone	3	5	1	3	0	4
Carrollton	3	5	1	4	1	2
Bellefonte	3	5	2	3	—	3
Gather	3	5	4*		—	4
Koen Forest	6	10	1	3	5	7
Totals	30	50	11	4* 25	17	23

*Sex Unknown

Initial Dispersal

For one to three weeks after their release most of the turkeys wandered in apparent confusion before becoming localized in specific areas. In one case five turkeys moved approximately ten miles west of their release site (Figure 3) and in another case eight turkeys moved approximately five miles north of their release site before becoming localized. In two other study areas the flocks dispersed in different directions, eventually becoming established in areas surrounding the release sites (Figures 4 and 5).

Survival

Of the original eighty turkeys released in March, forty were still known to be present in September (Table 3). Their status has changed very little since that time. Of the nineteen turkeys known to be dead, (only seventeen in Table 7 because two died since September), seven may have been killed by predators, four died following illness, two were killed by automobiles, one drowned, and five died from unknown causes. The fate of the other twenty-three turkeys is a matter of speculation. Undoubtedly some of these birds have perished but others may be living undetected in or around the study areas.

Reproduction and Increment

Mating activities were noted in all study areas soon after the release., In one area males established territories during the last of April and defended them vigorously. Strutting, fighting, and gobbling were prominent during this period. Two turkey nests found in May contained ten and twelve eggs respectively. Two June nests contained eleven eggs each. Of eighteen females which attempted nesting, fifteen produced broods during June and July (Table 4). Eight broods, which were observed within two days after hatching, averaged 8.1 young each. In one study area, during July and August, there was an average of 4.1 young for every female that was known to have attempted nesting. One female mated with a domestic turkey and produced eight young in June of which only one has survived. Turkeys on two study areas, one which received 16 and one which received 32 birds, increased their numbers to 19 and 51 respectively (Table 5). In four areas which received eight birds each, one still had a population of eight in December, while the others decreased to five, five and four (Table 5).

The Effects of Domestication

All pen-raised turkeys were comparatively tame when released, The degree of wildness or tameness which these birds demonstrated later seemed to depend largely upon their experiences soon after being released. Some of the birds, which were encouraged by well-meaning residents, settled near farm homes and became barn-yard pets or pests in at least eight known cases. Those which were chased away by dogs or otherwise discouraged eventually lost interest in becoming domesticated and assumed a wild or semi-wild existance. In two known instances turkeys which were extremely tame, staying close to farm homes, later left these homes and Joined semi-wild flocks in the vicinity,

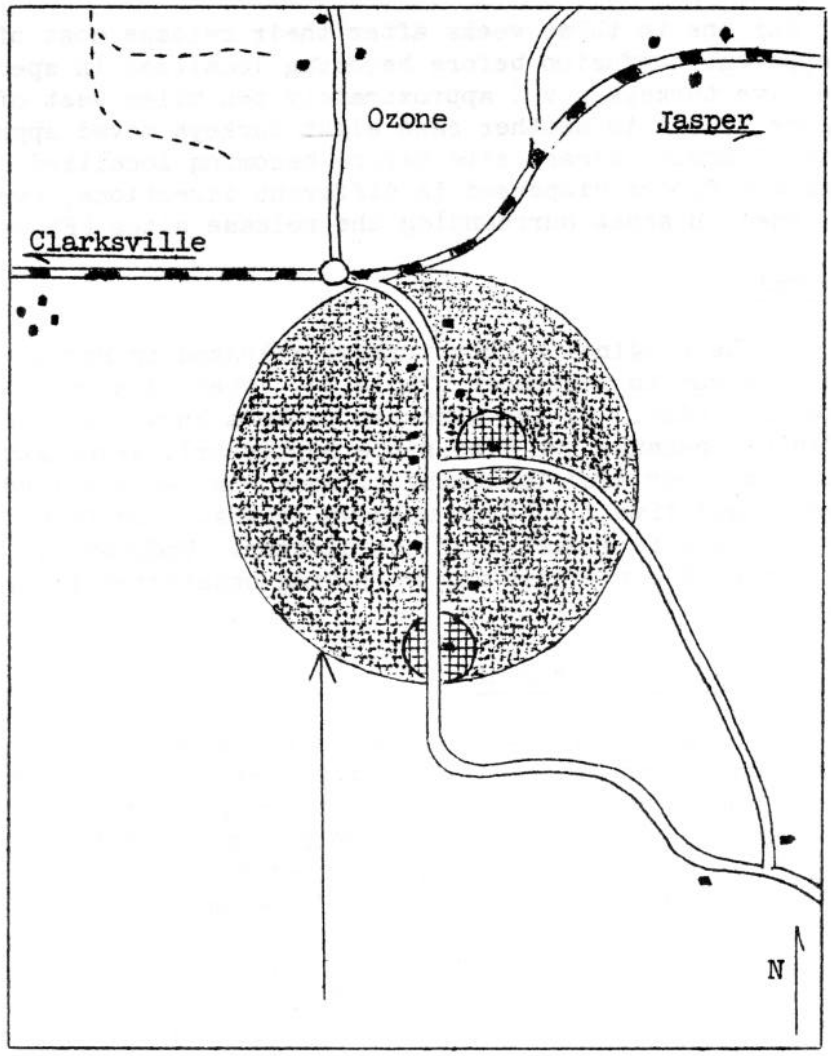

Fig. 3

0. 1. 2.

Ozone Pen-raised Turkey Study Area.

Range of one male and one female turkey.

Location of individual female turkey.

Direction of travel from release site.

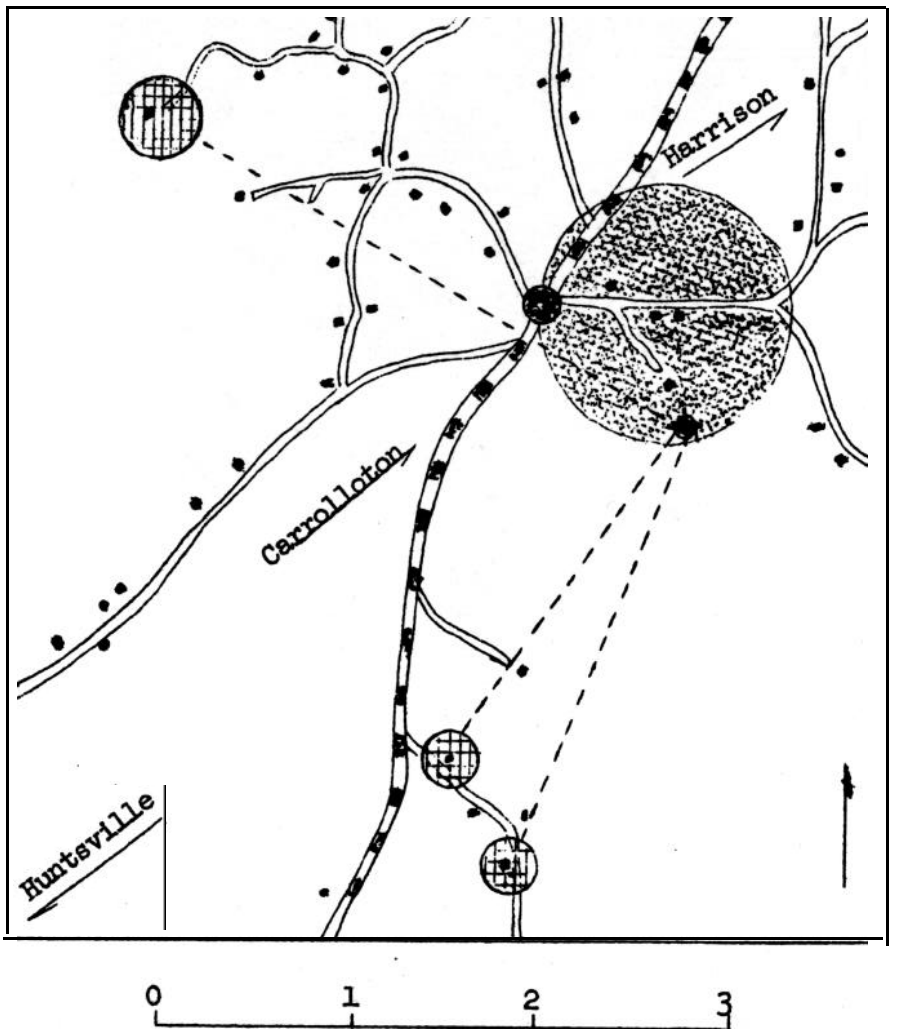

Figure 4. Pour-Off Mountain Pen-raised Turkey Study Area

Release site.

Range of one male and one female turkey.

Location of individual female turkey.

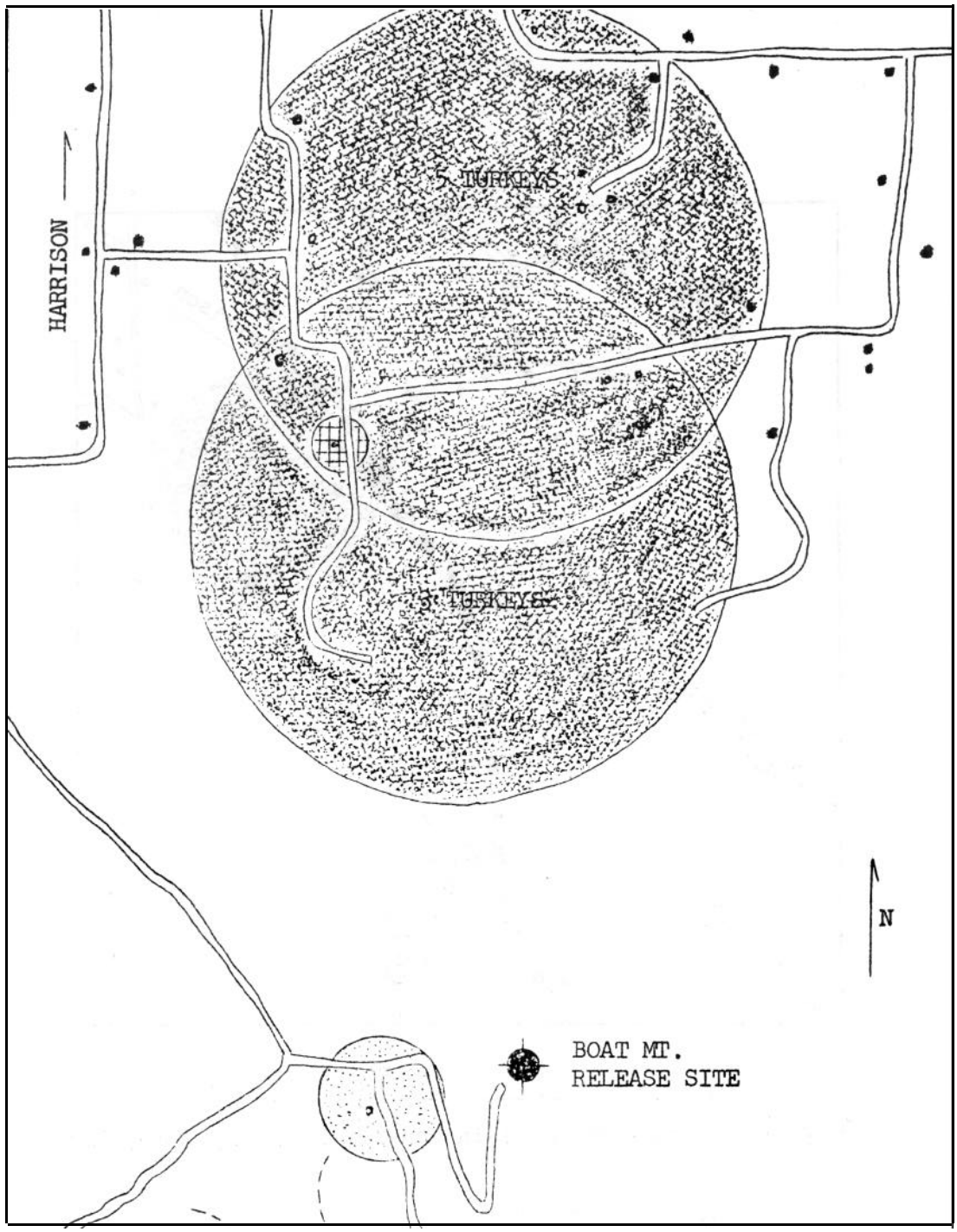

Fig. 5

Boat-Mountain Pen-Raised Turkey Study Area

Release Site.

Spring & summer range of 5 & 3 turkeys respectively.

Location of one male & one female turkey.

Location of one female turkey.

TABLE 4

NESTING SUCCESS OF TEE PEN-RAISED TURKEYS

Study Area	Number Female Turkeys Released	Number Known to Have Attempted Nesting	Number Which Produced Young	Average Brood-Size Within Two Days of Hatching (Number Broods Counted)
Fort Chaffee	20	8	7	8.7 (3)
Ozone	5	3	3	3.5 (2)
Carrollton	5	3	1	8 (1) (1)
Bellefonte	5	1	1	*12 (1)
Koen Forest	10	3	3	12 (1)
Totals	45	10	15	8.1 (8)

*Unconfirmed Observation

TABLE 5

INCREMENT OF PEN-RAISED TURKEYS

Study Area	Number Released	Present in December			Per Cent Change
		Adult	Young	Total	
Fort Chaffee	32	18	33	51	+59
Ozone	8	4	4	8	0
Carrollton	8	4	1	5	-38
Bellefonte	8	5	0	5	-38
Koen Forest	16	3	16	19	+19
Gather Community	8	4	0	4	-50
Total	80	38	54	92	+15

SUMMARY

Because of recent favorable changes in the environment it has become feasible to attempt turkey restoration in parts of the Arkansas Ozarks. Since two methods of restoration, that of stocking with wild-trapped turkeys and that of using pen-raised turkeys, are being employed it is desirable to evaluate the success of each. For this purpose a turkey investigation project was

established as part of the University of Arkansas-Arkansas Game and Fish Commission cooperative research program. Investigations have been conducted in four study areas containing wild-trapped turkeys and in six containing pen-raised turkeys. A combination of the personal interview method and field investigation was used to collect turkey population data.

Two areas which received wild-trapped turkeys between 1950 and 1957 have supported sizable populations near the original release sites. In one of these areas turkeys now occupy parts of an area twenty-six miles in diameter from northeast to southwest, and twenty miles in diameter from north to south. In the other area turkeys occupy parts of an area approximately twelve miles in diameter. An area which received wild-trapped turkeys in 1955 and 1956 has supported a population at least equaling or slightly surpassing the original number released. Successful reproduction occurred during the first spring following a late winter turkey release in another study area and records have been received which indicate a five to six mile dispersal from the release area.

Since the study of pen-raised turkeys has been in progress only ten months final conclusions would be premature. However, a study of eighty individuals on six study areas has shown that some free-ranging pen-raised turkeys are able to survive for at least ten months, that they can reproduce successfully at eleven months of age, and that some females have shown the ability to raise young.

DISCUSSION

MR. SCHORGER: How did that turkey happen to drown? They are good swimmers.

MR. PRESTON: That's partially an unanswered question. An elderly lady who was fishing on the creek in that vicinity heard the bird in the water and she waited approximately thirty minutes before she investigated, and she found the bird attempting apparently to go up a rocky bluff or slick bank, and it couldn't make it. She went to a farm in the area and the local resident came down and retrieved the bird and by that time it was dead and that's all the information I have. I believe that is authentic. I didn't actually see the bird myself.

MR. GREENLY (Nevada): You mentioned releasing a known number of birds on an area, then going back later and counting them. I just wondered how large an area it was, what type of vegetation was found thereon, and how you went about determining just how many birds were there.

MR. PRESTON: You are talking about the game farm releases no doubt?

MR. GREENLY: That and any other releases,

MR. PRESTON: We have made no count on our wild trap study areas for obvious reasons, but on the game farm birds it was no problem. You could go into an area two days after a release and locate the birds in the vicinity of the farm homes.

MR. GREENLY: They were released in heavily populated areas?

MR. PRESTON: Not necessarily. They moved to heavily populated areas. Some of them were released in areas of 20 square miles on either side with very little habitation.

MR. GREENLY: I was just wondering how many you had, say, a year later.

MEL PRESTON: Well, it's not very much of a problem. I could go into areas at any time and talk to the local residents or forest and game service employees who had seen or heard the birds recently. Once in a while we made actual sight records, which wasn't too difficult. The birds periodically visited homes, even the birds in a semi-wild condition, so counting really wasn't too much of a problem. As far as the habitat is concerned, it's typical Ozark country, end in the wild part of this area it is pretty rough -- very few roads going into it. It would be very difficult to obtain accurate counts if they remained in those areas, but they didn't.

MR. GREENLY: That is what I was wondering.

MR. PRESTON: They didn't remain there. On the wild trapped study areas it was virtually impossible with the time we had available to count those birds. Of course, we could get authentic sight records one place or another, but as far as saying how many birds were in the area, we just couldn't do it.

MR. GREENLY: That is what I was wondering. Thank you.

THE AERIAL DROP METHOD OF RELEASING WILD TRAPPED TURKEYS FOR RESTOCKING PURPOSES

James A. Powell and Louis F. Gainey
Florida Game and Fresh Water Fish Commission

The Game Management Division of the Florida Game and Fresh Water Fish Commission has been trapping, banding and restocking wild turkeys for the past decade. During this period, several methods of transporting and releasing these wild trapped turkeys have been employed. Each year during the months of January and February, approximately two hundred wild turkeys are trapped from the Fisheating Creek Wildlife Management Area in Glades County, Florida and released in suitable turkey habitat that is open to public hunting throughout south Florida.

Formerly these birds were loaded into carrying crates on the back of a pick-up truck and transported to the release site. This would necessitate confining the birds for as much as 8 to 10 hours and on some occasions overnight, depending upon the distance between the trap site and the release point. Since the wild turkey is by nature a strongly freedom loving creature, attempted escape is continuous throughout the period of confinement. Self inflicted trauma was common, the turkeys scalping themselves and rubbing their necks raw regardless of how smooth the inside of the carrying crate was constructed. Mortality figures between the trap site and the release points averaged about four percent each year. In addition, many birds released with severely scalped heads and necks probably fell victim to shock and screwworms after release. No definite figures of course are available on this mortality factor.

During the 1956 trapping season, several discussions were held in regard to the feasibility of dropping wild turkeys out of an airplane and near the end of the trapping period, it was decided to "sacrifice" one turkey in an attempt to show the possibilities of such a release. The turkey, a sub-adult hen, was put into a burlap bag, tied securely around the feet and loaded into one of the Commission's Super cubs. Upon reaching the area above the proposed release site, the turkey was untied, removed from the bag and held by hand. The pilot, holding the plane at approximately 200 feet altitude, put down the flaps showing the plane to about 45 miles per hour airspeed. The turkey was thrown down and out from the plane and was in a free fall for only 20 to 30 feet at which time the bird righted itself and went into a long glide.

During the 1958 season, all of the trapped turkeys, with the exception of those released in the near vicinity of the trap sites, were released by the air drop method. To date, mortality between the trap sites and the release points for the air released birds is 0 percent and not a single bird has failed to regain its equilibrium from the free fall and glide to the ground. The confinement period has been reduced to two to three hours from the time the turkeys are trapped and the birds are unable to scalp themselves in the burlap bags. In addition to greatly reducing the confinement period and mortality rate, it is possible to restock areas that are completely inaccessible to ordinary means of transportation. While sportsmen do reach these areas during the hunting season by traveling one to two days in specially constructed swamp vehicles, thus making these turkeys accessible to the hunter, it would be impractical both physically and financially to attempt to release turkeys in these areas other than by the air drop method.

Since the initiation of the turkey restoration program in Florida, 1,210 turkeys have been trapped, banded and released throughout the State. We have received notification of 96 kills for approximately an 8 percent band return. Of these 1,210 releases, 94 turkeys have been released from the air. While it is still too early to determine band return percentages since most of these turkeys were air released in January and February of this year, it is logical to assume that a greater percentage of these birds will survive to reproduce since the self-inflicted damage factor has been eliminated.

This paper was first presented at the October, 1958 meeting of the Southeastern Association of Game and Fish Commissioners in Louisville, Ky.

TABLE 1

FLORIDA TURKEY KILL BY MANAGEMENT AREA
1950 - 1959

AREA	YEAR									TOTALS
	1950 1951	1951 1952	1952 1953	1953 1954	1954 1955	1955 1956	1956 1957	1957 1958	1958 1959	
Ocala				29	12	13	36	14	18	122
Gulf Hammock	18	65	115	32	52	122	139	66	79	688
Avon Park		4	31	7	10	61	118	72	131	434
Steinhatahie		12	21	13	6	73	116	51	75	367
Farmton		25	85	43	62	39	59	62	53	428
Tomoka		5	16	19	31	18	11	37	29	166
Corbett							62	18	31	111
Collier			679	502	179	459	518	249	100	2,686
Hendry		203	283	252	317					1,055
Sumter			12	58	74	83	94	66	64	451
Fisheating Creek			296	240	229	302	396	382	302	2,147
Aucilla					8	12	42	14	33	109
Lee				48	26	30	23	9	10	146
Richloam					38	33	28	63	63	225
Gaskin						2	2	12	14	30
Croom						9	16	12		37
Devil's Garden								18	25	43
Okeechobee						16	14	13	38	81
Holopaw						7	6	20	23	56
Camp Blanding							20	22	28	70
Lake Butler								20	12	32
TOTALS	18	314	1,538	1,243	1,044	1,279	1,700	1,220	1,128	9,484

TABLE 2

FLORIDA STATE-WIDE TURKEY KILL AND PRESSURE
1950 - 1958

YEAR	KILL	PRESSURE	
		HUNTERS	MAN-DAYS
1957 - 1958	20,200	33,600	183,200
1956 - 1957	17,100	29,000	150,000
1955 - 1956	16,300	33,000	150,000
1954 - 1955	14,300	25,000	130,000
1953 - 1954	17,800	29,200	139,000
1952 - 1953	13,150	18,860	96,300
1951 - 1952	10,200	16,000	76,000
1950 - 1951	15,000	28,000	110,000

DISCUSSION

MR. DeARMENT: Is that trapping in addition to the hunting take?

MR. POWELL: Yes sir, it is. The trapping is done on the closed area. The hunting is on the management area. When I said management area, we call both the breeding ground and the open area the Fisheating Creek Management Area.

DR. KOZICKY: I wonder if anyone else has tried aerial releases of wild turkeys? I know that California has used a similar technique with chukars. California is the only other state I have heard of that is using this same technique.

(No response.)

MR. POWELL: When I said that the mortality rate was reduced to zero, I didn't mean by that that we never lost a bird, but our mortality rate is restricted to birds that die in the trap immediately from shock. We do have turkeys, primarily old gobblers, that will immediately go into shock when the door is dropped.

QUESTION: Do you ever use any poles?

MR. POWELL: Solid poles on the side?

QUESTION: Yes.

MR. POWELL: Yes, we did, and they just won't go in. They like to see through the trap, which is why we use the wire.

QUESTION: When transporting them by plane, how many do you take?

MR. POWELL: I can get about eight in the type of plane we have.

QUESTION: Would you make a trip for one?

MR. POWELL: Generally, we do some restocking in areas around our trapping site, so when we only come up with one turkey in the morning we use a truck.

QUESTION: What would you say is your cost per bird for this?

MR. POWELL: That's a good question. I can answer it. It may sound a little high, but we do it anyway. Those birds run us about $27.00 apiece; that includes everything: depreciation on vehicles, salaries, traps, bait, everything.

QUESTION: Have you used any band other than the riveted leg band?

MR. POWELL: No, we have not employed any other leg band.

I had a band returned this year from an adult hen that was banded nine years ago. I had a band returned from a gobbler banded six years ago that traveled 50 miles, and I had two bands returned from young gobblers that were sub-adult a year ago -- in other words, they were a year and a half old -- that had eight-inch beards. I have been called a liar on that point many times.

MR. MASON (New York): Do you find you have to use a larger size band as you tie them?

MR. POWELL: This is a particular band that came off the bird that was banded nine years ago. It is the rivet type. We have one size for gobblers and one size for hens.

DR. DUSTMAN: Jim, this morning I think you mentioned the river area where you made that transplant. What was the size of that transplant again and what was the growth of the population?

MR. POWELL: I believe the exact figure was 163. I am not sure of the figure, about 160 birds, and within about three to four years we had a shootable population. As far as telling you how many birds there were, there again I don't know how to count turkeys, but the population was big enough so that you could see bunches of 20, 30 to 40 turkeys working in and out. In the Peace River country, which is heavy cypress swamps, you have a lot of orange groves which, of course, are clean underneath and here they work out of the swamp and through the groves; they roost in the cypress swamps. You can see 30 or 40 in a bunch.

There again we have been fortunate with Mother Nature. We had three good hatches there.

Generally, in Florida, they don't appreciate the fact that the turkey is being brought back where they didn't have them, but in this particular section of the state they did. They were highly indignant if anything happened to any turkey. In fact, we had a hard time opening the season when we got a shootable population.

MR. SHEAFFER (Virginia): What is the local reaction to the turkeys being moved to the adjoining county or someplace else? Do they object to it?

MR. POWELL: Yes, they do. Those turkeys belong to Glades County and that's where they ought to stay. We do have a little trap difficulty once in a while, such as a door being sprung. It's a matter of public information and we have a lot of work to do along these lines. We do release birds in areas in Glades County where they can be shot, and every year a few Glades County people take the band off the turkeys, which tends to ease the pain a little bit.

MR. CALHOUN: In your opinion, if you were transplanting a very small number of wild-trapped turkeys in an area where there was none, would an airplane release be possible?

MR. POWELL: When I want to make a group release, we just circle that area. Then the pilot makes a circle until I have another turkey unbagged and ready to go and it's dropped out in the same place, and, of course, they will get together in a short time. Financially, it would depend on how easy you could get there other ways, and so forth.

MR. CALHOUN: Time is important to us.

MR. POWELL: There again you have the distance from the trap site. If it is any distance at all, the plane will be advisable.

DR. MOSBY: Do you make any effort to keep in the same release birds from the same flock? Have you run into any difficulty in mixing two flocks and having them disperse or not getting together as a result of not being from the same flock?

MR. POWELL: We make no attempt at all to try to keep the birds from the same flock at the same release point. In other words, we are trapping about five traps a morning which involves five different groups of turkeys, and generally any one morning I will take all the turkeys that are trapped that morning and put them in a particular area.

DR. MOSBY: Would you comment on the number of birds released? What you would consider the minimum to release in one place?

MR. POWELL: That would vary quite a bit, depending on the habitat and the acreage involved. If you release five hens and two gobblers in an area, that should give you a pretty good breeding stock.

DR. MOSBY: After you release those seven birds, how long do you wait to determine whether or not that release is successful before you stock some more birds?

MR. POWELL: At least through one breeding season. The idea is to restock the area so the birds will repopulate naturally. We try to make sight records and feeder observations. We generally have feeders in operation in an area before we release the birds. That isn't always the case, but we do in many of our areas.

MR. CROSS (Virginia): We have just gotten into the wild trapping now, and I think of one area in particular where we have released five to seven birds a year for about three years. We are not sure whether it is time to forget that release and try another one or not.

MR. POWELL: Do you have any records at all of poult counts?

MR. CROSS: Yes.

MR. POWELL: Have you tried any trapping in that area?

MR. CROSS: No.

MR. POWELL: You might. If the area should have any turkeys at all, you might try some trapping to see what your sub-adult ratio would be from your trapping and that result would determine whether the population was progressing or regressing. In Florida, when our population gets off that 70-30 ratio of sub-adult to adult birds, we know that something happened to the hatch.

MR. DOW (Tennessee): Your 70-30 ratio -- what time of the year do you trap?

MR. POWELL: We trap in January and February, but the 70-30 ratio is from sight records, trapping records and feeder observation records all year around. Of course, it doesn't include young poults but the year-around sample is about 15,000 birds.

MR. DOW: That wouldn't hold then at the time you were trapping?

MR. POWELL: Yes, that definitely holds at the time we are trapping.

MR. DOW: That's the time you see most of them in hand, isn't it?

MR. POWELL: That is the time we see most of them in hand, yes. Of course, that's where we get our most accurate figures, but the figure also runs for the kill that is processed through the checking stations, too.

RESULTS OF STOCKING WILD-TRAPPED AND GAME FARM TURKEYS IN KENTUCKY

Frederick C. Hardy
Kentucky Department of Fish and Wildlife Resources

The Eastern Wild Turkey (Meleagris gallopavo silvestris), the foremost upland game bird of pioneer Kentucky, was found originally in all counties of the state. Turkey hunting still was an important sport in some sections as late as the early 1900's. Populations declined rapidly following large lumbering operations and by 1945 the only known native population was located on the Kentucky Woodlands National Wildlife Refuge in Lyon and Trigg Counties.

Attempts by the Kentucky Department of Fish and Wildlife to restore turkeys on vacant range began in 1937 with the release of game farm stock purchased from a local game breeder. At least ten counties received stock from this source prior to 1943. Little is known of this operation except that it apparently was unsuccessful in all cases. More recent restoration work, the subject of this report, involved the use of wild-trapped native stock and stock produced at the Department's Game Farm.

Source of Stock

All wild stock was trapped from Kentucky Woodlands Refuge under an agreement with the U.S. Fish and Wildlife Service. Trapping and releasing were conducted by personnel of Kentucky Federal Aid Development Projects 17-D, 20-D and 30-D.

Stock produced at the game farm came from three sources: A private breeder in Alabama, a private breeder in Maryland and the Pennsylvania Game Commission. Most of the stock released prior to 1952 came from the Maryland source; most of that used after 1952 was of the Pennsylvania origin.

Releases

During the ten-year period from 1946 to 1956 a total of 214 wild-trapped turkeys was released on six areas. During the ten-year period ending in 1958, a total of 3,923 pen-reared turkeys was released on an additional 13 areas. Disposition of this stock is shown in Tables 1 and 2.

All stock was transported directly from the trap site or rearing pen and released without pre-conditioning to the release area. All wild-trapped and all but three game farm releases were made on refuges. Number released per area per season ranged from 2 to 30 wild birds and from 21 to 180 game farm birds.

Release records indicate that about 75% of the wild-trapped birds were poults and that approximately 60% were hens. Nearly all of the pen-reared turkeys were released at the age of 12-18 weeks, with a few hold-overs and excess breeders being released each spring; sex ratios were recorded in only a few instances.

Population Estimates

Some form of census procedure, either winter flock counts, gobbling counts or both, has been followed on all wild release areas. As these techniques could be applied to only small samples of range, district biologists' estimates based on all observations including censuses have been used in Table 1. These estimates probably are lower than actual populations.

Due to the extent of other work in progress, fairly intensive follow-up studies were possible on the Lewis and Bullitt-Nelson pen-reared release areas. Roadside gobbling counts were made annually on the Bullitt-Nelson, Harlan and Bell areas. Population figures in Table 2 are based on the above and on results of occasional post-release checks and random observations or lack of observations reported by biologists working in the various localities.

Results

All releases of wild-trapped turkeys have resulted in apparently established flocks with a minimum total population of 745 occupying at least 130,000 acres of range. One restored flock is being trapped for further transplanting; three other flocks could stand some trapping. On the basis of population density alone, four flocks are huntable.

With the possible exception of the Bullitt-Nelson and Ballard releases, all efforts to re-establish turkeys through the release of game farm stock evidently have failed. Reproduction was recorded during the past three

seasons and over-winter survival was reported the past two years on the Bullitt-Nelson area. Twenty-six locally-reared turkeys survived the winter of 1957-1958 and two of the hens produced broods in 1958. An indefinite number of turkeys present on the Ballard County Refuge were survivors of 1957 broods, but whether these survivors reproduced in 1958 is unknown.

Some Factors Possibly Affecting Results

As all releases of wild-trapped stock, both large and small, have been successful, it appears that larger releases may have been wasteful and that much more range could have been stocked with the turkeys available. During the past two years, releases have been limited to 8-12 birds per release site.

Mortality soon after release was much lower for wild-trapped stock (less than 5% known) than for game farm stock. Follow-up checks of eight releases, totalling 276 game farm turkeys, revealed that at least 61 were killed by predators or died from other causes within a few days after the release. Twenty-three of one release of thirty were found dead two days later. The forest development project leader estimated that only one or two birds survived from releases totaling 180 birds made on three areas during the fall of 1955.

Tameness of game farm turkeys as reflected by their affinity for barnlots and refuge headquarters has been an important factor limiting the success of this stock. Broods were observed in Lewis County as late as 1956 (three years after the last release) but their movements were almost entirely restricted to farms. The second generation of locally-reared turkeys on Bernheim Forest in Bullitt County are semi-tame also and seldom move from the fields surrounding the forest headquarters.

The effect of repeated large annual injections of new pen-reared stock on a few turkeys which may have survived from earlier releases is unknown, but the possibility of introducing disease is obvious.

Conclusions

1. The success of the wild-trapped stocking program warrants expansion of the operation to the full trapping potential which is at least five times greater than the current annual catch. Utilization of the increased catch in plants of up to one dozen birds in carefully selected blocks of range should provide sufficient populated area for an open season within a relatively short time.

2. There appears to be no justification for continuing the release of game farm turkeys at the present time. (A recommendation to this effect has been accepted and game farm production has been suspended indefinitely.)

Summary

Releases of 214 wild-trapped native turkeys on six areas resulted in apparently re-established populations on all areas. With two possible exceptions, releases of 3,923 farm game turkeys on 13 other areas were failures. Factors possibly limiting over-all results were: Unnecessarily large

size of wild-trapped plants, heavy post-release mortality and tameness of game farm stock and the effect of repeated injections of new semi-tame stock on survivors of earlier releases.

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TABLE1

WILD-TRAPPED TURKEY RELEASES AND POPULATION ESTIMATES

Kentucky
1946-1956

County Location Of Area	Period Of Releases	Total Release Seasons	Spring Or Fall Releases	Total Released	Estimated Present Pop.
McCreary-Pulaski	1946 - 1950	5	Both	39	200
Edmonson	1945*- 1949	2	Fall	15	60
Breathitt-Knott	1949 - 1953	4	Fall	46	175
Leslie-Clay	1951 - 1953	3	Fall	52	150
Wolfe-Powell	1954 - 1956	2	Fall	36	100
Jackson	1955	1	Fall	26	60
Totals				214	745

* Year uncertain.

TABLE 2

GAME FARM TURKEY RELEASES AND POPULATION ESTIMATES

Kentucky
1948-1958

County Location Of Area	Period Of Releases	Total Release Seasons	Spring Or Fall Releases	Total Released	*Estimated Present Pop.
Metcalfe	1948 - 1954	5	Both	302	0
Christian-Caldwell	1949 - 1958	9	Both	578 (80)	0
Lewis	1950 - 1953	4	Both	379	0
Bullitt-Nelson	1951 - 1957	7	Both	708	30+
Floyd	1952 - 1958	6	Fall	455 (80)	0
Christian	1953 - 1958	2	Fall	181 (160)	0
Letcher	1954 - 1956	2	Both	190	0
Harlan	1954 - 1958	3	Fall	225 (80)	0
Ballard	1954 - 1958	5	Both	345 (80)	?
Bell	1956 - 1957	2	Fall	160	0
Carter	1957 - 1958	2	Fall	160 (80)	**
Hardin	1957	1	Fall	80	**
Boyd	1957 - 1958	2	Fall	160 (80)	**
Totals				3,923	30+

* Before '58 releases
** No reports received
() Released in 1958

HISTORY OF TURKEY RESTORATION IN MISSISSIPPI AND ITS EFFECT OM PRESENT MANAGEMENT

Bruce C. Johnson
Mississippi Game and Fish Commission

In the days of the early settlers Mississippi was known to abound with game native to the Southeast, and the wild turkey was reported to roam the forest in every part of the state. Their number remained high until the big logging operations began about 1880 when a downward trend was first noticed. The period 1900 to 1925 found the major forest felled and much of the home range of the birds destroyed. Excessive kills accompanied the cutting of timber, but the loss of habitat was certainly the most important factor contributing to the major reduction in turkey populations. Turkeys remained only in natural refuges in the form of river-bottom swamps scattered over the state.

The establishment of the Mississippi Game and Fish Commission in 1932 found turkeys still low in number and located primarily in river bottoms. The ground work for the later restoration work was initiated this first year when the Commission requested the game wardens over the state to submit a report on existing turkey flocks. They were also asked to submit a

report on unoccupied turkey ranges suitable for stocking. These early reports were later used by personnel working on surveys and investigations of wild turkeys under various Federal Aid projects.

As a result of low turkey numbers and the existence of suitable unoccupied ranges, the Commission in 1934 began purchasing semi-tame stock for restocking purposes from private sources in the South. Between 1934 and 1939, a total of 2,743 birds were obtained and released in small groups either in unoccupied ranges or in ranges having low native stock. The county wardens for a time reported on the status of the plants so that records were available for later reference. Plants were made in 81 of the 82 counties in Mississippi.

In the fall of 1941 an opportunity was presented through Federal Aid Project 3-R, Survey of Game Birds of Mississippi, to make an inventory of the wild turkey in Mississippi. During the life of the project, the status of 576 individual plants composed of 2,039 birds made between 1934 and 1939 was checked. It was found that only 179 were successful, 57 partially successful, 28 uncertain, and 374 failures. No doubt the plantings considered partially successful or uncertain have since that time gone the way of the failures.

The final report of Project 3-R gave as the major factors for failures of the 374 plants listed under this category poaching, and the use of semi-tame planting stock. It was interesting to note that successes occurred when birds were released in ranges containing some native stock on lands where the owners gave them complete protection and supplied feed until the birds became adjusted.

A later Federal Aid Project, 31-R, Wild Turkey Survey and Inventory, which was conducted from July 1, 1949, to June 30, 1953, found 46 of the 82 counties in Mississippi contained established turkey flocks though much of the range was sparsely occupied. The project gave as the immediate limiting factor to good turkey populations in existing suitable ranges illegal kills, and especially the kill of hens.

On July 1, 1954, the Commission initiated as part of the State-Wide Development Project, 49-D, a trapping and restocking program for turkeys. Trapping was limited to State-operated game areas or to private lands where permission of the owners could be obtained.

Areas to be restocked were limited primarily to new areas obtained by the Commission through leases for management as public hunting areas or refuges. This program developed as a result of the poor success resulting from the past use of turkeys purchased from commercial raisers and due to the past project findings that poaching still seems to be a very important factor in the establishment of turkeys in new areas. It is felt that the public in general will benefit to a large extent from plantings made on areas to be operated for public hunting. Such areas have been located on U.S. Forest Service lands and on holdings of large landowners who operate their lands primarily for timber production.

For the past three years under F. A. Project 49-D a total of 227 turkeys were live-trapped and used for restocking purposes. Turkeys were obtained from Leaf River Refuge, Friars Point Refuge, and from a private area in Amite County. Trapping was accomplished with the aid of cannons and nets, and records were kept as to the cost of such operations. Listed below are the figures for the operations each year and the computed cost per bird.

Period	Total Trapping and Transporting Coat	Birds Caught	cost Per Bird
July 1, 1955 to June 30, 1956	$1,500.34	62	$24.21
July 1, 1956 to June 30, 1957	1,341.14	75	17.88
July 1, 1957 to June 30, 1958	604.99	90	6.72
COST FOR THREE YEARS	3,446.47	227	15.18

The reduction in cost of birds each successive year is due primarily to the fact that trappers became more efficient in carrying on such a project. Experience gained in the use of the cannon and net method and in selecting and baiting birds to trapping sites has paid off greatly. The first two years of operation contained equipment worth several hundred dollars that was not present in the total cost of operation for last year, but the major difference occurred in the cost of Commission personnel's time charged to such work. Labor costs were cut by about $500 during the third year as compared to the two preceding years.

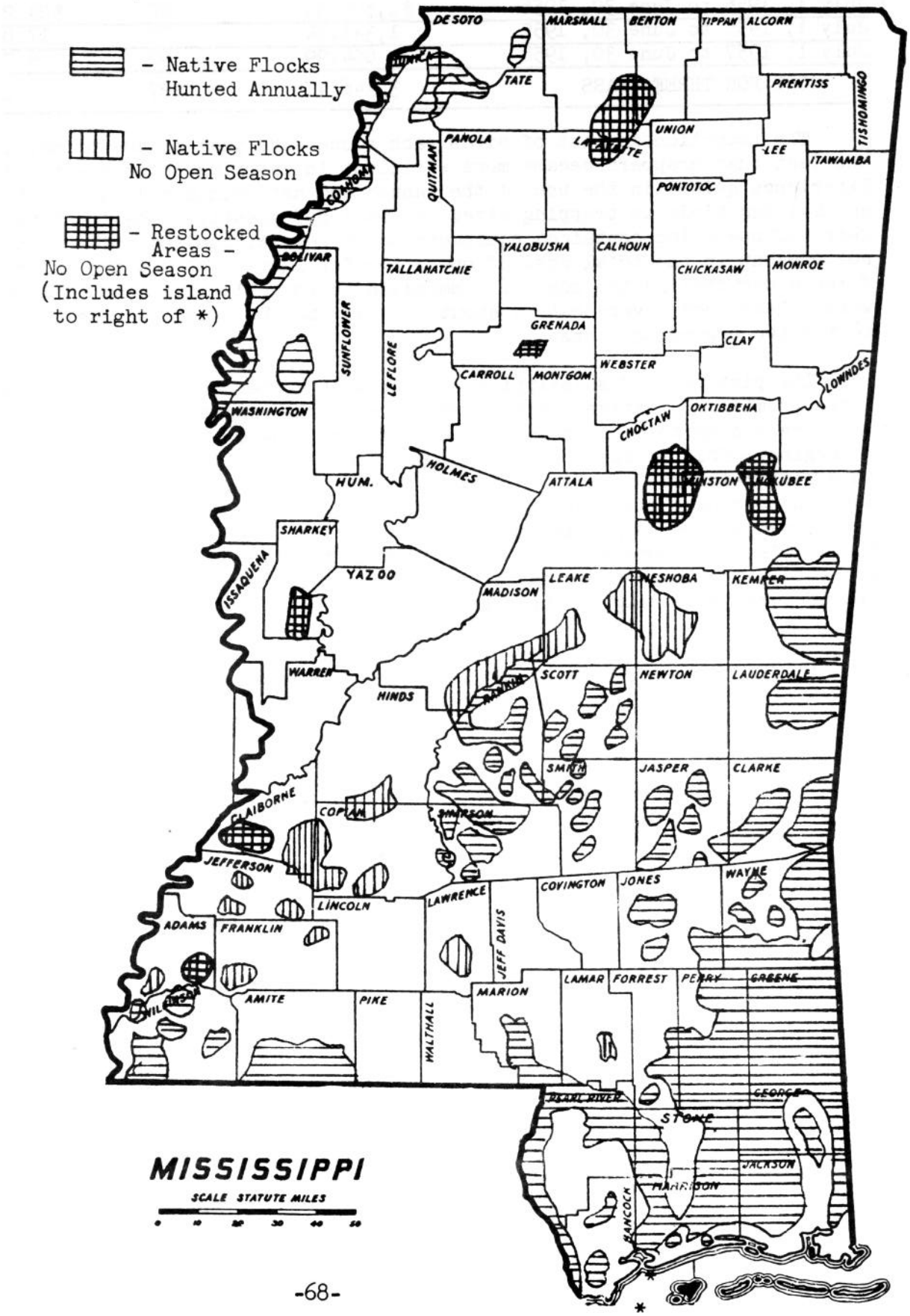
The picture in Mississippi at the present concerning turkey management looks promising. Native flocks found in suitable ranges outside of management areas seem to be increasing their numbers slowly, and their ranges are enlarging. This is due to better protection by law enforcement personnel and to a better-informed public. improved habitat resulting from timber management changes have also been a factor. Much of the timberlands in present turkey ranges are supporting more mature stands of trees than was true in the 1930's. The Commission has a big job in the future to provide better protection for these areas and to encourage public support in making poaching of turkeys a thing of the past.

Stocking and care of presently-operated management areas and refuges is still in progress. The obtaining of new areas suitable for public hunting grounds is expected to continue through the years and such areas will provide new sites for stocking and a chance to learn more about turkey management in different habitat types.

Population estimates made over the years, starting in 1943 under Federal Aid Project 3-R, again in 1951 under 31-R, and in 1958 under 48-R show a decided increase. Total populations for the state were recorded in 1943 as 4,530 birds, in 1951 as 10,000, and for 1958 at 20,000. Annual kills have increased from a known kill of 253 turkeys in the spring of 1942 to 974 in the spring of 1958. Turkeys are legally taken in Mississippi only during the spring gobbling season, and the harvest is limited to gobblers.

Much of the increased kill can be attributed to an increased interest in the sport by old turkey hunters and neophytes due to the recent buildup in populations. The Commission has for the past few years tried to publicize the fact that turkey ranges are enlarging and turkeys in the state can support more legal hunting pressure than they have been subjected to in the past. During 1956 the film "Pineywoods Tom" was produced by the Commission for use by the Public Relations Department to educate the people to the turkey hunting available on State-operated areas. The film gives information on the life of the turkey from nest to adult stage and gives highlights on hunting in the public hunting areas. More efforts are planned to make turkey hunting a popular sport in the state to help carry part of the increased pressure subjected on the over-all game population of the state by the public in recent years.

POPULATED TURKEY RANGES WITH BOTH NATIVE AND RESTOCKED AREA SET FORTH.



Mississippi is looking forward to continued turkey hunting and more areas in which to furnish such hunting. Along with this vision, we realize that plenty of work will be involved, and probably some failures will result. We hope to profit from experiences of the past at least to the extent of using wild-trapped stock and making our plantings in areas we feel will be protected and the birds given every chance to become established.

DISCUSSION

MR. GREENLY: I understood you to say you trapped on refuges, is that right?

MR. JOHNSON: That's true. We have one area that is operated primarily for that purpose.

MR. GREENLY: It's not hunted at all now?

MR. JOHNSON: No, sir. We have some areas that are hunted where we move some turkeys, and we have private lands that come within areas where they have legal kills. I mean where they have a legal season where we trapped some turkeys. We have to obtain permission from the owner before we go in on private areas and remove those turkeys.

MR. CLELAND (Arkansas): Sir, you state on Page 2 that your successful plants were in areas where local landowners gave the birds protection and fed them. It has been our experience in Arkansas that where birds come into farm homes and so forth, the mortality greatly increases for both the adults and the young.

MB. JOHNSON: That may be true. I was giving the results of the investigation that was made under Federal Aid Project 3-R. If you will notice, in that second paragraph it was stated that these birds that were successful were turned loose in the area that already contained turkeys. They were already there, and, too, this check was made probably about two years after the releases. It's the general thought of those of us in the Commission that some of those releases were not successful, would not have been successful if they were checked three, four, five or six years later. I threw that in there more or less as history on some of the restoration.

MR. COLIN (Alabama): I think another point should be brought out which hasn't, and that is -- in Alabama, besides quantity we are interested in quality hunting, and we have an entirely different type of turkey hunter in Alabama than we do in a lot of the other places. Turkey hunters in Alabama would rather kill one gobbler in the spring than kill four or five hens or gobblers in the fall, we are mainly interested in quality, and I think that's one thing that is being overlooked.

MR. JOHNSON: I think probably the Mississippi hunter will go along with that, and you might add too that most of them get as big a thrill out of calling the bird up as they do out of killing it.

DR. KOZICKY: I would also like to interject and comment that another word for quality, wouldn't it be tradition?

MR. JOHNSON: Yes sir.

WILD TURKEY RESTORATION IN MISSOURI
ATTEMPTS AND METHODS

John B. Lewis
Missouri Conservation Commission

Until recently, turkeys have been declining in Missouri. In 1952, the population had reached a low of 2,400 birds. Since 1952, populations have gradually been increasing. Turkeys presently number about 5,000 and occupy approximately 7,000 square miles. The potential expansion of the turkey range in Missouri could include about 21,000 square miles or roughly l/3 of the State.

The decrease in Missouri's turkey population can be blamed primarily on habitat deterioration brought about by burning, grazing, and over-harvesting of the timber. In former years, unlimited hunting and poaching also played an important role in the population decline.

The first step toward ending the deterioration of Missouri's timberlands was taken in 1933 when the first national forests were established in the State. Today 2/3 of Missouri's 15 million forest acres are being protected by state and federal agencies.

Along with this change for the betterment of habitat, there has been a change in the attitudes of the people toward the conservation program as a whole. This has been demonstrated by Missouri's very favorable results with the deer restoration program. Because of this favorable attitude, prospects for the success of the turkey restoration project are greatly improved. Fifteen years ago, they would have been very slight.

The chief objective of the turkey restoration attempt in Missouri today is the re-establishment of huntable populations in as much of the range as possible.

The first major need was a source of native wild turkeys which could be used to restock unoccupied range. The second problem, after this source was established, was to develop a more efficient method of capturing turkeys. And last, but certainly very important, was the selection of qualified release areas.

To establish a source of birds, the Missouri Conservation Commission acquired a large tract in the southern Ozarks. The area was selected for its isolation and because a few native wild turkeys remained there. These birds were supposedly not contaminated by any of the game farm turkeys released during an earlier restoration attempt.

This particular area had one major disadvantage. It was located in one of the few remaining open range counties in the state. This made it necessary to fence a large acreage to exclude livestock, and in rough country this

is a very expensive operation. Final acquisition was completed in 1952, bringing the total acreage under Commission control to 23,000 acres or 36 square miles.

During a statewide turkey census in the winter of 1952, the population for this particular area was 9 birds. Two years later, in January of 1954 when the first permanent employee was working on the area, the population had increased to 32.

This particular area, known as the Peck Ranch Wildlife Area, may not be unique from a turkey management standpoint as far as other states are concerned, but in Missouri it is the first attempt to manage exclusively for wild turkeys on a large area.

The turkey population continued to build up on the area and during the winter of 1957-58 the first trapping efforts were started -- net results: 14 turkeys. To date this winter's trapping has yielded 15 birds. A conservative estimate of the present population inside the 11,000 acre management area is 1 bird per 100 acres or approximately 100 birds. The population adjacent to the refuge and for some miles beyond has also increased during the past 4 years. Part of this increase can be attributed to egress from the management area and part of it to the general influence that the refuge has had on the community.

Control of such disturbance factors as general access by the public and by lumbering operations must be had before an area may become a satisfactory turkey refuge. Although there are turkeys on 3 other refuges in the state, Peck Ranch is the only one on which absolute control of all management activities is vested in the Game Section of the Commission.

At any rate, we feel that within the confines of the Peck Ranch Management Area, we have a start on the way back with turkey restoration.

The present expenditures on turkey restoration amounts to about $60,000, most of which is devoted to management.

Before the turkey populations on Peck Ranch reached the point where birds could be removed, turkeys were being trapped from some of the other refuges in the State and from privately owned lands. A few turkeys had been taken during the deer trapping program, but trapping turkeys in deer traps wasn't very productive or desirable.

Several types of pole traps and various types of wire traps have been used with varying degrees of success, mostly poor. The cannon net trap developed for capturing waterfowl looked promising for turkey trapping. Kenneth Sadler, the first area superintendent on Peck Ranch, used the cannon net trap to catch turkeys in 1954. After many trials and several errors, a fairly successful combination of nets, cannons, and charges has been worked out.

One great advantage of the net trap over other types is that you can pick it up and move the entire set-up in an hour's time. The trap can also be camouflaged completely and very quickly.

A disadvantage is that the net often defeathers the birds severely. This loss of feathers could be harmful but seldom fatal, for temperatures in Missouri are not extremely cold for long periods.

We are presently using two sizes of nets -- 75' x 25' and 60' x 30'. These are all nylon with a 3″ mesh. On these particular nets we use 3 breech loading cannons firing a 12 gauge shotgun shell loaded with 2½ to 3 drams of black powder. The charges are wired in series and are detonated by either battery or electric detonator.

This certainly is not a fool-proof method, but it has proven fairly successful. There is just one drawback in using this type of trap. You must have turkeys using an established bait station regularly to catch birds without a long wait in the blind.

In selecting an area for a prospective turkey release, several factors must be considered carefully. One of the most important is the attitudes of the people living within a proposed release area.

The feeling on this subject is that the people who exert some effort in behalf of the program feel closely allied to it. They will give greater protection to the released birds than if the Commission selects an area without knowledge of the attitudes of the local residents.

It isn't quite as simple as it sounds. After a request is submitted to the Commission for an area to be restocked with turkeys, a meeting is held within the community and the overall program is explained and the areas of responsibility are outlined. The Commission is under a moral obligation to inspect and give consideration to each restocking request.

Prior to the community meeting, the area is inspected for general habitat conditions. Aerial photos are checked for the relationship of timber to open areas. This latter relationship is rather flexible and a definite minimum or maximum working figure hasn't been established. However, the ratio of 70% timber to 30% open land appears to be very close to the optimum for turkeys in Missouri.

To assign a definite boundary to a turkey release area, or to limit it to a certain size, is rather presumptious: the turkeys will make the final decision themselves. A figure of 15,000 acres is one that we have been using so far. This means that most of the people living inside this area must agree to protect the birds before a release is made. This is not set up as an inviolate refuge, nor is it posted. It is more or less a gentlemen's agreement between the State of Missouri and the people living in this one small community.

Since the recent restoration program was initiated in 1954, 6 areas have received turkeys. Two of these can be classed as successful and one is doubtful. It is still too early to definitely appraise the 3 releases made last winter. Different numbers of birds have been used in an attempt to determine a satisfactory stocking combination. The normal stocking rate has been twelve birds (4 toms and 8 hens), but this hasn't been strictly adhered to. One area stocked in the winter of 1955-56 received 24 birds. The present population in this area has been reported as up to 300 birds. This figure may be high, but reports of 20 to 30 birds being seen in several separate flocks aren't too uncommon and one farmer reported seeing over 40 birds in one field.

Dispersal of birds released into unoccupied range may be one of the major factors contributing to success or failure. To keep dispersal at a minimum, it is desirable to make the first release in a new area with several

birds captured from the same flock, if at all possible. These birds, after release, will quickly re-assemble and are much more likely to stay in the general release area than to wander aimlessly off for several miles. Releases this winter have demonstrated this to some extent. Checks made a month later on several birds trapped from separate flocks and released on separate areas showed one group had stayed exactly where they were released and the other group had moved only ½ mile from the release point.

Prospects for the future of the wild turkey in Missouri are looking more encouraging all the time. Habitat in general is improving. With better fire protection and timber management now being employed on approximately 10 million acres of forest land, the breaks are finally going for the turkey instead of against him.

Some consideration is being given to having a short open season (soon) to help overcome the general apathy of local people toward the wild turkey. All in all I think that conditions are becoming more favorable for restoration of wild turkey in Missouri.

DISCUSSION

MR. SCHORGER: What percentage of bearded hens would you get?

MR. LEWIS: We haven't trapped enough of those birds to give actual percentages. I would say out of over a hundred birds that we have handled I doubt if we have had four bearded hens.

MR. SCHORGER: Four out of a hundred?

MR. LEWIS: Four out of a hundred. Some of that hundred would be gobblers, you understand. I would say out of fifty hens we have handled, I doubt if we have had four bearded hens.

MR. SCHORGER: Even that's high,

MR. LEWIS: Well, I have heard that practically all hens are bearded. I have handled only about four bearded hens out of the fifty.

MR. SCHORGER: Out of the fifty?

MR. LEWIS: That's a rough approximation.

MR. GWYNN: You had those weights on your net. How far did your nets pull after you shot it? How far did it pull out?

MR. LEWIS: It, of course, depends on how the net hits the birds. If you fire the net without any birds out in front, the center edge of the net will be out even with the bait. It doesn't do that all the time, but we try to place the center edge of the net about six feet from where it's laid down.

MR. JANTZEN: I notice you said the morning you fired the net, it was four above. Is that right?

MR. LEWIS: That's right.

MR. JANTZEN: Did you have any trouble or have you had any trouble with that net casting properly?

MR. LEWIS: That's one real trouble that we have had this winter. The net has to be absolutely dry. The temperatures fluctuate violently in Missouri, and you can have four above one day and the next day it can be 50 degrees. If you get moisture in the net, you have to dry it out again before you make your shot.

MR. JANTZEN: We have found that same thing.

MR. PRESTON: How long does it take, or how many man-hours are involved in getting a flock of birds into a trapping site?

MR. LEWIS: Well, this is rather a peculiar area we were on. Although I had worked on that area for about five years and more or less knew the habits of these birds, I started baiting the latter part of July and I tried to keep bait there at least once a week. There might be a period of ten days between visits to the trapping site and sometimes the birds wouldn't happen to eat the bait. When the weather started getting cold, they started coming more regularly to the site.

MR. PRESTON: In other words, you started baiting turkeys in July?

MR. LEWIS: Yes, sir. Those birds visited that area while they were poults.

I started baiting with hen scratch, which is composed of cracked corn, wheat and oats and stuff like that, and later on, I changed to whole corn.

MR. PRESTON: If you went to a new area how much trouble would it be to set this up and attract birds?

MR. LEWIS: I don't like to stick my neck out on this point, because we have been fooled so many times. Usually you can have birds in three or four days after you set it up, and they might go three days and then quit you completely and not be back in a month. Then, again, you can move right in and catch them, so it's an unpredictable situation.

MR. GLAZENER: To show you an extreme of that, I recall one experience in January, 1943, trapping in ranch country of lower South Texas. I had located a gobbler feeding route, baited it in the morning, set up a drop trap at noon and trapped gobblers that afternoon. You couldn't want anything easier than that.

MR. LEWIS: I can beat that one on Texas. We have set a net trap up and had birds out in front of the net in 45 minutes. You don't do that all the time though.

COMPARATIVE RESULTS OF STOCKING GAME FARM AND WILD TRAPPED TURKEYS IN OHIO

Arthur C. Sickels
Ohio Division of Wildlife

Ohio's history relates that the last recorded native wild turkey (Meleagris gallopavo silvestris) was shot in Adams County in 1904. Fifty years prior to this date wild turkeys were still common over much of the state. I recall the stories my grandfather told of standing guard over isolated grain patches and vegetable gardens. It was part of the daily chores to keep the wild turkeys out of the family crops.

By 1880 the bulk of Ohio's native hardwood forests had been lumbered. This was followed by hillside farming and mining. These factors, plus expanding human populations and continuous hunting, were responsible for disappearance of the wild turkey from the Ohio scene. Years later the mines became worked-out, and the hillside farms poverty stricken and eroded. These factors caused much of the southern human population to migrate to industrial centers.

By 1940 the landscape had changed considerably, and the hills were once again forested with unbroken patches of timber as large as 50,000 acres. By 1950 several species of forest game had made a remarkable come-back in Ohio. There was one deficit: The wild turkey was missing.

Wildlife biologists, recognizing an environment that appeared to be suitable for the wild turkey, began work on a restoration project in southern Ohio.

METHODS

To set the project in motion 73 game farm turkeys were purchased from the Woodmont Club in Maryland and the Indian Echo Game Farm in Pennsylvania. Fifty-three of these birds were released in the fall of 1952, and 20 were held at the Waterloo Experiment Station for brood stock. In 1954 the brood stock was replaced with wild turkeys obtained from the Pennsylvania Game Commission's wild turkey farm.

A total of 1,400 game farm turkeys was reared and released between 1952 and 1957. These turkeys were released in what was considered to be good or excellent turkey range. Turkeys released ranged from 11 weeks of age to adults. Seven release areas were used during 1952-1957. These areas ranged from 1,500 to 23,000 acres and the total number of turkeys released on these areas varied from 31 to 513. Table 1 shows the number of game farm turkeys released, time period, ages and the name and size of the release area.

Wild trapped turkeys of three subspecies were released on three disjunct areas. These releases were made in 1956 and 1957. Two of these subspecies were released on areas where game farm turkeys had failed. The third subspecies was released in an untried area. Table 2 shows the number of wild trapped turkeys released, time period, ages and the name and size of the release area. Three types of censuses were conducted: Release site observations, farmer interviews, and gobbling counts.

RESULTS

Reported observations in 1958, where game farm turkeys were released, indicated that broods were produced on two areas. Observations on one area indicated 5 flocks of adults. The absence of turkey observations on three other areas indicated that no turkeys were present. Table 3 shows the total number of game farm turkeys released per area and the 1958 census of broods, and estimated populations.

Observations in 1958 where Eastern wild trapped turkeys (M. g. silvestris) were released revealed that at least two broods were produced on the area. Reported observations during 1958 where Florida wild trapped turkeys (M. g. osceola) were released indicated that broods were produced on the area. Only a few turkey observations were made where Rio Grande wild trapped turkeys (M. g. intermedia) were released. Two broods were reportedly observed, but it was uncertain whether these were Rio Grande turkeys or game farm releases. Table 4 presents the total number of wild trapped turkeys released per area, and the 1958 census of broods and estimated populations.

DISCUSSION

Release site censuses were conducted to determine the relationship between the behavior of game farm turkeys, and their environment after release, as it influenced their survival. There is a well-defined period between release and dispersal during which the flock seldom moved more than one-fourth mile from the release point. This characteristic provided a good opportunity to make intensive observations upon the birds.

Following each release, observations were made twice daily, once in the morning and once in the evening. Morning observations usually started between 6:30 A.M. and lasted until 9:00 A.M. or 10:00 A.M. Several morning observations began at daybreak, before the birds left the roost. Censuses at all release sites revealed that birds remained an average of ten days at each site.

Predation, and birds that disappeared before the flocks dispersed from the release sites, accounted for thirty-six birds or forty-six per cent of the releases in 1953.

Mo information is available concerning the population density of the three species of turkey predators on the areas: The great horned owl, and the gray and red fox. Judging from field sign, droppings and tracks, foxes may be considered "abundant". Trapping on the 900 acre Turner Ridge Refuge in the fall of 1952 yielded 38 foxes.

Special attention was directed to behavioral traits that might influence survival. Two obvious sources of mortality, due to poor behavioral coordination with the environment, were predation and poaching. Since most or all poaching occurred after dispersal, it was impossible to evaluate the loss from this source. The behavior of the birds while at the release site is probably an accurate guide to their reaction to humans after dispersal.

All released birds appeared tame in the field, and showed less fear of humans after release than they did in the pens at the game farm. One could easily approach within 50 feet of an observer who remained motionless. With one exception, there was no noticeable difference in their reaction during the interval between release and dispersal. The survivors of releases that

were continually harassed by predators were noticeably wilder near the end of their stay at the release site.

Probably the outstanding factor which contributed to predation was the failure of the birds to roost in trees at night. Most of the flocks were purposely flushed by the observer after it became apparent that they had settled on the ground for the night. Once the flocks voluntarily started roosting in trees, they continued to do so. The first roosts were shrubs and saplings from 4 feet to 20 feet from the ground. One release persisted in roosting in a thicket of sassafras and dogwood for a period of 10 days. This roost was only 4 to 5 feet from the ground. Four birds disappeared from the flock at night before the roosting site was changed to black oak and white oak trees. Although lower limbs were available at the latter site, the flock roosted from 20 to 40 feet from the ground. The other releases performed similarly.

No known cases of poaching occurred while the birds remained at the release site. After the first flocks had left the release site, several reports were received that turkeys had been poached. One farmer reported that squirrel hunters took 6 to 8 turkeys in one day. Dispersal from the release sites ranged from one mile to twelve miles.

Another obvious reason why the game farm birds failed to establish themselves was due to their being genetically half wild. This was shown later in the course of the restocking program (cf. Knoder, 1956).

Establishment of game farm stock on Tar Hollow State Forest and the Waterloo Wildlife Experiment Station, while not on other areas, was probably due to two factors: The release stock on these areas was derived from Pennsylvania game farm stock. These birds were apparently genetically wilder than the Maryland stock. Maryland turkeys comprised the release stock on the other areas. Secondly, little or no poaching occurred on these flocks compared to those on other areas.

Release censuses were conducted on all releases of Eastern wild trapped turkeys. Known dispersal from the release sites did not exceed two miles.

Both 1956 and 1957 releases produced broods. This was confirmed by tracks and one hatched out clutch of eggs that was found in the spring of 1957. The wild trapped, released turkeys were seldom seen.

Only one case of mortality was found after the wild trapped birds were released. One adult hen was in an advanced stage of shock at the time of release and a few days later it was discovered that a fox had caught and killed her.

Census coverage on areas where the Rio Grande and Florida wild trapped turkeys were released were not as complete as those on the wild trapped eastern turkey release area. This plus the larger size of the areas, probably accounted for the small number of observations on the former two areas.

SUMMARY

Since 1952, 1,400 game farm turkeys have been released in areas suitable for wild turkey populations. Data compiled from the 1958 censuses indicated that 232 turkeys were present on three of seven release areas. This is approximately an 84 per cent decrease of the number released. Censuses in 1958

TABLE 1

SUMMARY OF GAME FARM TURKEYS RELEASED IN SOUTHEASTERN OHIO

Time Period	Number of Game Farm Turkeys Released	Ages	sex M	sex F	Area of Releases	Size (Acres)
Oct. 16-19, 1952	53	juv.	11	30	Zaleski State Forest	23,000
		Adult	2	10	Zaleski State Forest	23,000
Sept. 1, 1953 to Apr. 3, 1954	65	18 wks.	29	36	Zaleski State Forest	23,000
Sept. 1, 1953 to Apr. 3	20	18 wks.	9	11	Vinton Furnace Forest	16,000
*Fall 1953	16	Adult	6	10	Waterloo Area	'1,500
Mar.-June 1954	33	36 wks.	5	28	Vinton Furnace Forest	16,000
May 1954	9	1 yr.		9	Waterloo Area	'1,500
Dec. 1954	3	Adult	1	2	Waterloo Area	'1,500
Mar. 1955	118	36 wks.	71	47	Raccoon State Forest	5,400
July 1955	212	11 wks.	unknown		Zaleski State Forest	23,000
July 1955	7	Adult		7	Zaleski State Forest	23,000
Aug. 1955	127	12 wks.	Unknown		Tar Hollow State Forest	16,000
Jan.-Sept. 1955	6	Adult	2	4	Waterloo Area	'1,500
Aug. 1956	31	12 wks.	unknown		Carbon Hill Unit of Wayne National Forest	10,000

* Unscheduled release: Turkeys escaped from breeding pens and settled on the west section of the Waterloo Area.

' Approximately 40,000 acres of contiguous range is located adjacent to this area.

TABLE 1 (Continued)

Time Period	Number of Game Farm Turkeys Released	Ages	Sex M	Sex F	Area of Release	Size (Acres)
March 1956	6	Adult	2	4	Zaleski State Forest	23,000
Feb. 1956	77	32 wks.	42	35	Shawnee State Forest	57,000
March 1956	40	36 wks.	20	20	Shawnee State Forest	57,000
Dec. 1956	71	24 wks.	37	34	Shawnee State Forest	57,000
Feb. 1956	40	32 wks.	20	20	Tar Hollow State Forest	16,000
March 1956	36	Adults	20	16	Tar Hollow State Forest	16,000
Oct. 1956	23	Adults	12	11	Tar Hollow State Forest	16,000
Dec. 1956	70	24 wks.	37	33	Tar Hollow State Forest	16,000
**Fall 1956	240	20 wks.	unknown		Zaleski State Forest	23,000
March 1957	84	36 wks.	33	51	Tar Hollow State Forest	16,000
Oct. 1957	5	Adult	1	4	Tar Hollow State Forest	16,000
Total	1,400					

** Unscheduled release: Turkeys escaped from a 25 acre wooded hardening field and moved into the Zaleski State Forest Area.

TABLE 2

SUMMARY OF WILD TRAPPED TURKEYS RELEASED IN SOUTHEASTERN OHIO

Time Period	Subspecies	Total No.	Ages	sex M	sex F	Area of Releases	Size (Acres)
Feb. 1956	M. g. silvestris	6	Adult	2	2	Vinton Furnace Forest	16,000
			Juv.		2		
Sept. 1956	M. g. silvestris	4	Adult		1	Vinton Furnace Forest	16,000
			Juv.	1	2		
Feb.-Mar. 1957	M. g. silvestris	6	Adult	2	2	Vinton Furnace Forest	16,000
			Juv.		2		
Oct. 1957	M. g. silvestris	2	Adult		1	Vinton Furnace Forest	16,000
			Juv.	1			
Mar. 1957	M. g. intermedia	24	Adult	4	17	Shawnee State Forest	57,000
			Juv.		3		
Mar. 1957	M. g. osceola	6	Adult	1	1	Telegraph Ridge Unit of Wayne National Forest	40,000
			Juv.	1	3		
Total		48		12	36		

TABLE 3

SUMMARY OF 1958 CENSUS OF GAME FARM TURKEYS RELEASED IN SOUTHEASTERN OHIO

Release Area	Number of Game Farm Turkeys Released	Number of 1958 Broods	1958 Fall Observation	1958 Fall Estimated Population
Zaleski State Forest	513	0	30	45
Vinton Furnace Forest	53	0	0	0
Raccoon State Forest	118	0	0	0
Waterloo Area	34	2	18	27
Carbon Hill Unit	31	0	0	0
Tar Hollow State Forest	393	15	130	160
Shawnee State Forest	258	?	?	?
Totals	1400	17	178	232

TABLE 4

SUMMARY OF 1958 CENSUS OF WILD TRAPPED TURKEYS RELEASED IN SOUTHEASTERN OHIO

Release Area	Number of Wild Trapped Turkeys Released	Number of 1958 Broods	1958 Fall Observation	1958 Fall Estimated Population
Raccoon State Forest	18	2	30	30-60
Shawnee State Forest	24	2	54	40
Telegraph Ridge Unit Wayne National Forest	6	1	8	8
Totals	48	5	92	78-138

indicated only two or possibly three of the seven original release areas had produced young birds. The Tar Hollow area has shown turkey production for two years: 1956 and 1957. The Waterloo Area has had broods reported every year since 1954. Although populations have presumably become established on some areas as a result of game farm stocking, these turkeys are much tamer than wild trapped turkeys, and whether the populations are permanently established is still in doubt.

Since the first release of wild trapped Eastern turkeys in 1956, the birds have shown a remarkable population increase. A total of 18 Eastern turkeys was released and today census records show a population of 30 to 60, an increase of at least 60 per cent.

CONCLUSIONS

As a result of the data presented herein, propagation and release of game farm turkeys were discontinued in 1956. Experiments are currently in progress to determine if pure wild turkeys can be propagated in numbers. If positive results are forthcoming, some trial releases will be conducted. Otherwise, only wild trapped stock will be used in future stocking.

A contribution from the Waterloo Wildlife Experiment Station, Ohio Division of Wildlife, New Marshfield, Ohio.

DISCUSSION

DR. KOZICKY: I would like to ask have you been successful at all in raising the pure strain turkey in captivity?

MR. SICKLES: Yes, we have. This is our third year of rearing birds from eggs in the wild, and we have about twelve birds that were raised from wild eggs.

MR. PRESTON: Are you planning on collecting eggs from the wild birds you have in captivity?

MR. SICKELS: At the present time we are experimenting with propagation procedures on wild trapped birds. If this method can be perfected and results are satisfactory after the birds have been released, we shall try larger releases.

MR. POWELL: Do you have any figures at all on the capabilities of these wild turkeys that you raised in captivity from eggs as to whether they can cope with the wild environment or not?

MR. SICKELS: We have never released any of these birds. We still have them all at the experiment station.

MR. ALEXANDER: Have you experienced any mortality in the pens from these birds? If so, do you know the cause?

MR. SICKELS: Yes, we have; but not as much mortality as you might expect. The major cause has been slipped tendons or trouble with the hock joints, which is undoubtedly a nutritional factor.

MR. ALEXANDER: Have you noticed any difference in the behavior of those birds as compared with other birds?

MR. SICKLES: No comparison whatsoever. The birds I told you about -- the gobbler that is two years old and a couple of hens that were two years old -- are as wild now as the first time they were turned out in a pen, and as long as the regular man goes down to feed them and water them they don't fly around too much; but let a stranger go down that trail, and they just about tear that pen apart.

DR. KOZICKY: I am wondering whether Harvey Roberts will give us a report on Pennsylvania's efforts on the restoration of wild turkeys.

MR. ROBERTS: I have one comment I would like to make before I go into Pennsylvania's efforts. It seems to me that as a group of people interested in the restoration of the wild turkey we actually know nothing or very little of what constitutes good turkey range. By that I mean actual measurements, forest type, composition, age, and so on and so forth. I get the impression that the general idea as to the best way to restore or reintroduce wild turkey is either purchase eggs, poults or adult turkeys from Pennsylvania, or wild trapped birds and in several years you will be hip-deep in wild turkeys, regardless of where they are released. I think that as a group, this is one area in which we lack knowledge.

We have made some recommendations, and as you all can appreciate, this game farm business can become something at times. Our recommendations have been that we have to live with it. We are going to have to use the stock that we are now producing in the best manner possible. We see no reason to believe that our commissioners will see fit to curtail or eliminate production at a wild turkey farm. We have advised that no game farm stock can be released in the north central part of the state, and they have followed our thinking on it.

No matter how clean an operation you run at a turkey farm, you have a disease problem, and rather than run the risk of introducing game farm stock in established populations and the possibility of disease, we are trying to get away from that as much as possible.

Our releases, as I related this morning, fall into two categories. We raise breeding stock for release in the spring. In the course of our operation at the wild turkey farm, we have roughly 3,000 young toms that are more or less surplus. At ten to twelve weeks of age, these birds are put into hardening areas, so-called, in our six divisions in the state and for a month or a month and a half these birds are more or less left to take care of themselves in 75 to 100-acre vermin-proof enclosures. These hardening areas were chosen on the basis of abundance of natural foods and so on. These birds are then released in the fall just prior to the hunting season.

MR. KING: You mentioned this morning that your north central range is the birch-beech and maple forest type. I wonder if you could enlarge a little bit on this type of range, the abundance of food, and if there is any winter limiting factor involved?

MR. ROBERTS: We have found that the beech crop in the north central range is not at all dependable. Our big food producers in the north central part of the state, as far as reliability is concerned, are the wild black cherry, grape, horn beam and ash. Some of these producers give us a

crop almost every year. And that brings up another item that is divorced from this -- we are big believers in winter feeding. As a matter of fact, two years ago I think we spent $91,000 to feed our turkeys in the wintertime. That has its pros and cons too, of course.

MR. JAMES (Arkansas): I would like to make a comment concerning your initial statements about habitat evaluation. In Arkansas we have taken a six-mile transect through the center of all our wild trap release areas, evaluating certain habitat qualities which are supposed to be good for turkey populations, such as openness of the forests, maturity, and evaluating food species and productivity and distribution of fields. The thing that remains, of course, is what the population of turkeys does in these areas.

I view this concept with rather mixed emotions because in order to arrive at valid conclusions from the data, we would expect -- we would want to expect -- that the turkey population was going to have to fail or do poorly in some of these areas due to other factors and poaching, which, of course, is another enigma of the old problem. How do you evaluate poaching? As several speakers have already pointed out, this is a difficult problem.

MR. WILLIAMS: You say that you don't want to release turkeys in the north central portion of your turkey range in Pennsylvania. Am I to understand from that that you are not entirely satisfied with the genetics of game farm turkeys?

MR. ROBERTS: I think I mentioned our biggest concern there is the possibility of disease. In other words, regardless of how sanitary you keep your game farm, you still have black head and blue head and so forth, and putting them in an area where we have an established turkey population, I think, is pretty risky business. That's our reason for not releasing game farm stock in the north central part of the state.

MR. WILLIAMS: As I understand you started with domestic blood in order that they could be raised in captivity. Is that right?

MR. ROBERTS: I have no proof anywhere in the literature that we started with any domestic stock whatsoever.

Now, I will be the first one to question anyone who says that their turkeys are 100 percent pure wild. The genetics of the thing are, of course, somewhat questionable. I don't consider any of our stock to be pure, but inasmuch as it has survived at least long enough to produce a population that is self-sustaining, I think that the bird has done its job well.

MR. WILLIAMS: It's pretty well agreed that you can't do a good job of propagation by taking turkeys that have been wild for several generations.

MR. ROBERTS: We have tried that and, of course, there is considerable individual variation as far as a pure wild turkey is concerned.

MR. WILLIAMS: I understand that, but don't you think the degree of success in raising turkeys in captivity is proportional to the domestic blood?

MR. ROBERTS: Not necessarily domestic blood, no. You can get your wildness above a certain level that you can't possibly raise them and get any production from them at all in captivity.

MR. WILLIAMS: That's what I mean.

MR. ROBERTS: You have to keep that wildness down, yes; but just keeping that down doesn't necessarily imply domestic blood is keeping the wildness down.

MR. POWELL: Don't you think, or do you, that regardless of the proportion of wild blood in your birds that you have just as much chance of them being a carrier of disease whether they were full-blooded wild birds or 25 percent domestic birds? The fact that they are raised in a pen would make them just as --

MR. ROBERTS (interrupting): Oh, definitely, yes.

MR. ALLEN (Indiana): In your north central area you have established wild turkeys. Why would it be desirable to introduce other birds there, even though the disease factor wasn't present? Would additional birds increase the population?

MR. ROBERTS: You are speaking of the north central part of the state?

MR. ALLEN: Primarily, yes -- where you have populations established.

MR. ROBERTS: Well, as you can all appreciate, there is a considerable public relations angle involved in this thing. In some experimental trapping and transferring that we have attempted, the sportsmen in that area tear our traps down as rapidly as we can build them. Rumor had it that we were shipping thousands of turkeys to Switzerland and Germany -- things like that. But getting back to your question, there would be no need to release any more birds up there regardless of the disease factor, no; we feel the population is very much self-sustaining.

MR. PRESTON: As I told you a while ago, our problem is getting these things to go wild after they are released. In a banding operation a few days ago I actually saw a technician reach down and pick up birds off the ground and put bands on them. That's not exactly a desirable thing since the bird is going to be released in the wild within three or four hours.

MR. ROBERTS: Definitely not.

MR. PRESTON: These birds presumably are fed and watered at night and the caretaker of the 50-acre plot supposedly wasn't in the area too much in the daytime; but in spite of that, the birds wouldn't run from them.

MR. ROBERTS: This is Pennsylvania stock again?

MR. PRESTON: That's it,

MR. ROBERTS: In how large a group were the birds held that you just released?

MR. PRESTON: Mr. Rush from Arkansas may correct me on this -- I believe there were something like 300 birds in a 50-acre enclosure and they were amazingly tame. Last year, the birds were cared for by a man who lived about 30 steps from the pen -- and they are no wilder this year than they were last year.

MR. ROBERTS: I can't give you a definite answer. I can give you a theory. As you know, the turkey through the fall and winter months is gre-

garious by nature. This is often the case with farm reared stock, and possibly you can expand it to include wild trapped stock, if this were possible. If you could hold any of those in groups of three hundred, five hundred and a thousand, and they were accustomed to traveling in groups of that size and you drop them off in units of small numbers hither, thither and yon, the bird is bewildered -- that gives it more of a stupid expression than really should be credited to the bird.

MR. PRESTON: That may be so, but we have birds come out of the pens that, upon release have spent several days wandering down highways. They are probably bewildered all right, but maybe they are bewildered because of food source and so forth. I don't know.

MR. ROBERTS: Either food source or the sudden loss of their friends.

DR. KOZICKY: There are two thoughts on this. I think one is genetics. What you are trying to do is condition the bird to the wild, and you are bypassing genetics, that is the wildness in the bird that you are rearing. Somewhere there is an answer, and I am going to refrain from getting into this. It is quite interesting, and as many of you know, I am tied up at the present time with the management of shooting preserves. Many of the situations that you are talking about this afternoon confront us daily. There is a striking parallel between some of our game birds on preserves and this wild turkey situation.

MR. DOW: Do you have any idea of the cost per bird of these that you released for the gun?

MR. ROBERTS: Unfortunately, the figures for our game farm production are not obtainable. The only way I can answer that -- knowing what it would cost some of our independent raisers in Pennsylvania, I would say that you could probably raise and release a bird for the gun in October in the neighborhood of eight dollars.

RECENT RESULTS OF WILD TURKEY RESTOCKING EFFORTS IN WEST VIRGINIA

David D. Gilpin
Conservation Commission of West Virginia

In recent years the State of West Virginia abandoned efforts to replenish turkey flocks by use of turkey pens containing captive hens to be mated with wild gobblers. Since better trapping methods were developed than were previously available, most restocking was done with wild stock. In contrast to the State's efforts to use native turkeys, sportsmen's clubs have made several releases of pen-reared stock purchased from commercial sources.

A comparison of the results obtained by each method is in order.

West Virginia's first major attempt to establish wild turkeys in uninhabited range by using live-trapped wild birds was made in March 1950 on Coopers' Rock State Forest, an all-wooded, 13,000 acre tract of the oak-hickory type. Although the release was of only six birds, four hens and two gobblers, reproduction occurred the year of stocking and an estimated 30

turkeys were present the year following. They have thoroughly established themselves on and around the forest and a short open season has been recommended. A much larger release of pen-reared turkeys was made on this area in 1945 and met with unqualified failure.

The second attempt to transplant wild birds was made in February and March of 1953.

Two adult male turkeys were live trapped on Watoga State Park and released on the Bluestone Reservoir Area in February 1953, followed by the release of three additional adult males and four hens in March of the same year. No follow up releases were made in subsequent years. Reproduction occurred the year of release and the population was estimated at between 60 and 80 birds by the fall of 1954. Bluestone was opened to hunting in 1958 for two days when an estimated 1,200 hunters bagged nine turkeys. .

On February 24, 1956 five wild turkeys were live trapped on Watoga State Park and were released on Camp Creek State Forest. Two hens, two young gobblers and one adult gobbler were released. On March 24, 1956 the gobbler was found dead. On April 3, 1956 two additional turkeys were released, an adult hen and an adult gobbler; however, the gobbler was injured and died on the date of release.

In July 1956 a hen with a brood of six was seen on the area.

Due to the loss of all the adult gobblers in 1956, it was believed desirable to make a follow up release on Camp Creek State Forest. On February 5, 1957 another adult gobbler was released and on March 20, 1957 four young hens and one young gobbler. At least three broods were observed the following summer. On February 13, 1958 one flock of 20 turkeys was found and at least 20 more were believed to be on the area.

Several broods were observed during the summer of 1958 and an unknown number of illegal kills were reported during the ensuing hunting season. An estimated population on and near the forest in the fall of 1958 was 75 to 100 birds. A flock of 40 was seen the first week in January 1959.

Another wild turkey release was made on the Chief Cornstalk Hunting Area in Mason County. This area contained a large percentage of pasture and hay type crops and was considered marginal turkey habitat compared with the other areas stocked. On March 20, 1957 two young gobblers and three hens were released. An adult gobbler was released on March 25, 1957. Reproduction occurred in 1957 and again in 1958. The turkeys dispersed considerable distances. Little is known about this population except that it still exists.

The latest release made by the State was on the Blue Creek Area in Kanawha County, a 70,000 acre former game refuge now owned by the Carbon Carbide Corporation. In March 1958 two adult gobblers, two young gobblers and five hens were released on Blue Creek. Deer hunters reported turkey tracks "everywhere" during the first week of December 1958. No other information is available.

The following data on releases of game farm turkeys were compiled from personal interviews and field observations:

In March 1956 a sportsmen's club released twelve hens and three young gobblers on the Pond Fork Watershed in Boone County. These turkeys were purchased from commercial sources in Pennsylvania. An adjoining area was stocked in 1957 with six hens and two adult gobblers. Reproduction occurred on both release areas in 1957 and 1958. If all reports are reliable, a total of fifty turkeys were on the combined areas in the fall of 1958.

A sportsmen's club in Greenbrier County released 36 hens, six adult gobblers and three young gobblers, all pen-reared, in March 1957. This release was made on the Clear Creek watershed, an extensive area having native wild turkeys. All birds in this release were banded. Twenty-four percent were taken by hunters the first year; no banded turkeys have been reported since.

This area has long been open to public hunting and, interestingly, the reported kill in 1957 was below that of 1955, despite the release of 47 pen-reared turkeys just prior to the breeding season of 1957.

Another release of 42 hens, five adult gobblers and four young gobblers, was made in this area in April 1958. These birds were all purchased from the Pennsylvania Game Commission. They were not banded. Nests were observed and broods of as many as 12 young were reported from the first release in 1957. No broods or nests were reported from the 1958 release.

A sportsmen's club in Raleigh County released 12 hens and three adult gobblers on a 6,000-acre leased area. These were pen-reared birds purchased from Pennsylvania and released in March 1957. All birds were banded. No reproduction was observed. A small flock of four adult turkeys was reported seen in October 1958 several miles from the release site. No additional information is available.

Another sportsmen's club in Raleigh County released eight hens, one adult gobbler and one young gobbler in March 1958. The association owns about 1,500 acres adjoined by reasonably good turkey range. No reproduction was reported. As of November 1958 all but one of the original birds were still on the area.

In May 1958 the Conservation Commission tried a pen-reared turkey release on the 5,200 acre Lewis-Wetzel Public Hunting Area in Wetzel County. Twenty-nine birds were released, twenty young hens and nine young gobblers. Some of the birds were laying at the time of release. There are no known wild birds in the immediate vicinity. This release was made to compare results with some of our wild stockings. Reports of reproduction were received but survival records are not available at this time.

In conclusion it should be mentioned that outstanding results were obtained by releasing native live-trapped wild turkeys in small numbers. Generally, such transplants occupied all "available habitat" (limited) within two breeding seasons. It was desirable to have adult gobblers in the initial release. Support from the local people was considered essential. Care should be exercised in the selection of suitable release sites. A turkey population may have been established through the use of pen-reared stock but it remains to be seen whether it will sustain itself under public hunting.

TABLE 1

DATA ON RELEASES OF LIVE-TRAPPED WILD TURKEYS 1950-1958

RELEASE AREA	SIZE	TIME OF RELEASE	NUMBER RELEASED						COMMENTS
			ADULTS		YOUNG		FEMALES		
			M	F	M	F	AGE	UNKNOWN	
Coopers Rock State Forest	13,000 acres	March 1950	2					4	Reproduction occurred the first year. Turkeys established and a short open season recommended.
Bluestone Game Management Area	18,000 acres	Feb.-March 1953	5	2		2			Reproduction occurred the first gear. Turkeys established. Seventy-five reported two years after release. Two-day open season in 1958 resulted in the harvest of nine turkeys.
Camp Creek State Forest	5,000 acres	Feb.-April 1956	2	1	2	1		1	Reproduction occurred the first year. Population estimated between 60 and 100 in 1958.
		Feb.-March 1957	1		1	4			
Cornstalk Public Hunting Area	10,000 acres	March 1957	1	2	2	1			Reproduction reported in 1957. Sparse population still present. Marginal range.
Blue Creek Area	70,000 acres	March 1958	2		2			5	Reliable reports indicate sizeable flocks present in fall of 1958.

TABLE 2

DATA ON RELEASES OF PEN-REARED TURKEYS 1956-1958

RELEASE AREA	SIZE	TIME OF RELEASE	NUMBER RELEASED ADULTS M	ADULTS F	YOUNG M	YOUNG F	FEMALES AGE	FEMALES UNKNOWN	COMMENTS
Pond Fork, Boone County	10,000 acres	March 1956			3			12	Reproduction reported 1957-58. Possible population of 50 turkeys.
		March 1957	2					6	
Clear Creek, Greenbrier County	50,000 acres	March 1957	9					36	Reproduction reported in 1957. No reproduction reports received in 1958. Only few adult birds believed remaining.
		April 1958	9					42	
White Oak, Raleigh County	6,000 acres	March 1957	3					12	Possible reproduction of one brood in 1957. Only a few adult birds remain.
Flat Top Lake	1,500 acres	March 1958	1		1			8	Nesting occurred but no young produced. Nine adult birds remaining in November 1958.
Lewis-Wetzel Public Hunting Area	5,200 acres	May 1958			9	20			Two male birds found dead about 10 days after release. Nesting occurred but data is lacking as to the survival of the young.

MR. PRESTON: I hate to make a nuisance of myself, but since we are tied up with this game farm thing, I would like to find out if you have a problem with birds going into farms and visiting?

MR. GILPIN: You mean wild trapped birds?

MR. PRESTON: No, pen-reared birds.

MR. GILPIN: Yes, quite a number of those birds went into the farm yards.

MR. PRESTON: Did you make any effort to remove the birds?

MR. GILPIN: I didn't happen to be following that release. I assisted with making the release, but they were in the other part of the state from where I work primarily, and that was the last account that I have. Just what the district game manager informed me about the birds is all I know.

MR. MASON: You made a reference to the need for using adult toms in your release. Could you explain why you believe that necessary?

MR. GILPIN: It is my opinion that in the presence of adult toms, immature males do not breed with the females. I may not be correct there.

MR. MASON: That's the reason I asked. I know that very often the virile adults will dominate, but we have had quite a bit of reproduction where we released juvenile males and females together.

MR. GILPIN: Since we lost all of our adult gobblers that year and the status of the immature gobblers was uncertain, we felt it desirable to make a follow-up release.

DR. KOZICKY: I would like to open the meeting for general discussion, and I would like to start it off by asking Mr. Roberts to bring us up-to-date on two things: first, am I right in thinking that the Pennsylvania wild turkey range has doubled in size since the early forties; and secondly, as I recall the turkey harvest in the early forties, it was around three thousand birds, perhaps thirty-four hundred, and my understanding is that in recent years it has gone to twenty thousand. Am I correct in that?

MR. ROBERTS: We have had one year of twenty thousand-some odd birds being harvested. That was the year before last, I think. For the last five years our average has been somewhere in the neighborhood of fifteen thousand. We reached the twenty thousand mark on only one occasion. You are correct about the expansion of the range, definitely.

DR. KOZICKY: I would like to make these comments concerning Pennsylvania. Perhaps three things are involved. They all happen concurrently or approximately concurrently.

One is that poaching is less of a problem. The people have moved off the ridges and out of the hills to town. At least, there are a number of abandoned small farms back in turkey country. This happened in the post-depression years in the thirties. Secondly, in Pennsylvania there is a lot of saplings and brush, up to the pole stage type timber, which means that

they have prime turkey habitat. The third thing that Pennsylvania has is a pen-reared turkey program.

Harvey explained some of the reasons they couldn't trap and transplant birds. First of all, techniques weren't developed at that particular time and you had public opposition. The turkey farm was not just a few turkeys on a farm and gobblers being caught up and brought in. As Roberts pointed out, there were twenty-one propagating areas established. Hens were mated to wild toms and the resulting offspring were high quality birds.

I can tell you this from my shooting preserve experience. You can look at two birds -- and I am thinking of turkey as well as bobwhite quail. They may look exactly the same, but one will give you proper field behavior when released and the other one is a dud. I have seen turkeys that are completely duds, and I have seen pen-reared birds that responded very well.

In Pennsylvania, the turkey range has doubled itself in the past fifteen years, not through trapping and releasing wild birds but through the release of pen-reared birds, so the proof is in the pudding.

MR. LEWIS: Harvey, you said that in 1914 there were releases made in the north central region in Pennsylvania. Do you know if those birds persisted up into the thirties when you started your game farm releases or not?

MR. ROBERTS: To my knowledge, they didn't. We have no written records of that, so that's a qualified no.

DR. KOZICKY: That's a qualified no -- a pretty well established no, because one of the first things that was done was to make a state-wide survey, and this goes back to the time that preceded me. For some mysterious reason turkeys could never cross the Susquehanna River and exist. There was quite a theory at that time that this was a point of no return as far as turkeys were concerned. Now, I understand, that area has one of the highest populations in Pennsylvania.

MR. CLELAND: I would like to ask Mr. Roberts -- of these 15,000 turkeys (the average harvested annually) how many are on a put-and-take basis?

MR. ROBERTS: As far as we can tell from our game protectors' estimates, the bulk of our kill in the south central range is made up of put-and-take; whereas very little of it is of that type in the north central range.

DR. KOZICKY: What is your game farm production at the present time?

MR. ROBERTS: It ranges between six and eight thousand birds. Of course, half of those are held as breeding stock.

DR. KOZICKY: About three thousand, perhaps, are released in the fall.

When a fellow kills a turkey, you can't ever tell him it's a game farm bird. He won't believe you, and he is a pretty happy hunter. In Pennsylvania, you have close to a million hunters to satisfy. In spite of the fact that it may look like an awkward technique, if you ask the people in Pennsylvania I am sure they will justify it.

MR. GLAZENER: Gene Walker and Walt Daniel, I think, have completed a survey in which they analyzed transplants in Texas involving live trapped wild

birds, and they found three things: one, that the success of the transplant depended on the rainfall -- as the rainfall went up, the chances of success went down; second, there was direct correlation with the decrease in human population; and, third, there was a tie-in with the land yield.

Now, the question -- some of the early transplants we found went like this: for a period of three or four years the birds would build up steadily; they would level off and then, perhaps the fifth year, a crash would set in. That was during the period when our federal aid restocking was under the restriction of not hunting until the end of the five-year period. As a consequence, a lot of the turkey population went down the drain for some reason. I am wondering if that experience has been paralleled in any of the other states?

MR. JANTZEN: In some of our southern mountain ranges where we have successful transplants of Merriam's turkey we have thought that to be the case.

MR. ROBERTS: Have any of the states that have gotten breeding stock from Pennsylvania tried this enclosure system at all with their hens, allowing the wild toms to come in and mate?

DR. KOZICKY: As a propagation technique?

MR. PRESTON: As far as I know, Arkansas has never tried that. Mr. Alexander may shed light on that.

MR. ALEXANDER: As far as I know it has never been tried in Arkansas.

MR. ROBERTS: I think it might be worthwhile looking into. Don't get into it on a scale above and beyond your means until you see how it is going to work, but that's how we originally got started. We didn't collect the eggs in these vermin-proof enclosures, which were surrounded by electrified wire and a few pole traps to keep the area fairly predator free and just let the hens nest in there and hatch their poults out and open the gates.

MR. PRESTON: That would presume to produce a wilder bird there?

DR. KOZICKY: Let's put it this way: That bird doubled the range of the wild turkey in Pennsylvania.

MR. HANKLA (North Carolina): I would like to know if anyone has found that deer are serious competitors for food with turkey?

MR. MASON: We can't prove it, but we strongly suspect we have competition in Allegheny State Park. We did experience some turkey loss last winter. We had an unusual winter -- more snow than usual -- and a portion of our turkey population starved. I think, though, that we have competition with deer every month of the year.

MR. DOW: Our turkeys for the most part are on our better deer range. We don't have figures on competition, but that's where the turkeys are.

MR. PRESTON: For what it is worth, in northwest Arkansas where we have one of the highest deer concentrations, we also have presumably our highest turkey population.

MR. GWYNN: In Bath County in Virginia, we have our best deer harvest and also our best turkey harvest.

MR. ALEXANDER: I can understand the utilization of almost any possible technique on ranges where you don't have any turkeys but where you do have established native populations of turkey and they experience some habitat deficiency which has reduced the population or is holding it to a certain level, how can you justify releasing birds on that type of range other than on a put and take basis?

In southwest Arkansas there are such areas of established populations, and-they arc at a certain level because of certain factors. If you have a native strain there that has persisted under adverse conditions, how can you introduce other birds that will survive in excess of those native birds?

DR. KOZICKY: I don't think there is argument with the point you are making. If you have turkeys established, there is no sense in trying to add turkeys to that particular flock; but in order to justify it -- at least, if you want to try to justify it -- in Pennsylvania, as I told you previously, there are a million hunters looking for something to hunt. I don't know what your Arkansas figure would run, but I imagine it is a couple of hundred thousand. The Pennsylvania hunter wants an opportunity to harvest a turkey, and it is a put-and-take proposition on an established range; whether or not it is justified is up to someone in administration, not the biologist.

MR. POWELL: We don't do any put-and-take restocking as such, but when you are working with the public you have got a very strong public relations problem. When we have an area that drops way down due to spring rainfall, we will put in a few turkeys. It may not do the existing population any good. It certainly won't do any harm, because we are using the same type of turkey, and the value you receive from the public and the support from the public in the future is hard to place a dollar value on.

MR. GIVENS (U. S. Fish and Wildlife Service): Is there any information as to what happens to the sex ratio in a stagnated population? In other words, on a range fully stocked and where no hunting or-trapping occurs?

MR. LEWIS: We have been working on areas where we are trapping, and our figures don't reflect, I think, the actual situation. I think we run a little heavy on adult males in these areas, particularly in the areas where we haven't had hunting for several years. I wouldn't say our population is in a stagnated condition, though, because we have so much range in which these birds can move if they had the opportunity -- or it is available for them to move into if certain other factors would allow them. We do find in areas where we have had very little poaching that we have a preponderance of adult gobblers in the population.

MR. ALEXANDER: One more comment on that business of sort of priming the public, you might say. You mentioned there might be two hundred thousand turkey hunters in Arkansas. We really don't have any estimate.

DR. KOZICKY: I was thinking of total hunters, not turkey hunters. I wouldn't know how many there are in Pennsylvania.

MR. ALEXANDER On these areas where there are no birds, if you can establish them, fine; but I can't see the feasibility of going in each year and trying to find the turkeys for the hunters to take off those areas.

DR. KOZICKY: It's a question that revolves around this. The average turkey hunter -- if he kills a turkey every three years -- is a pretty happy

individual. It isn't like pheasants, or quail, or duck. It's unique; but if a turkey hunter goes out five or six years and doesn't find some scratchings or something to warm his heart and doesn't get a crack at a bird, you are going to hear from him.

MR. PRESTON: I would like to know how much money the sportsmen are putting into this turkey program in Pennsylvania?

MR. ROBERTS: I don't know what our game farm operation would cost.

DR. KOZICKY: Well, I am going to make an attempt to very briefly summarize what has transpired this afternoon. All of the states that have tried pen-reared versus wild trapped, transplanted stock -- with the exception of Pennsylvania -- have had mediocre success at best, and most of it has been a failure. The use of wild trapped birds and transplanting them into desirable habitat, as far as turkeys are concerned, appears to be the most common technique at the present time. One of the problems with live trapping is the difficulty in estimating your success because turkeys are not easy to count. The aerial technique is a new one, and very interesting.

SATURDAY--FEBRUARY 14

Program Chairman For The Day: SAMUEL P. SHAW

U. S. Forest Service

RANGE MANAGEMENT

Session Chairman: DANIEL W. LAY
Texas Game and Fish Commission

BRIEF SUMMARY OF TURKEY RANGE MANAGEMENT

Daniel W. Lay
Texas Game and Fish Commission[1]

A review of many publications on wild turkeys reveals fairly general agreement on some points of turkey range management.

1. Well distributed water is essential.

2. Disturbance should be minimized.

3. Excessive livestock grazing is detrimental. (Many writers favor exclusion of all livestock.)

4. In forests, well distributed clearings are essential.

5. In brush, savannah, and grasslands, trees for roosting are important.

6. The common components of turkey diet are mast and fruits of trees and shrubs, grass seeds, succulent greens, and insects. Acorns are the staple diet when and where available.

7. Competition with hogs and other livestock, as well as with deer, may be critical where mast supplies are limited.

8. Pure stands of pine have little value to turkeys.

9. Turkeys prefer savannahs and forests with open understory to dense brushland.

10. Plantings of locally adapted cool season grasses and legumes, as well as some summer foods, are desirable.

It is not surprising that some points of disagreement emerge from a review of the literature. The ecology and land use of turkey range is varied and research remains far from complete in the various related disciplines.

These include: fire, timber stand improvement, timber cutting, brush clearing, and predator control.

[1] Contribution of Federal Aid Project W-80-R

It is interesting that all of these concern extensive turkey range management, as distinct from intensive management.

Not only are these major questions that have not been settled, they also seem to reflect a current trend towards more emphasis on extensive range problems.

This is sound, if our experience with quail is applicable. Intensive development of spots of quail range will not produce many quail if the surrounding acreage is untenantable, as in an overgrazed pasture.

Timber Cutting and Turkeys

The papers by Shaw and by Wentz and Hardy will show how turkeys are being considered in forestry operations in the eastern region of the U. S. Forest Service. The timber cutting is done by group selection in small (1 to 5 acres) blocks. Three to four per cent of the area is left in uncut mature timber in spots of 15 to 20 acres. About 2 per cent of the area is maintained in small openings. These are the most definite recommendations I have seen.

The general objective, as most authors have stated, is to regulate cutting to provide a continuous production of trees and shrubs which produce food for turkeys.

Practicable methods of doing this are yet to be developed for some forest types. Stoddard says the greatest threat to forest wildlife in southern woodlands is short rotation pine forestry. Under this system a full canopy of pine is present about 25 out of every 30 years.

Foresters in the southern pine region generally favor even-aged stands, which is opposed to group selection. Also, where pine will grow, a common practice is to sell all merchantable hardwoods. Where wildlife is being considered, some hardwoods are being left. Recent discussions with the southern region of the U. S. Forest Service have brought about some improvement in the kinds and numbers of hardwoods left.

One question that has received considerable attention is the best distribution of hardwood trees left in pine-hardwood stands. The two papers presented suggest that they should be in groups. Such groups have been given a name - holm. Some of us have recommended that foresters should leave hardwoods as widely distributed as possible, thinking that this would bring the range into fuller use by all species. Another factor, in Texas at least, is that we need those scattered trees to supplement the groups that might be left.

Thinning of pole-size hardwoods is a cutting practice that can be used to increase mast production by making space for crown development.

Timber Stand Improvement and Turkeys

Many authors have pointed to the need for protecting mast trees and shrubs for turkeys. The release of pines and other desirable commercial timber species is sound forestry and may or may not be detrimental to turkeys. The danger is that it may seriously reduce the food supply if carried too far.

The safest recommendation for those who want turkeys is to leave as many of the turkey food species as is commensurate with other land use objectives.

In many southern forests this is a critical problem. On thousands of acres of pine-hardwood site, all merchantable hardwoods have been cut and most of the remainder have been girdled. One National Forest compartment in East Texas was surveyed after treatment in 1956. Less than two hardwoods over 9 inches were left per acre, including three-fourths of one oak. Since then new TSI rules have been adopted which will leave about 10 hardwoods per acre, where they are present for leaving.

Aerial application of herbicides may cause even greater damage to turkey range because it affects all sizes of broad-leaved plants and because it is becoming cheap enough to be widely used. However, it might serve as a cheap method of creating clearings.

Fire and Turkey Range Management

Most early publications on turkeys deplore fire, yet Stoddard and a few others have found some range situations that require properly used fire.

Both pines and hardwoods of certain sizes can withstand certain intensities of fire. Foresters and some wildlife people have developed burning techniques which eliminate most of the hazards and make it possible to use fire as a tool.

It must be remembered that fire was a normal aspect of the ecology of southern forests before the arrival of white man.

Some of the purposes of burning for turkeys (as reported by various authors) are: to keep down brush; to remove litter that makes foods unavailable; to stimulate fruiting of such fire-tolerant species as blackberry, runner oak, and gallberry; to increase the production of succulent greens and insects; and to reduce chiggars and ticks.

It seems obvious that fire may have a place on some turkey ranges. Certainly fires during the nesting season would hurt. Since most young hardwoods are killed or scarred by fire, fires must not be hot enough or frequent enough to prevent reproduction of replacements for the hardwood stand as needed.

Disastrous fires in the mountain states of the west seem to have had undue influence on the thinking in the south. Forest Fire Prevention efforts have oversold the evil of fire for wildlife in the south.

Brush Clearing and Turkeys

As mentioned earlier, too much brush can be a problem on turkey range. Currently there is a controversy in Texas and possibly other states as to the effects of extensive brush clearing on turkeys. Farmers and ranchers, with the assistance of the Soil Conservation Service and other agencies, are clearing brush (including some forest types) on a large scale in order to increase livestock production.

With the aid of heavy machinery and herbicides they are literally changing the face of the earth. For those landowners who want turkeys, some brush and timber must be left. How much and in what pattern remains to be determined.

Predator Control and Turkeys

More emphasis on predator control is found in the older publications. Current thinking seems to attach little significance to moderate predator pressure. This does not rule out possible need for control in special situations.

This, then, is the general scope of turkey range management as reflected by the literature.

TIMBER SALES AND TURKEY MANAGEMENT ON EASTERN NATIONAL FORESTS

Samuel P. Shaw
United States Forest Service, Eastern Region

A wild turkey needs one thing for sure, and that is lots of timberland with not much human disturbance. Tracts of land like this have become increasingly scarce since the white man began to push back the wilderness. Shrinking forests, expanding human population, and concurrent destruction of turkey habitat naturally showed up first in the Northeastern and Middle Atlantic states where our pioneer settlers showed the first signs of growing pains.

Although the habitat base for turkeys has become increasingly restricted, I think we can agree the outlook for turkey management is far from dismal. Much of the credit goes to those who have had the sense and vision to set aside publicly owned forest lands to serve the resource needs of future generations. The original purpose of acquisition was often for purposes other than wildlife management, but regardless of why these public lands were acquired, they will furnish most of the habitat where permanent turkey programs can be practiced. We can count on their being left largely in timber cover and usually managed on the basis of multiple use. Nearly all these lands are administered by State or Federal forest and game agencies.

The Eastern Region of the Forest Service, which I represent as a wildlife staff man, includes seven national forests--two in New England, two in Virginia, and one each in Pennsylvania, West Virginia, and Kentucky. These forests cover a net ownership of 4.3 million acres in seven states. In the same seven States, forest park, and wildlife agencies at the State level control 3.3 million acres, and the Fish and Wildlife Service about 90,000 acres. This gives a total of 7.7 million acres on which wildlife management can be practiced--ostensibly for all time. Discounting States not now considered suitable for turkey, roughly 83 percent of this total or 6.4 million acres, are present or potential turkey range.

The purpose of this paper is to present some of the turkey-management measures the Forest Service is applying in its field program. I am also here to learn of new management practices and techniques which can be applied on national forest lands as an integral part of our multiple use activities. This information will be passed on to field administrative officers who have the responsibility for putting multiple use into practice.

Improvement of turkey habitat can be a priority objective on certain national forest lands--if we know the techniques and have active guidance to put the improvements into effect on the ground. Most of our forest officers close to field programs are trained primarily in fields other than wildlife management. Also, they have so many diversified duties that it is difficult for them to keep apace of new developments in the wildlife field. Therefore, the responsibility is actually on us as wildlife managers to furnish the Forest officers with clear, easily applied guidelines for improving wildlife habitat.

We always benefit from cooperation with State game departments. In turkey management, we are fortunate to have well versed and practical turkey biologists in all the State game agencies with which we cooperate. Most of these men are here today. We respect their advice and we will continue to welcome their suggestions.

Turkey management on National Forests is accomplished in two ways. First, through cooperative agreements and planning with the Forest Service, State game agencies install direct improvements --sod clearings and water holes, for example--and they also take on the job of establishing turkeys where necessary, and winter feeding the birds artificially when justified. In other words, the States install intensive practices on a small percent of the land area. Of course, States also are responsible for setting hunting regulations.

The second, more extensive approach is where the Forest Service carries out habitat improvement on broader areas as an indirect, but still planned, by-product of other management programs. The principal activity of the Service that affects habitat is timber cutting. Last year in the Eastern Region, Forest officers supervised commercial sales on 62,000 acres, about 86 percent of which took place on "turkey" forests. Although we do not have accurate methods of evaluating the effect of these cuts on turkey habitat, if we can accept Trippensee's statement in '"Wildlife Management" (page 316), we believe most of it is beneficial. He describes the relation between forest management and turkey management as follows:

> "Forests managed on a sustained-yield basis in which there is an adequate distribution of size classes are preferable to solid blocks of one age class. Clear cutting in small units and group selection systems provide more desirable forest-cover conditions than other methods of harvest, although cutting of any kind is beneficial if the age groups are well interspersed. Openings of the sort created by tree-selection and group-selection cuttings are highly desirable, in that for several years following the removal of portions of the forest canopy suitable conditions exist for the growth of herbaceous plants and fruit-producing species....."

On this basis, one might think we need do nothing but carry on routine sales--the more the better--and the quality of turkey range keeps on improving. This may be true, at least in part, but I am sure we can do a better job by providing specifically for turkey-habitat requirements. We realize that rarely in multiple use management can the development or improvement of one resource automatically be of maximum service to another. It takes coordination.

In the case of timber sales helping turkey range, we need advance planning to determine how timber cuts and stand improvement work should be designed to satisfy pre-determined deficiencies in turkey habitat--and to protect habitat units which are already providing excellent food and cover.

I would like to report on one wildlife study just getting under way on the George Washington National Forest. It illustrates, I believe, the type of analysis and planning we need in order to do a professional job of wildlife management. The area under study is an 8,000 acre watershed--largely undeveloped. Roads and recreation areas are lacking, timber is uncut, and hunting and fishing are restricted to those few brave souls who will hike several miles to bag their game. It is as near to virgin country for development as one can find in the East. I should add that the watershed includes a 2,000 acre natural area which will not be disturbed.

Forest officers responsible for management of resources on this area decided that wildlife should have high priority, so they told us to look at the 8,000 acres from a selfish point of view. We were told to consider habitat improvement for wildlife as the first objective of management, after water protection. They could not promise to incorporate all recommendations the study leader might make, but they did say that plans for other resource developments would be modified to meet the wildlife recommendations whenever it was possible to do so. That puts wildlife biologists on the spot. I hope we can produce.

The plan we settled on includes five basic steps:

(1) Inventory -- What plants and animals are present?

(2) Evaluation -- What are present capabilities or carrying capacity of the habitat?

(3) Diagnosis -- What are the habitat deficiencies that limit carrying capacities?

(4) Remedy -- What should we do to correct deficiencies and increase carrying capacity?

(5) Program -- How do we do the things that need to be done?

After a one-day reconnaissance of the watershed with representatives from the Virginia Commission of Fisheries and Game, the U. S. Fish and Wildlife Service, and the Forest Service, it appeared to us that the terrain, vegetation, and water conditions were best suited to turkey, bear, and native brook trout. These species will take priority of management if a conflict should arise. In the uplands, deer, grouse, and squirrels will definitely be considered but only after the major habitat requirements for turkey and bear have been satisfied. One of the most significant recommendations, I feel sure, will be how timber should be cut to provide better turkey habitat.

This approach to wildlife management is, of course, quite comprehensive. We cannot expect to spend so much time, manpower, and money on developing a similar plan for each watershed, but out of it the Forest Supervisor expects to get some guidelines for habitat manipulations that can be applied elsewhere particularly for the wild turkey.

Speaking of guidelines for turkey management, it strikes me that they vary considerably from State to State. Recommendations for Virginia conditions may not be the best ones for Pennsylvania. Nevertheless, I would like to list here the things we now think will help increase the quality of turkey range generally. The list was developed for use on the Monongahela Forest in West Virginia, but it would seem to have application on other turkey

forests. Discussions are welcome on the soundness of these measures.

General Program

(1) Block out public land ownership to insure contiguous tracts of forest land where turkey management can be practiced on more extensive areas.

(2) Build access roads and trails into large, undeveloped lands for hunter distribution and greater harvest, remembering it is just as bad to have too many roads as not enough.

(3) Cooperate with law enforcement personnel to protect turkey flocks.

Timber Harvest Program

(4) Cut timber by group selection whenever possible, creating small blocks of clear-cut areas from one to five acres in size. Certain of these small openings should be designated for complete removal of woody plants and establishment of herbaceous cover, following a predetermined plan of distribution. The minimum goal is to have two percent of the Forest in herbaceous clearings.

(5) Establish additional food plots of clovers and grasses after the sale is closed, using logging roads, mill sites, and other cleared areas. These, too, should be established according to a planned distribution.

(6) Favor occasional clumps (3 to 10 trees) of large crowned oak, beech, black cherry, or black gum primarily for mast production.

(7) In sales covering 500 acres or more where the cut is uniform and fairly heavy, leave uncut at least one block of mature trees 15 to 20 acres in size. The block would be primarily for roosting but should include as high a percent of mast trees as can be found.

(8) In timber stand improvement work, leave a liberal stand of understory vegetation that produces mast or berries, such as serviceberry, elderberry, wild grape, blackberries, huckleberries, raspberries, blueberries, black gum, chokeberry, greenbrier, holly, hawthorn, dogwood, and viburnum.

(9) In extensive, even-age pole stands where saw-log sales are not practicable, encourage pulp and sales of other products to thin out these stands which are relatively unproductive for wildlife.

That completes the list so far. I wish I could tell you that we are actually doing all these things. In some cases we are, but in many others we are just making a small dent in the total job. The big reason for this slow start, I believe, is the tendency of wildlifers generally to concentrate on projects which give quick results in terms of use by game in the immediate area. Perhaps we are looking for a panacea and expect that intensive development of one or two percent of a total area is it. I can assure you that the Forest Service needs and would welcome more advice on how to treat the other

98 percent, particularly as treatments can be planned as an integral part of timber sales.

In the future the Forest Service may get funds for direct habitat-improvement projects. If these funds materialize, we want to supplement in the most effective way the important work the States are now doing. It is my personal feeling that more habitat improvement per dollar can be gained by working through and following up behind a timber sale, than in any other way. Working closely with wildlife technicians from State agencies and the Fish and Wildlife Service, the Forest Service will do its best to plan for and practice good wildlife management.

I feel privileged to be a member of the Turkey Subcommittee which conceived and helped plan this meeting. I am looking forward to working with game men from other agencies, and together I hope we can come up with some firm recommendation which can be applied readily in field programs.

TURKEY MANAGEMENT AS A FACTOR IN THE MULTIPLE USE MANAGEMENT OF THE CUMBERLAND NATIONAL FOREST

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and
Frederick C. Hardy
Kentucky Department of Fish & Wildlife Resources

The paper presented by Sam Shaw, outlining the overall objectives for turkey management within Region 7 of the Forest Service, has aptly defined the programs on our eastern national forests. Fred Hardy and I have tried to prepare what might be considered an example of some progress made in following the programs developed in Mr. Shaw's talk.

The Cumberland National Forest, situated in the Cumberland Mountain Range of Eastern Kentucky, is a long narrow forest extending 150 miles by 12 miles. Within this area, there is a total national forest ownership of 457,000 acres in scattered blocks intermingled with private lands. This makes the Cumberland National Forest the largest single ownership in the State of Kentucky and provides an excellent opportunity for the management of all wildlife species. The Forest tries to direct its activities toward the improvement of habitat for deer, turkey, squirrel, and ruffed grouse. The topography, climate, and timber types lend themselves well in general to the establishment and maintenance of a fine turkey population.

In accordance with the basic Forest Service policy, we are active in the field of habitat management in cooperation with the Kentucky Department of Fish and Wildlife Resources which is involved primarily in management of the animals. Working together since 1946, we are able to have our wildlife resource contribute its full share to the economy of the community of which we are a part.

The Beaver Creek Wildlife Management Area of 17,300 acres was established in 1946 for the development of direct wildlife habitat improvement. This area provides a convenient unit to study inter-relations between animals and their habitat, in an effort to discover new and improved management techniques.

It was our intent to develop techniques on this area which could be applied on the remainder of the National Forest, in coordination with our other activities. The Beaver Creek area was stocked with both deer and turkey and careful population inventories were maintained by the wildlife managers of the Department of Fish and Wildlife Resources. Since its establishment, this area has been improved to the point where we are now removing both deer and turkey for restocking to other sections of the State of Kentucky.

During the 12 years of its existence, there have been 400 acres of wildlife openings created and maintained, as well as 40 water-holes and numerous salt licks. Several project studies have been carried out and experimental work in coordinated timber management techniques with wildlife needs has been developed. This area has served to demonstrate the feasibility of cooperative wildlife operations on the Forest. With the benefit of this experience, two new units consisting of approximately 18,700 acres were established as management areas for the expansion and development primarily of turkey. These areas, the Sky Bridge Management Area on the Morehead Ranger District and Mill Creek Management Area on the Berea Ranger District, were established primarily to correlate timber sales with the re-establishment of a nucleus of wild turkey. Direct habitat management as practiced on the Beaver Creek Area has not been applied on these two new areas; thus they serve as checks on the different treatments provided in our original management effort.

Under our present timber program, the Forest has an allowable cut of 38 million board feet annually. However, due to lack of markets for cordwood, and to a certain extent the lack of adequate roads, present plans include the cutting of approximately 22 million board feet a year for the next several years. With this timber sale business, opportunity is provided for the manipulation of habitat on seven to eight thousand acres a year. In addition, a sale area betterment program covers an additional five thousand acres a year.

Considerable progress has been made in applying accepted techniques to our timber sale operations. Perhaps our greatest achievement to date is the development of habitat-improvement techniques which the forester can apply in developing his other functional plans. In 1957, a comprehensive timber inventory was made on the entire forest. This provided us with information on the condition of our timber stands, as wall as the composition and species distribution throughout the Forest. Based to a great extent on this information, the technicians from the Department of Fish and Wildlife Resources, in company with the rangers, have been able to make a rough analysis of the potential habitat available to the various game species. Setting up the desired criteria for turkey range (i,e., large areas of contiguous ownership with heavy percentage of mature timberstands), the most suitable blocks of national forest ownership within each district were studied. In spite of the broken pattern of ownership, approximately l50,000 acres of the Forest have been designated as desirable turkey range. Our resources objectives inside these blocks will lean heavily toward turkey management.

All activities on the Forest are coordinated through a multiple use management plan, a part of which is a system of overlays for each resource activity. Turkey range areas are delineated on these wildlife overlays so that in the planning phase of all operations, the district ranger is reminded that turkey management must be a part of his functional planning. Since timber sales provide the best means of cover manipulation, it follows that the timber management section handles wildlife habitat coordination at the Forest level.

To provide the ranger with the necessary equipment for proper planning, a wildlife handbook has been issued. This handbook was developed as a cooperative venture between the biologists of the Kentucky Department of Fish and Wildlife Resources and the National Forest staff. To give some examples of the items

that a ranger has available, I would like to quote a few of the measures which are policy in regard to timber sales; and I quote:

"In timber management, the timber sale is the principal tool the Cumberland National Forest can use in the habitat improvement and development work.

a. Group selection for the cutting in both hardwood and softwood stands will be practiced (groups to be l-5 acres in size).

b. Maintain pockets of mature hardwoods and/or conifer-covered glades within sales areas for wildlife habitat.

c. Maintain mast-producing hardwood clumps on ridge tops at reasonable intervals where practicable for better annual game food production dispersal. Larger clumps with wide spacing is more desirable.

j. Revegetation of mill logging camps, log-landing sites, logging roads and skid trails to temporary wildlife herbaceous ground cover of grasses and legumes.

q Adjustment of cutting practices for limited periods by areas may be necessary when critical wildlife treatments would require the delay of cutting for short intervals."

These are but a few of the items that the ranger considers in developing his marking plans for a specific sale area. To show how these work, I'd like to point out two very short case histories that have recently taken place and are samples of what we hope will become standard operating procedures. The first is a quotation from a timber sale report prepared on the Stearns Ranger District on a relatively large sale. Under the section on wildlife and recreation in this report, the ranger says; and I quote:

"Several groups of old growth hemlock were left because of glade conditions that exist under them, and to serve as roosting trees for turkey. The thickets of hemlock should provide good cover for deer and roosting sites for grouse already present on the area. The oak stands on the slopes should provide sufficient quantities of mast for both deer and turkey. The quantity of mast should increase as the stand matures. The understory in the oak type is quite open."

This description is part of the general sale prescription for that particular drainage.

The second example of the active use of our wildlife guides occurred recently on the Somerset Ranger District in the preparation of a proposed three-year cutting budget. To manage our road and timber programs in an orderly manner, we are engaged in developing sale plans a minimum of three years in advance so that the road construction may take place in time. In the case I refer to on the Somerset Ranger District, the ranger had a specific area in mind which was very desirable from a timber management standpoint. This area was reasonably accessible because of a recently completed forest development road and was the easiest area in which to harvest his timber. It was in one of our blocks designated for turkey management and, because of access, several other sales had been programmed in the immediate vicinity. With the objective of leaving reasonably large blocks of land undisturbed, it became apparent that, from a turkey standpoint, this series of compartments was being disturbed too frequently. It was, therefore, decided by the ranger that the timber cutting operations in that "easy compartment" would

be postponed for a period of not less than three years to permit the adjoining sale areas to become stabilized and undisturbed before resuming operations.

Another example of the coordination we try to achieve is a program just getting under way where watershed management needs are planned jointly with wildlife needs. In the abandonment of temporary skid trails and storage class logging roads, we have asked the operator to contribute to erosion control--by seeding. With assistance from Don Strode and Fred Hardy, we expect this spring to sow grasses and legumes which will serve both as desirable wildlife plants and as plants to check erosion and stabilize soils. We also will use desirable wildlife species to revegetate mill sites, log landings, etc. For example, in clause 7f (Erosion Control), in one of our most recent timber sale contracts we say,

"f. Roads and skid trails as designated by the Forest officer in charge shall be limed, fertilized, and planted using the following materials and minimum rates of application.

1. Mixture of Ky. 31 fescue and orchard grass or other grasses named by the Forest Service, at the rate of 60 lbs. of fescue and 10 lbs. orchard grass (or other grasses) per mile.

2. Four tons of lime per mile of road

3. 1600 lbs. 4-12-8 fertilizer per mile

Soils on areas to be treated will be loosened to a depth of at least one inch to provide satisfactory seedbed and to increase chances for successful stand of grass."

We have tried to show here some of the positive measures we are taking on the Cumberland to do a better job of developing desirable habitat for turkey. We recognize that much is still to be done. We will continue to search for wildlife management principles that can be made an integral part of the development of all of our timber sale operating plans. In the development of a prescription for treatment in a specific watershed, we must have not only a timber prescription, a watershed management prescription, but also a specific wildlife management prescription, for that sale area. Without a wildlife plan, we cannot practice true multiple-use management. As Mr. Shaw indicated, the forester charged with the management and development of a ranger district needs assistance from the professional wildlife technicians in applying the latest techniques in his every-day activities.

It has been encouraging to note that in cases on the Cumberland where the Kentucky Department technicians have been able to spend some time with our foresters in developing coordinated plans on sale areas, our foresters appreciate a chance to learn a little more wildlife management. Also, the technicians have been grateful for a chance to learn something of the forestry business. We intend to continue and expand this exchange of information. Only through such cooperation can our national forests contribute their full share to resource development in the public interest.

I appreciate the invitation to participate in your meeting and know the information I am able to gain here will help me do a better job of applying habitat management for wildlife on the Cumberland National Forest.

MR. ROBERTS (Missouri): Missouri has two million acres of national forest, and it is very much the type that has been discussed in the Cumberland Forest evidently. I would like to ask two questions of the gentleman who discussed the Cumberland Forest. What percentage of the Cumberland Forest is now in these active turkey management units or wildlife management units and about what is the cost to the Kentucky Department annua1ly to carry out this program.

MR. HARDY (Kentucky): The three management areas total 35,000 acres. We have a total budget for their management of about $20,000 of which maybe $15,000 should be charged to turkey work.

DR. MOSBY: Dan, you could probably comment on the success of the Rio Grande turkey in the range that was formerly Eastern Turkey habitat. I am a little confused as to whether or not the Rio Grande is still there and whether or not they adapt themselves to any of the Eastern Turkey range?

MR. LAY: We have put Rio Grande birds in the silvestris range at least twenty times. Sometimes as many as 400 birds on one range over the last twenty years, simply because that was the only bird we had for trapping, and as of today we have no areas that have been stocked successfully. In approximately three areas, we still have straggling individuals, a few bands, still reported. For instance, near Texarkana up in the northeast corner of the state, which is not typical silvestris range, they have done better than elsewhere and yet they are now down to two small bands that are depending on artificial feeding, so it looks like there is something wrong with the rainfall or the range in the eyes of the Rio Grande birds. Of course, he is used to feeding on mesquite beans and cactus, and he has a herd time finding them in pine woodland.

MR. ELLIS: I believe that the post oak belt was original1y inhabited by silvestris. What experience have you had in putting Rio Grande in there?

MR. LAY: We have some areas in the post oak belt of Texas, which is west of the pine woodland region, where the Rio Grande has done very well. Of course, most of our plants do receive considerable artificial feeding. I would say that the post oak region is adapted to the Rio Grande where other factors are present. In other words, there is a possibility of success with the Rio Grande in post oak range.

MR. ELLIS: Do you think that supplemental feeding in the post oak range is necessary in order for the Rio Grande to adapt there?

MR. LAY: No, I wouldn't think it necessary, but when you spend all the money you do in moving birds and setting up an area, you might as we11 spend a little more on sack feed. Certainly we don't want to predicate a program on continuous artificial feeding. Some ranchers are quite willing to do that.

MR. ELLIS: But established supplemental feeding is probably not necessary?

MR. LAY: No, I wouldn't say so. I think you can succeed without it.

MR. KNODER (Ohio): Have you observed any ill effects on the populations where you have those tremendous densities of Rio Grande, such as disease or ectoparasites?

MR. LAY: That's an interesting question, and I have a real authority here in the audience. Mr. Glazener has had more experience with the Rio Grande than anybody else here, about as much as anybody in Texas, I guess.

MR. GLAZENER: As I recall, there have been some reports of die-offs in some instances. The only observation that has come to my attention personally involved birds that I trapped off the King Ranch country in lower south Texas. I found infestations of blue bugs, or fowl ticks, in some of those birds, and also other parasites, including common occurrence of tapeworm. As to actual losses from those sources, we do not have any figure.

You must recall also that these concentrations are for relatively short periods, they may start in October or November and terminate about the end of January or the middle of February. Our turkeys then are beginning to scatter, so that may be one of the factors, that it is a relatively short time proposition.

MR. LAY: I might make one further point a little clearer here -- part of the reason we get these huge concentrations in the Rio Grande Range is that trees suitable for roosting are very scarce, and with wide distribution of roost trees there is a good chance we would get a better distribution of birds.

MR. DeARMENT: From the Panhandle this past fall we had requests for investigation of turkey die-off on the ranch, and after investigating the situation, it was found that many of them died of paratyphoid. They developed it from a local situation. It's bad when poultry and turkeys mix around ranch headquarters. They can pick up everything under the sun. In this particular case chickens died off earlier in the fall and turkeys were roosting right at the ranch headquarters where there were hogs and chickens, and, incidentally, during the summer about one hundred and fifty turkey vultures roost in the vicinity. In this particular period of the fall we have warm weather. After we started investigating, it turned cold and seemed to stop it, but there was a definite die-off due to paratyphoid.

MR. GLAZENER: I might add that in the early 40's Harold Blakey was working in Texas and became interested in the possibility of disease among turkeys. He took a number of blood smears. I took a number from further down in the south Texas region, and to the best of my knowledge, there was no indication of any infection from any of the blood smears that we took.

MR. KNODER: Specifically, did you have any cases of blackhead?

MR. GLAZENER: There was none. If there were outbreaks, they must have been localized and of short duration.

DR. DUSTMAN: Caleb, what do you mean by blue bugs?

MR. GLAZENER: I brought some of those in for determination, and I don't recall what they were, but it may have been a species that is restricted to Texas.

DR. DUSTMAN: It's an ecoparasite?

MR. GLAZENER: Yes, sir. It has a tremendous abdomen and a small head, and I would suspect it's the same species that is closely related to the common parasite of domestic poultry. (Editors note: Argas mineatus)

MR. SNYDER: I understood you to say that the timber stand in East Texas

had been detrimental to turkeys. I wondered just what type of timber stand you had in mind and in what way it was detrimental.

MR. LAY: Well, I could go into considerable detail. I have the report here that they worked up. TSI in the East Texas Forest has been going on since CCC days, and the third round of treatment is going on now on many tracts. The last time we checked Compartment 588 was two years ago, and the figures I quoted were from that compartment. The stand of pine-hardwood has been converted to almost a pure stand of pine and although there is a lot we don't know about what turkeys need in the way of food supply, it seems obvious that when you lose practically all your oak trees (during this last treatment they removed about ten oaks of mast bearing size and left about three-quarters of one per acre) the big loss of acorns is bound to hurt the turkey range, in my opinion.

MR. SNYDER: Was that the area that you introduced the Rio Grande bird into?

MR. LAY: No, it was two or three miles from one of the areas where Rio Grandes were introduced about ten years ago.

MR. SNYDER: I was interested in the effect anywhere, in these eastern areas, of timber stand improvement, particularly thinning, on the turkeys.

MR. LAY: Maybe someone can help you. The question is does anyone know of an example where thinning in timber stands has improved range of turkeys.

It seems likely that examples could be found, although no one apparently knows of one now.

QUESTION: On your food plot plantings in any of your areas, what do you plant for your green stuff and why? I would be more interested in what you might do in the south than in Pennsylvania and Kentucky.

MR. LAY: In general our recommendation is to plant whatever grows best in a given soil and in a given location. Locally, in Eastern Texas we use oats and occasionally vetch, and Dutch clover. Elsewhere other things grow better, so I think it would depend on your local situation and what grows best in the way of grains.

QUESTION: Have you people ever made a study on the green stuff that you get to grow best as to whether or not a turkey likes it and will eat it?

MR. LAY: Oh Yes, it's apparently very attractive to turkeys. In each case where we have used it, turkeys eat it readily.

QUESTION: From my own experience, out from Montgomery, I have heard all my life that clover was real good for turkeys, so I planted a bunch of food plots with clover and last spring we killed a turkey that had come across a field that had a two-acre plot of crimson clover in it. He came across that plot, and we killed him when he came in. His crop was stuffed with green stuff, and there wasn't a thing in it but vetch tendrils. There wasn't a single clover leaf; consequently this year I didn't plant a single clover seed. I have gone to vetch. Has a study ever been made on the preference that a turkey might make on that green stuff if he had a choice?

MR. LAY: Not that I know of. Can anyone help on this question?

Of course, you must realize that what one turkey eats one given morning before he is shot can't be considered as conclusive. That afternoon he might have gone back and preferred some clover, and before the vetch got just right he might have been depending on the clover. It's hard to tell. In general, it is wise to have a mixture and not depend on one thing.

MR. ROBERTS: The question was raised yesterday on competition between deer and turkeys. The comments from the floor seemed to be that there were many areas that had good deer populations and also had good turkey populations--the assumption seeming to be, therefore, there was no competition. It seems to me this assumption should be qualified for several reasons. There might be factors on that particular area that have caused that deer herd to build up and to become a big herd. There might be climatic factors or a combination of any other factors. These same things might have caused the turkey to expand in that area. Therefore, the turkey populations might be high in spite of the deer populations rather than because of the deer populations.

Another point -- while this no-competition assumption might hold true for certain areas in the country, it doesn't seem that it would hold true for all. In a good many parts of the country when the deer herds start to go up, some of the first things that start to go out of habitat are a certain species of plants which might be important turkey foods. I am not sure. I think there are other factors that we should consider in qualifying this. We don't know exactly what the deer foods are and perhaps they might be taking a lot more of the plants that are good turkey plants than we realize.

MR. LAY: I appreciate those remarks very much, because they are right down the line. Certainly with the vast land use and the food conditions that we are encompassing in this discussion, there are bound to be situations where the deer may have some influence on turkey foods. Certainly in my work with deer it's apparent that we have a long way to go before we learn all that we need to know about the productivity of mast and important species and secondary species and that sort of thing; so let's don't overlook the possibility that our deer herd is affecting the turkey range.

MR. ALEXANDER: I want to raise this question of water holes again. Over on the low Ozarks Forest they are giving strong consideration to going into the uplands with bulldozers and scooping out shallow pools. Personally, I just don't know whether it is a justifiable thing or not. I don't think it will do harm, but if anybody has any evidence I would like to hear about it.

MR. GIVENS: We have tried that on several of our refuge areas, particularly the Kentucky Woodlands Refuge where we have this dry ridge type country used only seasonally by turkeys, and we have put those water holes in. We have had that program going on for six or seven years now, and about all we know is this: The water holes are used rather intensively, and it seems to have affected to some extent the distribution of birds over the entire area. We have also put water holes in on our refuge in Mississippi. Burt Webster is here, and he might want to comment on this.

MR. WEBSTER (U. S. Fish and Wildlife Service): That's in flat woods, post oak type country, and in the summertime it becomes very dry. We noticed that our turkeys would come off those areas through the summer months; that was particularly true in the drouth years of ‘53, ‘54 and '55. We put in several water holes, and it stopped movement of our turkeys in the summertime from that flat woods type country. It was not only beneficial for turkeys but for squirrels, deer, song birds, and practically everything else. Through the flat woods in times of drouth water is very much a critical factor, I think.

MR. LAY: Another example -- West Texas is replete with ranches that have widened the distribution of their turkeys by putting in windmills and developing water sources. That may be an extreme example, not similar to Arkansas, but I will throw it in.

(Editors note: Lewis' discussion with A. Artus; Artus concurred that water holes were highly beneficial in maintaining good summer distribution in dry years.)

MR. MOODY (International Paper Co., Alabama): That gives us a series of good comments, Dan, on a couple of your statements there concerning pure pine stands and short rotation. I think there is probably some misconception on this thing, I don't know of any pure pine stands on any appreciable acreage. You speak of pure pine stands, and most people get the impression of clear-cut areas that are planted all with pine, and then in fifteen or twenty years it is all cut and used as pulpwood and planted again. I would like to point out that pure pine stands, in small acreages, do provide travel lanes and loafing spots for turkey, which I see them using quite a bit. Since forest services furnish most of the acreage for wildlife, I can't speak for all, but in our particular case we don't follow a short rotation. If we had to set a rotation period, I would say it would probably be fifty years but as long as timber is growing we let it grow with, of course, the necessary thinning which does provide for quite good turkey range.

MR. LAY: I know you realize I was quoting from the literature on those comments about pure pine stands. Certainly where pines are planted or where natural regeneration is encouraged on an even-age basis you get an entirely different pattern in your forest from that that we were discussing for the forest where they cut in small blocks. Raymond has got a good point, which we should all keep in mind, that industry has got its problems and they are trying to do something with regard to wildlife on a voluntary basis. They own that land and can do what they wish, and we shouldn't be too rough on them. Within the family, we are more interested in the ecology of the situation more than we are with who is doing. what, and if anything is said that sounds too critical, I hope you won't think we are being critical. It's just a matter of talking about the ecology of the range situation.

MR. SCHORGER: It is my understanding that the best way to drive turkeys from an established range is to start logging, and I would like to know how serious this could be?

MR. LAY: That's a good question. There are a lot of comments in the literature about how too much logging of a large area hurts turkeys. Small operations apparently don't move them too far.

DR. MOSBY: I suppose we are dealing in such general terms it is difficult to be too specific, but the history of the disappearance of turkeys about forty or fifty years ago was rather spectacular in many places. Virginia affords a rather interesting example in that approximately one-half of the western part of the state has continuously supported turkeys, and the remaining half lost their turkeys. Presumably the cutting was done in comparatively small blocks, five hundred to a thousand acres in the section that has always retained its turkeys. When they got to cutting in the southwestern part of the state, they were cutting in larger tracts, fifteen or twenty thousand acres, and, of course, in that section the destruction was primarily by the logging crew -- a large number of woodworkers scattered over a large area that took the turkey as and when they found it. I have quite a number of re-

cords where tracts of only several hundred acres in size were cut, and it had relatively little effect, if any, on the bird, unless the woodworkers themselves caused the destruction.

MR. SCHORGER: Even selective logging has no effect?

DR. MOSBY: So far as I can see in the section I am familiar with it does not have any drastic immediate effect.

MR. GRELEN (Tennessee): Back to your failures in East Texas in restoration efforts. You didn't mention the hog. Do you consider that a factor at all?

MR. LAY: We don't have any valid information. We do know that the hogs will eat turkey eggs or any kind of eggs when they find them. Whether they are serious, we don't know. We did spend a good deal of money fencing our turkey restocking site hog proof. We were worried about it to that extent. Whether we should be worried I don't know.

I have one other thing I want to be sure to inject into the record. We had an interesting conversation here last night after the film. Wayne Bailey put on a real good show, and one of the things that he said was striking to me, and I would like to get it into the record.

Wayne, how about expanding a little on your statements that food is not a problem in West Virginia turkey ranges? So much emphasis here has been on food and the problems related to it that we need your thinking on it.

MR. BAILEY: Speaking in reference to the area that I know well, West Virginia -- over the years I have become convinced that food, in strict reference to mast crops, has little bearing on the survival, physiology and productivity of turkeys in any given area.

I don't mean to imply that turkeys don't need food. The reference is that their diet is so varied and the flora of the region is so abundant with respect to species other than trees, that there is always an abundance of foods, no matter if there are acorns or beech or any of the standard foods of that order produced. I make special reference to a plant I have come to think of as the "chufa of the North" --Claytonia virginica or "Spring Beauty" as you may know it. Various other tubers are produced by herbs and flowers in the hardwood forests of that state, particularly in the northern hardwoods or the beech-birch-maple woods.

Turkeys eat a wide variety of insects and animal life, many of which are abundant enough, even in winter, to support them, so much that I don't attach any particular significance to the scarcity or abundance of mast with respect to its effect on turkeys.

I think mast abundance or scarcity causes changes in turkey habits, distribution, vulnerability to hunting and so on. They prefer the high quality foods, but basically such foods don't seem to affect productivity, at least as far as we can determine.

It was also brought out that during periods of extreme mast abundance such as we have now, turkeys are hard to harvest because there is an abundance of food wherever they go and hunters just can't keep up with them. They are

on one mountain one day and on another mountain the next. Where quality foods are abundant in limited localities, is where we get heavy harvests. Occasionally we have wild grape abundance, and turkeys, during the abundance of wild grape, with scarcity of other foods, may be concentrated in those places where grapes are plentiful, and hunters can repeatedly go back to those places and keep killing birds, and thus we get a big harvest.

QUESTION: I would like to know what good food plot planting might do in your area?

MR. BAILEY: We have, in our management areas in the cooperative programs, planted as many as a hundred clearings on individual areas. We have well over one thousand on National Forest lands. A great majority of them have been planted at one time or another in wheat and Ladino. Our main objective has been to get them in Ladino clover.

I will agree with you almost a hundred percent with respect to what you have previously said about clover being of little value to turkeys. We haven't much specific information on it. We have checked crops in turkeys coming from these areas, and I have found a few crops filled with Ladino clover, but the incidence of clover was small compared with native foods. On the other hand, those crops were collected in the fall of the year when food is abundant about everywhere, and if we had similar data for the whole winter, or spring and early summer, it might show something different. I do know that the clover pastures are very attractive to grouse throughout the year. In fact, I think that one method by which you can achieve a high harvest of grouse, is proper fertilization and liming of the soil and establishing either Ladino or wheat or Dutch clover. Grouse particularly respond to that. Of course, that's a little bit off the subject, but in many ways grouse and turkey are alike.

DR. KOZICKY: Wayne, I know you are speaking in generalities, but also since I have been here, I understand you had a case of turkey starvation in West Virginia.

MR. BAILEY: We have had several cases of starvation. In the winter of '46-'47 we had three or four feet of snow on the ground and that was for three or four months, and we had cases of starvation then. Also we had starvation losses in '57-'58. I have had turkeys brought to me that had died of starvation by the middle of December, when the winter had hardly begun, but I think that during any period of stress you will get occasional mortalities from either very old birds or very young birds or birds that are in any way weakened to the point where they are prevented from properly responding to stress.

DR. KOZICKY: Wasn't this starvation in sizeable numbers?

MR. BAILEY: No, it wasn't. It has never been to my knowledge.

MR. GWYNN: I would like Wayne to talk about how he justified his plantings of wheat.

MR. BAILEY: Turkeys are strongly attracted to cereal plantings, particularly wheat, the grain we have had the most experience with. It is very possible that such plantings do not increase the turkey populations, but they increase the kill because they concentrate the birds in specific locations where the hunters can find them. In a sense it's about the same thing as

baiting. In our state such management increased the harvest and did not result in overshooting; therefore it was justifiable. Turkeys were attracted not only to the patches of mature wheat, but also to the green wheat in fall. In fact, on one area -- it was the fall of '56, I believe -- we had a scarcity of natural food and apparently all the turkeys were visiting young green wheat daily. During the open season the manager picked up 22 empty shotgun cartridges in front of one blind at the edge of one of these wheat patches, and was tremendously worried about it. He thought they were killing them all, and after the season closed it was about six weeks before he could even find a turkey track in the area, but the next fall the kill was the same as it had been before.

MR. LAY: The point there is regardless of whether food patches are essential for food production, they do facilitate harvesting of the birds.

QUESTION: In stressing these points that bugs and insects are very vital to turkeys, does anybody know which of the green planted crops are the best bug producing crops?

MR. LAY: That is a good question for some local area, and that will probably have to be worked out for each place where you need an answer.

MR. BAILEY: I might comment on that again. I don't wish to monopolize the conversation, but I have never seen any plantings of an agricultural nature that, as far as I could see just in casual observation, increased insect abundance to the point where it would make any difference in turkey foods. The greatest concentration of grasshoppers that I know occur annually in early spring in patches of Bracken fern which grows in untreated, unmanaged soil in northern hardwood areas.

DR. DUSTMAN: I notice in the literature that Dalke and others have pointed out there is a distinct relationship in Missouri between soils and turkey populations, and, as they stated, limestone soils, derived from limestone materials support the highest turkey populations, and the other aspects of the landscape superficially are the same. I mean the forest type is the same, and so far as they could determine everything else was the same but the soils. Now, I am wondering if John Lewis has had occasion to make additional observations on that situation to a point where he could take a stand definitely and demonstrate whether this is holding up at the present time or not.

MR. LEWIS: Well, the time Leopold and Dalke were doing their work in Missouri was in the early 40's. At that time the south west part of Missouri I think had the highest turkey population in the state, and since then due to the fire prevention efforts in that section, the turkey population has gone down considerably, and now we find that our best turkey population is not on limestone soil.

POPULATION DYNAMICS AND SPECIES BIOLOGY

Session Chairman: EUGENE H. DUSTMAN
Wildlife Unit, Ohio State University

MORPHOLOGICAL INDICATORS OF HERITABLE WILDNESS IN TURKEYS (Meleagris gallopavo) AND THEIR RELATION TO SURVIVAL

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The literature on wild turkey re-stocking is replete with examples of the failure of domestic and certain game farm stocks of wild turkeys to establish self-maintaining wild populations following release (Mosby and Handley, 1943; Gerstell and Long, 1939; Leopold, 1944). Gradually, and by costly experience, it was realized that there were innate differences between wild and domestic turkeys. In areas that appeared to have good habitat, but from which wild turkeys had been exterminated, it was learned that wild populations of turkeys could not be established by releasing domestic turkeys or certain game farm stocks of wild turkeys. Also, the release of these birds in areas which contained a remnant wild population contributed little or nothing to population size or density. By 1929, twenty-six states had attempted artificial propagation and release as a tool in restoring wild turkey populations (Mosby and Handley, op. cit.). Using typical game farm methods and game farm stocks of wild turkeys, all of these attempts have been failures on a statewide basis.

The origin of these game farm stocks of wild turkeys is of interest and has a bearing on the present problem. Mosby and Handley (op. cit.) state that most of this stock originated in one of the following three ways: (1) obtaining eggs from wild nests, (2) trapping wild stock, and (3) mating domestic turkey hens to wild gobblers. However, Leopold's discussion of this matter (op. cit.) leaves little doubt that the latter method was the principal one employed. The early game farm stocks then, were selected from F_1 hybrids, or perhaps in some instances the F_1's were backcrossed again to wild gobblers and the backcross generation formed the basis of the captive game farm stock. Usually,, selection for external characteristics resembling those of the wild turkey was practiced.

Following re-stocking failures with this type of turkey, efforts were directed to other means of producing wild turkeys for release. Mosby and Handley commented on the obvious method of obtaining pure wild stock for propagation as follows: "It is true that the poults produced from "wild" eggs simulate wild turkeys very closely in many of their reactions but they soon become tame and this behavior pattern is passed to the progeny. Thus, the obvious method of obtaining a brood stock of pure wild turkeys by taking eggs from native wild nests is not the whole solution to the problem." This interpretation evidently gives full credence to the Lamarckian theory of inheritance of acquired characteristics. Leopold (op. cit.) also discussed this problem and concluded that reproductive failure and high mortality rates in

[1]A contribution from the Waterloo Wildlife Experiment Station, Ohio Division of Wildlife, New Marshfield, Ohio.

captivity accounted for the fact that pure wild turkeys were not used in artificial propagation programs.

The next step in artificial propagation was the inauguration of the wild pen mating system. The essence of this system is that game farm turkey hens are enclosed in a pen and wild gobblers are allowed to enter and breed them. This system was used extensively by severa1 states but only Pennsylvania has claimed general success with it. Early prognostications of success elsewhere have since been modified due to the failure of turkeys produced under this system to establish self-sustaining wild populations upon release. The efficiency with which the technique was used may account for the difference in result obtained. See Leopold (op. cit.) for a discussion of mechanical factors that may influence successful use of this system. However, it apparently became obvious that certain factors or processes were not clearly understood because at this time several investigations were begun which attempted to elicit in more detail the nature of wildness in turkeys.

In 1939 Gerstell and Long (op. cit.) published the results of certain physiological tests designed to measure differences in metabolism and muscular activity in game farm and wild turkeys. In their experiments they used juvenal game farm turkeys and juvenal wild turkeys produced by mating game farm hens with wild gobblers. In their summary they state, "The metabolism of the wild-mated area poults reacts to changes in environmental conditions in a greater degree than the game farm poults. Also, the physiological resistance during twenty-four to seventy-two hours of continuous fasting seems higher in the "WM" (wild mated) birds ...". Again, in a conservative manner they state, "Nevertheless, it is concluded that the wild mated ("WM") poults are more suitable for restocking turkey ranges and better fitted to meet present-day recreational requirements than the game farm ("GF") birds, simply because the former represents a physiological strain which is somewhat different from the latter with respect to environmental reactions and functional properties".

In 1944 Leopold (op. cit.) published the results of a comprehensive and detailed study of the problem. He concluded that the wildness syndrome was associated with the central and sympathetic nervous systems and the endocrine glands; differences existed in these characteristics between wild and domestic turkeys and these differences were hereditary. He theorized that intense selection pressure operated on game farm turkeys. During the period of captivity selection pressure operates against genes responsible for heritable wildness, and in the wild state, selection pressure operates against genes responsible for heritable tameness. The higher the frequency of wild genes in a captive population the more intense selection pressure is against them. This explanation solved many perplexing problems, especially the one regarding the inability of turkeys produced by the wild pen mating system to successfully exist in a wild state. An extensive discussion of Leopold's findings are not intended here and the reader is referred to his excellent paper for further details.

However, since his work on endocrines, in particular, form the basis for this paper, they will be reviewed in more detail. Leopold excised and weighed the adrenals, thyroids, pituitary and brain from samples of wild, domestic and (hybrid) game farm turkeys. Using a technique developed by Crile (1941), he expressed these weights as per cent of body weight and compared the three samples. In all instances, not only did a mean difference exist between the wild and domestic strains, the wild being larger, but, except for the pituitary, a discrete difference existed. Considerable varia-

bility existed in the hybrids but their mean was intermediate between the wild and domestic. Basing his conclusions partly on Crile's work, who had demonstrated numerous correlations between gland size/body weight ratio and function, and partly to account for his own extensive field observations on behavior, reproductive chronology, age of breeding and studies of feather moult, Leopold postulated functional differences in the endocrine glands and nervous systems of wild, domestic and hybrid turkeys. If this premise is granted, a ready explanation of hereditary wildness and tameness can be deducted from the known function and relationships of the endocrine glands and brain. In view of the previous work of Gerstell and Long, where actual metabolic differences were demonstrated, it appears highly probable that functional differences are present in the endocrines and nervous system, also.

Disregarding the functional aspect entirely, Leopold has demonstrated a correlation between gland weight/body weight ratios and heritable wildness and tameness in turkeys. The intermediate mean of the hybrids as well as the variability exhibited by them (an indication of gene segregation) leaves little doubt that the differences are heritable. As long as the correlation exists one should be able to predict relative wildness from the organ weight/body weight ratios alone without resorting to field studies of costly release.

Large samples and considerable time are required to make a valid evaluation of turkey releases due to acquired adaptation to captivity. A simple formula may more clearly depict this situation. If we let σ^2_p stand for observed or phenotypic variance in wildness, and σ^2_h and σ^2_e stand for the variance due to heredity and environment respectfully and let $\sigma^2_p = \sigma^2_h + \sigma^2_e$, then σ^2_e will have a large value relative to σ^2_h. I know of no published data on the comparative survival (a function of both σ^2_h and σ^2_e) of captive reared pure wild and hybrid turkeys after release, so there are no expected values with which to compare the performance of regular game farm turkeys. This situation makes it difficult to determine whether relative wildness is due to hereditary factors or acquired environmental factors unless long-term field studies are made. Thus, the comparison of organ weight/body weight ratios would not only be less expensive, but at the present time perhaps a more valid quickly determined index to wildness.

Following this idea I dissected a sample of game farm turkeys, hereafter referred to as "Waterloo" turkeys, and compared their organ weight/body weight ratios with the data published by Leopold on wild and domestic turkeys. Several hundred Waterloo turkeys have been released during the period 1952 to 1956 and reasonably detailed records are available concerning survival, dispersal, reproduction and behavior which can be correlated with the endocrine data.

In addition, scattered data are presented on certain other characteristics that have a bearing on relative wildness. Leopold (op. cit.) noted that wild turkeys retain their 9th and 10th juvenal primary feathers through their first winter. The domestic turkey retains only the 10th juvenal primary feather during this period. The hybrids were variable in this respect. Data relative to this characteristic are presented in this paper.

Although the situation is far from being clear, it is generally accepted that yearling wild gobblers do not breed (see Leopold, op. cit., for a review). Yearling domestic gobblers, however, breed readily and usually produce a

higher percentage of fertility in eggs than older gobblers (Cline, 1936; Marsden and Martin, 1939). The relative fertility of yearling and adult wild, domestic and hybrid turkeys, as determined by fertility of eggs, is compared in this paper.

METHODS

The dissections were performed according to the methods described by Leopold (op. cit.), except that I excised all of the endocrine glands under a binocular microscope. I dissected several specimens for practice prior to recording data, but several endocrine weights are missing, due to errors in dissection. All weights were made on an analytical balance sensitive to 0.0002 of a gram.

The inclusion of the single wild specimen was due to an accident, otherwise it would have been dissected at a younger age. This specimen died, apparently of shock while being handled, and a Waterloo turkey was sacrificed intentionally the same day to compare with the wild bird. As will be pointed out later some of the data from the two specimens probably are not comparable.

RESULTS

Body Weight

The body weights of the Waterloo turkeys were considerably higher than those of Leopold's game farm turkeys (hereafter referred to as Lost Trail hybrids in keeping with his terminology). Figure 4 shows the regression of body weight on age between five and twelve days of age, for Waterloo and Lost Trail turkeys. Not only were the Waterloo turkeys heavier, but their rate of gain was faster than the Lost Trail hybrids. This is shown by the slope of the regression line and the regression analysis. The Lost Trail hybrids gained an average of 2.8 grams per day whereas the Waterloo turkeys gained an average of 5.8 grams per day. Without controls, this difference might be interpreted to mean that the frequency of domestic turkey genes was higher in the Waterloo turkeys than in the Lost Trail turkeys. However, five pure wild turkeys (4 males, 1 female) were weighed at 10 days of age and their mean weight, shown in Figure 4, was 72.0 grams. This was compared with a mean weight of 57.2 grams for three native wild turkeys 11 days of age, also shown in Figure 4 as Missouri wild (calculated from Leopold's data). Subject only to sampling error, the mean weights of both wild samples should have been identical. Therefore, using the magnitude of the difference between the wild samples as a base, the weights of the Waterloo turkeys were reduced by age group in the percentage amount that they exceeded the Lost Trail hybrids. In other words the Waterloo turkey weights were transformed so that they were identical with the Lost Trail hybrids. This procedure was necessary since the excess weight of the Waterloo turkeys was due to environment (probably diet), not heredity, as shown by the weight difference of the wild "controls". In essence, the weight transformation consisted of partitioning body weight "variance" into a hereditary and environmental component and discarding the environmental portion above the level present in both the Waterloo turkeys and Leopold's sample of wild and domestic turkeys. Thus, a comparison of the three samples revealed hereditary differences.

Some idea of the validity of this procedure may be gained by comparing the mean body weights of the Waterloo wild turkeys with the mean weight of the Missouri wild turkeys, after the Waterloo wild turkeys had been reduced by the same percentage that the Waterloo hybrid turkeys were reduced. At

ten days of age the Waterloo hybrid turkeys exceeded the Lost Trail turkeys in body weight by an average of 27.2 percent. Reducing the Waterloo wild turkeys by this amount, their calculated mean weight at 10 days would be 52.4 grams. This compares favorably with the mean weight of 57.2 grams for the Missouri wild turkeys at 11 days of age, or in other words, it is within the range of what would be expected from sampling error alone.

At 10 days of age, the actual body weights of 4 males and 1 female Waterloo hybrid turkeys averaged 97.5 grams. At this same age the 4 male and 1 female Waterloo wild turkeys averaged 72.0 grams. The hybrids exceeded the wild birds in body weight by 27.2 per cent. This may be compared with Leopold's data on Missouri wild and Lost Trail hybrids. At 11 days of age the 3 Missouri wild turkeys averaged 57.2 grams while five Lost Trail hybrids averaged 72.9 grams or a difference of 2l.5 per cent in body weight. Leopold's sample of domestic turkeys consisted of only two birds at 11 days of age and they exceeded the Missouri wild turkeys in weight by 33.7 per cent. Despite the small size of these samples the results are consistent and seemingly real.

Figure 5 presents a comparison of the body weight growth curves of pure wild and Waterloo hybrid turkeys up to 85 days of age. Both groups of turkeys received the same diet and were reared in a like manner. Sample sizes are shown in Table 3. Due to the violent actions of the wild turkeys when handled, only four measurements of body weight were obtained. The remainder of the growth curve was interpolated. Throughout the period of growth measured the hybrid turkeys exceeded the wild turkeys in body weight by 20 to 25 per cent.

Brain Weight

Brain weight, expressed as per cent of body weight is shown graphically in Figure 2 for Waterloo hybrid, domestic and Missouri wild turkeys. justed body weights, explained previously, were used in converting brain weights in the Waterloo turkeys.

A source of error is introduced when body weights are adjusted to allow for environmental differences in weight increases, and a corresponding adjustment is not made for absolute increase in brain and endocrine weight which is correlated with body size. The sample sizes are too small relative to the variability exhibited to make such an adjustment from the data on hybrid turkeys. Likewise, Leopold's (op. cit.) sample of wild turkeys is too small, and I have been unable to ascertain a correlation between organ size and body weight within a constant age group in his sample of domestic turkeys. There is no doubt that such a correlation exists but I cannot measure it independent of age from these samples. This bias will result in all Waterloo turkeys having a higher organ weight/body weight ratio, and consequently appearing to be more wild, than is really the case. The magnitude of the error is unknown but it is probably relatively small compared to the actual size of the ratios given.

Inspection of Figure 2 shows that the Waterloo turkeys approached the mean brain/body weight ratio of the wild turkeys much closer than they did the domestic turkeys. A regression line was fitted to the data according to the method of Snedecor (1946), $(\hat{y}=0.03866-0.000778x)$.

Adrenal Weight

Adrenal weight, expressed as per cent of body weight, is shown in Figure 1 for wild, domestic and Waterloo turkeys. In mean adrenal weight ratio the Waterloo. turkeys approached the domestic much closer than they did the wild turkeys. Although there appears to be more variation among the hybrids than among either the wild or the domestic, the hybrids do not over lap the mean of the wild turkeys while they do overlap the mean and almost reach the lower extreme of the domestic turkeys. Linear regression was used to establish mean adrenal/body weight ratios in the Waterloo turkeys ($\hat{y}$=0.000228-0.000004x).

Pituitary Weight

Pituitary Weight/body weight ratios are shown in Figure 3. As Leopold (op. cit.) has noted, the actual relationship between pituitary weight and body weight may be curvilinear within this age range, but for comparison I have calculated his data and expressed it and the Waterloo data as a linear regression. The pituitary was weighed to the nearest ten-thousandth of a gram. This fact and the difficulty of dissection, especially obtaining all of the anterior lobe, probably accounts for the large amount of variation in weights obtained. Assuming that positive and negative errors were equally frequent an accurate relative mean would be obtained although the absolute weights were not accurate. For comparison of the means, these types of data would suffice. I assume here that the mean is accurate. Reference to Figure 3 shows that the mean pituitary ratio of the Waterloo turkeys was almost exactly intermediate between the domestic and wild turkeys.

The regression formula for the Waterloo turkeys was $\hat{y}$=0.000028-0.00000015X, and for the domestic turkeys $\hat{y}$=0.000022-0.00000010X.

Fertility of Turkeys

Table 2 is a summary of information regarding the relative fertility of adult and yearling wild, domestic and hybrid turkey gobblers. In all instances the criterion of fertility was embryonic development within the egg.

While most authors question the capability of the yearling wild turkey gobbler to mate and produce fertile eggs, most of them assume that the yearling wild turkey hen produces eggs and is as productive as older hens. Only Wheeler (1948) questions this assumption. His field observations over a four-year period led him to conclude as follows: "It is believed that few if any of these birds (yearling hens) nest the first year." A single wild turkey hen at the Waterloo Wildlife Experiment Station failed to produce eggs as a yearling in 1956, however, in 1958 another yearling wild hen did produce eggs. Studies of a marked wild population are needed to settle this question.

The records presented in Table 2 show only one instance of a yearling wild gobbler producing fertility in eggs. This was a gobbler observed from a blind (Leopold, op. cit.). Yearling hybrid gobblers are intermediate in this respect as shown by the data in Table 2.

From the few data available, I suspect that the degree of fertility in yearling hybrid gobblers varies with the frequency of genes for wildness and tameness. The record of 75.5 percent fertility for yearling gobblers, shown in Table 2, was made by a small flock of hybrid turkeys obtained from a different source than the other game farm birds. This group and their progeny

were eliminated long before the fertility records were analyzed due to their apparent close relation to domestic turkeys. Three yearling wild gobblers kept at the Waterloo Wildlife Experiment Station were never observed, even from a blind, to gobble or display during the breeding season. Two wild hens have laid eggs in these same pens, so it is unlikely that reproductive failure was due to captive conditions.

Mosby and Handley (op. cit.), and McDowell (1956) have shown that fertility in wild populations is high. A two year study by the first two authors which involved 163 eggs revealed a fertility of 95.7, and a study by the latter author of 158 eggs in 13 nests showed a fertility of 96.8. The other data in Table 2 are self-explanatory.

Primary Feather Moult

Leopold (op. cit.) discussed the difference in primary feather moult between wild and domestic turkeys, and presented a discussion of the role of the thyroid and pituitary in controlling moult in general. He also noted a difference in the moult of secondary coverts and retrices but only primary moult is considered here. Due to the presumed endocrine basis for differences in moult, he suspected that the difference was associated with hereditary wildness and tameness.

A sample of 112 Waterloo hybrid turkeys was examined for this characteristic in March 1956 as they were crated for release. The results are shown in Table 4. In Leopold's sample of 32 Lost Trail turkeys 17 or 53 per cent had moulted the 9th primary. In the Waterloo sample 13.4 percent had moulted the 9th primary. Also, 3 hens had adult 9th and 10th primaries. This may have resulted from accidental loss of the 10th primary and subsequent replacement.

The difference between the Lost Trail hybrids and the Waterloo hybrids is difficult to reconcile if there is a correlation between wildness and retention of the 9th and 10th primaries. Selection for this trait had not been practiced among the Waterloo hybrids, and the Lost Trail hybrids were produced from ten generations of backcrossing to wild gobblers via the wild mating system so they should have possessed hereditary wildness to a much greater degree than the Waterloo hybrids, despite selection against wildness in captivity. I can only conclude that the difference in primary moult is due to genes that are segregated independently of those primarily responsible for wildness, and that they have little or no selective value, hence are maintained at a constant frequency in the population subject to the laws of probability.

Comparison of Waterloo Wild and Hybrid Turkeys

One specimen of each of these strains was dissected, and the data are compared in Table 5. As noted previously, the wild specimen died of shock while being handled. In general, the data support Leopold's thesis concerning the differences between wild, domestic and hybrid turkeys.

The larger testicle size of the hybrid turkey may be of significance in connection with the earlier sexual maturity of domestic and hybrid turkey gobblers. Also the thyroid ratio is larger in the wild than in the hybrid turkey.

The low adrenal and pituitary ratio of the wild specimen may need explanation. This bird died, presumably of acute stress, which is a function

of the adrenal-sympathetic system. During stress conditions rapid changes occur in the adrenal: the medullary cells discharge adrenaline and chromaffin granules, the cortical cells hypertrophy and discharge lipid, cholesterol, ascorbic acid, ketosteroid and plasmal granules (Selye, 1947). This change may produce a weight loss of the adrenal, therefore the two specimens may not be comparable. Errors in technique previously discussed may account for the difference in pituitary weights. Even accepting the actual weights, no harm incurs to the thesis of heritable wildness since a few of the hybrids customarily fall into the wild range.

Field Studies of Released Hybrid Turkeys

Field studies have been made of released turkeys to determine mortality, survival, dispersal, reproduction and behavior, and the factors affecting these processes. The area encompassed by these studies has of necessity been on the scale of hundreds of square miles. Due to this large area and limitations of time and personnel, sampling of these measurements has often been fragmentary. However, enough information is available to establish certain of these measurements accurately. A more thorough treatment of these data will be published elsewhere; only certain aspects of post-release behavior are considered here.

Within two weeks after release, mortality, usually due entirely to predation, may account for as high as 50 per cent of the number of turkeys released (Knoder, 1953). The amount of mortality depends somewhat upon the age of the turkey when released and rearing methods while in captivity (Knoder, unpublished). This point needs further study, but at the present time I assume that mortality during this period is largely nonselective. Usually within two weeks after release the turkeys disperse from the release site. Flock size at dispersal time is dependent on the number of turkeys released at one site. Customarily if less than 20 turkeys are released at one site they disperse as one flock, although occasionally two flocks are formed. Where numbers up to 120 are released at one site, flocks ranging in size from 1 to 20 turkeys may disperse, although usual flock size is from 6 to 14 birds. Dispersal usually results in flocks establishing a home range within one-half to five miles from the release site.

Three types of turkey flocks emerge after dispersal, the types being based upon location and behavior. These are designated as (1) domestic, (2) semiferal, and (3) feral. These types are defined as follows: (1) domestic: This type disperses to houses or barnyards and settles there permanently. They seldom leave the premises and are as tame as ordinary domestic turkeys. Not uncommonly they associate continuously with chickens or domestic turkeys. These turkeys, if they are hens, may mate with near-by released gobblers or domestic gobblers but they do not succeed in rearing young. Usually only individual birds behave in this manner and seldom more than 3 at one location. These releases have consistently produced less than 5 per cent of the total of this type. (2) Semiferal: This type disperses to the vicinity of human habitation, but does not permanently remain there. Customarily they spend most of their time in adjacent wooded areas and return once a day or once every 2-3 days to a house or barnyard and feed. Some flocks reside near houses or barnyards but do not visit them, yet they are not disturbed by the near-by activities of man. Sometimes, in inclement weather during the winter these flocks temporarily move to barnyards to feed. Only rarely do these flocks succeed in reproduction and productivity is never high enough to sustain their numbers. If poaching does not occur, these flocks may exist at one location for several years. Approximately 70

per cent of the hybrid turkeys that survived after release followed this pattern. (3) Feral: As the name indicates, this type of flock maintains an existence in a completely feral state. They are usually found at least one-half mile and frequently several miles from the nearest dwelling. Usually they become progressively wilder and most of them are wary enough to escape poaching by direct approach of man. Even in these flocks productivity is not high but they do succeed in raising some young. Whether productivity is high enough to maintain a selfsustaining population is still moot. From 10 to 15 per cent of the turkeys that survived after release followed this pattern.

DISCUSSION

There may be several explanations of the varied behavior of these turkeys following release. The most logical, I believe, is that behavior is dependent upon the amount of heritable wildness. If this interpretation is correct, the observed differences in behavior are explainable as follow. As a consequence of segregation, a normal distribution of genes controlling wildness and tameness would result, if a large number of genes were involved. Thus, a small number of turkeys would approach pure genetic wildness, and similarly, pure genetic tameness. A much larger number would be intermediate. If the theory of selection against genetic wildness in captivity is accepted, and there are compelling reasons for accepting it, fewer genetically wild turkeys would be produced than genetically tame ones.

The differences in behavior after release, appear then, to be a reflection of the relative amount of domestic and wild genes present in the release stock. The genetically tame turkeys descend to the barnyard and remain there. The bulk of this release stock appears to be intermediate, and lead a half domestic, half feral existence. A small percentage is genetically wild, and consequently maintain a truly independent, feral existence.

If the situation depicted by this line of reasoning is true, a rough measure of the amount of genetic wildness in a game farm strain is afforded by their behavior after release. Much conjecture could be eliminated here if some close studies were made of captivity-reared pure wild birds after release.

Considering the amount of mortality that occurs following release and the number of non-productive flocks that result after dispersal, it must be concluded that propagation and release of this type of turkey is an inefficient way of establishing a wild turkey population. In practical terms, if poaching is much of a problem, it is impossible.

Two situations are known to me which contradict, to a degree, the interpretation presented here. One is the experience in Pennsylvania where widespread establishment of turkey populations was credited to releases of game farm stock. I believe that this is not really in conflict with the thesis presented here. Rather, from numerous sources of information, it appears that this was one of the few instances in the history of wild turkey propagation and stocking that a genetically wild strain was developed for stocking.

The other contradiction is not readily explainable. Holland and Colin (personal communication) have informed me that the stock of wild turkeys present on the Alabama game farm were obtained by collecting eggs from "wild" nests. They further state that the first generation captive birds were as tame as run-of-the-mill game farm stocks, and that yearling gobblers were capable breeders.

These observations do not corroborate those made on wild turkeys at the Waterloo Wildlife Experiment Station. Eastern wild turkeys raised there, obtained from eggs collected from "wild" nests, have been noticeably much wilder (phenotypically) than game farm stocks. Three yearling gobblers have failed to gobble, display or breed. The differences between the Alabama observations and ours are not readily reconciled by the data available.

SUMMARY OF DATA

Body weight. At the ages measured, the Waterloo turkeys exceeded the wild turkey in body weight by 20 to 25 per cent. This clearly indicates the presence of domestic turkey genes in the Waterloo turkey population.

Brain weight. The mean brain weight/body weight ratio of the Waterloo turkeys intermediate between the wild and domestic turkeys. This, too, indicates that the Waterloo turkeys are hybrids.

Endocrine glands. The endocrine weight/body weight ratio of the Waterloo turkeys was intermediate between the wild and domestic turkey. The low adrenal/body weight ratio of the Waterloo turkey probably indicates a high frequency of domestic turkey genes.

Breeding tests. Yearling wild gobblers did not produce fertility in eggs when mated with laying hens. Yearling Waterloo gobblers produced between 34.8 and 75.5 per cent fertility when mated to laying hens. Since yearling domestic gobblers are fully fertile, the intermediate performance of the Waterloo gobblers suggests that they are hybrids.

Primary feather moult. Only in the respect of the timing of the moult of the 9th and 10th primaries did the Waterloo turkeys appear similar to wild turkeys. I suggest that this relationship has a minor correlation with the wildness syndrome responsible for maintenance of a wild population.

Field studies. The final arbiter of wildness is the ability of a turkey population to maintain a self-sustaining wild population. Wild turkeys can do so, but domestic turkeys cannot. Only a relatively small percentage of the Waterloo turkeys have done so.

CONCLUSIONS

Heritable differences and some of the mechanisms through which they operate have been demonstrated to account for some of the differences in survival of domestic, hybrid and wild turkeys in different environments (Leopold, op. cit.). His analysis has been repeated to a limited extent with the intention of ascertaining the validity of these measurements as criteria of wildness. In the main this study substantiates his conclusions. The possibility is apparent then that the survival potential of captive turkey populations may be diagnosed in advance of release by these criteria. Comparable samples of wild, domestic and the proposed release stock should be available for such a diagnosis, however.

ACKNOWLEDGEMENTS

I wish to thank Mr. David Papier for loan of the analytical balance and his assistance in transporting and assembling it. Also, thanks are extended to Dr. E. H. Dustman for his loan of a binocular microscope and certain dissecting equipment.

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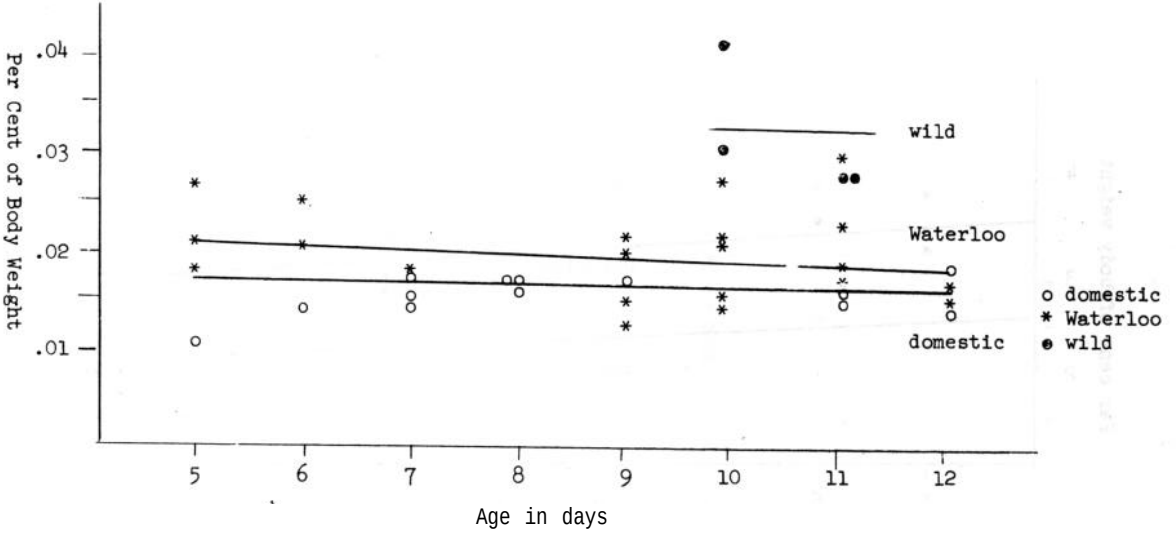

Figure 1. Adrenal weights expressed as per cent of body weight in wild, domestic, and Waterloo turkeys

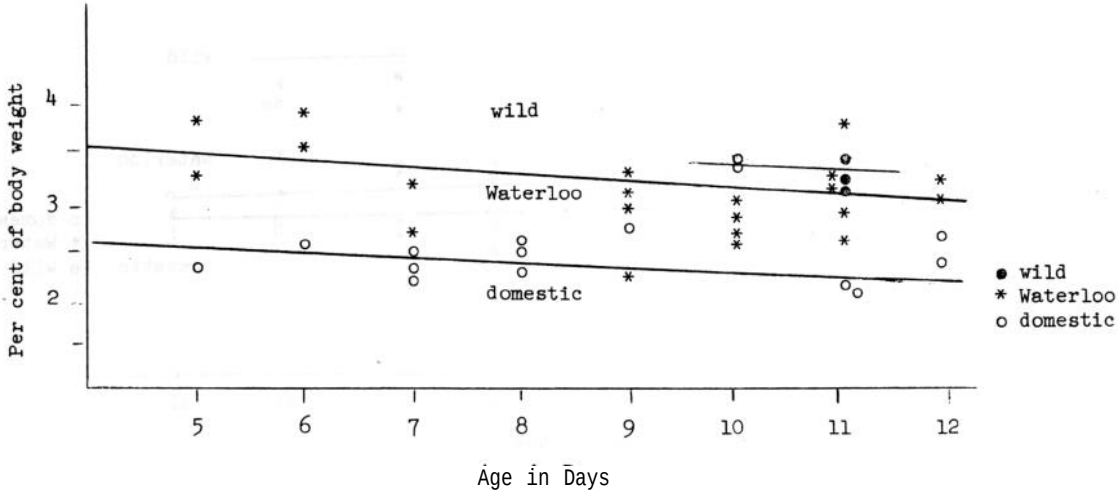

Figure 2. Brain weights expressed as per cent of body weight in wild, domestic, and Waterloo turkeys

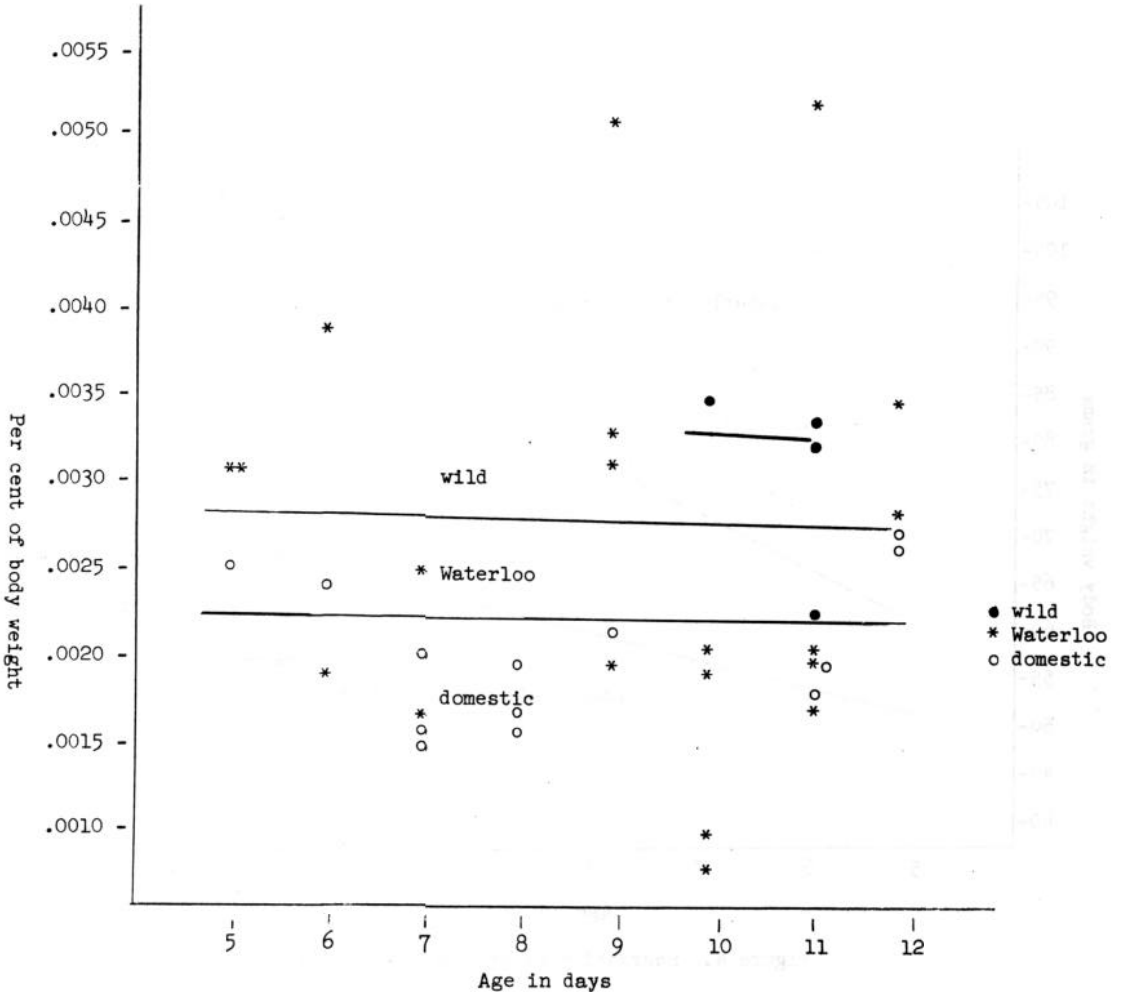

Figure 3. Pituitary weights expressed as per cent of body weight in wild, domestic, and Waterloo turkeys

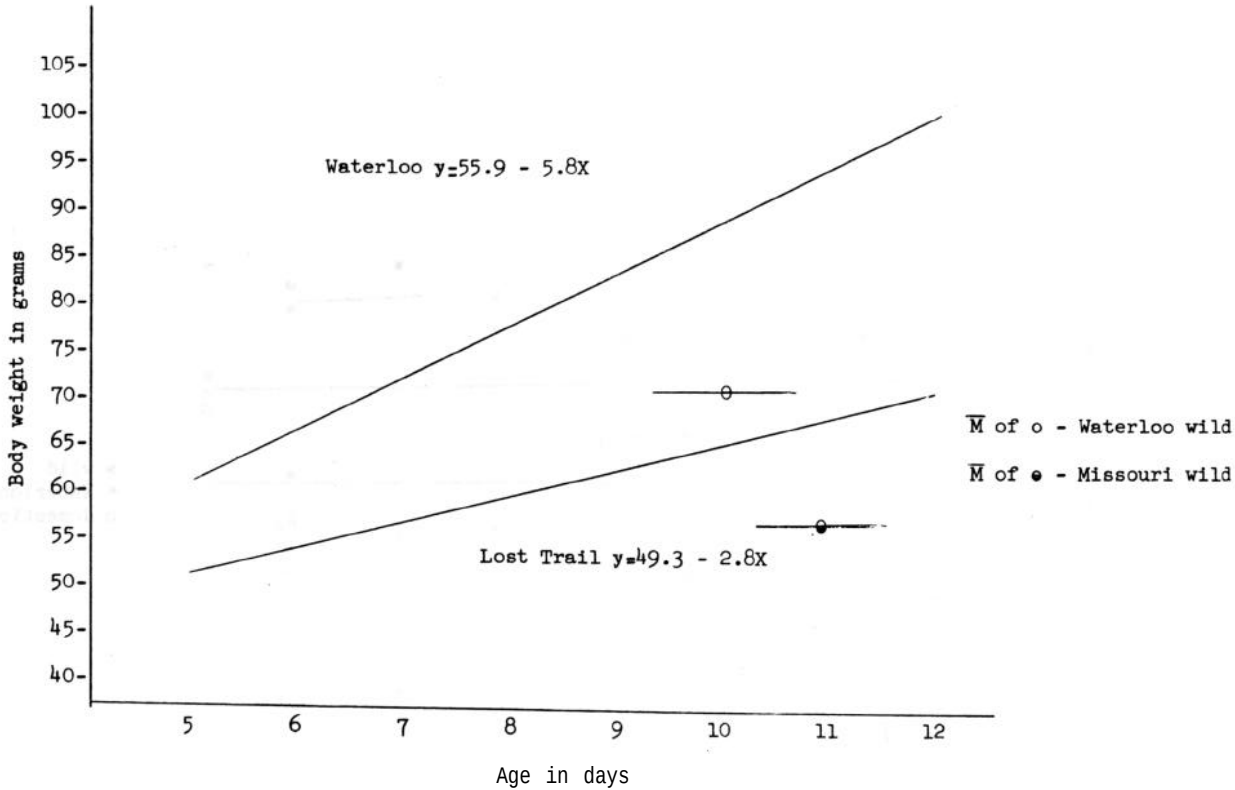

Figure 4. Regression of body weight on age

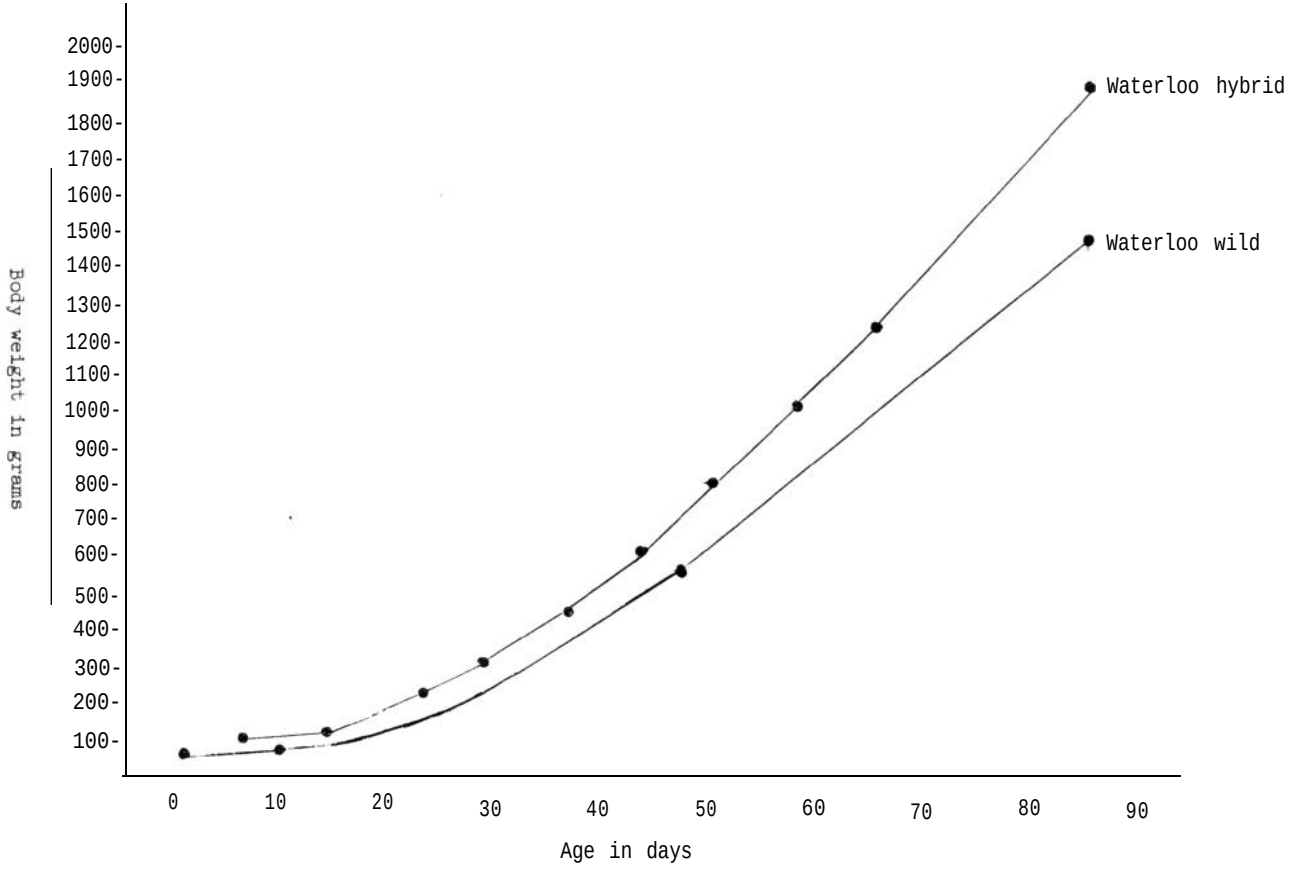

Figure 5. Mean body weight growth curves of pure wild and hybrid turkeys

TABLE 1

DATES OF DISSECTION, SEX, AGE AND WEIGHTS IN GRAMS OF BODY, BRAIN AND ENDOCRINES OF WATERLOO TURKEYS, AND ONE WILD TURKEY

Date	Sex	Age	Body	Brain	Adrenals	Thyroids	Pituitary	Specimen Number
6/13/55	M	10	79.1	2.009	0.0165	0.0034	0.0012	1
6/14/55	M	11	95.5	2.200	0.0155	0.0040	------	2
6/15/55	M	12	94.2	2.151	0.0110	0.0040	0.0024	3
6/15/55	F	12	104.0	2.225	0.0103	0.0073	0.0020	4
6/16/55	M	3	54.9	1.477	0.0115	0.0030	0.0013	5
6/16/55	F	3	48.4	1.588	0.0111	0.0067	0.0010	6
6/17/55	M	4	42.7	1.633	0.0108	0.0038	0.0014	7
6/17/55	M	4	60.3	1.680	0.0087	0.0043	0.0008	8
6/17/55	M	4	56.2	1.703	0.0082	0.0035	0.0012	9
6/18/55	F	5	50.0	1.601	0.0075	0.0033	0.0013	10
6/19/55	F	6	54.7	1.660	0.0109	0.0047	0.0017	11
6/19/55	M	6	62.0	1.920	0.0100	0.0051	0.0010	12
6/20/55	M	7	91.7	2.009	0.0119	0.0058	0.0018	13
6/20/55	F	7	72.4	1.774	0.0095	0.0068	0.0010	14
6/22/55	M	9	87.3	2.033	0.0145	0.0058	0.0021	15
6/29/55	M	5	62.7	1.739	0.0139	0.0054	0.0016	16
7/3/55	M	9	91.0	2.051	0.0136	0.0040	.0.0034	17
7/3/55	F	9	113.0	1.909	0.0126	------	0.0029	18
7/3/55	M	9	77.3	1.938	0.0070	0.0015	0.0012	19
7/4/55	M	10	112.2	2.092	0.0168	0.0062	0.0007	20
7/4/55	M	10	98.2	2.003	0.0157	0.0054	0.0014	21
7/4/55	M	10	107.6	2.146	0.0114	0.0048	0.0008	22
7/4/55	F	10	90.5	1.965	0.0100	0.0061	------	23
7/5/55	F	11	86.7	1.894	0.0117	0.0047	0.0010	24
7/5/55	M	11	74.4	2.050	0.0161	0.0044	0.0011	25
7/5/55	M	11	115.3	2.103	------	0.0055	0.0016	26
7/5/55	M	11	103.3	2.150	0.0130	0.0047	0.0039	27
7/755	M	13	136.7	2.369	0.0176	0.0089	------	28
7/7/55	M	13	139.9	2.332	0.0197	0.0094	0.0020	29
7/7/55	F	13	104.1	2.148	0.0126	0.0083	0.0015	30
7/7/55	F	13	110.5	2.301	0.0186	0.0063	0.0013	31
7/8/55	M	25	282.1	3.144	0.0452	0.0102	0.0056	32
7/8/55	F	25	286.4	2.938	0.0320	0.0266	0.0022	33
8/27/55	M	85	2126.2	5.774	0.1755	0.0710	0.0178	34
				Pure Wild Turkey				
8/27/55	M	84	1587.5	5.379	0.1201	0.0688	0.0101	35

TABLE 2

COMPARATIVE FERTILITY OF ADULT AND YEARLING WILD, DOMESTIC, AND HYBRID TURKEY GOBBLERS

Strain	Number Males	Number Females	Sex Ratio	Number Eggs Incubated	Fertility	Dates of Breeding	Environment	Source of Data
					Yearling Gobblers			
Wild	1	2	1:2	12	0	up to 5/12/58	50' x 60' pen	This report
Wild	2	23	1:11.5	179	0	4/30-6/6/56	16 acre pen	This report
Wild	?	?	?	?	0	up to 6/15/?	captivity	Mosby and Handley
Wild	?	?	?	?	0	?	captivity	Leopold (Leach)
Wild	1	20	1:20	?	0	1937-1938	wild mating pen system	Leopold (Mohr)
Wild	1	20	1:20	?	22 hatched*	1943	wild mating pen system	Leopold
Hybrid	4	8	1:4	246	45.5	1953	2 acre pen	This report
Hybrid	3	12	1:4	129	34.8	1954	10' x 40' pen	This report
Hybrid	4	11	1:2.75	139	75.5	1953	2 acre pen	This report
Domestic	12	118	1:9.8	?	90.0(approx.)	?	8 acre pen	Cline
					Adult Gobblers			
Wild	?	13	?	158	96.8	1953	wild population	McDowell
Wild	?	?	?	?	0	?	captivity	Leopold (Leach)
Wild	?	?	?	163	95.7	1939-1940	wild population	Mosby and Handley
Hybrid	1	9	1:9	270	75.5	1953	3 acre pen	This report
Hybrid	1	16	1:16	154	98.1	1954	5 acre pen	This report
Hybrid (1)	3	39	1:13	603	65.8	1954	10' x 40' pen	This report
Hybrid	10	78	1:7.8	2396	80.5	1955	5 acre pen	This report

(1) Average of 3 pens; 1 gobbler and 13 hens per pen.

TABLE 3

SAMPLE SIZES AND MEAN BODY WEIGHTS
OF WATERLOO HYBRID AND WILD TURKEYS

Strain	Age (days)	Sex	Sample Size	Mean Body Weight
Wild	1	———	3	52.9
	10	4-M & 1-F	5	72.0
	47	4-M & 1-F	5	581.0
	84	4-M & 1-F	5	1502.5
Hybrid	7	M	4	74.0
	14	M	3	101.7
	23	M	4	211.0
	29	M	5	312.4
	36	M	6	459.3
	43	M	6	610.8
	50	M	7	804.0
	57	M	7	1020.7
	64	M	7	1232.6
	85	M	7	1920.7

TABLE 4

MOULT OF 9th AND 10th PRIMARY FEATHERS
IN JUVENAL WATERLOO HYBRID TURKEYS, APPROXIMATELY 9 MONTHS OF AGE

		Hens	Gobblers	Total
Sample Size		59	53	112
Retain 9th and 10th juvenal primary	Number	45	49	94
	per cent	76.3	92.4	83.9
9th primary adult	Number	11	4	15
	per cent	18.6	7.6	13.4
9th and 10th primary adult	Number	3	0	3
	per cent	5.1	0	2.7

TABLE 5

BODY AND GLAND WEIGHTS OF TWO SPECIMENS OF TURKEYS
All weights in grams

	Waterloo Wild	Waterloo hybrid
Specimen Number	34	35
Date dissected	8/27/56	8/27/56
Age	84 days	85 days
Sex	Male	Male
Body weight	1587.5	2126.2
Left testicle length	5mm.	9.5 mm.
Brain weight	5.3793	5.7741
Adrenal weight	0.1201	0.1755
Thyroid weight	0.0688	0.0710
Pituitary weight	0.0101	0.0178
Brain/body weight	0.0033	0.0027
Adrenals/body weight	0.000075	0.000082
Thyroid/body weight	0.000043	0.000033
Pituitary/body weight	0.0000063	0.0000083

DISCUSSION

MR. WILLIAMS (Alabama): I have noticed on about fifteen or twenty immature gobblers from North Florida and South Alabama that the ninth primary was shed by the fall of the year. The literature says that the ninth and tenth are retained. My observation has been on turkeys that seem to be intermediate between the subspecies osceola and silvestris, which are the North Florida and the South Alabama turkeys. I wonder if anybody has a comment that deals with the other species, particularly the Florida subspecies, because it seems to be characteristic of the Florida subspecies.

MR. KNODER: According to the study of Petrides published in the North American Transactions in '42 and the publication of Leopold the ninth and tenth primary is retained in all the subspecies, when you are dealing with wild turkeys rather than populations that have been mixed with domestic or game farm strains.

MR. WILLIAMS: I understand that, and apparently it is not too well known Maybe the turkeys from the Gulf States haven't been examined closely enough, but I find contradictions. I know that in 15 or 20 young gobblers the No. 10 only was retained. These are wild birds.

MR. KNODER: Do they have any history at any time in the past of releases of game farm birds in that area?

MR. WILLIAMS: I suppose that's happened on a private basis in a lot of places.

I wonder if the people in Florida have looked at enough turkeys that they might notice that No. 9 was moulted in Florida.

MR. POWELL: Both the hens and the gobblers retain the tenth. At the time of year when I am trapping, during the latter part of February and March, I find that the tenth juvenile primary is retained. Now, I have caught birds that I know are from the same hatch that display all the characteristics of the adult bird but with one having the primary retained and another one without it.

MR. WILLIAMS: How about the fall birds, the late summer and fall, after the regular moult is pretty much completed?

MR. POWELL: I don't have any real good experience with late summer birds because I don't trap at that time.

MR. WILLIAMS: How about November?

MR. POWELL: The birds that are killed in November all have the tenth primary retained.

MR. WILLIAMS: And the ninth has been dropped?

MR. POWELL: Yes.

MR. GWYNN: Just what were your conclusions of the ninth and tenth primary? I wasn't quite clear on that.

MR. KNODER: There was no correlation between retention of the ninth primary and heritable wildness.

MR. GWYNN: In other words, you could have a wild turkey that would have replacement of the ninth primary, is that correct?

MR. KNODER: Yes, that was my conclusion.

MR. GWYNN: In Bath County, Virginia I have noticed -- I have no records, but from casual observations from my checking stations there are birds coming in where the ninth primary has been replaced. This is in November, but most of them do have the ninth and tenth juvenile primary, and there are records, of course, of game farm stock being released in this county -- in fact, in all counties.

MR. KNODER: One thing that I didn't have in that paper. We have taken Pennsylvania game farm stock, where we had loss of the ninth primary, and have backcrossed that stock to wild stock from Bailey's domain, made two backcrosses, and we still had the variation in the retention of the ninth primary in the juveniles produced from the second backcross.

DR. DUSTMAN: The paper to which Mr. Knoder referred, Petrides paper -- I think he dealt with 34 skins in all subspecies in which he makes the statement that the ninth and tenth primaries are retained in all subspecies.

MR. WILLIAMS: What I was getting at -- I have found this to a great extent in osceola. The frequency is high here.

MR. JAMES: I think that possibly imprinting might have some bearing on wildness and tameness of birds, and particularly those that are handled in a hatchery. I think that it might be considered important, although it may not be the whole answer, and some studies should be done on that factor.

DR. DUSTMAN: You would include conditioning in that as well. I think there is a fine point of distinction between imprinting and conditioning.

MR. JAMES: Well, imprinting, of course, is a special situation of rapid conditioning, and the regular conditioning would be a long term association between the hen and the young in the wild condition, but imprinting is something that I think should be considered. If the young is imprinted when someone is pulling them out of the incubator shortly after hatching, this would have an important bearing on the behavior of the organism the rest of its life.

DR. DUSTMAN: This is certainly a subject for further research and could be a very important one in our understanding of behavior.

QUESTION: I wonder if this gentleman would give us a minimum glandular weight under which it would be foolish to try to release turkeys.

MR. KNODER: No, I couldn't.

DR. KOZICKY: I wonder if Eugene would comment on his thoughts on imprinting, if he has any.

MR. KNODER: I have very little to go on there, Ed, other than the fact that we have raised a few pure wild birds and judging from their behavior in the pen, compared with the game farm stock, I would say it would be at least non-existent or purely a minimum in determining wildness.

MR. SCHORGER: I would like to ask Mr. Knoder or anybody else who has had what they consider a pure wild population if they have ever encountered any color phases other than typical color? I have reference to white.

MR. KNODER: I think Wayne could answer that better than I.

MR. BAILEY: A few years ago I had a brief note in the Journal of Wildlife Management with regard to several cases of albinism that had come to my attention. Apparently I didn't investigate two or three of those as thoroughly as I should have, and a year or two after that was printed I inadvertently picked up some information which caused me a little bit of embarrassment personally over that. The only thing I can say in answer to your question is that unquestionably cases of albinism turn up, but any abnormal color phases as such along other lines, I have little or no information on that.

MR. SCHORGER: I would like to say that at least a hundred and fifty years ago white turkeys were found rarely on the Upper Missouri where there was no chance of hybridization.

A PRELIMINARY PROGRESS REPORT NEST PREDATION AS A LIMITING FACTOR IN WILD TURKEY POPULATIONS'

James R. Davis
Alabama Department of Conservation

Introduction

Although Alabama has some of the best wild turkey hunting in the southeastern United States, anticipated increased hunting pressure has directed management efforts toward more and better hunting. In order to accomplish these plans, certain problems must be overcome. One factor that appears to be a major obstacle in the increase of wild turkeys in Alabama is predation during the nesting season.

A portion of our wild turkey project, known as the Poisoned "Dummy" Nest Study, was directed toward determining the major predator or predators important in wild turkey nesting attempts. Studies conducted by Wheeler (1948) revealed that only 50 per cent of hens attempt to nest and approximately 50 per cent of these are successful. Therefore, the number of successful nests is one of the major limiting factors influencing wild turkey populations. If the number of successful nests could be increased, a definite management obstacle would be overcome.

These first efforts reported here were directed more toward developing techniques than collecting scientific data. However, some interesting facts were revealed concerning nest predators. It is with these points rather than the actual predation to the poisoned "dummy" nests that this paper is concerned.

Procedure

Strychnine sulfate was selected as the poison to be used because of its fast-acting properties to the nervous system. Study areas upon which to conduct the experiments were selected in known turkey range.

Eggs for the study were obtained from caged poultry houses. These culls (either too small for sale or containing a blood spot) were purchased at a very low price.

The poison was put into a water solution and injected into the eggs with a hypodermic syringe. The hole left by the needle was sealed with a drop of Duco plastic cement. This proved to be fast-drying, and did an excellent job of sealing. As a precaution against someone using these eggs, they were stamped "Poison" in red ink.

Enough eggs were dosed with 7 mg. of poison per egg to construct 56 nests of five eggs each. Enough eggs for an additional 51 nests were later dosed with 14 mg. of poison per egg.

As soon as the eggs were ready, dummy nest construction was started. These nests were built on three separate areas of varied topography and ecol-

1 A contribution from Federal Aid to Wildlife Restoration Project W-35-R, Alabama.

ogy, all of which had wild turkey and predator populations.

Each nest was constructed to simulate a wild turkey nest as nearly as possible. All types of nesting sites were used, including actual sites of previous wild nests. Cover type varied from heavily wooded areas to open fields, but always were located within 75 yards of an opening or road.

The nests were checked every other day, or as nearly to this schedule as the work load permitted. Except for the periodic examination, they were undisturbed for 43 days. This allowed 12 days for completion of a clutch (using 11 eggs as an average clutch, Mosby and Handley, 1943), 2 days for incubation to commence, and 29 days for the hatching to be completed. If there had been no disturbance during the 43 day period, the nest was considered successful.

Results and Discussion

Although many minor obstacles were encountered, the results were considered satisfactory. It was soon apparent that the poison killed many predators near the nest. Those that did not die in the vicinity of the nest left characteristic "sign" which indicated the particular predator species involved.

Even though this sample was not large enough to determine a definite major predator, the predatory species will be treated in sequence, beginning with the most important encountered in this experiment.

The sign left by a raccoon (Figure 2), as with other agents, can be distinguished usually with one look at the nest site. Almost invariably, one or more of the eggs will be removed from the nest site to be eaten. The distance will vary, but generally will be from six to 10 feet. The appearance of the egg shells left by the raccoon is difficult to describe. However, they are well cracked and crushed, and usually one or two will be sufficiently intact to show a line of fracture along the longitudinal axis of the egg. The nest will show a disturbance of the nest materials, but not so severe that the site itself will be lost to the observer.

A nest destroyed by a skunk is much easier to identify. Invariably the end of the egg will be opened almost as if it had hatched. Seldom will any of the shells be over three feet from the nest site. There is generally a hole made in the nest material as if the skunk looked for more eggs hidden there. Figure 3 illustrates this feature.

Being a scavenger type, the opossum (Figure 4) literally destroys everything in and near the nest. The egg shells appear to have been ground up. The nest site is sometimes completely lost to the observer.

Although no snakes were found dead near nest sites, nine nests were thought to have been destroyed by this agent. The absence of sign in or near the nest site is the basis for this conclusion.

Crows treat the eggs in such a manner that identification is easy. A hole (Figure 5) will be pecked in the side of an egg and the contents eaten. Occasionally some of the eggs will be removed from the nest site.

Some other destructive agents were recorded, but there were not enough records to identify sign.

The results of the 107 poisoned "dummy" nests are shown in Table 1,

TABLE 1

RESULTS OF 107 "DUMMY" WILD TURKEY NESTS

Raccoons	Skunks	Opossums	Snakes	Crows	Foxes	Unknown	Cattle	Hogs	Dogs	Successful
				(Number Destroyed)						
31	23	15	9	6	2	2	1	1	1	16
				(Percent Destroyed)						
29	21	14	8	6	2	2	1	1	1	15

There are at least three points that came to light during this experiment that might have biased the data presented in Table 1.

First, the eggs used in this experiment were culls; therefore, many were old and had started to decay when used. The scent of there probably attracted some agents.

Second, the activity of checking might possibly have attracted some predators. Usually the nests were observed from a distance; however, if dead twigs or rain had caused a disturbance to the nest, the site was visited to correct the trouble.

Third, checking the nests as often as every other day might have established trails which led predators to the vicinity of the nests.

In future studies, attempts will be made to reduce or eliminate the above influencing factors. Fresh eggs will be used in place of old or rotten eggs. A time interval for inspection will be planned to prevent excess activity in the vicinity of the nest.

The same study areas will be used during the 1959 nesting season. A total of 100 nests will be constructed on each area. The egg poison concentration will be at least 14 mg. per egg. One area will receive intensive predator control; the second moderate or limited control, while the third will have no predator control other than the kill by poisoned eggs.

Literature Cited

Mosby, Henry S. and Handley, Charles 0. 1943. The Wild Turkey in Virginia: Its Status, Life History and Management. Richmond.

Wheeler, Robert J. 1948. The Wild Turkey in Alabama. Montgomery.

POISON

W-35-R-32 P

Nest Record

DISTRICT 7

OBSERVER James R. Davis

Species Wild Turkey Nest Study Date 5-15-58 Locality Salt Spring Sanc. County Clarke

Twp. 5N R. 2E Sec. SW4 of 16

Landowner State of Alabama Cover Type Mixed pine-hardwood with various shrubs

Vegetation at Nest Huckleberry, Persimmon, Red Oak sprout

Cleared Area Faces: a. Toward b. Parallel c. Away. Was Nest Drainage Good or Bad Good Nest in Relation to Openings or

How Far to a Constant Water Supply 100 yards

Stumbling on it, Mowing Operations, Etc.) How was the Nest Found (Accidently

Material was the Nest made of Oak, Huckleberry leaves and grass What Type of Vegetative Concealment of Eggs from Above is:

a. Good b. Little c. None. No. of Eggs [redacted] used 5 No. of Eggs in Complete Clutch 5

Date Clutch was Completed 5-15-58

Sex of Incubating Bird: a. Female b. Male.

Nest Successful:

No. of Eggs Hatched Date Hatched

No. of Infertile Eggs No. of Dead Embryos

Nest Destroyed: Agent Raccoon Date 5-26-58

Nest Deserted: Cause Date

Nest Near Agricultural Operations Yes If so the Operation Was: (Small Grain, Row Crops, Livestock Production) Managed Food Plot During the Course of your Observations of this Nest were other Active Nests of same Species Known to be Present in same General Locality? a. Yes b. No If Yes, Indicate the Distance to nearest Nest yds. Nest under my Observation Yes No

Near fence from large Red Oak

SS19

(OVER)

-141-

FIGURE 1

FRONT SIDE OF NEST RECORD FORM USED IN "DUMMY" NEST STUDY

Additional Notes or Remarks Only 3 eggs eaten. One 8 feet from nest, one two and other edge of nest site. Characteristic treatment of shells. Very little disturbance of nest material. Agent (raccoon) found within 20 feet of nest site. Decay of agent not advanced.

EXAMINATION OF NEST

DATE	OBSERVATIONS
May 17, 1958	Nest not disturbed any way.
May 20, 1958	O. K.
May 22, 1958	O. K.
May 26, 1958	Nest destroyed. See remarks.

FIGURE 1 (Cont.)

REAR SIDE OF NEST RECORD FORM USED IN "DUMMY" NEST STUDY

Figure 2. **This "dummy" turkey nest was destroyed by a raccoon. In the foreground you can see fragments of eggs removed from the nest site to be eaten.**

Figure 3. **"Dummy" turkey nest destroyed by a skunk. Note the manner in which the eggs are opened.**

Figure 4. **This is the typical opossum destroyed "dummy" nest. Very little remains to be recognized.**

Figure 5. **This "dummy" turkey nest was broken up by crows. The hole pecked in the side of the eggs is typical.**

MR. AMBROSEN (Fish and Wildlife Service, Georgia): It is noted that you didn't list the bobcat as a predator.

MR. DAVIS: We have the bobcat in great quantity, but there was no evidence that he had disturbed any of the nests. In fact, I did my Master's thesis on the bobcat, and in 239 stomachs there was nothing other than things that the bobcat had killed and eaten -- no insects, no eggs or anything like that.

MR. AMBROSEN: I believe that in Central Georgia that a bobcat is a nest predator. I have one observation of finding broken turkey eggs in a slab pile where a bobcat had been denning, and from that I assume that a bobcat had robbed a nest.

MR. DAVIS: Taking the bobcat population as a whole, he has no place in predation of turkey nests other than what effect he might have on the adult hen -- the psychological effect, you might say.

MR. SCHORGER: Were any of those eggs covered with leaves?

MR. DAVIS: All of them were covered to some extent. Some were partially covered just to break up the outline, and those that were exposed in the open field were completely hidden.

MR. WILLIAMS: I found a nest last year that apparently was destroyed by a bobcat, but it was the hen that the bobcat jumped on, and the eggs were eaten by crows. I think you can pretty well see that the cats aren't egg eaters.

MR. DOW: Were there any hogs on any of your study areas?

MR. DAVIS: Yes. I did not read the list of all the predators, but we did record wild hogs that destroyed one nest site. The nest was located in a food plot, however. We have a population of hogs, but they are mostly a nuisance on our management areas rather than a serious competitive or predation factor.

MR. DOW: Are you basing that on the fact that you didn't kill hogs or that you didn't find nests destroyed?

What I am getting at -- was your poison of such a concentration that it would have killed a hog?

MR. DAVIS: No. If he had eaten all five eggs and eaten all of the poison without any loss, it might have killed him depending on his size.

PRELIMINARY REPORT ON WILD TURKEY BANDING STUDIES AS APPLICABLE TO MANAGEMENT IN WEST VIRGINIA'

R. Wayne Bailey
Conservation Commission of West Virginia

INTRODUCTION

Study of the wild turkey (Meleagris gallopavo silvestris), in one form or another, has been in progress in West Virginia for the last 20 years. Progress in management was highlighted by (1) completion of an investigations project and two statewide population surveys, (2) opening as much public lands as possible to hunting, (3) abolishment of refuges wherever their presence was considered unnecessary, (4) lengthening the open season to provide maximum recreation, (5) re-establishment of the turkey in previously unoccupied range, a portion of which was opened to hunting, and (6) multiple-phase habitat development on State, Federal, and, to a lesser extent, private lands.

Under such conditions, and greatly augmented by natural factors, the reported kill rose steadily after 1940.[2] The lowest kill during the years 1955-58 was 1,173. Prior to 1955, the highest (in 1951) was 886 (Bailey, 1958).

In the late 1940's twelve wildlife management units, averaging about 50 square miles in area, each with a resident manager in charge, were established on the two national forests within the State. These provided the basis for intensive management and study on a rather large scale.

THE PROBLEM

One of the greatest problems encountered in regard to turkey management on those units, as well as for the State as a whole, was that of accurately determining the population, the harvest and the annual rate of replacement.

For a period of years the reported harvest did not seem nearly as high as desirable when viewed in relation to known populations. As more and more data were collected, the more imperative it became to find answers to various fundamental questions. Was hunting a significant factor in population control? Would liberalization of hunting restrictions he feasible? What was the maximum permissible harvest? How much gun pressure was required to achieve that maximum?

TECHNIQUES USED

To answer the above questions, as well as many others, the following were employed: (1) Live-trapping, banding, and releasing at the point of capture as many turkeys as possible on selected study areas; (2) counting hunter vehicles on designated roads at strategic times and places to measure trends in hunting pressure; (3) raising the level of kill reporting by establishing convenient check stations, publicizing the importance of reporting,

[1]These studies made possible by Federal Aid Projects, 26-R, 33-R, and 17-D.

[2]Kill reports became mandatory in 1940.

operating "road blocks" at strategic times and places, intensifying ground work by all personnel, and (4) liberalizing regulations to measure the effects on both harvest and population.

The Rimel and Neola Management Units, 50 and 60 square miles respectively, oak-pine-hickory habitat in the Ridge and Valley section of the State (Pocahontas and Greenbrier counties), were selected for study areas for three primary reasons: (1) Hunting pressure thereon was the heaviest on the two national forests, averaging twice that of any other areas on opening day; therefore, conclusions concerning the effect of pressure upon the harvest and population would be conservative when applied to other national forest management areas; (2) the range was more accessible owing to better road systems; and (3) winter weather on these areas usually permitted trapping.

With the exception of minor, private holdings, both areas, in their entirety, were open to the public hunting of turkeys throughout the study period. A refuge of about 5,000 acres embraced portions of both areas prior to the study. It was abolished in 1953.

Trapping began in March, 1955 and was conducted during two separate periods in each year -- January to early April, designated hereinafter as the "spring trap period", and late August through September, hereinafter called the "fall trap period". This report covers eight trapping periods.

For the most part the resident managers of the two areas and the author performed the trapping and banding operations. Assistance was rendered at various times by two other managers, other Commission personnel, and three laborers.

Five wire traps, each employing two top-hinged drop gates, were erected on the Rime1 Area in 1954-55 and three additional ones the following year Six were built on the Neola Area, for a total of 14. In the spring of 1956 a 25' x 50', two inch mesh, cotton net, thrown by three mortars, was used. This net proved unsatisfactory due to its large mesh which engulfed the wings of turkeys, causing a loss of feathers and superficial injuries. Also, adult males were capable of tearing the net, permitting escape. Beginning in September 1956 three nylon nets 30' x 60', one and three-fourths inch mesh, each propelled by three mortars, were employed for the remainder of the trapping and proved very satisfactory.

Baits used were wheat, oats, buckwheat and shelled corn A mixture of wheat and oats in about equal proportions was generally effective and most commonly used. Apparently, poults did not eat corn during the fall trap periods; however, corn was as attractive as other grains during late winter and early spring.

Bait lines were extended from traps, or bait sites, as far as a mile, but usually no more than 500 yards, A handful of wheat or oats was sufficient to bait 30-40 yards of line. Use of bait in larger quantities did not seem to be more attractive to turkeys, and often resulted in intensive use of the area by foxes, songbirds, crows, chipmunks, raccoons and deer. Deer were little attracted by grains other than whole corn.

As many as 40-50 bait sites were maintained simultaneously. An attempt was made to visit each at least 2-3 times per week until it was in use by turkeys. Once turkeys showed interest in a site, it was checked daily in the late afternoon where possible. Turkeys visiting a baited trap site, or enter-

ing a wire trap, 2-3 days in succession, were considered "ready" for trapping. It often required the work days of the week to complete preparations for trapping a flock, with the result that the trap had to be "watched" on Sunday.

Blinds usually consisted of a 12' x 14' tarpaulin draped over a limb or spread over a rough framework of poles. The "front" was a separate piece of canvas or tarpaulin. Source of heat was a kerosene, circular wick heater, which proved to be an inadequate device in cold weather. In warm weather a 6' x 6' x 4' blind of camouflaged marquisette netting, with a knock-down aluminum frame, was used. Turkeys never once shied from it, even from a distance of six feet, but it was uncomfortable for two men after a few hours.

We nearly always entered the blind at the "break of dawn" or before. Several frustrating experiences taught the impossibility of estimating in advance the time turkeys would arrive. They often appeared before sunup. Occasionally they visited bait spots at dusk. A flock of 26 was captured at 5:30 p.m. Most catches, however, probably three-fourths of them, were made before 11:OO a.m.

Habitat development on the areas in the form of 1-2 acre clearings planted in wheat adversely influenced trapping success during the fall trapping period when the wheat was mature. Turkeys were frequently concentrated in the vicinity of the wheat fields and in no instance was it possible in those localities to lure them into a trap or into a situation where they could be netted. No trapping effort was successful within a mile of a wheat crop. In the spring trap period, however, turkeys were netted in clearings that had been seeded to wheat the preceding fall.

To secure accurate and complete information on the marked turkeys, road "blocks", or check points, were operated at strategic locations the first two days (Friday and Saturday) of the respective hunting seasons of the study. With the aid of the State Police, all traffic was brought to a halt and each hunter questioned by a staff biologist as to his success, band recoveries, etc. (Bailey and Chambers, 1958). The human population of the study areas was sparse and practically all hunters entered and left by auto. At those checks 2,216 hunters were interviewed in 1956, 1,809 in 1957 and in 1958 about 2,000.

RESULTS

Trapping began on the Rime1 Management Unit in spring, 1955. Five turkeys were banded during that period. With such meager results, abandonment of the project was seriously considered. However, effort resumed the following August with the encouraging result that 30 turkeys, a retrap included, were captured. This presented a sample that might be adequate to derive a population estimate of the area. The following March (1956) trapping began on the Neola Area also. Twenty-nine turkeys, including a retrap, were caught, and in the following September, 59 more, including one retrap.

There was an abnormal shortage of natural foods on the study areas in the winter of 1956-57. Turkeys responded well to bait but were extremely wild and trap-shy. In the 1957 spring trapping period a total of 36, including seven retraps, was taken, of which all but four were females.

Thirty were banded during the 1957 fall trapping period. Turkeys were then more plentiful than usual and intensive efforts were made to trap them. An abundance of blackberries and huckleberries, plus exceptional wariness on

the part of the turkeys, greatly reduced the catch. The wariness was considered a result of the rather large number of hens caught the preceding spring.

Only two turkeys were caught in the spring of 1958. Natural foods were very abundant and snow conditions prevented normal maintenance of bait lines and operation of traps.

During the 1958 fall trapping period 287 turkeys, including 35 retraps, were caught. This was almost double the number previously captured during seven trapping periods. Total number banded during the seven trapping periods was 432 (Table 1).

The unusual success in 1958 was attributed to the following factors, listed in their presumed order of importance:

1. An abnormally high population, the result of two good reproductive years in succession.

2. Natural foods, blackberries and huckleberries, were scarce.

3. Baiting began earlier than usual (early August).

4. Improved techniques and "know how".

During the seven trap periods a total of 76 captures was made. The number of turkeys taken at each varied from one to twenty-six and averaged six.

A total of 323 turkeys was captured by net, 154 by wire trap and one by hand. Considering the number caught in relation to the number "fired upon", the effectiveness of the wire trap was about 95 per cent, and that of the mortar-thrown nets about 80-85.

The two largest captures were of 24 and 26 turkeys, with wire trap and with net, respectively.

A characteristic of turkeys was the manner in which local concentrations occurred at various times and places for no readily discernible reason. For example, 43 were caught in a wire trap (two captures) within a ten day period in August 1958. Another flock of ten was "spooked" at the same trap, but was taken nearby with net. At another locality, a wire trap was sprung on two separate flocks in one day.

DISCUSSION

Reaction to Persistent Trapping -- Forty turkeys were trapped twice and four were captured three times. An adult hen was taken twice in the same wire trap within a week and an adult male was netted twice within ten days at places about 200 yards apart. A flock of nineteen loitered for several weeks within a mile of the trap in which they were caught. These observations, along with other data (Table 2), showed rather conclusively that they were not seriously "disturbed" by trapping and handling.

On the other hand, there was ample evidence that banded turkeys rarely returned to the immediate vicinity of the places where they were trapped. It also appeared that the greater the number trapped in any given period, the more difficult it was to make captures in the same area the succeeding trapping period. Trapping success was influenced by a great many factors, includ-

ing behavioral differences among turkeys themselves; hence, only generalizations as to causes and effects were possible.

By the fall of 1957, turkeys were sufficiently bait and trap shy as to be avoiding baited areas or areas where they had been trapped. Blinds had to be erected farther from the traps than formerly. Sometimes the birds would flush at sight of the blind. Nets had to be perfectly camouflaged, i.e., concealed beneath leaves, grass, etc. If a single wire or piece of net or metal were seen by the turkeys they would immediately run or flush. They were particularly responsive to the dark, hollow insides of a mortar. They often approached the bait with utmost caution and when they first began feeding were ready to flush at the slightest cause. Upon arriving at the bait, they would approach it, or the net, no more closely than necessary, stretching their necks as far forward as possible, furtively pecking the grain, their bodies held low to the ground, their wings half-spread to enable instantaneous flight, as though prepared for sudden danger.

Turkeys as alert as mentioned above were trapped only through close attention to all details of procedure. Each time an observer visited a bait site during the baiting period, leaves and grasses were added to a smooth row of such materials at the exact spot where the net would lie and heaped in a pile at the place where each mortar would be positioned. Turkeys were likely to abandon any baited area in which sudden changes were made.

Poults, far more naive about bait and traps than adults, rarely displayed the alertness previously described. However, they never failed to instantly obey a warning signal from the mother hen when her suspicion was aroused.

Speed of Turkeys and the Mortar-Thrown Net -- Moving pictures (16 mm.) were taken on an occasion when a 30' x 60' net was fired over two adult gobblers. Examination of the film through a viewer showed the net in air in five frames. Camera speed was 34 frames per second; hence, the net's average speed was 30 ft. in 5/34 seconds, roughly, 140 miles per hour. However, the first frame that showed the net, revealed it over the turkeys. It had been propelled about half its width in l/34 second and therefore its initial speed was at least 400 m.p.h.

Hens and young turkeys frequently outraced the net, which, of course, did not in all cases attain the speed described. Adult males rarely escaped by out-speeding the net.*

Reaction speed of hens and young turkeys was such that their capture was never assured, even when no malfunctioning of the trap occurred. To effectively throw the net, the mortars were "depressed" as low as possible and "charged" as heavily as permissible. Consequently, the equipment was subjected to maximum stress and damage to it (loss of projectiles, burst mortars, broken clamps, cables, etc.) constantly occurred.

Trapping Mortalities -- Mortalities resulting from the trapping totalled five (one per cent of total trapped), injuries about a dozen, with only one serious. Two mortalities occurred when the wings of small poults were broken

* Inconclusive evidence indicated that adult males were considerably more vulnerable to the gun than adult females. The faster reaction of hens, and their greater speed once in motion, would largely account for differences in vulnerability.

by the net. One poult was trampled to death by other turkeys when 21 were taken in a wire trap. The only mortality among adults was the instantaneous death of a hen, by shock, the moment the trap (wire) was sprung.

Band Recoveries -- Band recoveries* during the hunting periods varied from five in 1957 (est. 10 per cent of banded individuals available) to 65 in 1958 (est. 24 per cent of banded individuals available). No information was secured with respect to possible loss of bands by turkeys. Seven turkeys were either retrapped or "recovered" two or more years after banding. In no case did any band show evidence that it was about to be lost, even when it had been incorrectly (overlapped) attached.

It was improbable that a significant number of banded turkeys was killed by hunters and not reported. An unreported harvest of unbanded birds on the study areas may have occurred, but was likely not substantial.

Distances Travelled by Banded Turkeys -- Forty-four retraps were taken during the four years of trapping and banding and, to date, 96 recoveries (Table 1). Thirty-four of the retraps were in the fall of 1958 and mostly comprised individuals that had been banded only a few days or weeks previously. Dispersal data based on retraps was biased due to limitations of the trap area.

Distances travelled by the retraps ranged from 0 to 5 airline miles, of which 60 per cent were within two miles. Recoveries varied from 0 to 25 airline miles, with 59 per cent within two miles. Eleven recoveries had ranged distances exceeding 10 miles (Table 2). Average distance travelled by retraps and recoveries was 3.2 miles.

These data, as well as information secured on areas in West Virginia where transplants have been made, showed that a small turkey population was capable of "occupying" within a few years dozens, even hundreds, of square miles of previously uninhabited range.

Calculated Populations -- Populations calculated on the basis of band returns from a species as mobile as the wild turkey are not nearly as reliable as those, say, derived from marked fish in a lake situation where ingress and egress are slight or non-existent and the assumption of randomness is valid.

Since the trapping and hunting occurred on an area exceeding 100 square miles, the data were reliable. Band returns, however, showed that egress of marked individuals was substantial. It was not known whether that factor was cancelled by ingress in equal proportion, but it was logical to assume that it was.

For all years, on both the Rime1 and Neola Areas, populations calculated by means of the Petersen Method (Petersen, 1896) were higher than field estimates by 8 to 32 per cent (Table 3). The highest population thus derived as 13 turkeys per square mile on the Rime1 Area in 1958, the lowest, 4 per square mile on the same area in 1955 (Table 3). Considering that hunters were less likely to report non-banded turkeys than banded ones, actual populations were higher than calculated populations.

The highest reported kill during the study -- 1.8 per square mile -- occurred on the Neola Area in 1958; the lowest, 0.4 per square mile, was on

* In this paper "recovery" refers to the known mortality of a banded individual.

the Rimel Area in 1957. On both areas the population and kill have greatly increased within the last 15 years (Bailey, 1958).

Hunting Intensity -- During three of the four years when a portion of the population was marked, the length of the hunting season for turkeys was 12-13 weeks (mid-October to early January). Vehicle counts on the study areas on 41 miles of sample roads during opening weekends of the turkey season showed average pressures of about 5-6 hunter vehicles per mile. Total miles of roads was at least four times that of the sample checked. Hence, allowing three hunters per vehicle*, gun pressure on opening day for the years 1955-58 (annual variations were insignificant) amounted to approximately 24 hunters per square mile, or one hunter per 27 acres.

As a comparison, the Bluestone Management Area in West Virginia, 18,000 acres of isolated range restocked in 1951 with live-trapped wild turkeys, was open to public hunting of turkey for two days in 1958. In those two days it received a pressure of at least 1,200 hunters, one per 16 acres, who bagged nine turkeys, an estimated 15 per cent of the population, well within the margin of allowable harvest. This area is exceptionally steep and rugged.

The above, particularly the long-term data on the study areas strongly suggest that the wild turkey's response to hunting coincides with that of most small game species. That is, the hunting of it may be self-regulatory owing to increased wariness of the turkeys following harvest of 10-15 per cent of the population, to declining interest on the part of the hunters as the season progresses and the quarry becomes less and less vulnerable and to the fact that turkey populations bear the same relationship to range size and quality as rabbit populations have with respect to extent and quality of cover, and deer numbers to vegetative quantity and quality.

The banding data, known kill, and known populations, studied in relation to all known pertinent factors, showed beyond question that a twelve week "any-sex-age" season did not adversely affect the turkey population of the study areas.

Indices to Productivity -- Turkey productivity is best measured by the number of immatures per adult female. Fall live-trapped samples, as well as total seasonal kill of known sex and age, clearly showed that both 1957 and 1958, with 2.4 and 4.6 immatures per adult female (total kill sample), respectively, were unusually good years for turkey reproduction (Table 5). Two such years in succession were no doubt the cause of the high population, live-trapping success, and high kill, in 1958. On the Rime1 Area in 1955 the number of immatures per adult female in the total kill sample was 0.95, and on both areas in 1956 the number was 1.04 (Table 5).

Live-trapped and total kill samples, while no doubt adequate to show trends, changes, or differences in productivity, were both biased, the former more so than the latter. Bias in live-trapped samples was due to sex and age differences in vulnerability to trapping. Adult males were very difficult to trap during the fall period. Immatures were disproportionally easy. Adult hens succeeded in escaping, or avoiding, traps, especially nets, in almost every instance where escapes occurred. Samples trapped in spring were no doubt far more representative than those taken in fall.

* Most sample checks in West Virginia, and elsewhere, were near this figure.

Bias in shot samples may occur because of difference in vulnerability to hunting between adults and immatures or between males and females. The data in 1958 indicated, almost incredibly, that vulnerability of adults was equal to, or perhaps greater than, that of immatures. However, the number of adults available was difficult to estimate.

If it be assumed that broods inhabit the vicinity of roads, trails, clearings or "microhabitats" more frequently than elsewhere (a rather "safe" assumption), it follows that ordinary field observations do not yield productivity data having absolute values. Therefore, a precise method of measuring productivity awaits development.

Difference in Reproductive Capacity Between Young and Adult Hens -- A minor objective of the study was to determine whether a difference existed between yearling hens in ability to rear young to the hunting period. Five known age, i.e., banded, hens with broods were captured. None was a yearling. Three were known to be more than two years old and one had minimum age of four years.

Thus, the data suggest that hens two years of age, or older, are more successful than yearling hens in rearing young to the fall period. The data, however, are too meager to be conclusive. This is an important subject for further investigation, owing to its obvious usefulness in transplanting wild stock.

CONCLUSION

1. Study of a wild turkey population by means of live-trapping, banding, and retrapping is practical, though time-consuming and expensive.

2. Live-trapping met with such greater success in fall than in spring that spring trapping, for banding purposes, was not practical.

3. Mortar-thrown nets, though far more laborious to utilize, were more effective in live-trapping than were wire traps.

4. Operation of road blocks at strategic locations was very successful in obtaining data on the study areas.

5. Wild turkey productivity was subject to great variability from year to year.

6. Turkey dispersal and productivity were such that small populations were theoretically capable of occupying large areas within a few years.

7. The unobtrusiveness of wild turkeys, as is the case with most species of upland game, was sufficient to result in calculated populations invariably higher than those derived by other means.

8. Under normal conditions, ability of hunters to harvest turkeys is equalled, or exceeded, by the eternally insidious elusiveness of the latter.

TABLE 1

SUMMARY OF WILD TURKEY TRAPPING, RETRAPPING AND BAND RECOVERIES
1955-58

Band Period	No. Banded (exclud. retraps)	Period in Which Retrap/Recovery was Banded																Total		
		Spg. '55		Fall '55		Spg. '56		Fall '56		Spg. '57		Fall '57		Spg. '58		Fall '58				
		Re-trap	Recov-eries	Re-trap	Recov-eries	Re-trap	Recov-eries	Re-trap	Recov-eries	Re-trap	Recov-eries	Re-trap	Recov-eries	Re-trap	Recov-eries	Re-trap	Recov-eries	Re-trap	Recov-eries	To-tal
Spg. '55	5																	-	-	-
Fall '55	29	1			8													1	8	9
Spg. '56	28			1														1	-	1
Fall '56	58				4	1	1		10									1	15	16
Spg. '57	28			1		3		1		1	1[1/]							6	1	7
Fall '57	30				1				2		1		1					-	5	5
Spg. '58	2												1[1/]					-	1	1
Fall '58	252			1		1		1	1	1	3				1	31	60	35	65	100
Total	432	1	0	3	13	5	1	2	13	2	5	0	2	0	1	31	60	44	95	139

1/ Found dead.

TABLE 2

AIRLINE DISTANCES TRAVELLED BY WILD TURKEY FROM POINT OF BANDING TO POINT OF RECAPTURE/RECOVERY*

Distance Travelled (miles)	Retraps	Recoveries	Total	Distance Travelled (miles)	Retraps	Recoveries	Total
0-1	14 (32)	34 (39)	48 (37)	13-14	--	--	--
1-2	13 (30)	18 (20)	31 (23)	14 -15	--	1 (1)	1 (.8)
2-3	2 (5)	6 (7)	8 (6)	15 -16	--	1 (1)	1 (.8)
3-4	13 (30)	3 (3)	16 (12)	16-17	--	1 (1)	1 (.8)
4-5	1 (3)	5 (6)	6 (5)	17-18	--	1 (1)	1 (.8)
5-6	--	4 (4)	4 (3)	18-19	--	--	--
6-7	--	1 (1)	1 (.8)	19-20	--	--	--
7-8	--	3 (3)	3 (2)	20-21	--	--	--
8-9	--	1 (1)	1 (.8)	21-22	--	1 (1)	1 (.8)
9-10	--	2 (2)	2 (1.5)	22-23	--	1 (1)	1 (.8)
10-11	--	2 (2)	2 (1.5)	23-24	--	--	--
11-12	--	1 (1)	1 (.8)	24-25	--	1 (1)	1 (.8)
12-13	--	1 (1)	1 (.8)	25-26	--	--	--
	Total Retraps 43					Total Recoveries 88	Grand Total 131

* Includes records of individuals that were both retrapped and recovered. Per cent in parenthesis.

TABLE 3

WILD TURKEY POPULATIONS ON THE RIMEL AND NEOLA MANAGEMENT UNITS, BY FIELD ESTIMATE AND BY BAND RETURN, FOR THE YEARS 1955-1958

Area & Year	No. Banded Birds Afield[1]	No. of Recoveries	Total Kill	Calculated Population[2]	Population Est. by other means[3]
Rimel, 1955	30	8	50	190	150
Rimel, 1956	45	5	30	270	150
Neola, 1956	47	7	50	336	200
Rimel, 1957	45	4	20	215	200
Neola, 1957	25	3	31	258	200
Rimel, 1958	170	16	66	700	250
Neola, 1958	90	38	106	250	300
Total, 1958	260	54[4]	172	950	550

[1] Based on number banded during year prior to hunting season, plus very conservative allowance for number banded birds surviving from previous trapping periods.

[2] Using Petersen Method. $N = \frac{nT}{t}$, where T = total number individuals banded, t = number banded individuals killed during the season, n = total killed during season (banded plus unbanded), and N = total population.

[3] Area manager's estimate based on daily field observations, hunter contacts, road checks, etc.

[4] Eleven additional bands were recovered outside the study areas, several in the neighboring State of Virginia.

TABLE 4

AGE COMPOSITION OF WILD TURKEYS LIVE-TRAPPED ON THE NEOLA AND RIMEL MANAGEMENT AREAS, 1955-58

Area & Year	Adults M	Adults F	Immatures	Imms. per Ad. Female	Per Cent Immatures	Total (n)
Rimel, Fall '55	1 (3)	11 (37)	18	1.6	60	30
Rimel, Fall '56	3 (10)	16 (55)	10	0.62	34	29
Neola, Fall '56	2 (7)	10 (33)	18	1.8	60	30
Total, Fall '56	5 (8.5)	26 (44)	28	1.1	47.5	59
Rimel, Sprg. '57	4 (11)	27 (75)	5	0.2	14	36
Rimel, Fall '57	1 (8)	1 (8)	11	11.0	85	13
Neola, Fall '57	--	3 (18)	14	4.7	82	17
Total '57	1 (4)	4 (13)	25	5.0	83	30
Rimel, Fall '58	2 (1)	21 (13)	142	6.75	86	165
Neola, Fall '58	2 (3)	9 (10)	78	8.7	87	89
Total, Fall '58	4 (2)	30 (12)	220	7.3	86	254

TABLE 5

COMPARISON OF AGE COMPOSITION (IN FALL) OF LIVE-TRAPPED WILD TURKEYS WITH SEASONAL KILLS OF KNOWN SEX AND AGE, RIMEL AND NEOLA STUDY AREAS

Area & Year	Adults M	Adults F	Immatures	Imms. per Ad. Female	Per Cent Immatures	Total (n)
Rime1 Live-Trapped ('55)	1 (3)	11 (37)	18	1.6	60	30
Rimel, Kill ('55)	2 (4)	22 (49)	21	0.95	47	45
Total Trapped* ('56)	5 (8.5)	26 (44)	28	1.1	47.5	59
Total kill* ('56)	22 (29)	26 (35)	27	1.04	36	75
Total Trapped ('57)	1 (4)	4 (13)	25	6.2	83	30
Total Kill ('57)	7(18.5)	10 (23)	24	2.4	58.5	41
Total Trapped ('58)	4 (2)	30 (12)	220	7.3	86	254
Total Kill ('58)	18 (11)	26 (16)	120	4.6	73	164

* Both Rime1 and Neola Areas.

SUMMARY

On two adjacent, heavily-hunted, managed areas, totaling 110 square miles, 432 wild turkeys were live-trapped, banded, and released at the point of capture during eight trapping periods in 1955-58. Wire traps and mortar-thrown nets were employed in the trapping procedures.

Band recoveries averaged about 15 per cent per year and suggested higher populations than were derived by other means. Dispersal from point of capture to point of recovery varied from 0 to 25 miles with an average of 3.2.

Study of a wild turkey population by means of live-trapping, banding, and retrapping was practical, though time consuming and expensive. Trapping was far more successful in late summer and early fall than in late winter and early spring.

Calculations made on the basis of band recoveries showed that the highest population during the four years of the study was 13 turkeys per square mile on the Rime1 Area in 1958. Harvest on the same area that year was 1.3 per square mile. Operation of road blocks at strategic locations was very successful in obtaining data on the study areas. No part of the areas was refuge and an "any sex-age" season was in effect. Hunting pressure on first two days of the various seasons averaged about 24 hunters per square mile. The open season was 12-13 weeks. Known kill and population were stable or increasing under such conditions.

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AN AGING TECHNIQUE FOR JUVENAL WILD TURKEYS BASED ON THE RATE OF PRIMARY FEATHER MOULT AND GROWTH

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The pattern of primary feather moult has been widely used as an age criterion in juvenal game-birds. The method was first used for pheasants (Phasianus colchicus) by Buss in 1946, and has been subsequently refined by Trautman (1950), Woehler (1953), and Westerskov (1957). Bump, et al, (1947) have also established the validity of this method as an age character in juvenal ruffed grouse (Bonasa umbellus). In addition it has been successfully applied to the bobwhite quail, Colinus virginianus (Essex, 1949), and the mourning dove Zenaidura macroura, (Swank, 1952, 1955). As these authors have shown, the primary feather moult is a fairly constant process and can probably be applied to most gallinaceous birds. The data presented herein show that primary moult can be reliably used to age the Eastern wild turkey (Meleagris gallopavo silvestris).

Westerskov (op. cit.) has pointed to one major difficulty to the use of this technique for aging pheasants during the hunting season. Usually at this time of the year all of the juvenal primaries have been moulted and aging depends upon the length of the tenth primary. Since the characteristic juvenal primaries are not present with which to determine age, some other means must be used to establish whether a specimen is a juvenal or an adult.

Petrides (1942) has shown that the juvenal 9th and 10th primary is retained through the post juvenal moult in the wild turkey. The domestic turkey retains only the 10th juvenal primary (Leopold, 1944). Thus, even in wild populations that have been mixed with domestic turkeys, there can be no confusion of adults and juvenals; either the 9th and lOth, or the 10th juvenal primary alone, can be used to distinguish juvenals from adults during the hunting season.

MATERIALS

The wild turkeys used in this work were pen-reared at the Waterloo Wildlife Experiment Station from stock initially obtained from the Pennsylvania Game Commission. Measurements were also taken, for comparison, from an additional five juvenal wild turkeys; these five were raised from eggs taken from a nest in the wild.

The question that immediately arises is what degree of correlation exists between the moult of game farm wild turkeys that probably are mixed with domestic turkeys, and native or pure wild stock. Data presented in Table 1, and previous work by Leopold (op. cit.) show that there is little or no difference in the size of the wing between the two groups, and consequently of the terminal length of the primary feathers. The scanty evidence available, then, indicates that insofar as genetic composition is concerned the moult and growth of the primaries of the two groups of turkeys are similar.

One other point of concern is whether primary feather growth rates of captive and feral turkeys are identical. Naturally, if there were much divergence between the two groups an aging technique obtained from one would not be applicable to the other. No data are available on this point for turkeys. However, Stokes (1954) and Westerskov (op. cit.) present some data which, although not conclusive, indicated there was no difference between captive and

wild populations of pheasants in this respect. Until information to the contrary is produced it seems safe to assume that a similar situation occurs in turkeys.

METHODS

Fifty wild turkey poults were selected from a group of 220 on the day they hatched (June 2, 1955). These 50 were separated and wing-banded with numbered aluminum bands for individual identification. Beginning at one week of age, the sample was handled each week until growth of the 8th post-juvenal primary terminated on each specimen. This involved the time period between June 9, 1955 and February 25, 1956.

An individual record form was kept on each turkey every time it was handled. The following data were recorded: Band number, age, sex, weight, length of each primary to the nearest millimeter, presence or absence of primaries and whether growth had terminated, and if a primary was juvenal or post juvenal. The proximal or innermost primary was numbered 1, and the distal primary was numbered 10. This numbering system corresponds to the sequence of moult. All feathers were measured from the base of the calamus, or point of emergence from the follicle, to the tip. Measurements were taken from primaries on the left wing.

In most cases it was impossible to fix the exact age at which a given primary was moulted. For example, many times a juvenal primary would be present at one time, and when the specimen was handled the following week this primary would have been moulted and the post juvenal primary would be present. To estimate the actual age of moult, the average growth rate during this period was determined and the time necessary for the measured growth of the post juvenal primary subtracted from the age of the turkey. The growth rate of the primaries was fairly constant (cf. Table 2), and it is believed that little error was involved in estimating the exact day of moult.

From tables presented, it may be seen that sample size varied considerably from one lot of measurements to another. The two reasons for this were mortality and breakage of primaries. Primary breakage was a vexing problem that could not be overcome. This resulted from the turkeys flying against the sides and top of the pen when attempts were made to catch them.

Heavy mortality occurred at about 106 to 120 days of age due to blackhead (enterohepatitis), and caused a plateau or loss of body weight. It was suspected that moult of the number 8 primary was delayed as a result of this disease. Therefore, another sample of turkeys of known age was examined to check on the age of moult. A considerable difference in mean age of moult was found, so the estimate of age of moult obtained from the original sample for the number 8 primary, and the mean growth rate, were discarded. Primaries less than number 8 had been moulted prior to the blackhead infection and consequently were not affected.

RESULTS

Moult of the primaries. In Table 3 are shown the mean ages in days when the eight juvenal primaries were moulted. A statistical test for correlation between age of the turkeys and age of moult was not performed, but a significant correlation seems apparent. Similarly, a test for normality of distribution was not made. From inspection of the data, it seems safe to assume that the variates were normally distributed.

Several of the samples on which the mean age of moult was based were tested to determine if they were adequate to establish the mean, within plus or minus two days, at the 95 per cent confidence level. The samples appeared to be adequate for the first few primaries moulted. The samples on which the outer primaries were based were definitely too small to set the confidence limits mentioned above. These means appear to be accurate within plus or minus 3 to 4 days. In subsequent use of these data to establish hatching dates, this limitation must be remembered, and greater accuracy not implied.

There was no difference in the mean age of moult of the number one and two primaries between males and females; therefore the samples were combined. A mean difference in age did exist between the sexes at the time of moult of primaries number 3 through 6, although it was not significant, therefore the means are shown separately. A significant difference between males and females in mean age at the time of moult of primaries number 7 and 8 was indicated by the t-test.

Growth of the primaries. Growth of the juvenal primaries is shown graphically in Figures 1 and 2, for males and females respectively. The data from which these curves were derived, and the sample sizes they were based on, are presented in Tables 4 and 5. No measure of dispersion was computed, but variation appeared to be comparable to that shown by the standard deviations presented in Table 8 and Figures 5 and 6.

As with primary moult, a good correlation between age and length of primaries is evident. From the data presented, the mean age of turkeys can be estimated between the ages of 7 and 90 days from the lengths of the juvenal primaries. Terminal lengths, or length of the primary when growth terminates, is not shown in Figures 1 and 2 except for primaries 9 and 10.

A comparison of juvenal primaries numbers 3 and 4 revealed a sexual difference in length between 30 and 40 days of age. The greater length of male primaries is evident at this age. Identification of sex by other external characteristics is usually not possible before 70 to 100 days of age, and this characteristic may be useful in sexing juvenals in future brood studies.

Growth of the post juvenal primaries, except number 8 is shown graphically in Figures 3 and 4 for males and females respectively. Mean primary lengths and sample sizes, on which these figures are based, are presented in Tables 6 and 7. It is apparent that a turkey's mean age can be estimated from the lengths of these primaries between 35 and 165 days of age. An increasingly pronounced sexual difference in mean primary length becomes apparent which is due largely to the earlier age at which females moult the juvenal primary. Reference to Tables 6 and 7 will show what is probably a significant difference between males and females in the terminal lengths of post juvenal primaries numbers 1 through 7.

Special attention was given to the number 8 post juvenal primary since it is the one most likely to be of use in aging turkeys. Most aging samples will probably be collected during the fall hunting season, and length of this primary will be the only criterion of hatching date.

Mean growth rates of the number 8 primary plus and minus two standard deviations in days is shown in Figure 5 for males and in Figure 6 for females. The mean age of a turkey can be estimated from these figures, and a confidence inference made, by calculating the number of days plus and minus the mean indicated by the line showing two standard deviations. When only individual

turkeys are aged, rather than samples, the correct age should be correctly estimated from the figures in about 95 per cent of the cases. The age of turkeys can be estimated from these data between the approximate ages of 130 and 190 days.

Other data on growth of the number 8 primary are presented in Table 8. Samples of turkeys were measured at the ages shown, and the mean and standard deviation of primary length calculated. As explained previously, the number of days required to grow a given length of primary may be estimated by dividing measured primary length by the mean daily growth rate. This was done, and a standard deviation in days is also presented in Table 8. Thus, mean age and standard deviation in days may be estimated from mean primary length. The reverse situation, although patently not as useful, is also true; a mean length and standard deviation in millimeters may be estimated from mean age.

CONCLUSIONS

A method for estimating the mean age of juvenal wild turkeys between the ages of 7 and 190 days based on the moult and growth of the primary feathers has been presented. The measurements of dispersion used herein indicated that the mean age of subsequent samples may be estimated within plus or minus 3 to 4 days. For practical use, then, hatching dates may be established within ten day periods from measurements of the primaries of autumn-shot samples.

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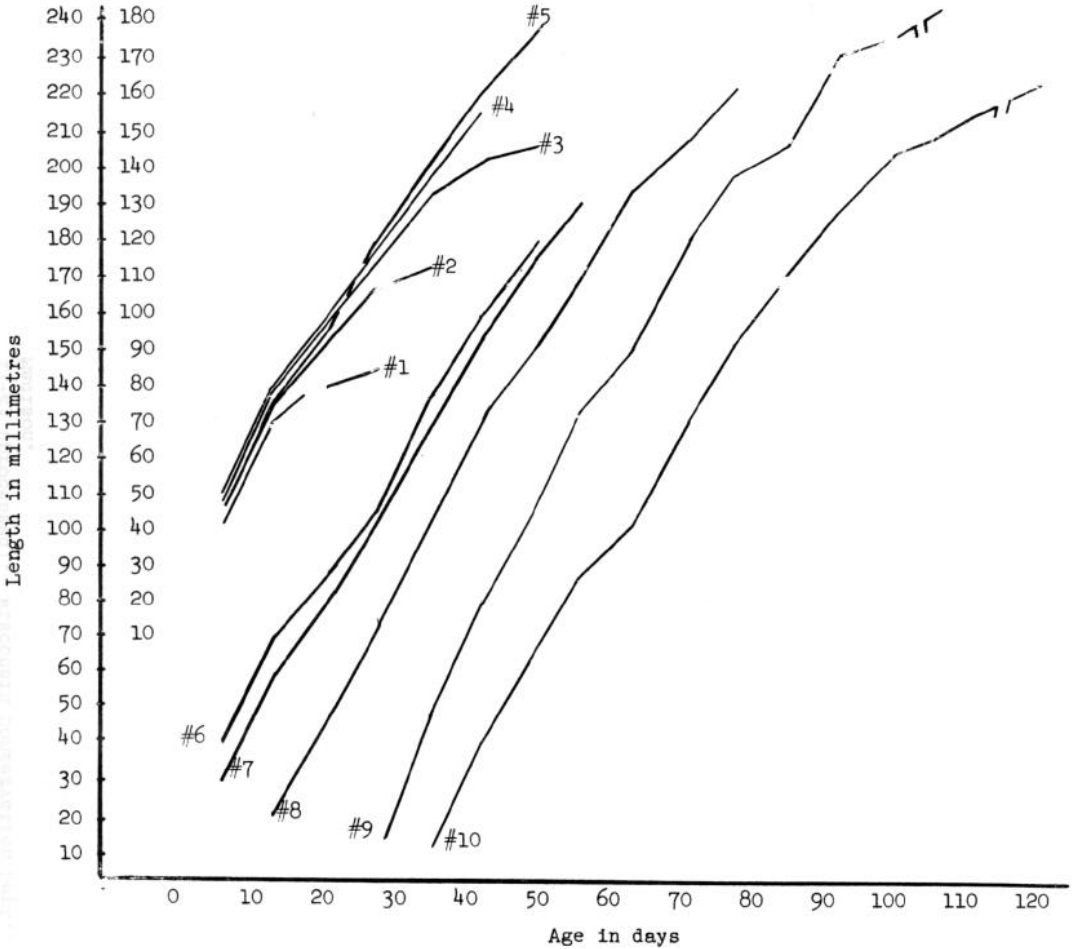

Figure 1 MEAN GROWTH RATE OF JUVENAL PRIMARY FEATHERS OF MALE WILD TURKEYS

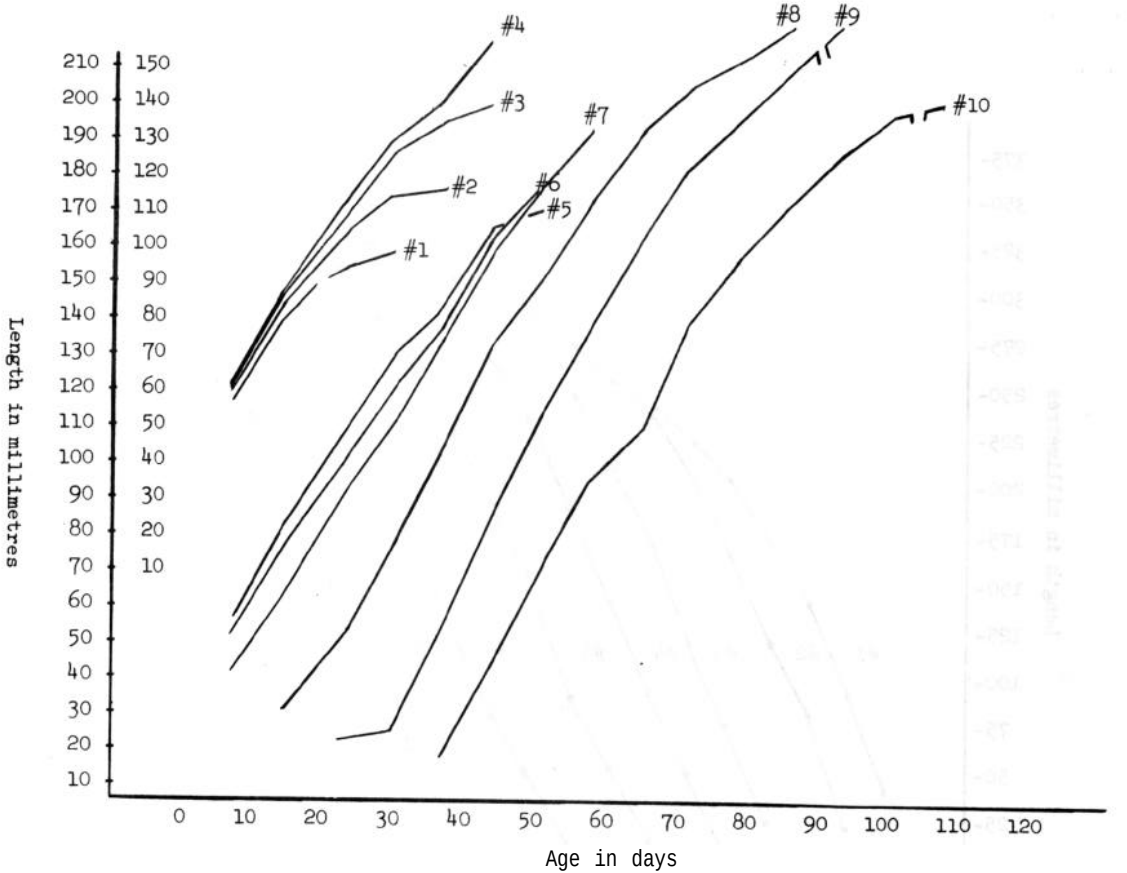

Figure 2 MEAN GROWTH RATE OF JUVENAL PRIMARY FEATHERS OF FEMALE WILD TURKEYS

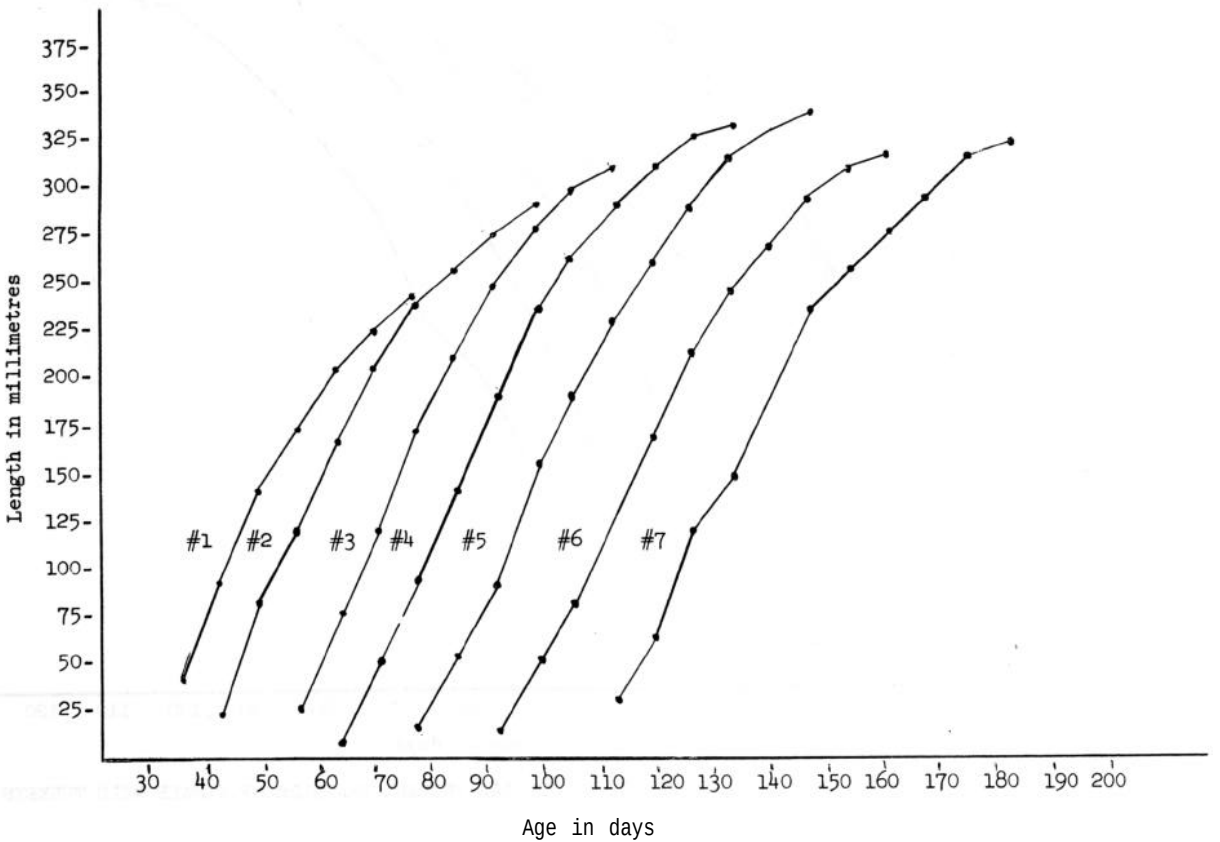

Figure 3 MEAN GROWTH RATES OF POST JUVENAL PRIMARY FEATHERS OF MALE WILD TURKEYS

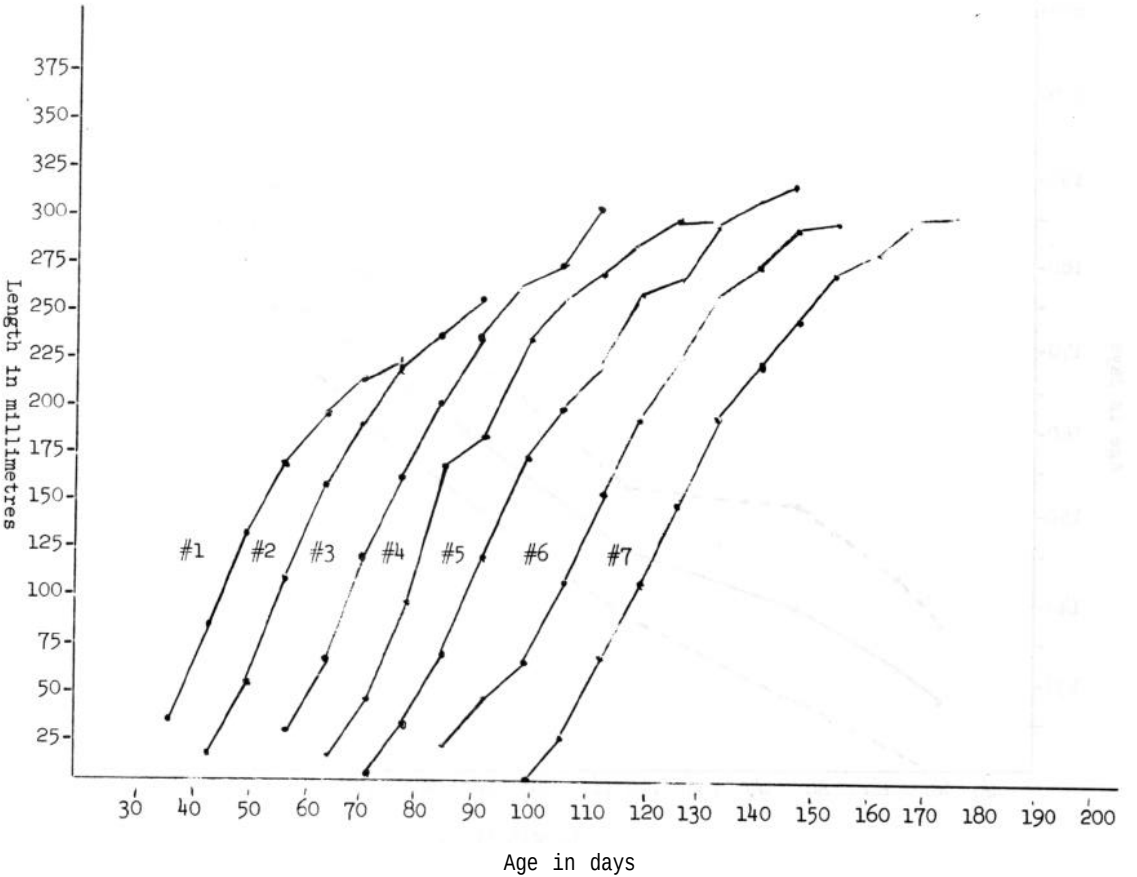

Figure 4 MEAN GROWTH RATES OF POST JUVENAL PRIMARY FEATHER OF FEMALE WILD TURKEYS

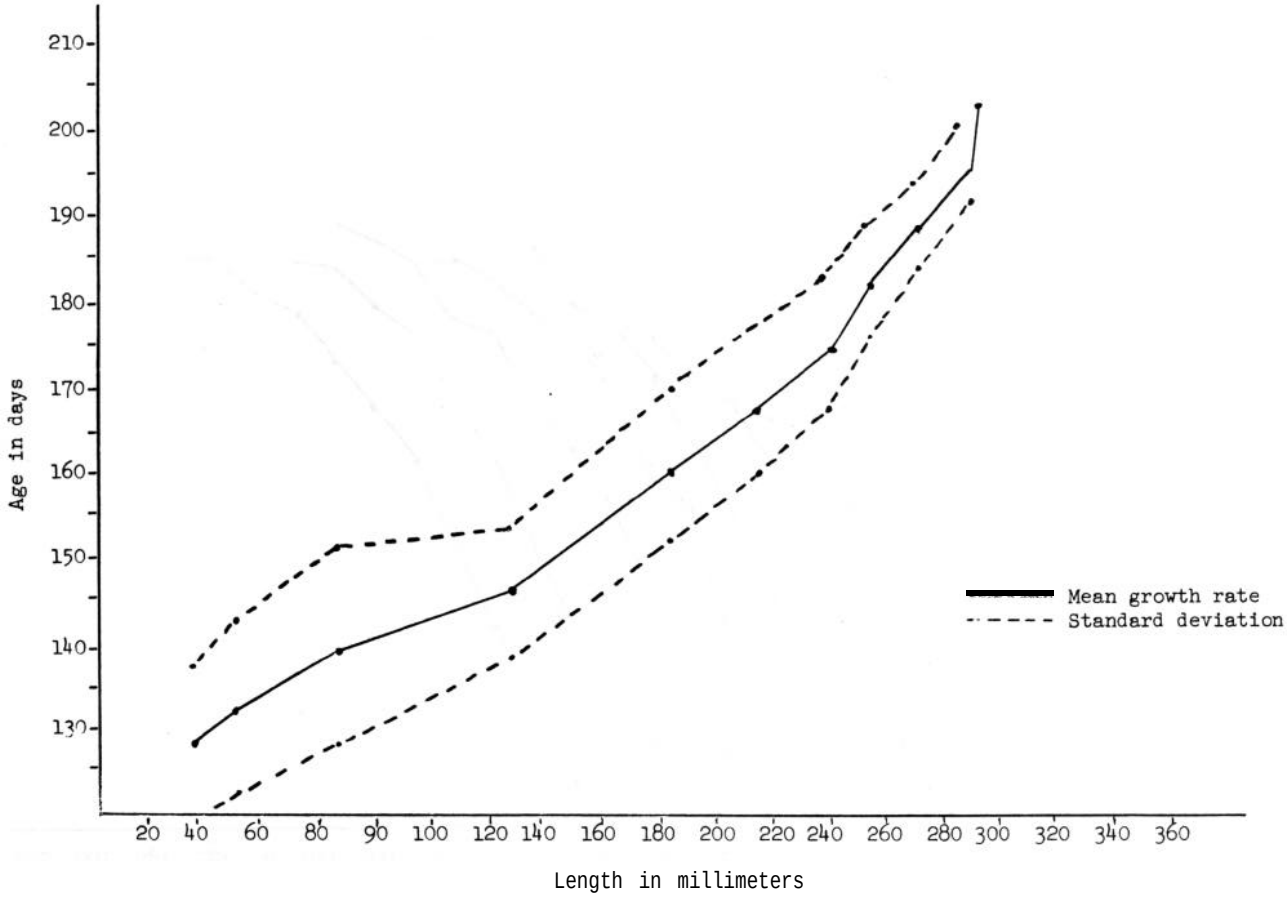

Figure 5 MEAN GROWTH RATE OF THE NUMBER 8 POST JUVENAL PRIMARY FEATHER OF MALE WILD TURKEYS. MEAN AGE PLUS AND MINUS TWO STANDARD DEVIATIONS IN DAYS IS SHOWN AS A FUNCTION OF PRIMARY LENGTH.

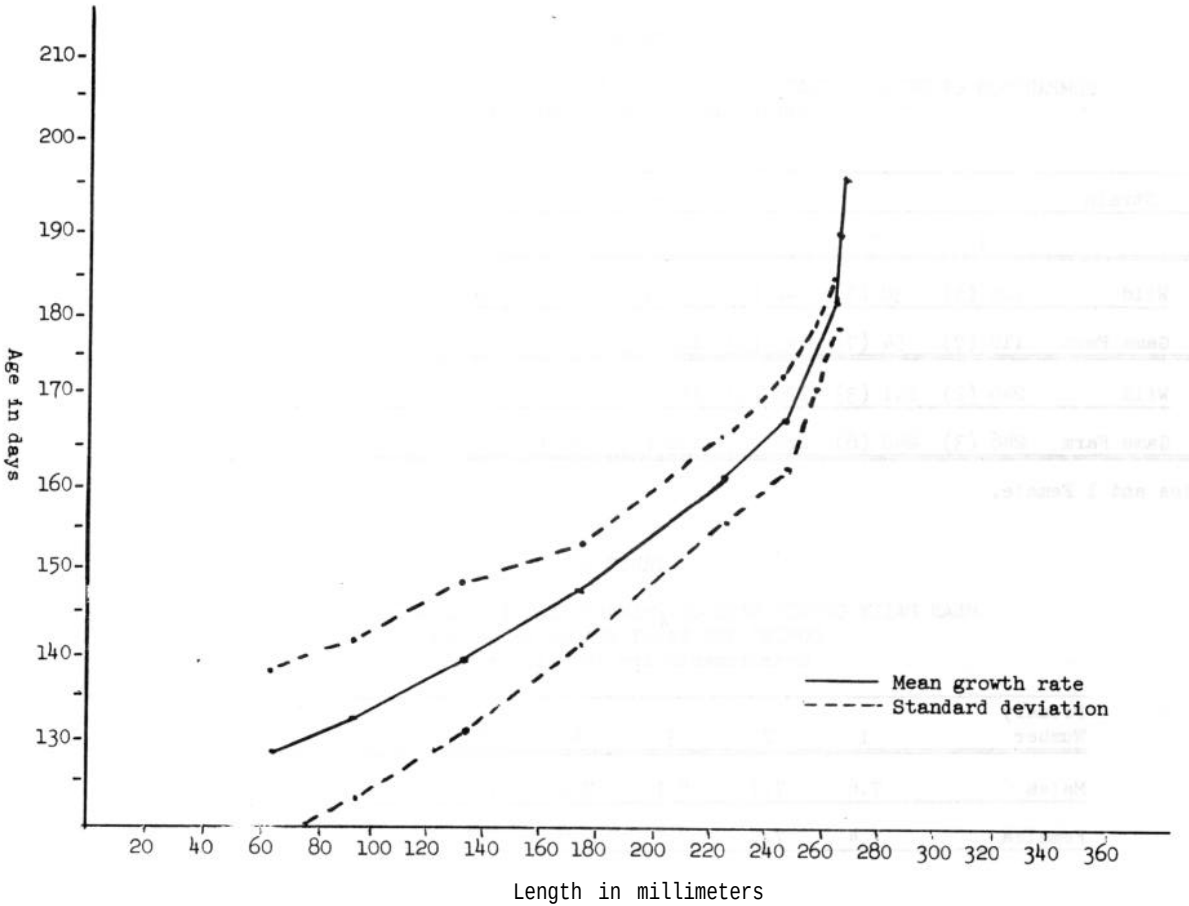

Figure 6 MEAN GROWTH RATE OF THE NUMBER 8 POST JUVENAL FEATHER OF FEMALE WILD TURKEYS
MEAN AGE PLUS AND MINUS TWO STANDARD DEVIATIONS IN DAYS IS SHOWN AS A FUNCTION OF PRIMARY LENGTH

TABLE 1

COMPARISON OF PRIMARY FEATHERS LENGTHS OF PURE WILD* AND MALE GAME FARM TURKEYS
Sample Size Shown in Parenthesis

Age	Strain	Mean Length of Primary Number									
(Days)		1	2	3	4	5	6	7	8	9	10
	Wild	105 (5)	30 (5)	142 (5)	156 (5)	165 (3)	All Broken	157 (1)	142 (5)	87 (5)	41 (5)
47	Game Farm	118 (7)	54 (7)	145 (1)	156 (3)	168 (1)	--	163 (3)	140 (6)	91 (7)	52 (7)
	Wild	240 (2)	241 (3)	226 (3)	165 (3)	82 (3)	All Broken	All Broken	208 (3)	207 (3)	164 (3)
84	Game Farm	246 (3)	248 (6)	202 (7)	126 (7)	46 (6)	--	--	--	204 (6)	166 (7)

* 4 Males and 1 Female.

TABLE 2

MEAN DAILY GROWTH RATE OF PRIMARY FEATHERS OF WILD TURKEYS
DURING THE EARLY STAGES OF GROWTH
Measurements Are in Millimeters

Primary Number	1	2	3	4	5	6	7	8
Males	7.6	7.7	8.1	7.9	7.7	7.9	6.9	6.4
Females	7.4	7.5	7.7	8.0	7.7	7.8	7.0	6.3

TABLE 3

ESTIMATES OF THE MEAN AGE IN DAYS OF MOULT OF THE JUVENAL PRIMARY FEATHERS OF THE WILD TURKEY

Primary Number	Mean Age of Moult in Days				Standard Error of Mean		Standard Deviation of Mean		Significant Difference Between Mean Age of Moult of Males and Females
	Males	n'	Females	n'	Males	Females	Males	Females	
1	31.1*			16*	0.56*		2.24*		NO.
2	41.8*			19*	0.76*		3.33*		No.
3	56.1	7	55.4	13	1.49	1.04	3.94	3.76	NO.
4	66.4	8	65.9	13	1.64	1.28	4.64	4.64	No. t=0.252,d.f.=19
5	79.3	8	76.3	11	1.70	1.27	4.81	4.23	No. t=1.521,d.f.=17
6	95.1	9	91.6	13	1.44	1.76	4.34	6.33	No. t=1.505,d.f.=20
7	109.5	9	103.6	17	1.51	0.97	4.54	4.01	Yes. t=3.552,d.f.=24
8	123.2	15	117.5	15	1.22	1.32	4.74	5.13	Yes. t=3.157,d.f.=28

* Males and Females Not Separated. n' = Sample size

TABLE 4

MEANLENGTH IN MILLIMETERS AND SAMPLE SIZES OF JUVENAL PRIMARY FEATHER
OF MALE WILD TURKEYS AT DIFFERENT AGES

Age	Mean Length and Sample Size																			
Days	1	n'	2	n	3	n	4	n	5	n	6	n	7	n	8	n	9	n	10	n
7	42	4	48	4	50	4	49	4	48	4	42	4	32	4	0	6	0	6	0	6
14	70	3	76	3	79	3	80	3	77	3	71	3	61	3	22	3	0	6	0	6
23	-	-	95	4	101	4	103	4	100	4	92	4	84	4	51	5	0	6	0	6
29	84	3	108	5	115	5	120	5	120	5	116	5	105	5	75	5	17	5	0	6
36			112	5	134	6	138	6	143	6	139	6	131	6	103	6	49	6	14	6
43					143	4	156	3	162	4	160	5	155	5	132	6	80	6	41	6
50					146	1			179	1	180	1	177	3	152	6	105	7	65	7
57													192	1	173	6	134	7	89	7
6 4															195		157	7	113	7
71															209	4	180	6	136	7
78															223	3	199	7	157	8
85																	216	6	172	7
92																	232	6	188	7
100																	235	3	205	7
106																			209	8
113																			214	4
T.L.*																	243	20	224	25

*T.L. - Terminal length 'n - Sample size

TABLE 5

MEAN LENGTH IN MILLIMETERS, AND SAMPLE SIZES OF JUVENAL PRIMARY FEATHERS OF FEMALE WILD TURKEYS AT DIFFERENT AGES

Age	Mean Length and Sample Size																	
Days	1	n'	2	n	3	n	4	n	5	n	6	n	7	n	8	n	9	n	10	n
7	46	10	48	10	49	10	48	10	46	10	41	10	31	10	0	10	0	10	0	10
14	68	10	73	10	75	10	75	10	73	10	68	10	51	10	20	9	0	10	0	10
23	-	-	92	10	97	10	98	10	97	10	91	10	81	10	42	12	12	1	0	10
29	86	8	103	11	115	11	118	11	118	11	111	11	100	11	65	11	14	11	0	10
36			104	9	125	10	129	10	131	11	129	10	123	10	92	10	40	10	8	8
43					129	5	147	5	154	5	152	7	149	8	122	11	74	11	33	11
50									161	1	166	1	166	6	146	13	101	13	61	13
57													183	3	166	11	128	11	86	12
64															182	8	152	12	109	13
71															194	6	171	12	131	13
78															204	1	186	9	149	13
85															211	1	201	9	162	11
92																	211	10	177	13
100																			187	12
106																			190	11
T.L.*																	212	13	193	22

*T.L. - Terminal length n' - Sample size

TABLE 6

MEAN LENGTH IN MILLIMETERS, AND SAMPLE SIZES OF POST JUVENAL PRIMARY FEATHERS OF MALE WILD TURKEYS AT DIFFERENT AGES

Age	Mean Length and Sample Size													
Days	1	n'	2	n	3	n	4	n	5	n	6	n	7	n
36	38	6												
43	91	6	20	5										
50	137	7	79	6										
57	173	7	119	7	24	5								
64	201	7	166	7	75	6	72	2						
71	221	6	203	7	116	7	50	6						
78	238	4	233	8	107	8	92	8	16	4				
85	247	3	252	6	206	7	140	7	53	6				
92			272	6	244	7	186	7	90	7	14	1		
100			286	7	275	8	233	8	152	8	53	7		
106					295	7	259	9	190	9	83	9		
113					306	3	285	9	226	9	127	9	34	7
120					-	-	304	7	257	8	166	8	67	8
127					322	1	322	7	286	8	212	6	115	7
134					334	1	328	5	310	9	241	7	143	8
141					338	1	340	2	324	7	267	6	190	7
148									333	8	291	7	233	8
155											307	9	251	10
162											313	5	271	7
169													288	5
176													311	4
183													318	3
T.L.*	255	18	296	13	332	19	349	23	353	24	346	24	335	25

*T.L. - Terminal length 'n - Sample size

TABLE 7

MEAN LENGTH IN MILLIMETRES, AND SAMPLE SIZES OF POSTJUVENAL PRIMARY FEATHERS OF FEMALE WILD TURKEYS AT DIFFERENT AGES

Age	Mean Length and Sample Size													
Days	1	n'	2	n	3	n	4	n	5	n	6	n	7	n
36	35	10												
43	87	11	21	5										
50	132	13	55	13										
57	167	12	109	12	31	8								
64	193	13	154	13	67	13	18	5						
71	211	12	190	13	119	13	47	12	9	1				
78	220	7	219	13	161	13	95	13	33	7				
85	214	4	237	12	201	12	142	12	66	11	22	2		
92	215	4	255	8	233	13	181	13	118	12	48	6		
100	218	1	295	5	262	11	232	12	170	12	68	12	5	3
106	216	3	252	4	273	9	251	16	197	16	107	17	28	12
113					302	1	270	15	220	16	151	17	68	15
120							284	12	255	14	190	16	105	15
127							296	9	263	13	221	14	146	15
134							291	6	294	13	253	15	192	15
141									303	8	272	12	221	14
148									313	5	289	7	243	10
155											292	14	266	17
162													277	13
169													291	10
176													292	8
T.L.*	228	16	260	9	288	17	302	23	305	23	299	24	290	24

*T.L. - Terminal length

'n - Sample size

TABLE 8

GROWTH OF THE NUMBER 8 POST JUVENAL PRIMARY OF MALE AND FEMALE WILD TURKEYS
See Text for Explanation

Age	Males				Females			
Days	Mean Length Millimeters	n'	S.D.[1] mm.	S.D. Days	Mean Length Millimeters	n	S.D. mm.	S.D. Days
128	37	13	26.8	4.2	67	15	32.6	5.1
132	52	15	33.0	5.1	95	15	27.8	4.4
139	87	15	37.0	6.8	137	15	27.8	4.4
146	150	15	22.9	3.6	179	15	19.0	3.0
160	206	15	29.3	4.6	228	14	15.2	2.4
167	237	14	27.7	4.3	248	13	14.5	2.3
174	261	13	24.8	3.9	261	13	11.8	1.9
181	277	12	20.9	3.3	267	9	10.4	1.6
188	293	11	17.0	2.6	272	8	10.9	1.7
195	311	13	15.1	2.3	274	15	7.5	1.2
202	314	11	9.4	1.5	273	12	7.8	1.2
T.L.*	315	25			271	24		

*T.L. - Terminal length 'n - Sample size [1]S.D.- Standard deviation

RESEARCH NEEDS

Session Chairman: W. C. GLAZENER
Welder Wildlife Foundation

WILD TURKEY RESEARCH NEEDS[1]

W. C. Glazener
Welder Wildlife Foundation

Any attempt to arrive at an understanding of wild turkey research needs must be preceded by and based upon some attention to work already done in that particular field. Search of literature reveals relatively little published material covering research efforts per se; in proportion to importance of the species as a major wildlife resource in North America, the scarcity of publications is startling.

Appended hereto is a list of seventy-nine titles, to serve as a suggestive line of reading for anyone desiring to determine the nature, scope and distribution of wild turkey studies. Some of the references from the Pittman-Robertson Quarterly are included for the purpose of indicating a lamentable failure of certain workers to compile valuable data and follow through with papers in media available to other technicians and to the public at large.

Our three common subspecies of wild turkey occupy regions of such diverse habitats, land use practices, hunting pressures, and other factors as to preclude general application of findings from one to the other. Geographic distribution of the subspecies, the eastern turkey (Meleagris gallopavo silvestris), Rio Grande turkey (M. g. intermedia), and Merriam's turkey (M. g. merriami) doubtless will be given in other panels of this symposium. If not, sources of that information are readily available.

A brief analysis of the bibliographical list reveals several points. Forty-seven titles referring to field studies concern the eastern turkey. Thirteen titles deal with the Rio Grande turkey, and four apply to the Merriam's turkey. This seems to reflect at least two considerations. First, possibly, is the heavier hunting pressure and consequent management interest in the eastern subspecies. In contrast, very high populations of the Rio Grande turkey, particularly on many privately owned areas in Texas, are accessible to a limited number of hunters. Recognition of the need for and willingness to undertake management have been so restricted in general as to develop all too little encouragement and support of research work. In states where the Merriam's turkey occurs there possibly exists such a high priority for intensive work on big game and fisheries as to leave neither personnel nor finances for turkey research.

By another breakdown the 79 titles reveal either sole or primary attention to categories, as follows:

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[1] Contribution # 35B, Welder Wildlife Foundation

a. Parasites and diseases--- 10
b. Ecology----------------- 17
C. Food Habits------------- 14
d. Life History------------ 19
e. Management-------------- 6
f. Physiology-------------- 2
g. Predation--------------- 1
h. Populations------------- 4
i. "Status"---------------- 3
j. Narcotizing birds-------- 1

With particular reference to research needs for wild turkey in Texas I would suggest a few lines, some of which we propose to pursue in behalf of the Welder Wildlife Foundation on our refuge area near Sinton, Texas. Others need to be worked out in different geographic regions of the state.

a. Population dynamics
b. Relation of poult survival to ground cover; including high temperatures to which poults are subjected.
c. Relation of turkeys to extensive brush clearing operations.
d. Determination of peck order for flocks of each sex: follow marked birds of known age to check on age relationship.
e. Production at various population levels.
f. Selective breeding by females.
g. Effects of harvesting both sexes.
h. Habits and behavior patterns.
i. Movements and distribution.
j. Ecological relationships.
k. Management requirements.

Candor demands that a previous implication be expanded and emphasized. Since the matter applies so unhappily to me, I feel that I can go on record without casting reflection on any one else. Enough information is on file in at least one state, in the form of notes, reports and unfinished manuscripts, to fill quite a gap in turkey literature. In addition to the need for research there is an appalling need for the preparation and publication of data already on hand.

Current research work conducted under the Pittman-Robertson program in 10 states apparently is tied to or carried on in conjunction with surveys covering (a) population trends, (b) mast production, (c) food habits, (d) harvest, and (e) restocking. Five other states have projects that include one or more of the above phases. It is not readily discernible how much man power is devoted to either basic research or to applied research.

Wild turkey research has received definite attention at several colleges, on the part of M. S. and Ph.D. candidates, as well as faculty members. Outstanding institutions in this respect have been the University of California, Oklahoma State University (formerly Oklahoma A, & M. College), Pennsylvania State University (formerly Pennsylvania State College), and Virginia Polytechnic Institute.

Papers being presented in our section of the Symposium will point up some needs seen by the authors. Further ideas naturally will result from papers presented in the various sections preceding our own. None of these will be equally or directly applicable to all three of our wild turkey subspecies. The task of adapting suggestions and the development of techniques remains ahead of us.

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RESEARCH NEEDS FOR MERRIAM TURKEY IN ARIZONA

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Arizona, as most other states, has a research program designed to furnish technical information needed to effectively manage our game species as a renewable resource. The responsibility for developing and testing new ideas and methods of management is delegated to a project that is carried on under Federal Aid assistance within the structure of the Arizona Game and Fish Department.

I am sure that our research situation is not new to any member of this audience. We have on file proposed research jobs needed by the department for better and more effective management of all of our game species. At the same time, we are faced with a lack of funds and manpower to carry out these proposed research activities as fast as we would like. One obvious answer to this problem is assignment of priority to these different research proposals on the basis of importance of the particular species to the overall picture of game management. It's a question of "we've got it all to do, which shall we do first?" Turkey is one species which has not had the attention given to it in the past that it perhaps should have had. Now, however, with increased hunting pressure on all species and changing habitat, turkey is nearing the top of the priority list.

To date, research on Merriam turkey in Arizona has been limited to one three-year project.

Briefly, this project, which terminated in 1952, yielded the following information (Reeves, 1953 and Reeves and Swank, 1955):

1. A food habits study was made of seasonal preference and importance of individual plant species. Over-winter foods consisted of ponderosa pine

seeds, acorns, juniper berries, and bunch grass seeds, plus other foods of less importance. Pine seeds were a very important item in the diet when available. However, neither pine seed nor acorns are dependable from year to year. Important winter 'staples' are juniper berries and grass seeds.

2. Predator-prey relationships were investigated by trapping predators in areas of high turkey density. Results of stomach and scat analysis showed that predation was not a principle limiting factor on turkey populations.

3. Mortality on young birds and critical periods for reproduction were examined. Work done by Gerstell and Long, 1939, showed that wild turkey eggs freeze at 25°F. if exposed for extended periods. Temperatures taken inside the nests during the laying period were found to differ only two degrees from outside temperatures. Arizona experiences wide variations between day and night temperature, especially during the Spring months. This has a definite effect during the laying period on turkey nesting success. Because of the turkey's high reproductive potential, extremes of temperature in April and May can bring about wide variation in adult: young ratios.

4. A trend count method, developed prior to this study, was evaluated and found to be an acceptable management tool. Annual production is indexed as a ratio of young to adult females and trends are determined by total numbers observed on standardized routes.

5. Disturbance was evaluated as a factor in limiting turkey populations. Human disturbance from logging practices, settlement, recreation, farming and ranching has greatly reduced the amount of suitable habitat.

Since the conclusion of this project, some additional work has been done in further evaluating the effects of minimum temperature on production. Figure 1 is a composite graph of minimum temperatures in turkey habitat for the years 1952 through 1955. The hen-poult ratio from the same area for each year is as follows:

1952	1:4.3
1953	1:1.5
1954	1:4.0
1955	l:l.l

Minimum temperature fluctuations were more severe in 1953 and 1955. Hen: poult ratios were much lower these two years. (Jantzen, 1957). Analysis of minimum temperatures in April and May from key weather stations in the turkey ranges has made possible fairly reliable forecasts of hatching success before the yearly production is actually measured.

Also, since the termination of the original research project, turkey have been trapped for banding and transplanting purposes. This resulted in definite trapping techniques, which are in current use.

In 1955 the shotgun was included with centerfire rifles as a legal weapon for the taking of turkey. This was done with considerable skepticism on the part of many people. Many felt that in the past, turkey hunting was almost lost to Arizona because of indiscriminate shooting with shotguns.

An effort was made to evaluate the shotgun and rifle as to their relative effectiveness and contribution to crippling loss. (Jantzen, 1955 & 1956. This was done by hunter questionnaire following the 1954 "rifle only" season,

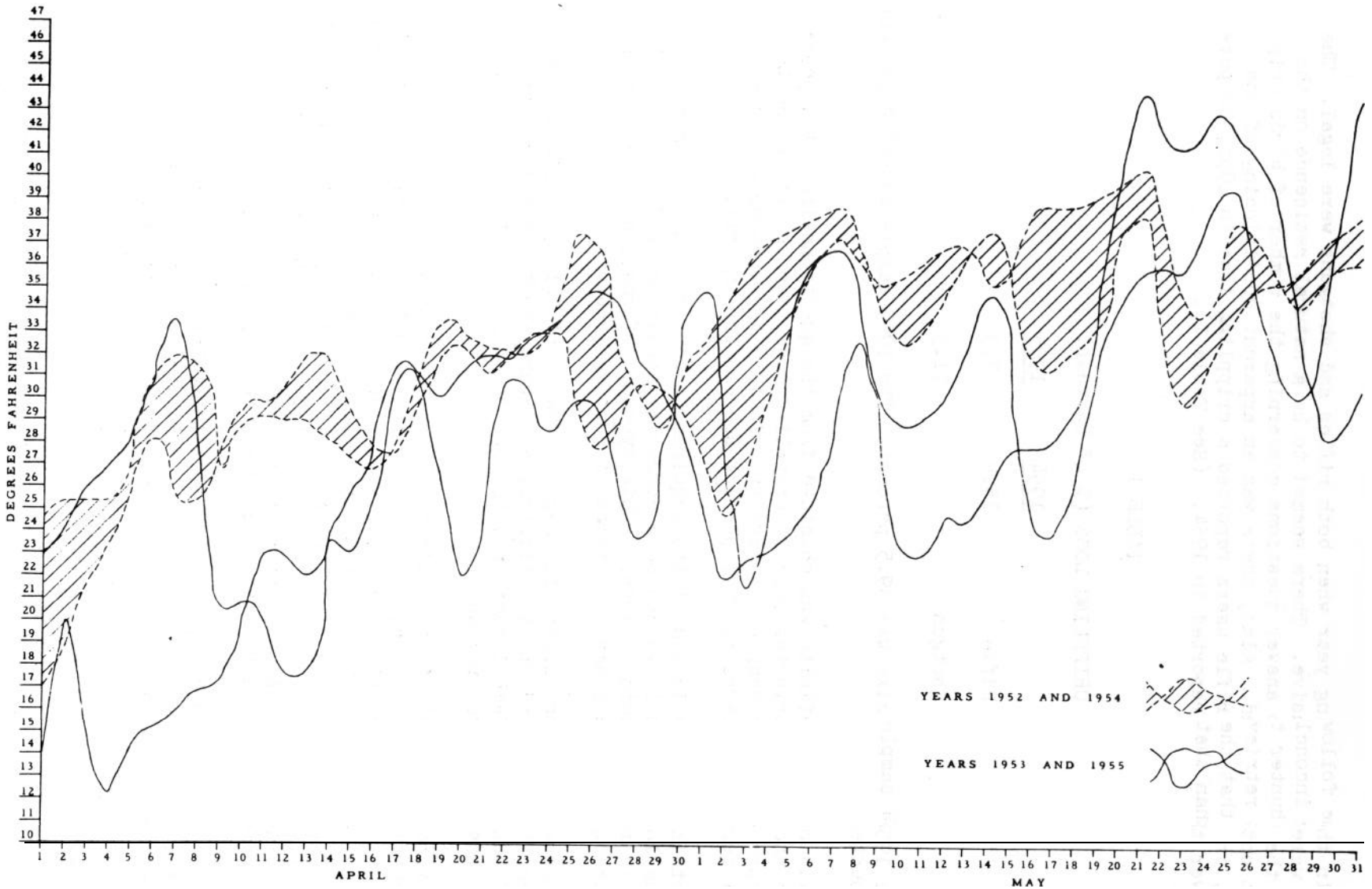

Figure 1. Minimum Temperatures for April and May of 1952, 1953, 1954 and 1955. Compiled from data from eleven weather stations in turkey habitat.

and again the following year when both rifles and shotguns were legal. The results were inconclusive. There seemed to be a natural reticence on the part of the hunter to answer questions concerning the number of birds crippled but not retrieved. Also, there was an apparent conditioning of the hunters, in that the rifle users reported a crippling loss in 1955, 50 percent lower than that reported in 1954. (See Table 1).

TABLE 1

CRIPPLING LOSS (% of Harvest)

	1954	1955
Rifle	15.4	7.5
Shotgun		11.5

The 1954 sample size was 39.5 percent. The 1955 sample was 45.9 percent of all hunters.

While nothing definite was obtained from the questionnaire, it appears that the shotgun contributes more to crippling loss than the rifle and is also a more effective weapon for harvest. In 1955 the shotgun hunter success was 41.4 percent compared to 25.7 percent success for the rifle user.

Certainly, there is a definite requirement for an accurate index to crippling loss. With it we can more correctly assess the efficiency of the harvest in terms of total removal. This type of information can also be applied directly to the study on effects of hunting pressure.

A research job on turkey will begin in March of this year similar to a study recently reported on by Gallizioli and Swank (1958) regarding the effects of hunting on Gambel quail populations in Arizona. It is scheduled for at least one three-year period.

Arizona's harvest of birds since 1951 has been only four to five percent of the estimated fall population. Population estimates are based on annual production, the number of birds observed during the regular scheduled summer survey, and amount of habitat. Population turnover was estimated to occur completely every 4-5 years; this is based on the high reproductive potential of the species, several years of known adult-young ratios, and banding studies. The low removal by hunters indicates that a much larger harvest could be made without detriment to the resulting populations.

The history of turkey management in Arizona has created an ultra-conservative attitude toward the bird as a game species. One of the first action programs initiated when the game department was organized in the 1920's was that of transplanting turkeys into areas which were supposedly low in density. Later, the bag limit was reduced from two birds to one. Still later, turkey was not included in the deer license and the season was divorced from the deer season. In 1946, the turkey season was closed entirely for one year, and the following year opened in a very limited area. In 1949 the first turkey research project was begun. Since 1951, hunting has been on a limited permit basis by management unit. This has resulted in more intensive management and more accurate methods for estimating kill from each unit. As a consequence, it appears that in many areas, the harvest is not adequate to properly utilize this game species. This situation and its background have

pointed up the need for an unemotional, objective study to determine the effects of hunting on populations of Merriam turkey.

The proposed study will commence by establishing two areas, one open to hunting and an adjacent unhunted control area. These two areas should encompass the entire seasonal range of the flocks. Relative density will have to be determined for each area so that a good basis for comparison is available before and after hunting. It is proposed that a Lincoln Index or one of its variations be used for this purpose. In consequence, trapping and banding or marking will be necessary in each area. Our previous trapping experience suggests that a modified waterfowl cannon-net trap can be used successfully. We are currently using this method in trapping turkeys on the North Kaibab. The open area will be hunted at various intensities. Follow-up comparisons will be made on resulting populations in the hunted area and protected populations in the control area. Additional information can be obtained from a study of this sort on the extent of seasonal movement and the interchange of individuals between areas.

A factor which will perhaps complicate the study will be different land use practices on the two areas. This is creating a problem now in the selection of study areas. Four years ago, the United States Supreme Court awarded thousands of acres of what had been public land in northern Arizona to the Aztec Land and Cattle Company, a subsidiary of the Santa Fe Railroad. The land is situated in alternate sections in a checkerboard pattern and involves two national forests. Sale has been made of marketable timber on many of these sections; grazing privileges have been leased or sold; and some sections have been sold outright. Naturally, land use practices on these areas do not lend themselves favorably to the research job contemplated, nor are they particularly beneficial to turkey populations, research notwithstanding. Unfortunately, these lands occur in relatively homogeneous turkey habitat which would be ideal for the proposed study.

This brings us to another problem which requires good answers from objective research. For several years, private and public lands in Arizona have been undergoing extensive treatment to alter existing vegetation in the pinon-juniper type to improve these lands for grazing purposes. To date, approximately 750,000 acres of pinon-juniper have been cleared. (Arizona Watershed Program Progress report, 1958). Much of the clearing has occurred in winter range for the Merriam turkey. This is accomplished in large blocks of several hundred acres to several sections by cabling or bulldozing.

Additional projects involving thousands of acres of pinon-juniper are proposed, and appropriations are being sought for the accomplishment of these proposals. Reeves (op. cit.) found that juniper was an important cover and food plant for the Merriam turkey. Not all of the acreage involved is turkey range, but we should certainly know what effects the eradication will have on established flocks using pinon-juniper areas. We need to know what types of treatments would accomplish the principle aim of conversion for higher grazing capacity and, at the same time, be compatible with the cover and food requirements of game species utilizing this vegetative type. It is questionable that treatment of large unbroken areas is beneficial to any of the large game animals that have a cover requirement.

We have, at present, a research program in cooperation with the U. S. Forest Service to determine the effects of habitat manipulation on density of deer and elk, primarily. There is a definite need for specific information of this nature applicable to turkey management.

Much of this habitat manipulation is being done on Forest Service lands which, of course, are administered in accordance with the multiple use policy. The various national forests in Arizona and the regional forester have always been most cooperative in adjusting land use practices wherever possible to alleviate wildlife problems resulting from conflicting land uses. However, it is our responsibility to furnish the administrators of these public lands with the necessary information. If game management problems exist or are being created by land use practices on public lands, it is within our province to advise the administering agency and offer constructive solutions. The need for research in order to accomplish this is apparent.

Arizona's efforts at turkey management have included some transplanting of native wild stock, Meleagris gallopavo merriami to areas which were historical range of M. g. mexicana, and a successful transplant to the Kaibab North which has no history of wild turkey. Most of these transplants were made in the southern desert mountain ranges and have been generally quite successful. Resulting populations in the Grahams, Catalina, Huachuca and Chiricahua Mountains are now supporting limited hunting. The North Kaibab plant was very successful; controlled hunting has been in effect since 1956. The original number released was 48 birds in the winter of 1948-1949; estimates of population exceeded 500 in 1956.

A lack of personnel has kept follow-up evaluation of transplants to a minimum. Very little qualitative work has been done other than infrequent and irregular field checks by personnel in performance of other duties. These follow-up field checks have indicated, in some cases, that there is an initial rapid build-up in numbers followed by a decrease and leveling-off. Annual production is generally lower and the population seems to stabilize itself.

Current programs envision no transplants in the near future. However, if new areas are recommended, consideration should be given to a comprehensive evaluation of the dynamics of a new population. Determining optimum population levels will enable us to use the new hunting resource to best advantage.

In summary, Arizona's research needs for Merriam turkey are focused on problems which are directly affecting the quality and type of management that we can provide for this unique and desirable game species.

Our changing world, and increasingly intensive use of all resources precludes the acceptance of static management procedure for any game species if we are to fulfill our responsibilities to the American wildlife heritage. Research is our tool and we must use it well.

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DISCUSSION

MR. GLAZENER: Bulldozing and plowing and so forth in the hill country of Texas and the Rio Grande brush plain is wrecking that beyond the grasp of your imagination, and some of that country involves what originally was the heart of the Rio Grande turkey range in Texas. We have been acting with the sportsmen's clubs of Texas recently and bringing that situation to the attention of the Soil Conservation Service, The A.C.B. and other agencies who are involved with that type of land treatment. We think there are some long range research programs that need to be instituted there, not only on the effect of vegetation, but on the rate of depletion of soil nutrients.

MR. KNODER: I am not in the same situation that some of the rest of these gentlemen are in that they had to abbreviate their papers, because I didn't have one for this. I have a few notes put together here. Several of us got together here recently, so these aren't all my thoughts by any means--we were discussing what we knew about turkeys and what we didn't know about turkeys to determine what the research needs were.

Before that little discussion was over, somebody made the comment that "It's damn well time that we got together in a meeting such as this".

I will limit my remarks here mostly to generalities. I think first of all turkey research is in need of quantitative and better designed studies. I think that's particularly true of research in range management. We have the opportunity in the eastern United States to work on that, especially with the excellent attitude of cooperation that I have seen evinced on the part of the Federal Forest Service and many of the State Forest Services for range management.

On a quantitative basis there isn't too much that we can recommend at the present time in the way of improving forests for turkey production -- that's either to maintain present densities or to increase densities. To my knowledge there is no quantitative description of what is good turkey range. I realize that that's a hard thing to boil down into a formula. I think more studies are needed though to determine if it can be broken down that way because the application of techniques from one area to another depend largely upon the forest structure from one area to another.

I think there is considerable that could be done in the way of improving techniques for gathering sex and age ratio data.

Another outstanding area that needs research is in census methods on turkeys. We have at the present time no methods other than the Lincoln Index, which Wayne Bailey explained here that they use in West Virginia, for estimating populations in limited areas. I am speaking of areas other than on a county basis or state-wide basis. I think along with this, the development of a census technique based on the gobbling count needs to be worked out. Surely it should be fully explored to determine if such a technique can be worked out. In reviewing some of the literature on this phase, I find there is inadequate quantitative information on the seasonal pattern of gobbling or on the daily pattern of gobbling. We guess as to what times of the day to run gobbling censuses.

The biology of the turkey is another thing that needs application of quantitative methods. For example, we have used adult hen-juvenile ratios in measuring productivity. At the present time there has been no measure of hen mortality between spring and fall. If there were much variation in this from year to year the adult hen-juvenile ratios would be meaningless as a method of measuring productivity.

A number of other things in connection with predation on turkey populations -- Mr. Davis made the statement that for Alabama he thought predation would largely be limited in the effect it would have on the population to predation upon nests. To my knowledge there are no studies in the literature on predation on turkey nests from a quantitative point of view. Most of the work that has been done resulted from accidental finding of nests and determining the subsequent outcome. Such studies are particularly hard to design on turkeys because of the fact that the wild hens frequently desert nests when they are first flushed, and it's difficult to get samples that aren't biased.

In the interest of conserving time, that will be the extent of my remarks upon research needs.

MR. GLAZENER: There were two points that I had on the list that have not been mentioned -- one is the comparison between the hatch and the survival up to about twelve weeks of age. Observation of our turkey indicates that if a poult gets up to ten or twelve weeks he has it made. Some years there is 50 to 75 percent loss before they reach that age. Other seasons we find that entire broods will come through -- broods by August will still have

twelve or thirteen poults. That makes a tremendous difference.

The other point -- this has been mentioned here -- and that is what percent of the turkey population can we safely harvest? That is a difficult one to solve in many instances. I know it's practically impossible in Texas at present because of legislative restrictions over most of the state. Also because of the reluctance of landowners; you must remember that probably 90 or 95 percent of the turkeys in Texas live on privately owned land where hunting is controlled by the landowner and operator, so that's a problem that some of you other fellows can answer more readily than we can through research that might be undertaken.

SUMMARIZATION OF THE FIRST NATIONAL WILD TURKEY SYMPOSIUM

Leonard E. Foote
Wildlife Management Institute

Starting with Rudolph Bennitt in 1946, each summarizer of North Ameri- Can Wildlife Conferences has apologized for his ineptitude. Now I see why, and my misgivings about accepting this assignment have come home to roost.

Yesterday Kozicky mentioned Gabrielson's Law of the Intellectual Maxi- mum which is simply that one's mind can absorb no more than one's seat can endure. I might add that seat endurance varies inversely as the square of the ineptitude of the speaker times the length of the presentation. My sum-mation will be almost telegraphic.

Roses before thorns. The committee of Strode, Bailey, Hardy, Knoder, and Shaw, with the assistance of the Peabody hotel, has discharged its responsibilities with workmanlike precision. The subcommittee's intention was to bring turkey workers together to summarize knowledge, and to provide for papers and group discussion on special turkey management and research problems. Dr. Watson ably presented the background of the conference and its relation to the Forest Game Research Committee of the Southeastern Section of the Wildlife Society. In his closing remarks, Dr. Watson indicated that registration at this symposium included 91 representatives from 26 state game and fish departments, many universities, the U.S. Fish and Wildlife Service, the U.S. Forest Service, International Paper Company, Gulf States Paper Company, Union Bag-Camp Corporation, the Audubon Society, Welder Wildlife Foundation, and the Wildlife Management Institute.

STATUS OF THE WILD TURKEY

Mosby summarized the status of the Eastern and Florida subspecies in 1948. Then, only 3 of 17 states reported turkeys increasing, and the total population was estimated at 129,000 birds. Twelve per cent of the ancestral range was occupied.

Today, we have about 460,000 turkeys in the continental United States, and the Eastern and Florida races have increased 127 per cent. More of the range is occupied; some 18 states report successful restoration efforts, including significant areas outside the original range. I wish Dr. Mosby's summary had included facts on the proportion of the population on private lands not open to public hunting so that one could appraise the opportunity a one-gallus hunter has to enjoy this sport. It was evident from the discussion that in some areas we owe much of our turkey population to the interest of private landowners.

Shaw foresees a favorable future for turkeys in the Northeast. Here, in spite of increasing human population pressure and economic development, there still are 6.4 million acres of present or potential turkey range on public lands. Prospects also are encouraging in Alabama, Arkansas, Florida, Georgia, Kentucky, Mississippi, Missouri, New Mexico, and Oklahoma; so we seem to have reversed the disappointing trend noted by Mosby in 1948. Initial success of some wild stock transplants outside the original range offer additional hope for increasing the overall occupied range. Many states, like Missouri, historically blame their limited populations on poaching and habitat deterioration through wildfire, over grazing, and poor forestry practices.

INVENTORY AND HARVEST

The inventory and harvest panel was a disappointment in that we do not seem to have progressed as far in these management phases as we should have.

Arkansas, Missouri, and other states use interview systems to inventory populations; Kentucky uses winter flock counts and gobbler counts; Virginia is testing gobbling counts; and Bailey in West Virginia trapped, tagged, and obtained recoveries from a sample sufficient for population estimations. Biases, as usual, were present, which need better understanding; but the tag-recapture method offers an avenue for future research. I will refer to Bailey's paper again shortly.

Powell reports that all types of inventory techniques are used in Florida, including gobbling counts, hen-poult observations, and trapping success. Texas uses hen-poult counts on watersheds and finds dry-hen counts may be a good index to productivity. Aerial counts appear successful in some parts of the Rio Grande range.

Harvest information is recorded in Florida from mail survey data; Pennsylvania uses a car-tag method; Virginia and several other states require reporting of kills. Jantzen, in Arizona, uses hunter report cards for harvest information and obtains population inventory trend data from total birds observed annually on standardized routes.

Roberts, in Pennsylvania, has made efficient comparison of hunting on two very different types of ranges. He leads one to conclude that when the large-area range requirement is met, native turkeys can tolerate relatively heavy hunting pressure. In Pennsylvania's south-central and other marginal ranges, which have high hunter accessability, other remedial measures must be taken. The guiding principle for states initiating turkey restoration programs seems to be to provide sufficient hunter access to insure reasonable pressure without overharvest.

Mosby compared populations and harvest in gobbler hunting and any-bird hunting states. That this point did not evoke major discussion was a surprise, but perhaps the question arose too close to lunch. There was considerable unrecorded and unresolved discussion following the fine Pennsylvania Wild Turkey film during the evening.

RESTORATION ATTEMPTS

Mosby's status summary indicated that most states in the turkey range were working at restoration attempts. This was reflected in the length of time, discussion, and number of papers dealing with this phase of the program. Powell's Florida airplane release system looks practical for inaccessable range. This is the one new technique noted in that panel.

Preston, in Arkansas, reports failure of several hundred pen-raised releases made in the 40's, and since 1950 the State has been using wild-trapped stock. Arkansas provided pen-raised stock in 1957, and the Commission is investigating the success of both types of birds.

Sickels presented comparisons of release success from game farms with that from osceola, intermedia, and sylvestris wild stock. Hardy, Gilpin, and others presented crystal-clear evidence of the futility of playing with game-farm stock when restoration is the objective. Why some states continue, even for

the sake of experimentation, is almost beyond my comprehension. I can understand why this was done in the past when wild stock was not available. Today, however, as New Mexico, South Carolina, Alabama, and the Kentucky Woodland National Wildlife Refuge have demonstrated, real progress can be made less expensively and at far less risk with wild-trapped stock. Look again at Hardy's results. In the face of such evidence, attempts to determine why game-farm stock is unsuccessful should have little priority in Wild Turkey research. Starker Leopold seemed to have discovered the basic reasons in 1944, and Knoder's corroborative evidence should prove to be the death knell of using game-farm stock in a progressive turkey rebuilding program.

Oklahoma gave poaching as a problem, but results from transplanting of Rio Grande subspecies in some areas have been phenomenal. There were other comments, in Hardy's data and Glazener's remarks for instance, which suggest that some new populations of good wild stock follow Aldo Leopold's explosive population expansion curve, while others inch slowly upward toward establishment. There are a few parallels, such as in western Virginia, where established populations known to be of good stock, seem to stagnate or decline slowly despite range management activities tailored to entice increase.

RANGE MANAGEMENT

In 1948, Mosby felt there was little incentive and little opportunity for management of Wild Turkeys on industrial forest lands. Several of the large industrial forest operators have wildlife representatives at this meeting--a hopeful sign that there is a challenging opportunity to mix turkeys and wood products on these large forest holdings, à-la-Stoddard.

Shaw suggests some guidelines for turkey management which can be applied to eastern public forest lands. He believes that more habitat improvement can be obtained by working through and following a timber sale. I concur, especially if the wildlife manager can assist in the sale marking and in decisions regarding the sylvicultural prescription for the stand, and for the forest as a whole. Shaw might have pointed out, in his discussion of multiple use of national forest lands, that habitat needs of other wildlife must be integrated with that for turkeys. Discussion from a number of areas suggested competition with deer on some ranges, but the problem was not resolved.

Wentz and Hardy report on attempts to do these things on Kentucky's Cumberland National Forest. They indicate again a need for specific comprehensive wildlife management prescriptions which can be used at the Ranger District level to provide for maximum coordination of forest uses. Their experience so far is a shining example of progress through cooperation.

Florida attempts to raise carrying capacity on marginal range in management areas. The smallest area managed is 16,000 acres. This seems to be the minimum size generally recommended. Missouri thinks 15,000 acres are necessary, and that cover type should approximate 70 per cent timber and 30 per cent open land. Shaw suggests two per cent of the range in openings for eastern national forests, while Bailey questions whether any openings are needed for food production for eastern turkey management. DeArment's Texas slides pointed out some of the essentials of habitat requirements of the Rio Grande subspecies.

Jantzen, in Arizona, indicates that grazing demands in the Pinon-Juniper type covering some 750,000 acres already chained and bulldozed are important factors in management of Merriam's Turkey.

Lay indicated that Timber Stand Improvement programs in East Texas have been detrimental to this range through elimination of oak mast. Research is in progress on this problem. Buckles, of Union Bag-Camp, asks--without answer--which food plot plantings produce the most luxuriant insect crops?

POPULATION DYNAMICS AND BIOLOGY

In New Mexico, Lee says turkey populations on sanctuaries are subject to "cyclical" declines. In Ohio, Knoder tested Starker Leopold's theory of heritable wildness, and his findings supported Leopold's conclusions. Missouri reported that even a closed season since 1937 failed to make any appreciable difference in the overall population. Missouri also reported that dispersal can be kept at a minimum if several birds captured from the same flock are released together on new areas. Powell, in Florida, does not consider this necessary.

Davis, in Alabama, believes that predation during the nesting season is an obstacle to increase of turkeys. Lee, in New Mexico, and Jantzen, in Arizona, do not agree. Latham, in the literature, says predator control helped in North Georgia and on the King Ranch.

Bailey, in West Virginia, has made a substantial contribution to knowledge of population dynamics on the Wild Turkey. His trap-retrap, hunter kill, and movement data should serve as a model for similar studies on other ranges. Of particular significance is Bailey's inference that Allen's law of diminishing returns from hunting may make this type of harvest self regulatory in turkeys. As in other species, Bailey's data also suggest differences in vulnerability, some of which may be exceedingly subtle in operation, but of monumental mathematical importance in population dynamics. Bailey also has demonstrated, although the data are not as precise, that Wild Turkey productivity is extremely variable from year to year. Pinpointing causes and effects here would seem to be a profitable area for basic research.

Florida suggests low kill years are related to rainfall, no renesting occurring. Texas data of DeArment suggest that rainfall trends are closely related to productivity, and Arizona reports relations between productivity and minimum nesting season temperatures. One can only conclude that we do not yet have a basic understanding of turkey population dynamics, and especially of productivity. No serious discussion occurred about juvenile pre-hunting season mortality, although this was suggested by Glazener as a research need.

RESEARCHNEEDS

Bailey suggests two research needs.

1. A precise method of measuring productivity. This was re-echoed constantly throughout the meeting.

2, Evaluation of hen age as a factor in productivity to the hunting season.

Powell suggested that the ability to count turkeys is an outstanding research need in Florida. This is clearly a range-wide research need of high priority.

Discussion by Jantzen suggested the need for an economical, statistically appropriate harvest inventory method. Knoder asks for quantitative studies

of population and population dynamics. A fundamental question of population dynamics appears involved in the 'gobbler' vs any bird controversy. Davis' Alabama data infer greater 'gobbler' survival; Powell's Florida data the reverse. Here also is another fundamental problem--what customs and traditions are involved In 'gobbler' or 'any turkey' hunting. Colin in Alabama makes the point of a quality bird; Jantzen in Arizona notes that custom and tradition prevent a realistic harvest. Here is an area for practical research.

Perhaps suppression of poaching should not be called a research need; so many of the speakers mentioned the problem that I would be remiss not to suggest that this is an area needing improvement.

Jantzen suggests that in Arizona, varying productivity is related to April and May minimum temperatures. Surely, this is food for thought in reference to the Eastern race as well. Jantzen's research needs suggestions were impressive and basic. Effects of hunting and how to assure a more realistic harvest, means of maintaining Merriam turkeys in the face of grazing demands for the Pinon-Juniper type, effects of forest habitat manipulations on turkey populations and comprehensive evaluation of dynamics of a new population are clear-cut problems in need of solution.

We may well ask of the Wild Turkey, a species on which nest predation may be important, if this wild Galliforme also exhibits the underlying tendency for rates of summer gain to follow inverse ratios with numbers of winter and spring adults, which has been so well summarized by Errington for other species.

Is the Wild Turkey an intercompensating species? Do intercompensations operate "amid the immensities of wastage and the cheapness of life in crowded colonies" and do they reflect the "ease of living in underpopulated habitats" of Errington? Only clues, not answers, arose from this meeting. Here indeed is a challenging area for basic research.

Hankla, at the evening session, was provoked to ask why food patches and planted openings were needed. This is a practical and immediate research need, especially since Mosby shows that two-thirds of our total restoration capability now is expended in developmental work.

Dustman attempted to generate discussion regarding the influence of soil quality on range quality and turkey populations. This factor is so basic in other species that its omission as a major subject is not a small oversight.

Home range was not discussed; does this vary with the level of security as in quail?

Questions arose about feather moult of subspecies, which could easily be answered by some coordinated counting.

Problems in Wild Turkey management obviously parallel those we are struggling with in other species. Population dynamics of pheasants, quail, and perhaps mourning doves are somewhat better understood, but we have been grappling with them for decades. Perhaps we have learned that there is no short-cut to basic understanding, and can begin basic research on turkey population phenomena without the false starts that eroded our research capabilities on quail, doves, and deer. Because we are starting with newly created populations in so many areas, perhaps we can proceed with turkey restoration unfettered by the old wives' tales that caused the waste of so many unharvested deer.

RECOMMENDATIONS

We know where we stand now in turkey restoration. This conference reflects an abundance of interest in restoration attempts and methods, with less attention to basic research on range needs, population dynamics, and harvest and management in relation to future human populations. Once the initial restoration impetus is spent, one can foresee a change in emphasis leading to refinements in range management techniques, and to population dynamics, especially as related to the complex problem of productivity. Here are challenging problems for the dedicated turkey researcher, If we are to compete with human and economic factors for land space, these problems must be solved.

Clarence Cottam wrote, "We live in an age of research, and this is as basic to sound wildlife management as it is in the fields of agriculture, medicine, or industry. Research gives us daily assurance that our opportunities are limited only by our breadth of vision, powers of imagination, and by our will to work together." The proceedings of this, the first National Wild Turkey Symposium, leave the impression that the leaders in wild turkey restoration possess these essentials. You have the vision to seek means to provide adequate range for reasonable harvest, the imagination to develop techniques to supply the populations, and a willingness to work together toward a cherished goal.

Frankly, I think some means should be found to continue to exchange information and to assist in guiding each other is our respective areas. I believe that this group should reconvene again in two or three years, perhaps spending one day in the field. I am sure we Southeasterners plan to continue our turkey subcommittee so that needed research can be organized with as much cooperative precision as possible. Once our Southeastern Committee has digested the data presented at this meeting, I am sure it will have some definitive research proposals to offer.

Some of you may recall that The Wildlife Society had a Turkey Monograph Committee, which had a manuscript partially prepared in 1942. Some means should be found to bring this manuscript up-to-date for publication. In conclusion, I really enjoyed observing the concentration of energy applied to this one problem species. I hope that progress can be continued and that this group will initiate appropriate action in this direction. Thanks.

CLOSING REMARKS

DR. WATSON: I don't think there is much more to say, Leonard, after that able resume. Thank you very much for taking the responsibility of that somewhat difficult chore.

I think it has been a very worthwhile conference. Thanks to all of you who have come. Thanks to the turkey committee, the sessions chairmen and the panel leaders and those who gave papers.

I went over the registration slips rather hastily and came up with a few figures that might interest you. There were 26 states represented; ninety-one persons registered. I think there might be slightly more than a hundred people here. The group represented a number of agencies, both governmental and private,

I think we started something here that shouldn't be allowed to drop. I think it should be continued, but I don't think it can be done every year. I am in doubt of every two years. We all realize the difficulty in getting State Administrators to permit travel.

Those are all the remarks I have. I suggest, like the Arab, we fold up the tent and go home, and I hope you all get there safely and that we can all be together again sometime, somewhere.

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William M. Stiteler - U. S. Forest Service - Upper Darby, Pa.
Don H. Strode - Dept. of Fish & Wildlife - 813 Cline Street - Frankfort, Ky.
Edward G. Sullivan - Soil Conservation Service - Box 523 - Grenada, Miss.
Ferd Sumrell - U. S. Fish & Wildlife Service - Atlanta, Ga.
Harold Terrill - Missouri Conservation Commission - Rural Rt. #l - Ashland, MO.
William P. Thomas - U. S. Forest Service - Oak St, - Gainesville, Ga.
W. H. Turcotte - State Game & Fish Commission - Box 451 - Jackson, Miss.
Harold E. Warvel - Tennessee Game & Fish Commission - Nashville,, Tenn.
Robert E. Waters - Alabama Dept. of Cons. - Courthouse Annex - Decatur, Ala.
C. W. Watson - U. S. Fish & Wildlife Service - 1423 Clairmont Rd. - Decatur, Ga.
Burton S. Webster - U. S. Fish and Wildlife Service - Brooksville, Miss.
William W. Wentz - U. S. Forest Service - Cumberland National Forest - P.O. BOX 56 - Winchester, Ky.
Clifford T. Williams - La. Wildlife & Fisheries Comm. - Box 426 - Ferriday, La.
Lovett E. Williams, Jr. - A.P.I. - Wildlife Res. Unit - 111 Mitcham Ave. - Auburn, Ala.
T. E. Williams - Clarksdale, Miss.