

THE IMPACT OF THE CONSTRUCTION OF PONDS
AND RESERVOIRS ON WATERFOWL
HUNTING CHARACTERISTICS
IN NORTH CENTRAL
OKLAHOMA

By

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CHAPTER I

INTRODUCTION

Oklahoma's Changing Environment

White settlement of Oklahoma began in 1892 and was essentially complete by 1906. In the eighty-three years since then, whites have modified Oklahoma's landscape in a manner unequalled since the last ice age. Among other changes, Oklahomans have transformed the rolling prairie and woodland into millions of acres of farmland, and drowned the natural wetlands, seasonal streams, and rivers of the area under hundreds of thousands of acres of man-made lakes and ponds.

The changes in Oklahoma's surface water resources are among the most dramatic environmental changes brought about by mankind anywhere in the world. Oklahoma had no natural lakes, few wetlands, and its natural waterways were not well suited to support large waterfowl populations. But the massive alteration of the area's hydrologic landscape that began in the 1920's and early 1930's and continues today has truly changed the complexion of the aquatic habitats in the state. In 1984, it was estimated that there were nearly 800,000 acres of surface water in the major lakes and reservoirs of the state. In addition, there are

at least 4789 small lakes and over 200,000 farm ponds (Ok. Water Resources Board). Changes of this magnitude have a major impact on habitats and the animals that utilize them.

In his classic account of waterfowl and their habits, H. Albert Hochbaum (1955) noted that when man intentionally or unwittingly changed the environment in ways that favored particular animals or groups of animals, the animals themselves moved in very quickly to utilize the new habitat. The scientific literature on waterfowl ecology in the state demonstrates conclusively that changes in the surface water characteristics of the state have resulted in several complex changes in waterfowl behavior. It has been demonstrated that reservoirs associated with nearby grainfields slow migrations in geese and grainfeeding dabbling duck species such as mallards, widgeon, and pintail (Weibe, 1950; White and Malaher, 1964; Barclay, 1976). It has also been demonstrated that large, clear man-made ponds offer hitherto unavailable habitats that are heavily utilized by most types of dabbling and diving ducks during both the winter and spring migrations.

What is less well understood is how these changes in waterfowl behavior have affected the behavior of waterfowl hunters in the state. Prior to these major changes in Oklahoma's habitat, Oklahoma's hunters hunted ducks and geese. However, as the number of ponds and reservoirs increased, it is reasonable to expect that there was more hunting. But there are very few studies in Oklahoma or

elsewhere that have attempted to measure the regional impacts of environmental changes on waterfowl hunting or hunters in an area.

Existing Research

There is abundant research to show the specific relationship between habitat change and waterfowl populations in the state. Studies on this relationship include: Copelin (1962), Logan (1975), Barclay (1976), Domanski (1979), Heitmeyer (1980), and Slimak (1980).

Three studies have measured Oklahoma waterfowl hunter and hunting characteristics. Baumgartner (1942) identified hunting trends on Lake Carl Blackwell in North Central Oklahoma, finding that most hunting was conducted on weekends, that the number of hunters and hunting hours reached a peak that coincided with the peak migration periods of most waterfowl through the state in late October and early November, and that harvest rates for waterfowl were actually twice that reported due to crippling.

In 1964 Copelin, Craven, Gilliam, and Adcock used brief questionnaires to identify travel distances, harvest, crippling, and hunting techniques utilized by hunters visiting the Tishomingo Game Management area on Lake Texhoma in South Central Oklahoma. They found that most hunters came to that facility to hunt geese, that the majority of hunters traveled less than 50 miles to get to the unit, and that success was surprisingly low, between 1 in 4 and 1 in

11 hunters succeeded in killing a goose over the three year study period.

Burks (1965) also concentrated on the Tishomingo Game Management unit, obtaining more detailed data on waterfowl hunters' travel distances. He found that the average visitor to the unit spent nearly \$5.00 per visit in the communities around the unit, and that nearly \$20,000 a year was brought into Tishomingo as a result of waterfowl hunting near that community.

A single study (Gorham, 1975) more nearly addressed the question central to this study. Gorham measured the impact of the construction of a new reservoir on waterfowl populations, and how the new reservoir affected hunters and hunting. Using leg band returns, Duck Stamp sales data, mailed questionnaires, and personal interviews, he found that hunting pressure became more concentrated on new reservoirs, that hunters in his sample population averaged 15 hunting days per person per year, that they hunted most frequently on weekends, that they hunted mostly on ponds, and that 50 percent of all hunters using reservoirs used a boat. Hunters also indicated that hunting had improved, they had more places to hunt, and they hunted more often as a result of the construction of reservoirs in eastern Oklahoma.

Inherent Difficulties in Waterfowl

Hunting Research

The greatest difficulty facing any researcher investigating changes in waterfowl hunters and or waterfowl hunting behavior in Oklahoma is an almost complete lack of suitable data. Some researchers have skirted this problem by creating their own data sets from on-site questionnaires, mailed questionnaires, or interviews. Another difficulty faced by researchers involves the size and variation of Oklahoma's geographical area. No researcher has attempted to generalize from his or her small study area to the state as a whole, partly because the state is so varied geographically, but more importantly because the huge size of the state itself precludes the detailed investigation of anything but a small portion of the state. Because of this, the published research has been conducted around a single lake, a series of lakes, or a wildlife refuge.

The limited geographic scale of these studies results in yet another difficulty experienced by researchers in this field. Because their samples were all centered around a particular surface water resource, their samples included only those hunters who utilized that particular resource. The limited groups of hunters in these studies are not representative of the state as a whole nor do they necessarily represent hunters in a particular region. Admittedly, it would be prohibitively expensive and difficult to develop a

state-wide study that would accurately reflect the changing behavior of Oklahoma's 35,000 waterfowl hunters.

Existing studies have only a very limited utility to measure past changes. None of the investigators attempted to assess past behaviors, but they can provide a limited picture of conditions in a particular area at a particular time. Therefore they can be used for comparison purposes.

Objectives

The objective of this study is to determine the nature of the impact, if any, of the construction of farm ponds and reservoirs on waterfowl hunting in North-Central Oklahoma by identifying and defining the historical waterfowl hunting practices that existed in this area. Using interviews with a panel of experienced hunters, this study will try to identify past and present characteristics of hunting methodologies, prey preferences, success perceptions, and characteristics of the hunting trip, including travel distances, frequency, and destination. The nature and perceptions of past and present hunting opportunities (i.e. places to hunt) will also be ascertained.

Rationale

One of the principle traditions in the field of geography involves the study of man's response to and modification of the natural environment. This study involves both elements of this tradition and has as its intellectual

antecedents work by Carl Sauer, Phillip Wagner, and Marvin Mikesell.

It is believed that this study extends knowledge of man's interaction with the natural environment. It examines how one aspect of culture can be modified by a change in the environment.

And Oklahoma offers a unique opportunity to do so because of its particular historical circumstance. Although Oklahoma lies in the geographical center of the United States, it was uninhabited by white Americans, and largely unchanged, until the beginning of this century. Because all of the whites that settled in Oklahoma were immigrants, any waterfowl hunting traditions that may have diffused into the state with these settlers have had less than 100 years to change and develop. Many hunters can be found who have hunted over a large part of this period. The presence of these hunters offers a unique opportunity to observe how the culture traits associated with waterfowl hunting were modified to adopt to changing environmental conditions.

CHAPTER II

RESEARCH QUESTIONS, METHODOLOGY,
AND STUDY AREAS

Research Questions

The primary objective of this study is to determine if there has been any impact on waterfowl hunting and hunters as a result of the construction of ponds and reservoirs in Oklahoma. The research questions are as follows:

1. Has construction influenced the number and type of waterfowl that the individual hunter is able to harvest in the state?
2. Has the construction of ponds and reservoirs in Oklahoma influenced the hunting techniques used by hunters in the state?
3. Has the construction of ponds and reservoirs in Oklahoma had an impact on how far Oklahoma hunters are willing to travel to hunt and on how far they actually travel to hunt?
4. Does the construction of ponds and reservoirs in a given area influence the number of hunters active in that area?

Methodology

The in-depth investigation of whether waterfowl hunting traditions have changed in the state was approached in two ways. The first approach included a search of literature on waterfowl hunting and waterfowl hunters. Although literally hundreds of scientific and popular articles and papers exist on waterfowl and waterfowl hunting, most deal simply with waterfowl ecology or with locations and techniques that are alien to conditions in Oklahoma. The four studies that are of value to this particular study were reviewed in Chapter 1. The second approach was based on selecting two study areas, identifying and interviewing each member of a suitable panel of older, active hunters in each study area, and using a questionnaire as an outline to make sure that all interviews were as similar as possible.

Panel design surveys are commonly used for establishing causation. They are utilized to obtain large amounts of detailed information from small groups of knowledgeable or experienced persons and are usually not representative of the general population because of their limited size. Although most panel studies involve multiple observations obtained over long periods of time to accurately reflect change (i.e. longitudinal studies), a single observation taken at a given point in time can elicit valid information on change if questions eliciting past behaviors or views are used in addition to questions defining present behaviors (Kessler, 1981).

The interview technique was selected for several reasons. Although more expensive than handout questionnaires, mailed questionnaires, or delayed mail questionnaires, the personal interview is generally accepted as the most accurate measure of response patterns. Data derived from personal interviews are more complete and more accurate because non-response is not a problem (Hunter, 1949; Shafer and Hamilton, 1967) and the investigator can select knowledgeable subjects. More importantly however, personal interviews provide flexibility for the interviewer to probe for the feelings and beliefs behind a single report or opinion. "To understand culture change and culture history one has to look at the individual, for the individual can reveal the propelling force that moves him or her or others" (Hoopes, 1979).

Because this investigation examined an eighty year segment of history, the target group for the personal interviews was defined as those persons who have intimate or personal knowledge of hunting techniques, patterns, and habits of the region over a significant portion of this period. On the basis of these criteria, the study group that was targeted included three age categories. The first age category included those persons who had lived and hunted in a study area for over forty years and served as a control group to which members of the other two groups were compared. The second group included persons who had lived and hunted in a study area between 21 and 40 years and the

third group was represented by persons who had lived and hunted in a study area between one and twenty years.

The target groups were stratified in this manner for a number of reasons. First, the inclusion of younger hunters provided a control to ascertain whether older hunters had changed the hunting habits that they acquired in their youth as a result of any social or environmental changes. Second, if all members of the target group were of a single age group, be it old, middle-aged, or young, the responses would be skewed and would not be representative of the active hunting population as a whole. Finally, the use of three different age groups facilitated the process of comparing and identifying changes in the hunting traditions.

Initially, potential subjects were identified through discussions and queries directed through the officers of local chapters of Ducks Unlimited, a waterfowl hunting/conservation organization. These informants were able to provide information about individuals, both members and nonmembers, who were highly active, knowledgeable hunters that might be interested in participating in this study. This round of inquiry produced about twenty-five potential subjects. As the first round of interviews began, the criteria for the study were explained as part of the interview process and each of the subject was asked to provide the names of any other individuals that they felt would be suitable for this study. These additional informants were then contacted, added to the list of probable interviews or

discarded if the investigator deemed that they were not suitable. Potential subjects were discarded if they were only infrequent waterfowl hunters, if they only hunted waterfowl out of state, if their waterfowl hunting had been conducted entirely in another state before their moving here, or if they had declined to participate. The main criteria for selection was that the hunter be active and knowledgeable. During the entire selection and interview process, only three persons declined the opportunity to participate or provide corroborative information.

Thirty hunters were eventually identified and interviewed in each of the two study area. The first study area, Payne county, was selected because the first reservoir in the state was constructed there in 1939 and a study on the hunting patterns of that area was made at that time (Baumgartner, 1942). Alfalfa county was the second study area selected, mainly because of the presence of Great Salt Plains National Wildlife Refuge and the existence in that area of an historical hunting tradition.

In Payne county, each age group comprised one-third of the thirty subjects. In Alfalfa county it was more difficult to locate suitable subjects so residents of Garfield and Grant counties were included if they hunted in the Alfalfa county area (Figure 1).

The questionnaire used during the personal interview was a thirty-six question instrument composed of 25 forced response questions generating categorical or ranked cate-

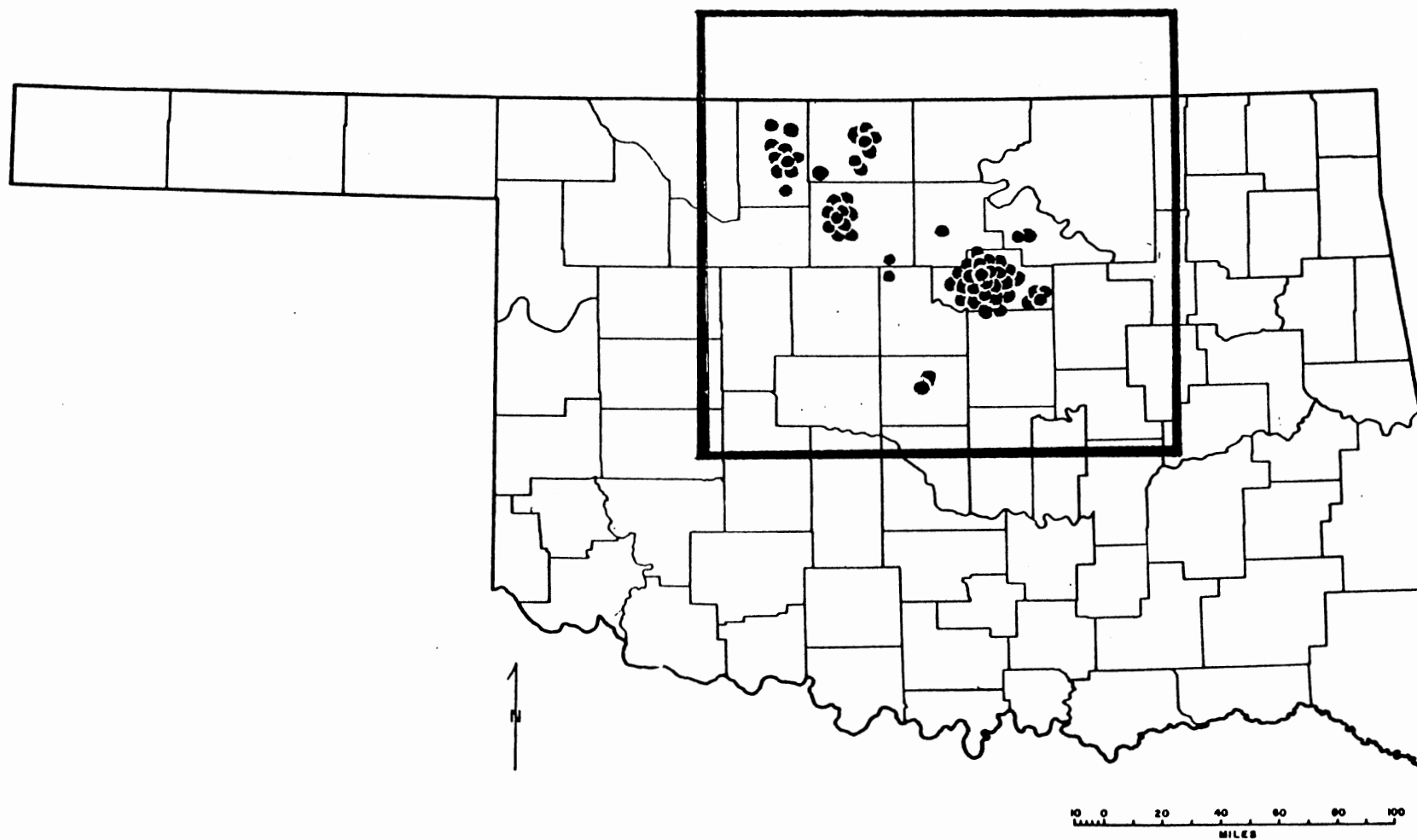


Figure 1. Distribution of Contributing Hunters, Scientists,
and Landowners in North Central Oklahoma

gorical data, eight questions that involved checking off components from a list, and four open-ended questions (Appendix B). A final version, used in the field after three trial interviews were completed, evolved from the earlier longer, more cumbersome version.

Four of the questions in the survey were included to test the viability of using United States Fish and Wildlife Service Migratory Hunting Stamp (Duckstamp) purchase data as an indicator of the magnitude of hunting pressure in a given area and as a rough estimate of the number of active hunters in a given area. The data on duckstamp purchases are available on an annual basis since 1961 and are organized by county for the 50 states. These four questions have been designed to determine: 1) whether hunters purchase duckstamps in their home county or hometown or whether duckstamps are purchased at locations near their hunting locations if these locations fall outside their home counties and 2) whether the number of purchases is an accurate representation of the actual number of individuals who hunt waterfowl in the state during a given season.

The Study Areas

Payne and Alfalfa counties are both located in north-central Oklahoma. Payne county lies approximately fifty miles north-northeast of Oklahoma City, the geographical center of the state. Alfalfa county lies approximately eighty miles north-northwest of Oklahoma City along the

Kansas-Oklahoma border, and approximately seventy miles northwest of Payne county. Both counties lie within the Arkansas River watershed.

The western two-thirds of Payne county lie in the Reddish Prairie or Central Red Bed Plains physiographic region, while the eastern one-third lie in the Cuesta Plains. Parts of Alfalfa county also lie in the Central Red Bed Plains and both counties share similar topographies and soil types (Figure 2). Sections of the two study areas also contain related vegetational communities. The northern sections of Payne county and all of Alfalfa county lie in the Cross Timbers vegetational area (Figure 3).

Climatically, the two areas are nearly identical. Both lie in the part of the state where potential evapotranspiration exceeds or equals average precipitation and both, therefore, are susceptible to drought and other climatic extremes of the region. Average seasonal temperatures are only one to two degrees different, but Payne county receives four to ten more inches of rainfall per year.

The differences in precipitation and available moisture between the two areas become readily apparent when examining the surface water resources of the two areas. A simple comparison of maps of both counties in 1900 illustrates that Payne county has much more available surface water (Figures 4 and 5).

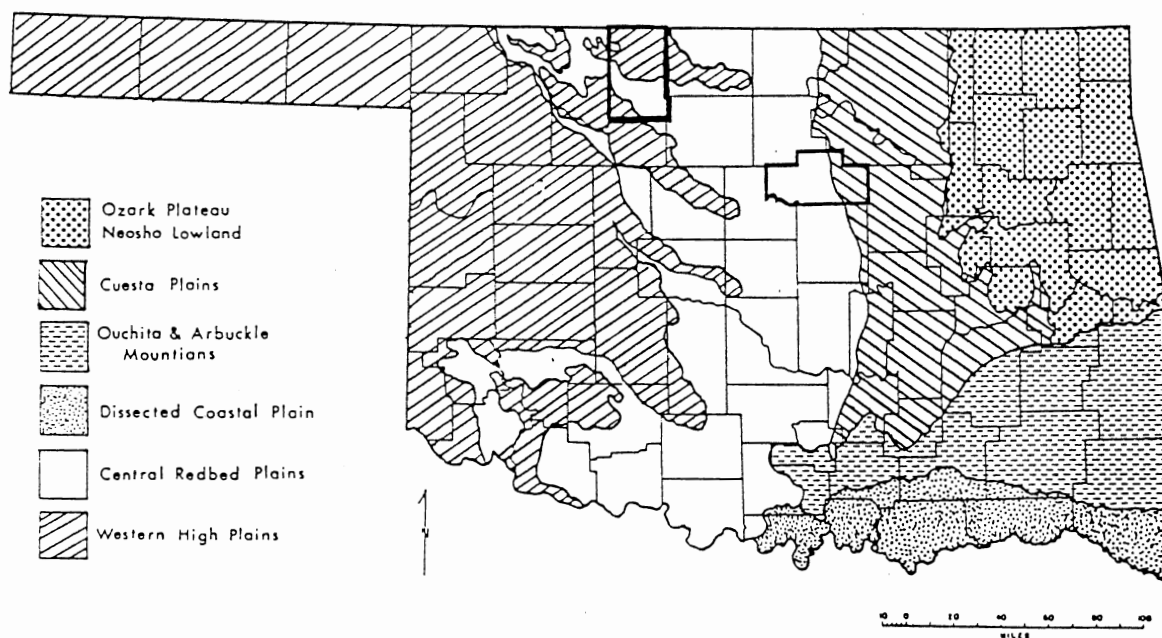


Figure 2. Physiographic Provinces of Oklahoma

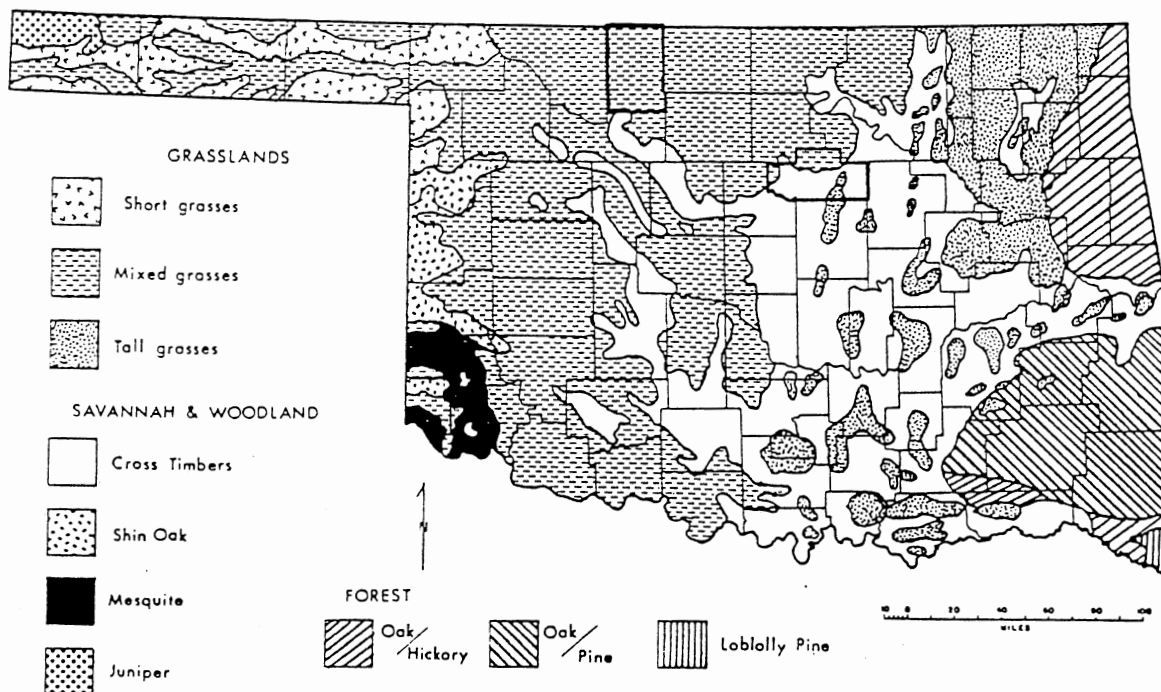


Figure 3. Natural Vegetation Types in Oklahoma

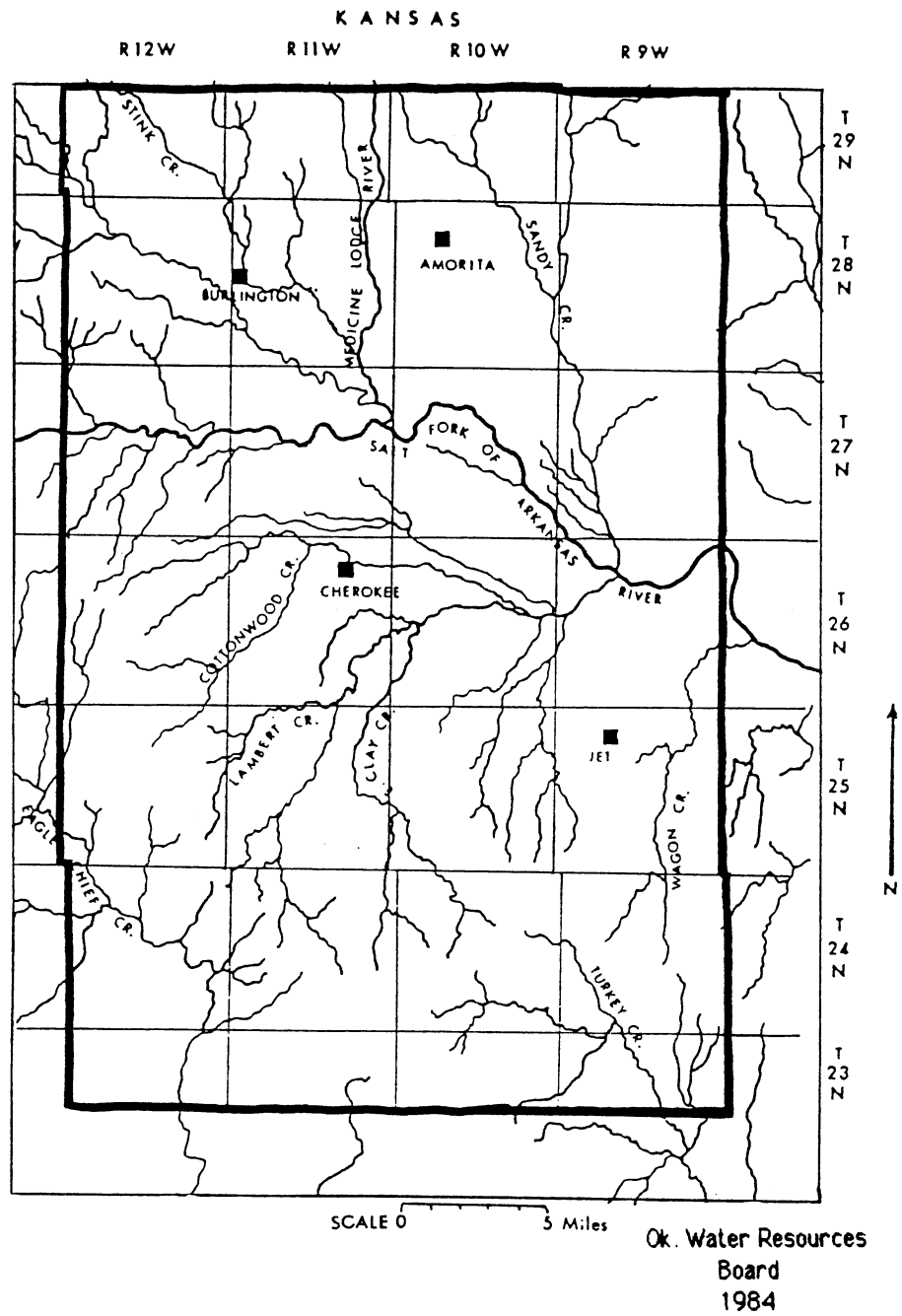


Figure 4. Alfalfa County, 1900

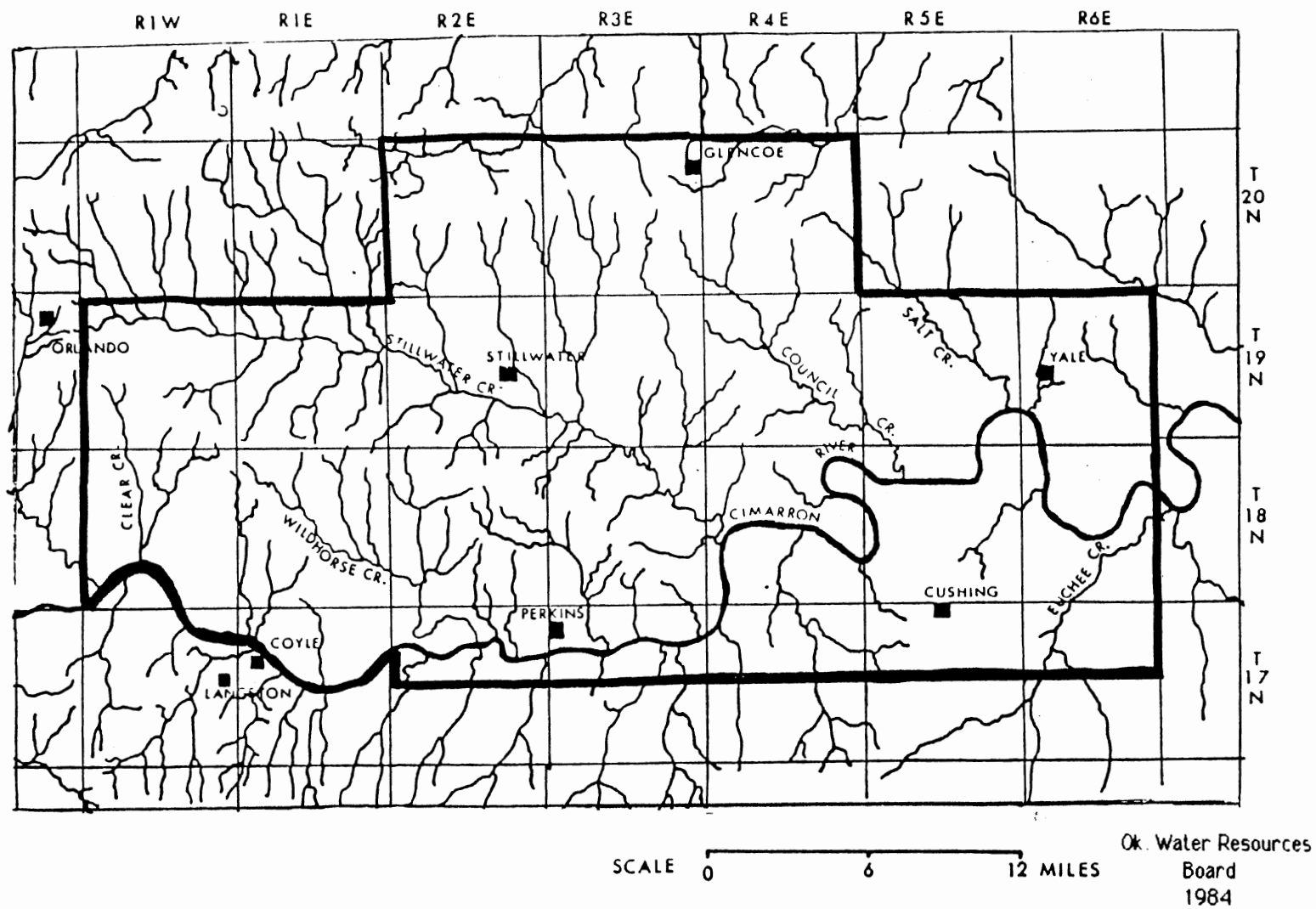


Figure 5. Payne County, 1900

But since 1930, both areas have had their surface water resources altered by man. Payne county has seen the construction of several large reservoirs, at least 50 smaller lakes, and over 1500 small ponds (Figure 6). Alfalfa county, on the other hand, has not experienced this change in the same magnitude as has Payne county. Only one reservoir, Great Salt Plains Lake, has been constructed within the county and there have been several hundred ponds and small lakes built in the county (Figure 7). Presently all of the major reservoirs in both counties are approaching fifty years of age. Silt deposition has influenced depth, available aquatic vegetation, turbidity, and water quality in all of these lakes.

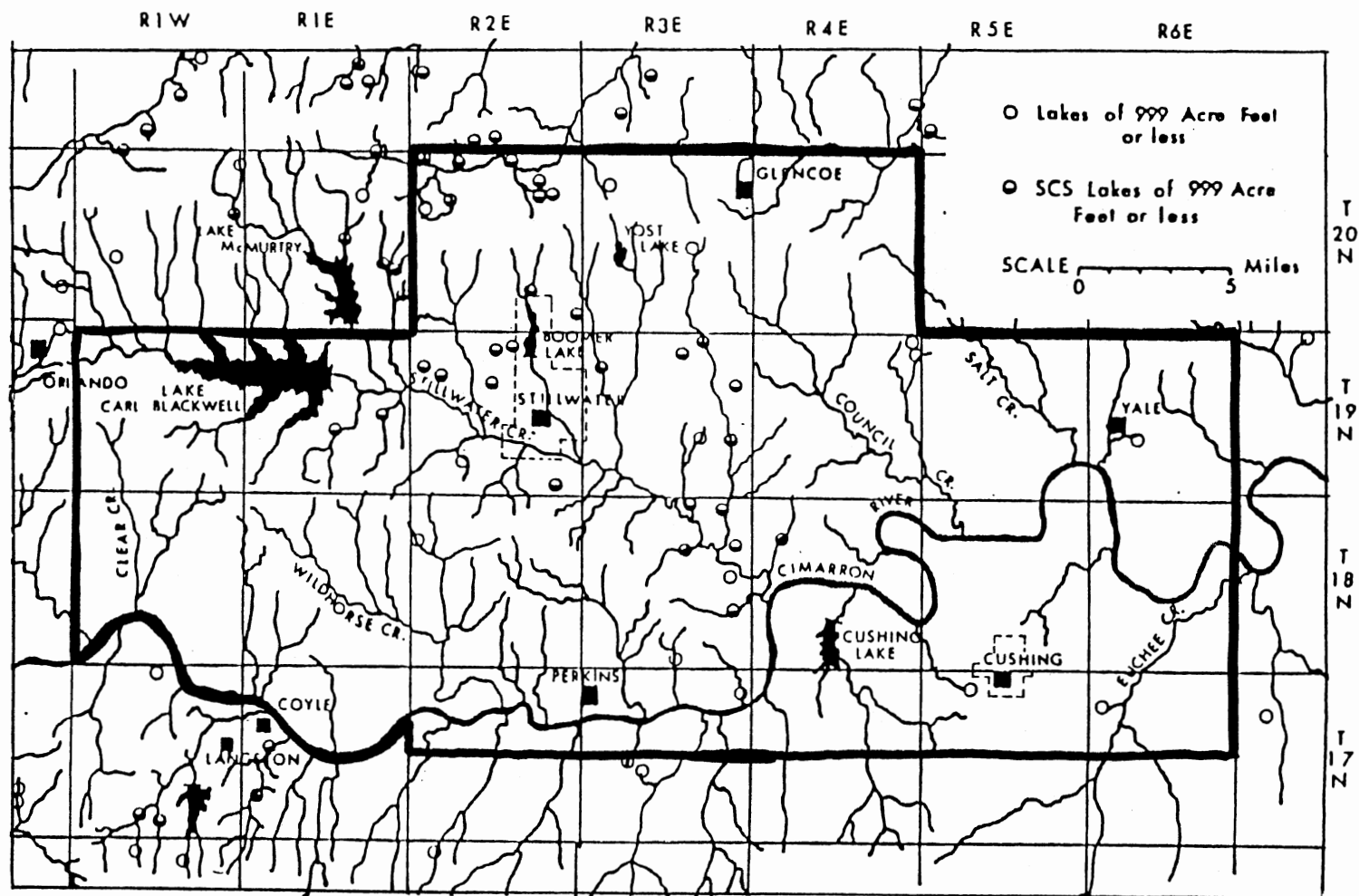


Figure 6. Payne County, 1987

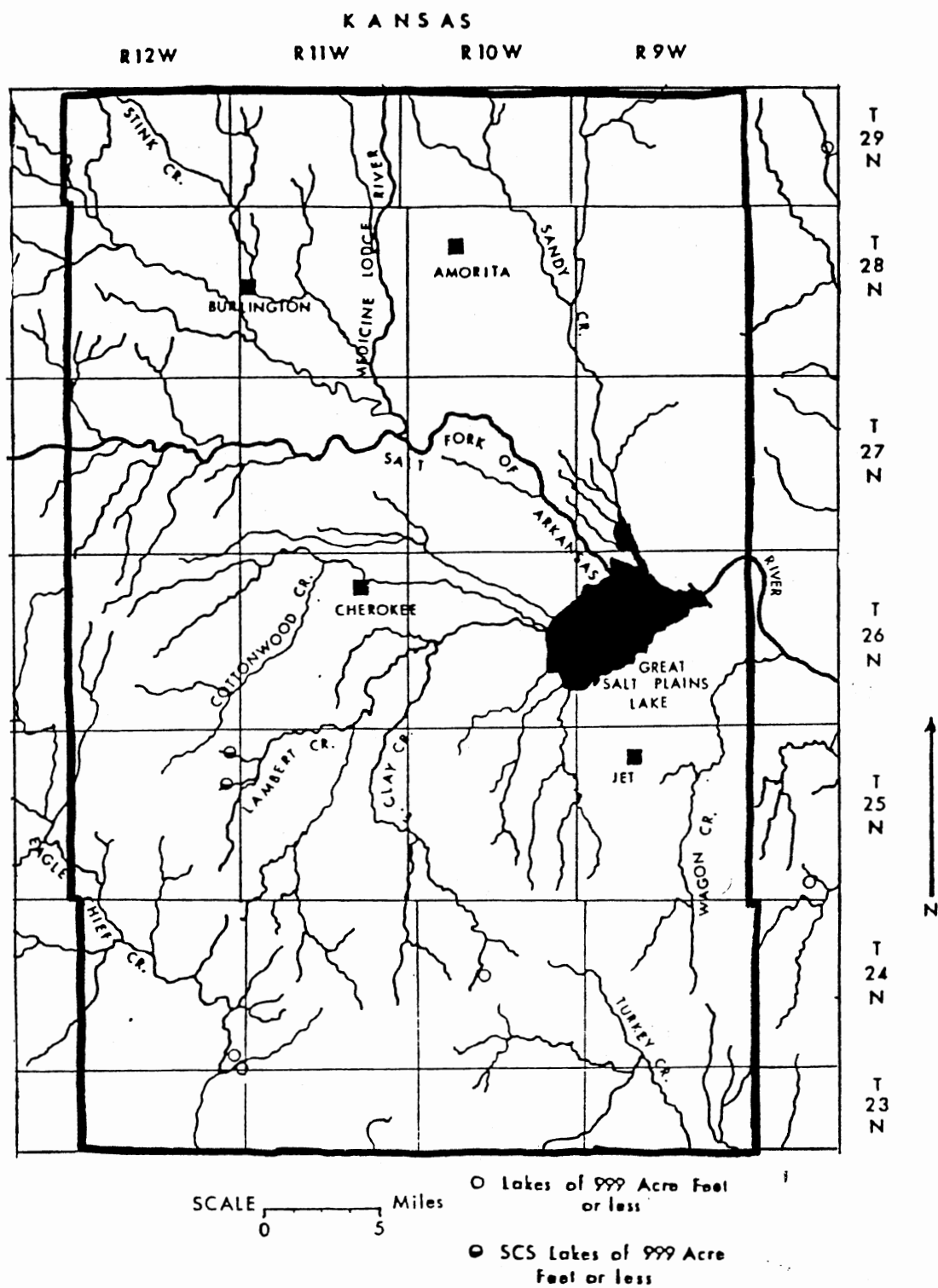


Figure 7. Alfalfa County, 1984

CHAPTER III

FINDINGS

Introduction

This chapter reports the findings from the research as they relate to the research questions described in Chapter 2. In general, the results of the analysis of responses from the panel interviews indicate that the construction of ponds and reservoirs in Oklahoma has had some impact on the characteristics of the waterfowl resources of Oklahoma as well as on some of the traditions and characteristics of waterfowl hunting and waterfowl hunters. They indicate, among other things, that younger, urban hunters are more likely to use dogs, that hunters who utilize boats are almost overwhelmingly urban, that urban hunters are more likely to travel than are rural hunters, and that goose hunters are more likely to travel than duck hunters. The hunters also indicate that they believe that the construction of ponds and reservoirs has provided more successful places to hunt and that goose hunting has gotten better as a result of these new resources.

The panel was composed of twenty four hunters aged 65 years or more, eleven hunters who were between 51 and 65 years of age, nineteen hunters aged 36 to 50, and six

hunters aged 20 to 35. Fifty eight members of the panel were men, two were women. Almost 70 percent were either self-employed or retired and 60 percent of the panel lived in large towns or cities (urban). Most Payne county hunters (90%) were urban while 51 percent of hunters utilizing Alfalfa county were urban hunters from Enid, Oklahoma. Table I provides information on waterfowl hunting experience and county most frequently hunted.

Hunting Methodology

It was expected that one of the effects of the construction of ponds and reservoirs and resultant changes in waterfowl resources, would be a change in the hunting practices of duck and goose hunters. It was expected that there would be fewer present-day duck and goose hunters using river and stream habitats because of the greater availability of pond and lake habitats. In fact, the data neither support nor refute this expectation. Decreases in the use of rivers and streams were reported, especially among goose hunters, but there are enough increases in the utilization of other habitats that there is no definite answer to the general question.

Nevertheless, there was a 21.7 percent drop in the number of duck hunters utilizing "pond jumping" as a hunting method. Most informants who made such a switch explained that their earliest waterfowl hunting experiences involved "pond jumping," or sneaking up on waterfowl, but

TABLE I
 WATERFOWL HUNTING EXPERIENCE AND COUNTY
 HUNTED MOST FREQUENTLY BY THE SIXTY
 HUNTER PANEL

Waterfowl Hunting Experience	Percent of Panel
Over 40 Years	43.3
31 - 40 Years	16.7
21 - 30 Years	23.3
15 - 20 Years	8.3
10 - 14 Years	6.7
Less than 10 Years	<u>1.6</u>
N=60	100%

County Most Frequently Hunted by the 60 Hunter Panel	Percent of Panel
Payne	45.0
Alfalfa	31.7
Grant	15.0
Garfield	3.3
Noble	3.3
Pawnee	<u>1.7</u>
N=60	100%

that as their level of hunting involvement and knowledge of waterfowl behavior increased, pond jumping was abandoned by some in favor of using boats and blinds (Table II).

One methodology that showed much greater popularity was the use of a dog in certain wetland habitats. The use of dogs with blinds increased on ponds, lakes and reservoirs, and rivers. The use of dogs also correlated significantly with age, indicating that the younger the hunter, the more likely he is to use a dog. Still another interesting relationship involving the use of dogs indicates that 75 percent of the hunters using dogs lived in urban areas. One might characterize the average hunter who utilizes a dog as a young, urban dweller.

The use of boat blinds (boats constructed and camouflaged specifically for waterfowl hunting) on lakes or reservoirs showed a 15 percent increase. Only eleven hunters reported using boat blinds either in the past or present and of these eleven, ten use them presently. All eleven of these hunters were classified as urban. Again, because urban hunters are forced to use public hunting land, and because much of the land associated with waterfowl hunting is located on reservoirs or lakes, the use of a boat is a necessity if one is to have access to more than just a few hunting locations.

There have been fewer changes in goose hunting methodology than there were in duck hunting methodology. The magnitude of those changes are also much smaller. Perhaps

TABLE II
PERCENT OF DUCK AND GOOSE HUNTERS
UTILIZING HUNTING METHODOLOGIES
IN THE PAST AND PRESENT

	Percent of all Duck Hunters N=56		Percent of all Goose Hunters N=48	
<u>Methodology</u>	<u>Past</u>	<u>Present</u>	<u>Past</u>	<u>Present</u>
Blind, w/call, decoys, pond	53.3	53.3	10.0	6.7
Blind, w/call, decoys, dog, pond	20.0	28.3	5.0	5.0
Blind, w/call, decoys, lake or reservoir	53.3	48.3	13.3	15.0
Blind, w/call, decoys, dog, lake or reservoir	18.3	26.7	6.7	6.7
Blind, w/call, decoys, river, stream	50.0	46.7	21.7	15.0
Pond Jumping	85.0	63.3	5.0	1.7
Pit blind on water	6.7	6.7	0.0	3.3
Agricultural land	41.7	40.0	70.0	70.0
Walking river/stream	31.7	25.0	5.0	1.7
Floating river/stream	5.0	5.0	0.0	0.0
Boat blind river/ stream	6.7	8.3	0.0	0.0
Boat blind lake/ reservoir	1.7	16.7	3.3	5.0
Guide	10.0	3.3	1.7	1.7

the most interesting aspect of the data is the fact that fully 70 percent of goose hunters hunt on agricultural land. The increases in dog use in duck hunting methodologies do not show up in goose hunting methodologies.

Two questions were included to measure any changes or differences in the type or quantity of items carried by duck and goose hunters. While there were some differences between goose hunters and duck hunters in the type and number of items utilized on an average hunting trip, there were no changes in the types of baggage utilized over time (Table III). The clear implication is that the construction of ponds and reservoirs has not led to the addition to or discontinuation of equipment utilized by hunters on a given hunting trip.

Another aspect of hunting methodology is the number of days an individual hunter actively pursues his quarry. The panel was composed of persons who were, for the most part, very active hunters. The author expected that with more wetlands and water surface (more opportunity), all hunters, but particularly the hunters in this survey, would hunt more frequently. The data indicate something else, however. Hunters hunt geese less frequently, but individuals seem to hunt somewhat more frequently now than before (Table IV). Most duck hunters hunted in excess of 18 days (or parts of days) but overall, duck hunting frequency has fallen drastically. Duck hunters usually cited the large

TABLE III
 PERCENTAGE OF HUNTER UTILIZING
 EACH TYPE OF ITEM

<u>Item</u>	Percentage of Total Duck Hunters N=54	Percentage of Total Goose Hunters N=48
Decoys	78.3	73.3
Dog	43.3	21.7
Call	73.3	70.0
Boat	46.7	16.7
Liquor	8.3	3.3
Other Beverage	68.3	56.7
Food	61.7	38.3
Chair	25.0	13.3
Portable Blind	16.7	11.7
Wading/Flotation	50.0	15.0
Guide	6.7	6.7
Misc.	25.0	0.0

TABLE IV
DAYS SPENT DUCK AND GOOSE HUNTING
PAST AND PRESENT, AND CHANGES
IN HUNTING DAYS

<u># of Hunting Days</u>	<u>Days Spent Duck Hunting</u>		<u>Days Spent Goose Hunting</u>	
	<u>Past %</u>	<u>Present %</u>	<u>Past %</u>	<u>Present %</u>
1 - 5	5.1	6.8	23.7	22.0
6 - 12	20.3	11.9	23.7	16.9
13 - 18	8.5	16.9	8.5	8.5
>18	61.0	45.8	23.7	28.8
Never	6.8	18.6	20.3	23.7

N=60

N=60

Change in #
of Days From
Past to Present

Duck HuntingGoose Hunting

Decrease	36.6%	26.0%
No Change	46.0%	51.0%
Increase	16.0%	21.0%

decline in the duck population as the primary cause of the decrease in duck hunting activity.

Contrary to expectation, there appears to be no relationship between hunting frequency and hunter perception of the impact of the construction of ponds and reservoirs, what these hunters take on a hunting trip, or methodology. Statistical tests on all these topics showed no significant relationships.

In conclusion, none of the survey results indicated that the construction of ponds and reservoirs had greatly influenced hunting techniques and methodology. Even though there is evidence of change in certain areas, we must conclude that hunting activity and methodology among the panel hunters was not greatly stimulated by the changes in waterfowl habitat.

Travel Characteristics

It was anticipated that, in response to the greater availability of hunter opportunities from the construction of ponds and reservoirs, hunters would travel less to hunt ducks or geese. It was also expected that urban hunters would have to travel farther than rural hunters in both the past and the present because urban hunters have to travel to reach any hunting location and because access to local hunting sites in both study areas had been restricted for a number of years.

The propensity of hunters to hunt exclusively in their home counties has not changed much over the survey period. Approximately 93 percent of hunters in both the past and present hunted exclusively or mostly in their home counties. But it is also true that between 55 and 59 percent of hunters travelled more than 30 miles to hunt at least occasionally (Table V). This seems to indicate that there are more people willing to travel to hunt than people not willing to travel. But because there is virtually no difference between the number of people traveling in the past and in the present, there appears to be no relationship between construction and the number of people traveling or not traveling. Statistical tests also indicate that there was no correlation between increased opportunity and increases or declines in the number of persons traveling.

Perhaps the most accurate assessment of how travel behavior has changed can be made by examining the respondents who actually changed their behavior over the period of the study. 40 percent of the hunters indicated that their travel behavior had changed (N=24). Of these, 66 percent indicated that they traveled farther while 34 percent indicated that they traveled shorter distances. Most of these indicated that the reason they traveled less was due to increases in age; they felt that they were getting too old to take longer, more complex trips. Fifteen percent (n=9) of the sample who had not traveled before con-

TABLE V
 PERCENTAGE OF HUNTERS HUNTING
 THEIR HOME COUNTY IN THE PAST
 AND PRESENT AND CHANGES IN
 TRAVEL BEHAVIOR

	Percentage of Panel Who Traveled in The Past	Percentage of Panel Who Traveled in The Present
Always Hunt Home County	45.1	41.7
Mostly Hunt Home County	48.3	50.0
Rarely or Never Hunt Home County	6.6	8.3

N=60

Travel Changes

No Changes in Distance	21.0%
Increase in Distance	26.0%
Decrease in Distance	13.0%

N=60

struction indicated that they had started traveling to new hunting locations after reservoirs and ponds were constructed outside their home counties, but 10 percent ($n=6$) of the sample who had traveled indicated that they had ceased traveling after ponds and reservoirs were constructed. There was no discernible influence exerted on travel changes by origin. Rural and/or urban origin were not statistically correlated with travel changes.

But when one looks at rural and urban origin and travel distances, there are meaningful results. It was found that urban hunters travel farther than rural hunters. However, as a group there have been no changes in the overall hunting travel distances (Table VI).

Yet another research question involving travel was selection of habitat. It was anticipated that as a result of new impoundments, hunters would shift from river/stream habitats to pond/reservoir habitats as preferred hunting destinations. In fact, it appears that reservoirs and agricultural land were most often selected by hunters in both the past and the present. This may be deceiving, however, as other habitats are utilized almost as heavily as agricultural land and reservoirs (Table VII). If this information is valid it too is not particularly surprising. Traveling hunters have problems obtaining access to privately owned land away from their local areas and most public hunting lands are associated with reservoirs or lakes and therefore are more heavily utilized by traveling

TABLE VI
PERCENTAGE OF HUNTERS BY
DISTANCE TRAVELED AND RURAL
OR URBAN CLASSIFICATION

	Percentage of Hunters Traveling, One-way, Presently		Percentage of Hunters Traveling One-way, Past	
	<u>Rural Hunters</u>	<u>Urban Hunters</u>	<u>Rural Hunters</u>	<u>Urban Hunters</u>
More than 150 Miles	0.0	10.0	1.6	6.6
101 - 150 Miles	0.0	8.3	3.3	6.6
76 - 100 Miles	1.6	5.0	0.0	8.3
51 - 75 Miles	0.0	6.6	0.0	3.3
31 - 50 Miles	10.0	1.6	5.0	15.0
Traveled Less Than 30 Miles or Did not Hunt	<u>30.00</u>	<u>10.0</u>	<u>33.4</u>	<u>16.7</u>
	N=25,41.6%	N=34,56.5%	N=26,43.4%	N=34,56.5%

TABLE VII
HABITAT SELECTION OF TRAVELING HUNTERS
IN THE PAST AND PRESENT

Habitat Selection		
Percentage of Total Panel Traveling to Each type of Habitat		
	<u>In The Past</u>	<u>In The Present</u>
Travel to Ponds	21.7	26.7
Travel to Reservoirs	31.7	40.0
Travel to Rivers and Streams	28.3	36.7
Travel to Natural Wetlands or Marshes	25.0	30.0
Travel to Agricultural Land	40.0	40.0

hunters. And because many of the traveling hunters are goose hunters, agricultural lands where geese feed are the preferred destinations for most goose hunters. Statistical tests also indicated no relationships between travel and habitat selection.

Of the hunters traveling to reservoirs, 91 percent were urban (n=22), and 79 percent used boats (n=19). Sixty-nine percent of boat users on reservoirs used them exclusively for duck hunting.

An unpublished study on waterfowl hunters in Oklahoma also indicates that participants in that study hunted most frequently in their home counties (Ok. Dept. of Fish and Game, 1961). 60.10 percent of goose hunters (n=689) stated that they hunted most frequently in their home counties. But 19.4 percent of duck hunters usually hunted outside of their home counties while 39.9 percent of goose hunters did so.

When further subdivided into rural and urban categories, it appeared that a higher percentage of urban duck and goose hunters travel than do rural duck and goose hunters, that goose hunters travel more than duck hunters and finally, that urban goose hunters travel much more extensively than any other group. Fully 55.8 percent of all urban goose hunters have to travel to hunt their most frequently hunted location. This compares to 9.0 percent of rural duck hunters, 30.0 percent of urban duck hunters, and 19.25 percent of rural goose hunters. These results

correspond to those obtained from the 60-person panel used in this study. Although this survey was not divided into duck and goose hunting groups, urban hunters traveled farther than rural hunters and roughly 90 percent of the survey group said that they hunted most frequently in their home counties.

Yet another interesting statistic indicates that almost 21 percent of goose hunters travel farther than seventy-five miles to go goose hunting. This is deceiving, for with the exception of the Garfield county hunters, all goose hunters from the major metropolitan areas in Oklahoma have to travel between 75 and 175 miles to reach any of the four leading goose hunting regions that have public access.

But what of the supposition that construction would decrease the distances that hunters would be willing to travel? The statistical evidence does support the hypothesis that urban hunters did in the past, and do now, undertake longer hunter trips than do rural hunters.

Perceptions of Waterfowl Hunting

The last hypothesis of this study centered on the direct affects of the construction of ponds and reservoirs on duck and goose hunting. Hunters were asked if the construction of ponds and reservoirs had affected their hunting. Clear majorities of both duck and goose hunters indicate that construction had caused changes in their hunting, but they are divided as to whether these changes had been

positive or negative (Table VIII). Among duck hunters, Alfalfa and Grant county hunters show a decided perception that duck hunting has gotten worse as a result of construction. A number of hunters commented that birds became more and more dispersed as new ponds and reservoirs provided additional habitat. Payne county hunters, on the other hand, are evenly divided on the impact of construction on their hunting.

Among goose hunters, Payne county hunters overwhelmingly feel that the construction of ponds and reservoirs has made goose hunting better. Alfalfa county hunters overwhelmingly feel the opposite.

There appears to be no relationships between feelings that duck or goose hunting is better or worse as a result of construction and the number of days hunters spent hunting, hunting frequency since construction, hunting methodology selected, or the age of the hunter.

Another aspect of hunter perception involved the panel responding to a question on whether or not the construction of ponds and reservoirs had provided more or fewer successful locations to hunt. A majority of the sampled hunters reported that construction had provided more successful places to hunt. Rural or urban status had no statistical impact on the answers chosen (Table IX). Interestingly enough, although respondents feel that there are more successful locations to hunt, they do not hunt more frequently as a result of the increased locations (Table IX).

TABLE VIII
HUNTER PERCEPTIONS ON THE IMPACT OF THE
CONSTRUCTION OF PONDS AND RESERVOIRS
ON DUCK AND GOOSE HUNTING SUCCESS

	Perceptions of Duck Hunting	Perceptions of Goose Hunting
Better	34.5	47.4
About the Same	25.9	22.8
Worse	39.7	29.8
No Answer	<u>1.1</u>	<u>2.1</u>
N=60	100%	100%

TABLE IX
THE IMPACT OF THE CONSTRUCTION OF PONDS AND
RESERVOIRS ON THE NUMBER OF SUCCESSFUL
HUNTING LOCATIONS AND HUNTING
FREQUENCY

	Construction Provides More/Fewer Successful Places to Hunt	Hunting Frequency Since Construction
More	76.0	30.5
Same	8.0	32.9
Fewer/Less	12.8	35.0
No Answer	<u>3.2</u>	<u>1.6</u>
N=60	100%	100%

So, what can we conclude about hunter perceptions on the impact of the construction of ponds and reservoirs? First, it appears that there are mixed perceptions on how it has affected hunting. Most of the panel feel that there are more successful places to hunt but most agree that this has not led to an increase in the days spent hunting. Most hunters also agree that construction has made goose hunting better, but hunters are evenly divided on whether duck hunting has improved or declined. These results seem to indicate that there has been an impact on perception about hunting and therefore we cannot give definite answers to all of the research questions.

CHAPTER IV

CONCLUSIONS AND INTERPRETATIONS

Summary of Results

The primary objective of this study was to determine if there has been any impact on waterfowl hunting and hunters as a result of the construction of ponds and reservoirs in Oklahoma. Literature on waterfowl ecology in the state shows, beyond a shadow of a doubt, that the presence of the new water resources has had a significant impact on waterfowl behavior in the state. The conclusions reached in this study are more ambivalent, however. It appears that there are geographical, age, and rural and urban differences in the response patterns that mediate against the identification of a single definitive answer.

The results of this survey indicate that there is no definite answer to the questions about the impact of new ponds and reservoirs on hunting methodology. Certain types of hunting methodology showed increases while others showed decreases. Statistical tests were also inconclusive, indicating that methodology changes were due to factors such as increased knowledge and experience and or an increase in the absolute number of active hunters.

It was also expected that hunters would travel less frequently and travel shorter distances as a result of the presence of new surface water resources. The results indicate otherwise. It appears that hunters actually travel more frequently and are traveling greater distances today than they did in the past. There may be several reasons for this. There is no doubt that traveling is much easier today than it was in the past. But more importantly, hunting success today depends on having access to waterfowl habitat that is productive. Much of the waterfowl habitat created over the last eighty years was never, or no longer is, good quality, productive habitat. Most hunters, particularly urban hunters, must travel at least some distance to have access to the productive habitat that does exist.

The last research question involved the perceptions of the hunters themselves. They were asked if the construction of ponds and reservoirs had improved their hunting, if construction had provided more successful places to hunt, and if their hunting frequency had increased as a result of construction. Hunters were evenly divided on the impact of construction on duck hunting. Half indicated that duck hunting had deteriorated (as a result of population declines rather than anything to do with the construction of ponds and reservoirs), and they were divided according to their home county as to whether goose hunting had improved. Hunters who lived and hunted near Alfalfa county uniformly indicated that goose hunting had declined,

whereas hunters in Payne county uniformly felt that goose hunting had improved. Hunters in both areas indicated that the construction of ponds and reservoirs had provided them with more successful places to hunt, but indicated that this did not cause them to hunt more frequently. These results indicate that there have been impacts on hunters' perceptions as a result of the construction of ponds and reservoirs.

One of the few relationships that yielded definitive results involved the use of dogs in duck hunting. It appears that there is a strong negative correlation between age and the use of a dog. Among this panel of hunters at least, the younger the hunter, the more likely is the use of a dog.

Another relationship that was statistically significant involved the rural or urban residence of a hunter and his use of a boat. Urban dwellers overwhelmingly use boats for hunting and overwhelmingly use them to hunt ducks on reservoirs.

Comparisons to Existing Studies

In his research on the impact of United States Army Corps of Engineers reservoirs on the behavior of hunters in 1975, Gorham found that the presence of reservoirs had 1) improved hunting, 2) provided more successful places to hunt, and had 3) enabled hunters to hunt more often. He also found that his respondents averaged 15 hunting days

per season, that they hunted most frequently on ponds, and that nearly 50 percent of reservoir hunters used a boat.

The results of this investigation are in accordance with most of Gorham's findings. Goose hunters felt that the presence of reservoirs had improved hunting; duck hunters were evenly divided as to their benefits. A majority of the hunters in this survey also believed that the construction of ponds and reservoirs had provided them more places to hunt, almost half utilize a boat, and most engage in some form of pond hunting. Unlike Gorham's sample, however, this did not lead to an increase in hunting frequency. Most hunters in this survey indicated that they hunt both ducks and geese more than 18 days per season, and that their hunting frequencies have declined over the period of the study.

Sterling Burks, in his research on hunters utilizing Tishomingo National Wildlife Refuge, found that 71.24 percent of all trips to Tishomingo were less than 50 miles one way. These results are very similar to the results obtained for this study.

Interestingly enough, researchers in other areas of recreational geography have found distance decay limits that closely correspond to the 50-mile limit found in this study. Hecock (1974) found a sixty-mile limit of influence around Lake Keystone in the early 1970's.

Based on the similarities of the three sets of travel distances examined in this study, the author believes that

this information could also be generalized to the Oklahoma waterfowl hunting population as a whole.

New Findings

One of the primary objectives of this study was to identify and define historical hunting practices in Oklahoma. Using information obtained during the interviews for this study, it was relatively easy to do this. Almost all of the early waterfowl hunting in both study areas was done along rivers and streams or in grain fields. In the early days, corn was the major crop in both of the study areas and many hunters would decoy rivers and grain fields using live decoys and calling ducks or artificial decoys and calls. Hunters in the early days did not have the variety of accessories used by present day hunters. In those early days, hunting was more difficult and less recreationally oriented; hunters relied on their skills to put needed food on the table. There were no heaters, there was no specialized clothing to provide warmth and shed water, roads and automobiles were primitive. Hunters had to walk more than they do today and they could carry less. Hunters used basically the same guns they use today but today's ammunition is significantly improved over that used by early hunters.

After the use of live decoys was outlawed in 1936, most hunters acquired wooden or paper-mache decoys. Gradually, paper-mache decoys supplanted wooden decoys which

have, in turn, been replaced by plastic decoys. Most hunters use duck or goose calls and some hunters use different varieties according to the situation.

The construction of ponds and reservoirs in North Central Oklahoma gradually began to change waterfowl hunting in the area. Ducks and geese immediately began to use the new lakes and ponds and hunting shifted from rivers, streams, and small natural wetlands to these new impoundments.

Some specific areas of change were noted. It appears that fewer hunters actively hunt ducks today than in the past, and among those that are still active, it appears that they hunt less frequently. It also appears that more hunters hunt shore birds and cranes today than in the past. Fewer duck hunters use pond jumping as a hunting methodology today and more hunters are using boat blinds for hunting today than in the past. All of these behaviors are consistent with the changes in habitat which characterize the Oklahoma hunting environment.

Strengths and Weaknesses

There were several weaknesses in this study that the author would rectify if the project could be repeated. Several of the survey questions would be reworded to provide more uniform results. For example, the two questions dealing with the propensity to travel in the past and the present would be worded to achieve more comparable results

(See Appendix B). The number of answer choices would also be decreased. This would have facilitated statistical testing.

The difficulties that were encountered in utilizing statistical tests for all the research questions could have been eliminated by increasing the panel size, but this would have necessitated the use of a different survey technique. The inability to successfully perform statistical tests on some responses was not considered a major shortcoming, however, because the methodology was not conceived of as a sample study representative of the population as a whole. Rather, it was intended to tap individual and collective wisdom of a group of expert hunters.

Another change that would be incorporated would be to include several of the questions that had not been a part of the original survey but were inserted after the research began. One new question would also be included; the author believes that socio-economic or income information would have enhanced this study considerably because there appeared to be a strong relationship between occupation and income and hunting frequency and knowledge.

The major strength of this study, however, is that it is broad enough to provide information on many aspects of changes in waterfowl hunting. The study did not provide a large number of statistical correlations, but it did define a large body of raw data that can be used as a basis for

comparisons with future research or research in other areas of hunting or recreation.

Recommendations for Future Research

Future research on the impact of the construction of ponds and reservoirs on waterfowl hunting could be conducted in the Southeastern sections of the state. According to Heitmeyer (1980), this area has the most remaining natural habitat and several reservoirs are scheduled to be built in the region. It would be instructional to compare hunter habits and perceptions in this area as it undergoes the changes that have occurred throughout the rest of the state for some time. Or research could be carried out in an area of the state where little change has occurred. This information could then be used as a control.

Yet another area of research that may be even more interesting, would be to try to define how waterfowl and waterfowl hunting fit into the customs and habits of the Native American population of the state. It would be instructional to see if environmental changes caused by white immigrants had an impact on Indian hunting customs and habits if they existed.

BIBLIOGRAPHY

- Allen, Durwald L. "Private Duck Clubs." In Waterfowl Today, Ed. J.P. Linduska. Washington: Bureau of Sport Fishing and Wildlife, 1964, pp. 519-526.
- Barclay, John S. "Waterfowl Use of Oklahoma Reservoirs." Annals of Oklahoma Academy of Science, No. 5 (1976), 141-151.
- Baumgartner, F.M. "An Analysis of Waterfowl Hunting at Lake Carl Blackwell, Payne County, Oklahoma for 1940." Journal of Wildlife Management. 6, No. 1 (1942), 83-91.
- Burks, Sterling. "Utilization of Tishomingo Wildlife Management Units By Waterfowl and Hunters." Thesis. Oklahoma State University, 1965.
- Carney, Samuel M., Michael F. Sorenson, and Elwood M. Martin. "Duck Stamps Sold Within States and Counties During Sales Years 1971-72 Through 1980-81." United State Fish and Wildlife Service, Special Scientific Report, Wildlife No. 251, 1983.
- Copelin, F.F., E. Craven, C.O. Gilliam, and J. Adcock. "Waterfowl Hunting Activities and Harvest in the Tishomingo National Wildlife Refuge, Oklahoma, 1960-1963." Unpublished paper presented at the 18th Annual Conference of the Southeast Association of Game, Fish, and Conservation Commissioners, October 19, 1964.
- Crawford, Bill T. "The Field-Check Method of Determining Hunting Success, Pressure, and Game Kill." Transactions of the North American Wildlife Conference, 16(1951), 207-315.
- Domanski, P.M. "Numbers and Distribution of Waterfowl in Oklahoma During Winter and Spring." Thesis. Oklahoma State University, 1979.
- Gorham, Walter E. "Influences of United States Army Corps of Engineer Reservoirs on Waterfowl Populations in Oklahoma." Thesis. Oklahoma State University, 1975.
- Hecock, Richard D. "A New Reservoir and Recreation Behavior." Growth and Change. (July 1974), pp. 17-22.

- Heitmeyer, M.E. "Characteristics of Wetland Habitats and Waterfowl Populations in Oklahoma." Thesis. Oklahoma State University, 1980.
- Hochbaum, H. Albert. Travels and Traditions of Waterfowl. St. Paul: University of Minnesota, 1955.
- Hoopes, J. Oral History: An Introduction for Students. Chapel Hill: University of North Carolina Press, 1979.
- Hunter, G.N. "The Utility of Using Personal Interviews in Obtaining Information on Game and Fish Resources." Transactions of the North American Wildlife Conference, 14 (1949), 239-252.
- Kessler, Ronald C. and David F. Greenburg. Linear Panel Analysis: Models of Quantitative Change. New York: Academic Press, 1981.
- Logan, Thomas H. "Characteristics of Small Impoundments in Western Oklahoma, Their Value as Waterfowl Habitat and Potential For Management." Thesis. Oklahoma State University, 1975.
- Oklahoma Department of Fish and Game. Untitled, unorganized, unpublished survey of 4.8 percent of Oklahoma Waterfowl Hunters, 1961.
- Shafer, Elwood L., Jr. and John F. Hamilton, Jr. "A Comparison of Four Survey Techniques Used in Outdoor Recreation Research." Northeastern Forest Experiment Station: U.S. Forest Service Research Paper, NE-86, 1967.
- Slimak, Michael. "Waterfowl (Anatidae) Utilization of Impoundments in a North-Central Oklahoma Watershed." Thesis. Oklahoma State University, 1979.
- Weibe, A.H., E.R. Cady, and Paul Bryan. "Waterfowl on the Tennessee River Impoundments." Transactions of the North American Wildlife Conference, 15(1950), 111-117.
- White, W.M. and G.W. Malaher. "Reservoirs." In Waterfowl Tomorrow. Ed. J. P. Linduska, Washington: Bureau of Sportfishing and Wildlife, 1964, pp. 381-390.

Supplemental Bibliography

- Barstow, C.J. "A Comparative Study of Availability of Waterfowl Food Species and Waterfowl Use on a Series of Clear and Turbid Ponds in North-Central Oklahoma." Proceedings of the Annual Conference of Southeastern Association of Game and Fish Commissioners, 11(1957) 364-372.
- Bauer, E.A. The Duck Hunter's Bible. Garden City, New York: Doubleday and Company, 1965.
- Bue, Ingalf G., Hans G. Uhlig, and J. Donald Smith. "Stock ponds and Dugouts." in Waterfowl Tomorrow. Ed. J.P. Linduska. Washington: Bureau of Sport Fishing and Wildlife, 1964, pp. 391-398.
- Buller, R.J. "The Central Flyway." in Waterfowl Tomorrow. Ed. J.P. Linduska. Washington: Bureau of Sport Fishing and Wildlife, 1964, pp. 209-223.
- Bumstead, A.R. "Game Management on a Flood Control Reservoir." Proceedings of the Southeastern Association of Game and Fish Commissioners, 8(1954), 19-22.
- Chabreck, R. "Winter Habitat of Dabbling Ducks-Physical, Chemical, and Biological Aspects." in Waterfowl and Wetlands, An Integrated Review. Ed. Theodore A. Bookout. LaCrosse Wisc.: Lacrosse Printing Company, 1979.
- Clement, R.C. "Instincts, Laws, and Ducks." Transactions of the North American Wildlife Conference. 34(1969), 346-352.
- Cook, A.H. "Better Living For Ducks Through Chemistry." in Waterfowl Tomorrow. Ed. J.P. Linduska. Washington: Bureau of Sport Fishing and Wildlife, 1964, pp. 569-578.
- Copelin, F.F. "Waterfowl Inventory On Small Flood Control Prevention Reservoirs in Western Oklahoma." Proceedings of the Oklahoma Academy of Sciences, 42(1962), 260-263.
- Cottom, C. "Limiting Factors of Present Waterfowl Knowledge." Transactions of the North American Natural Resource Conference, 14(1949), 42-57.
- Cowardin, Lewis M. et al. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior, United State Fish and Wildlife Service, December, 1979, FWS/OBS-79/31.

- Dodson, M.M. Oklahoma Migratory Game Bird Study. Oklahoma Game and Fish Department. Federal Aid Project No-W-32-r, 1953, 51 pp.
- Eklund, C.R. "Wildlife Habitat Development at Reservoirs." Transactions of the North American Wildlife Conference. 19(1954), 368-374.
- Gordon, D. "Condition, Feeding, Ecology, and Behavior of Mallards Wintering in North Central Oklahoma." Thesis. Oklahoma State University, 1981.
- Hancock, H.M. "Food Habits of Waterfowl Migrating Through Payne County, Oklahoma." Thesis. Oklahoma State University, 1950.
- Kadlec, J.A. "Effect of a Draw Down on a Waterfowl Impoundment." Ecology, 43, No. 2(1962), 267-281.
- Landes, Robert. "Phenology and Ecology of Migratory Waterfowl at the Fort Gibson Refuge and Vicinity During the Season 1960-1961." Thesis. Oklahoma State University, 1961.
- Lawrence, R.G. "Relationships of Certain Climatological Factors to the Autumn Migration of Waterfowl in the Central Flyway." Dissertation. Oklahoma State University, 1964.
- Leighly, Joh. Ed. Land and Life: A Selection From the Writings of Carl Ortwin Sauer. Berkeley: University of California Press, 1963.
- Leitch, W.F. "Water." In Waterfowl Tomorrow. Ed. J.P. Linduska. Washington: Bureau of Sportfishing and Wildlife, 1964, pp. 273-282.
- Lincoln, F.C. "The Migration of North American Birds." United States Department of Agriculture Circular, No. 363, 1935.
- Madsen, J. and C.H.D. Clarke. "Waterfowl and The Hunter." in Waterfowl Tomorrow. Ed. J.P. Linduska. Washington: Bureau of Sport Fishing and Wildlife, 1964, pp. 707-715.
- Meeks, A.H. "The Effect of Drawdown Data on Wetland Plant Succession." Journal of Wildlife Management, 33(1969), 817-820.
- Mendall, H.L. and H.K. Nelson. "Adventuresome Waterfowl." in Waterfowl Tomorrow. Ed. J.P. Linduska. Washington: Bureau of Sport Fishing and Wildlife, 1964, pp. 305-312.

- Mikesell, Marvin. "Tradition and Innovation in Cultural Geography." Annals of the Association of American Geographers, 68(March 1978), 1-16.
- Perdue, Randle. True Tales: 80 Years of Hunting and Fishing with the Old Timer. Oklahoma City: Oklahoma Wildlife Federation, 1984.
- Sanderson, G.C. and F.C. Bellrose. "Wildlife Habitat Management of Wetlands." An. Acad. Brasil. Cienc., Supplement 41(1969), 153-204.
- Shaw, S.P. and C.G. Fredin. "Wetlands of the United States." United States Fish and Wildlife Service Circular 39, 1956.
- Smith, A.G., J.H. Stoudt, and J.B. Gollop. "Prairie Potholes and Marshes." in Waterfowl Tomorrow. Ed. J.P. Linduska. Washington: Bureau of Sportfishing and Wildlife, 1964, pp. 39-50.
- Sutton, G.M., Oklahoma Birds. Norman, Oklahoma: University of Oklahoma Press, 1967.
- Tranger, D.L. "Habitat Factors Influencing Duck and Brood Use of Semi-Permanent and Permanent Prairie Potholes in North Dakota." Thesis. Iowa State University, 1967.
- Wagner, Phillip L. and Marvin Mikesell, Ed. Readings in Cultural Geography. Chicago: University of Chicago Press, 1962.
- War Department, United States Army Corps of Engineers. "Great Salt Plains Dam and Reservoir." Information Pamphlet. Tulsa Oklahoma, revision of June 1947.

APPENDIXES

APPENDIX A

OTHER FINDINGS

Analysis of Duck Stamp Purchase Data

Early in the study an analysis of migratory waterfowl hunting stamp (duck stamp) purchases was performed to determine if the number of duck stamps purchased within a given county could be used to, first, measure the relative hunting pressure within a county or area, and second, to map any changes in that pressure that may have resulted from the construction of ponds and reservoirs. Such a source would be invaluable because it could be used to show temporal changes in hunting pressure not only in Oklahoma, but throughout the United States as a whole.

However, it is known that raw duck stamp purchase data does not actually represent true hunter populations. Each year, the U.S. Fish and Wildlife Service provides an estimate of the percentage of all duck stamps purchased by non-hunting collectors (Carney, 1983). This figure is derived for each state based on a questionnaire distributed to a fixed percentage of all duck stamp purchasers and is reprinted annually in the Waterfowl Status Reports. In any given year, non-hunting collectors account for between 0.30 percent to 3.10 percent of purchased duck stamps, depending upon the state.

To compound the problem, while 93.7 percent of the hunters included in this study's panel reported that they purchased a duck stamp every year, many hunters purchased two, three, or even four duck stamps per season. Unfortunately, the author did not keep complete statistics

on this figure because the significance of this practice was only recognized after many of the interviews had taken place. Nevertheless, it was ascertained that more than thirteen hunters out of 51 purchased at least one duck stamp per year. Hunters commonly purchased one stamp to sign and use on their licenses while hunting, one, or on several occasions, two unsigned stamps for their collections (the author viewed at least seven such collections, two going back to the 1940's), and yet another as a spare for a hunting partner who had forgotten to get one, a friend who had lost or misplaced theirs, or for a family member.

Finally, the panel reported that they sometimes had purchased duck stamps outside their home counties, usually near their intended hunting locations.

Together, these three aspects of duck stamp purchase behavior indicate that there may be a thirty to fifty-percent range of error by location using the raw duck stamp purchase data. It is possible that this error is predictable and that patterns of purchases could be used to define patterns of hunting interests, but in this study, without the use of a more detailed investigation, the use of duck stamp purchases was considered ill advised.

Family Origin and Diffusion

It is conventional wisdom that hunting techniques are transmitted from generation to generation within a family.

It follows that as family members migrate, hunting techniques are carried to different locations. One question on the hunter questionnaire form was included to see if any hunting characteristics exhibited by the surveyed hunters could be tied to practices that have certain regional origins. Boat blind hunting and flooded timber hunting were of special interest because of their close association with particular areas. A second question, on the transmission of hunting knowledge, was later added to the questionnaire as part of this investigation. Table X portrays the numerical breakdown of the survey group by region and how hunting knowledge was transmitted.

It is not surprising that 73.3 percent of the panel originally came from the midwest, as most of the earliest settlers in North Central Oklahoma were from the Midwest. It was surprising to learn that nearly 40 percent of the panel were self taught waterfowl hunters or had been taught by a friend rather than a relative. From these results, it is clear that hunting knowledge (at least among this panel) is not transmitted solely, or even primarily, through families. Furthermore, statistical tests indicated that family origin had no impact on habitat selection, hunting methodology, species selection, or travel.

TABLE X
 NUMERICAL BREAKDOWN OF FAMILY ORIGIN
 AND TRANSMISSION OF WATERFOWL
 HUNTING KNOWLEDGE

Origins of the Panel	Percentage of Panel
East Coast	5.0%
Gulf Coast	0.0%
Upper-Midwest	73.3%
Texas	5.0%
Appalachian South	1.6%
Other (6 European Nations)	15.0%

(Note: "East Coast" includes the Atlantic Coast states from Maine to Georgia, including New York, Pennsylvania, and New England. "Gulf Coast" includes Florida, Alabama, Mississippi, and Louisiana. "Appalachian South" includes Tennessee, Kentucky, and West Virginia. "Upper-Midwest" includes all the Great Plains states, Arkansas and Missouri, Michigan, and Ohio.)

Transmission of Waterfowl Hunting Knowledge

Taught by Parent	19	45.0
Self Taught	14	33.3
Taught by other Relative	7	16.6
Taught by Friend	2	4.75
	N = 42	100%

Quarry and Success

Four questions were included to try to ascertain prey selectivity and hunter success. Table XI provides frequencies for selected quarry and actual kill in the past and present. Positive percent differences probably indicate the ease of taking that particular quarry or accidental success, while negative percent differences indicate the difficulty in killing that quarry.

The table indicates that large ducks, geese, and then small ducks were the most frequently sought game, while large ducks and small ducks were the most frequently killed quarry. Fewer hunters today actively seek ducks but more hunters are seeking cranes and shore birds. It also appears that hunters have the least success hunting cranes and geese. There were no statistical relationships between quarry and success and any of the other areas of investigation.

TABLE XI
QUARRY AND SUCCESS

	Quarry, Present	Actual Kill, Present	Quarry, Past	Actual Kill, Past
(Percentage of Panel)				
Coots	3.2	8.3	10.0	14.6
Small Ducks	71.6	78.3	83.3	88.3
Big Ducks	88.3	91.5	100.0	100.0
Geese	80.0	74.8	85.0	75.0
Cranes	25.0	11.6	10.0	5.0
Shore Birds	21.6	18.3	13.0	5.0
Others	0.0	1.6	0.0	0.0

APPENDIX B

HUNTER QUESTIONNAIRE

HUNTER QUESTIONNAIRE

1. How long have you lived in Oklahoma?
A. 10-15 years B. 16-20 years C. 21-30 years
D. 31-40 years E. over 40 years
2. How long have you lived in this area?
A. less than 10 years B. 10-14 years C. 15-20 years
D. 21-30 years E. 31-40 years F. over 40 years
3. From what area of the United States was your family originally from?
A. East Coast B. Gulf Coast C. Upper Midwest
D. Texas E. Appalachian South F. other
4. Do you purchase a U.S. Fish and Wildlife Department Duck Stamp for every year you hunt? A. always
B. sometimes C. never
5. Have you ever purchased a duck stamp at a location outside of your home county? A. yes B. no
6. If yes, how often? A. always B. sometimes C. never
7. If you have purchased a duck stamp at a location outside of your home county, was the site of your purchase close to your planned hunting grounds or "on the way" to your planned hunting grounds? A. always
B. sometimes C. never
8. How long have you hunted waterfowl? A. less than 10 years B. 10-14 years C. 15-20 years D. 21-30 years
E. 31-40 years F. over 40 years.
9. Do you hunt primarily in this area? A. always
B. most of the time C. some of the time D. rarely
E. never
10. If you have to travel more than 30 miles one way to arrive at your favorite hunting locations, roughly how far do you travel? A. 30-40 miles B. 41-50 miles
C. 51-75 miles D. 75-100 miles E. 101-150 miles
F. more than 150 miles
11. In your early days of hunting did you travel extensively to hunt?
A. always B. sometimes C. never
12. If so, roughly how far did you travel one way?
A. 30-40 miles B. 41-50 miles C. 51-75 miles
D. 75-100 miles E. 101-150 miles F. more than 150 miles

13. If you travel to hunt, where do you go?
A. ponds B. reservoirs C. rivers and streams
D. wetland or marsh E. agricultural land
14. In the past, if you traveled to hunt where did you go?
A. ponds B. reservoirs C. rivers and streams
D. wetland or marsh E. agricultural land
15. Is duck hunting better _____ about the same _____
worse _____ than it was before ponds and reservoirs
were constructed in your area?
16. Is goose hunting better _____ about the same _____
worse _____ than it was before ponds and reservoirs
were constructed in your area?
17. Has the construction of ponds and reservoirs provided
you more _____ same _____ fewer _____ successful
places to hunt waterfowl in your area?
18. Since the construction of ponds and reservoirs in your
area, do you hunt more _____ same _____ less _____
frequently than you did before their construction?
19. If you hunt more since their construction, why?
20. If you hunt less since their construction, why?
21. During what part of the year do you hunt most?
A. early fall B. late fall C. winter D. spring
E. summer
22. Has this always been the case? Explain:
23. What items do you take with you when you go duck
hunting?
decoys dog call family member boat/canoe
liquor chair food portable blind other
beverages binoculars professional or semi-
professional guides flotation or wading devices
24. What items do you take with you when you go goose
hunting?
decoys dog call family member boat/canoe
liquor chair food portable blind other
beverages binoculars professional or semi-
professional guides flotation or wading devices

25. What method of hunting do you use most often when duck hunting?
- A. blind w/decoys call guide dog boat on lake pond river
 - B. pond jumping
 - C. floating walking river/stream lake pond shore line dog
 - D. ag land call decoys guide
 - E. boat blind stationary moving lake pond river/stream call decoys dog guide
 - F. other
26. What method of hunting do you use most often when goose hunting?
- A. blind w/decoys call guide dog boat on lake pond river
 - B. pond jumping
 - C. floating walking river/stream lake pond shore line dog
 - D. ag land call decoys guide
 - E. boat blind stationary moving lake pond river/stream call decoys dog guide
 - F. other
27. What method of hunting did you use most often when duck hunting in the past?
- A. blind w/ decoys call guide dog boat on lake pond river
 - B. pond jumping
 - C. floating walking river/stream lake pond shore line dog
 - D. ag land call decoys guide
 - E. boat blind stationary moving lake pond river/stream call decoys dog guide
 - F. other
28. What method of hunting did you use most often when goose hunting in the past?
- A. blind w/decoys call guide dog boat on lake pond river
 - B. pond jumping
 - C. floating walking river/stream lake pond shore line dog
 - D. ag land call decoys guide
 - E. boat blind stationary moving lake pond river/stream call decoys dog guide
 - F. other
29. What type of waterfowl do you primarily hunt?
- A. coots B. small ducks C. big ducks D. geese
 - E. cranes F. shore birds G. other

30. In actuality, what type do you kill most often?
A. coots B. small ducks C. big ducks D. geese
E. cranes F. shore birds G. other
31. What type of waterfowl did you hunt primarily in the old days?
A. coots B. small ducks C. big ducks D. geese
E. cranes F. shore birds G. other
32. In actuality what type of waterfowl did you kill most often in the past?
A. coots B. small ducks C. big ducks D. geese
E. cranes F. shore birds G. other
33. How many times per year do you go duck hunting (number of days)?
A. 1-5 B. 6-12 C. 13-18 D. over 18 E. never
34. How many times per year do you go goose hunting (number of days)?
A. 1-5 B. 6-12 C. 13-18 D. over 18 E. never
35. How many times per year did you used to go duck hunting (number of days)?
A. 1-5 B. 6-12 C. 13-18 D. over 18 E. never
36. How many times per year did you used to go goose hunting (number of days)?
A. 1-5 B. 6-12 C. 13-18 D. over 18 E. never

APPENDIX C

PARTICIPANTS

PARTICIPANTS

The following list is composed of the names and home towns of the hunters and scientists that contributed their time and knowledge to this project. Some of the following men have already died, taking with them their unique experiences and heritage. Without their assistance this project could never have been complete.

Max Johnson	Stillwater, OK
Dr. A.B. Smith	Stillwater, OK
Buck Davenport	Stillwater, OK
Randall Perdue	Stillwater, OK
Ralph Remy	Stillwater, OK
Jack Costrer	Stillwater, OK
Leonard Woolworth	Stillwater, OK
Nolan Cathey	Stillwater, OK
Frank Lewis, Jr.	Stillwater, OK
Joe Ferguson	Pawnee, OK
Dr. Marion Smith	Stillwater, OK
John Brunemer	Stillwater, OK
Dr. Dale Toetz	Oklahoma City
Duff Reardon	Cushing, OK
Joe Wilson, Sr.	Cushing, OK
Frank Wilson	Cushing, OK
Lawrence Pound	Cushing, OK
Frank Davies	Stillwater, OK
Everett Wilson	Stillwater, OK
Herb Brand, Sr.	Perry, OK
Floyd Paris	Stillwater, OK
Alvin Murphy	Stillwater, OK
M.H. Billingslea	Stillwater, OK
Farrell Copelin	Edmond, OK
A.J. Ketch	Stillwater, OK
A.K. Carpenter	Stillwater, OK
Randy Murray	Stillwater, OK
Ben Fritz	Stillwater, OK
Chris Rice	Stillwater, OK
Ken Flesner	Stillwater, OK
Robert Alexander	Stillwater, OK
Dr. Ron Elliot	Stillwater, OK
Randy King	Enid, OK
Ronald Estenson	Enid, OK
Joy Lane Estenson	Enid, OK
Howard Estenson	Enid, OK
Mike Fathergill	Enid, OK
Frank Devore	Jet, OK

Bill Downing	Medford, OK
Ersal Dixon	Medford, OK
Lee Smitz	Medford, OK
Bill Batchelder	Enid, OK
Elmer Fink	Medford, OK
Dwayne Bland	Enid, OK
Gary Froeming	Enid, OK
Charles Dunn	Jet, OK
Richard Castle	Jet, OK
Dan Dunn	Jet, OK
Walt Butler	Byron, OK
Lloyd Clepper	Jet, OK
Earl Neilson	Pond Creek, OK
Betty Neilson	Pond Creek, OK
Howard Dunivant	Jet, OK
John Foltz	Byron, OK
Walter Elson	Enid, OK
Bill Cox	Marshall, OK
Randy Beeby	Marshall, OK
Ken Butts	Butler, OK
Herman Vincent	Jet, OK
David Campbell	Jet, OK
Mark Blackledge	Jet, OK

VITA 2

Mark C. Miller

Candidate for the Degree of
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