RESEARCH PROJECT COMPLETION REPORT
OWRR PROJECT NO. B - 022 - OKLA.

THE IMPACT OF A MAJOR NEW RESERVOIR UPON RECREATION BEHAVIOR

Submitted to

The Oklahoma Water Resources Research Institute
Oklahoma State University
Stillwater, Oklahoma

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PREFACE

Reservoirs are built for many reasons. Typically they are expected to provide power, irrigation water, flood protection, navigation improvement, and recreational resources. And while there may be some questions raised regarding how and why such projects are authorized and the methods by which plans for them are evaluated (Maass), there is little doubt that these projects accomplish their primary goals, at least within the limits (Rosenbaum, Freeman) of their specified objectives. But in addition to providing irrigation water, or flood protection, it is widely understood and planned that major impoundments have considerable secondary and tertiary effects - on the environment, on the regional economy, and on the social and economic welfare of the citizenry.

After many years of reservoir construction there is now a rapidly growing literature which attempts to assess the actual secondary and tertiary impacts of such projects. For example considerable attention has recently been devoted to understanding the contributions of such large investments on local economies (Jewett, Kalter and Lord, Cox et al, Pearson and Heideman, Denver Research Institute), and their impact on land values (Kneese, Kitchen and Hendon, Prebble). In addition there has been a continuing and expanding interest concerning the environmental impacts of such investments. And of late there has been increased interest in some of the subtle impacts of such projects: income distributions (Freeman, James, Shabman and Kalter); social structure (Biswas and Durie): attitudes (Hogg and Smith); and social disorganization (Whitman et al). Conspicuously absent from such discussions are considerations of the impacts of major public development investments upon recreation behavior and leisure-time utilization, factors which are becoming increasingly important in the fabric of American life.

We, the Principle Investigators, believe that it is important to pursue the assessment of such impacts, in anticipation of the day when criteria for the evaluation of major investments in public works projects will include, and realistically weigh, those types of impacts cited above. (Kriss, Freeman).

CHAPTER I

THE IMPACT OF A MAJOR NEW RESERVOIR UPON RECREATION BEHAVIOR

Under normal circumstances one of the most important primary benefits anticipated from the development of a major river impoundment are those which derive from increasing opportunities for outdoor recreation (87th U.S. Congress, Senate Document 97). And indeed, by conventional measurement such benefits have been more than realized as demonstrated by the visitation figures for most major impoundments. In Oklahoma for example, at least seven reservoirs generate more visitor days of outdoor recreation than do either Yellowstone or Grand Canyon National Parks. Lake Texoma hosts almost twice as many visitors as does the Great Smokey Mountains, our most visited National Park (Federal Reserve Bank of Kansas City, U.S. Bureau of Census). Yet one intuitively suspects that such figures are misleading to the extent that they are not telling the whole story when it comes to assessing benefits resulting from recreational facility development. For one thing there is a high incidence of double and even multiple counting of participants (Myles). It is well known that fully one-third of the population do not participate at all in water-based recreation and another ten percent do so at very low rates (Hecock and Rooney). Thus visitation data only describe the behavior of the attendors, and over-represent those who attend often, while ignoring substantial portions of the population who never boat (85%), swim (50%) or fish (73%) (BOR). Thus while some benefit from the development of new facilities, most do not - a fact which raises a serious question concerning equality in provision of opportunities.

Another difficulty surrounding present methods of assessment of recreation benefits has to do with the tacit assumption that visitation always represents a net benefit. In truth recreation participation is not fully elastic with regard to provision of new facilities, nor does a new facility necessarily provide a net increase in the recreational resources of an area.

To date no study has been undertaken which systematically attempts to assess the impact of new facilities in great detail; this project was undertaken as an initial step towards that end. In general the research was planned to estimate the extent and nature of changes in recreation demand and use which occur upon the introduction of a major new water-recreation facility to a region. Specifically, answers to the following questions are sought:

1. What impacts have resulted from development of a new reservoir?
2. What is the extent of these impacts?
3. What are the implications for water resource planners and administrators?

The Study Area

Keystone Reservoir was authorized under the Flood Control Act of 1950 (Document 107 81st Congress, 2nd Session, May 17, 1950). Construction was begun in 1957, the reservoir pool began filling in 1962, and is now completed. The reservoir controls runoff from about 22,000 square miles of the Arkansas and Cimmaron drainage basins. The lake under normal power-pool conditions features a volume of approximately two million acre feet, 26,300 acres of water surface and over 330 miles of shoreline. In terms of surface acreage it is the 5th largest reservoir in Oklahoma.

The reservoir is located in the northeast quadrant of Oklahoma, approximately ten miles west of Tulsa and approximately 80 miles northeast of Oklahoma City. It is well served by paved highways. To the East and South of Keystone there are many large reservoirs, but to the west and northwest there are no competitors in terms of water quality and size.

Keystone maintans boat-launching ramps (16) picnic grounds (368 grills, 9 shelters), camping areas (nine), swimming beaches (nine) and other services and facilities. According to Corps of Engineers records, visitation to Keystone in 1970 amounted to 2,440,100 ranking it fourth among Oklahoma's large reservoirs,

for which comparable data are available.

According to data in a recent survey (Oklahoma Outdoor Recreation Demand and Use Study) visitors to Keystone State Park come overwhelmingly from Tulsa and its suburbs, and to a lesser extent from Oklahoma City, Wichita, and many small towns in the region. For this reason, and because a ninety-mile hinterland is considered a realistic source area for reservoirs of this type, the survey area was bounded by a line ninety miles from the reservoir's recreation areas (Figure 1).

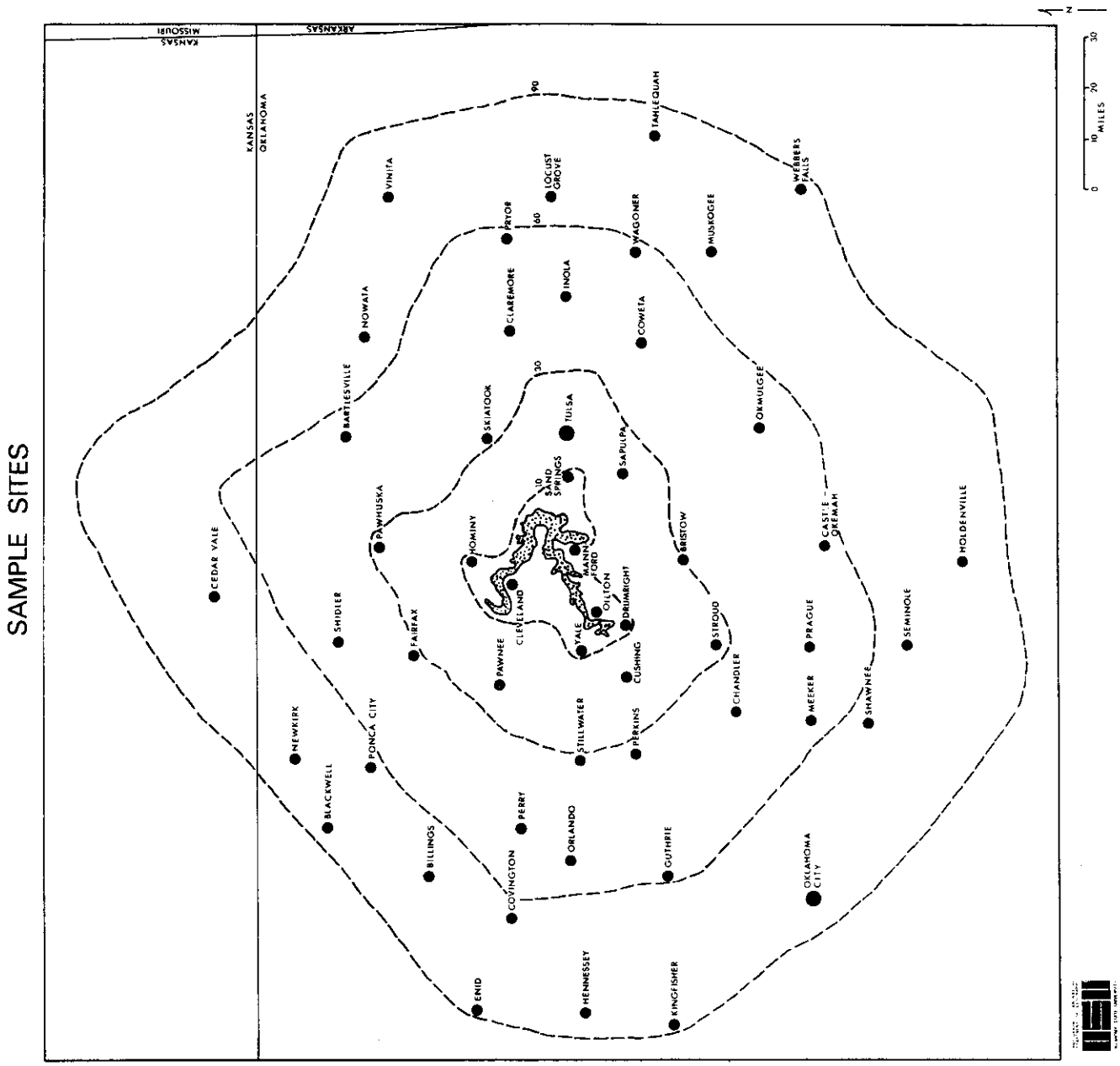
Fifty-one communities were selected to be included in this study. They were selected on the basis of their location relative to Keystone, competing water-based facilities, and to other sampled communities as well as their socio-economic characteristics, transportation routes and population size.

Sampling Procedure

With the exceptions of Oklahoma City and Tulsa for which 120 interviews were collected, and the very smallest communities where only fifteen interviews were practical, a total of thirty usuable interviews were taken in each town (See Figure 1). Within each community households included in the sample were selected in the following manner: a community was divided into quadrants and six interviews were taken in a one or two block area within each quadrant. In addition, six interviews were conducted in the neighborhood adjacent to the Central Business District. For the two major cities each quadrant was subdivided into four equal areas and six interviews in a one or two block area were administered in each of the sub-quadrants, as well as six interviews in the neighborhood where the sub-quadrants joined. This latter procedure yielded thirty questionnaires in each of four sections in both Oklahoma City and Tulsa.

Questionnaires were administered during the summer of 1971 and the spring of 1972. Interviews were conducted on week days as well as weekends. Prime consideration was given to the hours of 4:00 P.M. to 8:00 P.M. since this period was most favorable for collecting male responses. Often, however, it was necessary

Figure 1


SAMPLE SITES
KANSAS
MISSOURI
ARKANSAS
OKLAHOMA
90
60
30
10
TAHLEQUAH
WEBBERS FALLS
VINITA
LOCUST GROVE
PRYOR
WAGONER
MUSKOGEE
NOWATA
CLAREMORE
INOLA
COWETA
BARTLESVILLE
SKIATOOK
TULSA
OKMULGEE
SAPULPA
SAND SPRINGS
CEDAR YALE
PAWHUSKA
HOMINY
BRISTOW
CASTLE - OKEMAH
HOLDENVILLE
SHIDLER
CLEVELAND
MANNFORD
OILTON
DRUMRIGHT
FAIRFAX
YALE
STROUD
PAWNEE
CUSHING
SEMINOLE
NEWKIRK
PONCA CITY
CHANDLER
PRAGUE
MEEKER
SHAWNEE
STILLWATER
PERKINS
BLACKWELL
PERRY
BILLINGS
ORLANDO
GUTHRIE
OKLAHOMA CITY
COVINGTON
ENID
HENNESSEY
KINGFISHER
N
0
10
20
30
MILES

to interview for the entire day to achieve the quota required for each town.

The survey sought specific information on recreation use patterns for two time periods (Figure 2). Frequency of participation, most regularly visited area, and respondant's favorite area for four water-oriented activities as well as four other outdoor activities were recorded for the calendar year 1970. The same information was requested for 1960, five years prior to the completion of Keystone Reservoir. Questions pertained only to the individual respondent and not to total family occasions or other family members since it would be unreasonable to expect the respondent to answer with any reliability questions related to frequency of participation for another person ten years in the past. Other questions on occupation, age, and equipment sought information that might account for substantial changes that could not be attributed to the new facility.

OKLAHOMA STATE UNIVERSITY WATER RESOURCES INSTITUTE

Date_____

1. In 1960 what town did you live in or nearest to_____; 1970_____

2. How many times per year did you participate in the following activities:

	1960			1970			
	# of Times	most frequent visited area	favorite area	# of Times	most frequent visited area	favorite area	reasons for Change 60 to 70
Fishing							
Swimming							
Boating							
Water Ski							
Hunting							
Picnicking							
Camping							
Vacation Trips							
Spectator Sports							

3. Which of the following types of recreation equipment did you own:

Firearms: 1970____ 1960____; Fishing tackle: 1970____ 1960____; Boat: 1970____ 1960____; Canoe: 1970____ 1960____; Water Skiis: 1970____ 1960____; Boat Motor: 1970____ 1960____; Camper, Pickup/Trailer: 1970____ 1960____; Golf Equipment: 1970____ 1960____.

4. How many hours per week on the average did the head of the household work:

1970_____ 1960_____

5. Do you feel the establishment of Keystone Reservoir has effected your participation pattern in the last 10 years: yes____ no____ If so, how:_____

_____

_____

6. What was the occupation of the head of the household in:

1970_____ 1960_____ _____

7. What are the ages of your dependents: _____, _____, _____, _____, _____, _____.

8. Interviewer's estimate of age of the respondent_____.

9. Sex of the respondent_____.

Figure 2. Interview Schedule

CHAPTER II

GENERAL IMPACT IN THE STUDY AREA

Approximately twenty-five percent of all of the respondents, and thirty-five percent of those classed as recreationists in 1960 or 1970 indicated that they had experienced changes in recreational behavior as a result of the development of the Lake (Table 1). In both of these groups about forty percent reported an increase in recreational participation which was stimulated in whole or in part by the construction of the reservoir. A sizeable proportion indicated that their participation levels remained unchanged, but that they have switched locations of recreational activity because the new reservoir is closer or because it provides a higher quality recreational facility than that to which they had previously been accustomed. A substantial minority noted that routes for their "Sunday Drives" and other driving-for-pleasure experiences have been shaped by the presence of the new reservoir. A small, but vocal, group cite negative impacts - a decrease in fishing or hunting as a result of the destruction of wetland hunting resources or a stream fishery.

Only six percent of those sampled indicated that Keystone was now their favorite recreation area. (Table 2) This figure is low, due in part to the fact that many do not participate. Among those who now can be classed as water recreationists (participate more than five times per year in water-based recreational pursuits) twenty percent list Keystone as a favorite area. In terms of visit frequency a similar pattern exists. Approximately 21 percent of the fishermen indicated that they visited Keystone more often than other areas; among boaters in the sample, Keystone was the most-frequently visited area for twenty-eight percent.

TABLE 1. DO YOU FEEL THAT THE DEVELOPMENT OF KEYSTONE RESERVOIR HAS AFFECTED YOUR PARTICIPATION IN RECREATION IN THE LAST TEN YEARS? IF SO, HOW?

	SAMPLE* Percent Responding	RECREATIONISTS** Percent Responding
"Keystone has had no impact"	75%	65
"Yes, Keystone is closer than most frequently visited area in 1960, therefore we participate more often"	10%	16
"Yes, it is closer; now we use Keystone, but do not participate more often"	7%	10
"Yes, we use it primarily for pleasure driving..."	3%	3
"Yes, it has had some impact on our recreation behavior... (Miscellaneous responses including negative impacts)"	5%	6
N	1204	746

*Includes only those respondents who have lived in the area for 10 years or more.

**Excludes 37% of all respondents who did not participate in 1960 and do not participate now.

TABLE 2. KEYSTONE AS FAVORITE AND MOST-FREQUENTLY-VISITED AREA

% Of Total Sample Responding That Keystone Was Their Favorite Area N=1204	6.2%
Percentage of Recreationists Responding that Keystone Was Their Favorite Area N=746	20.3%
Percentage of Different Types of Recreationists Responding That Keystone is Most Frequently Visited Area in 1970	
Fisherman	21%
Swimmers	25%
Boaters	28%
Water-Skiers	28%
Campers	19%

The Impact of Keystone: Other Evidence

In addition to direct questions about Keystone's impact, several other questions were asked with the expectation that more information on the character of the impact could be obtained. For example respondents were asked to recall the general characteristics of their participation in recreational activities both in 1960 (before reservoir completion) and in 1970 (after completion). Thirty-seven percent of all respondents indicated that they (or their families) did very little in the way of outdoor recreational activities in 1960 and do very little now (Figure 3). Those respondents indicated that for all activities surveyed (swimming, fishing, boating, water-skiing, picnicking, camping, and hunting) they participated a total of less than fifteen times per year in both 1960 and 1970. This rate of non and/or low participation is consistent with national levels (BOR, 1971) and similarly conforms to patterns identified in Oklahoma (Oklahoma Demand Study, 1971). Another 18% of the respondents indicated that they were moderate to very active recreationists in 1960 and judged themselves to be active to approximately the same extent and in the same activities in 1970. These two groups then, totaling more than one-half (55%) of those sampled in the total study area indicated that no change in their leisure time use for Outdoor recreation had occured and one can safely conclude that for those sampled respondents the development of Keystone did not cause significant shifts in their recreational behavior.

A second group, totaling twenty percent of those surveyed did report increases in recreational participation, including water-based recreational activities over the 1960 to 1970 time period. More than one-half of these increased their participation in three or more types of activites.

Fourteen percent of the sample indicated that their recreational activity either decreased in general or in certain specific water-based recreational pursuits. Eleven percent of the sample exhibited mixed recreational behavior change - larger increases in come activity categories accompanied by large decreases in others.

RECREATIONAL BEHAVIOR, 1960 to 1970

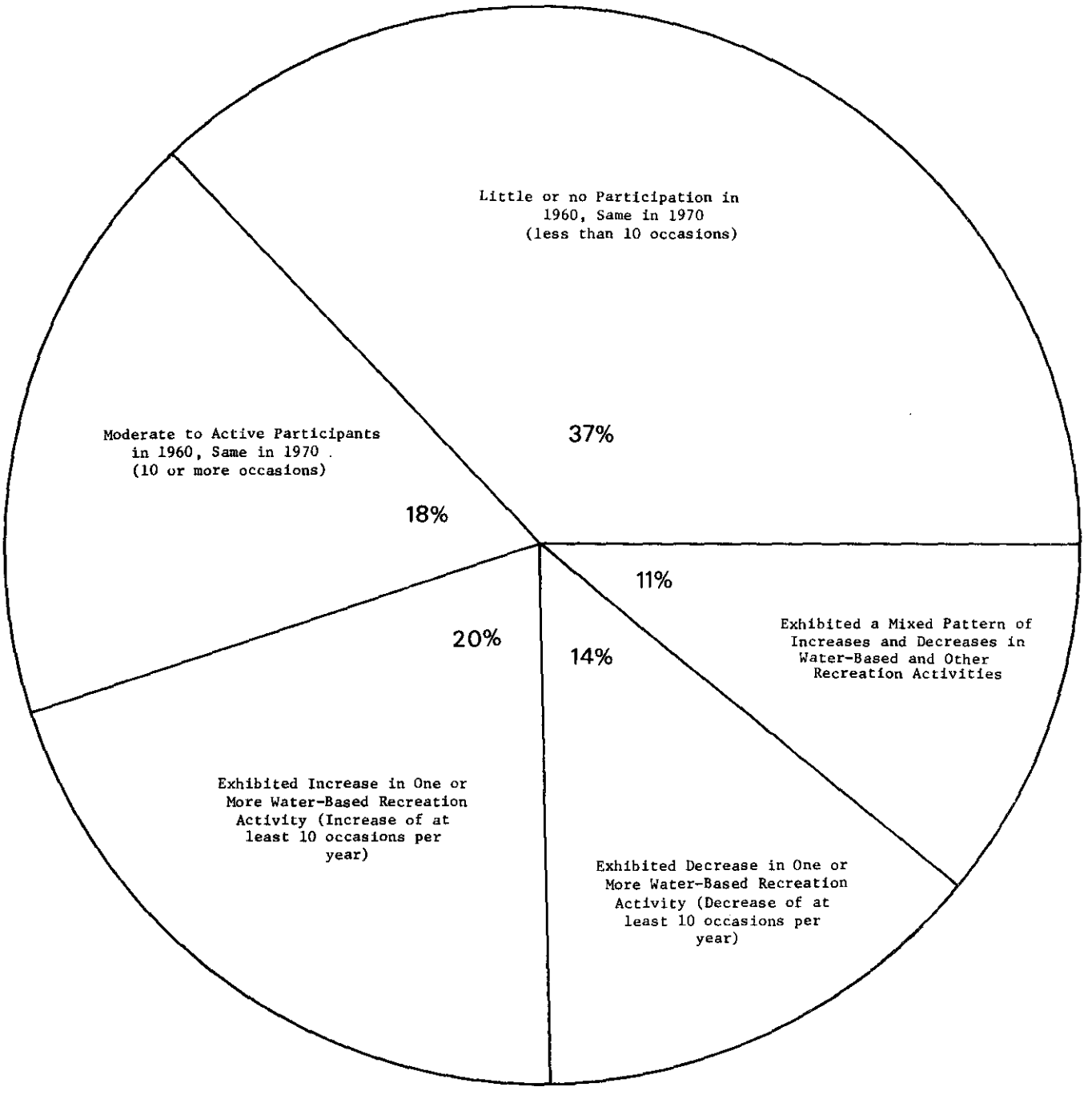


Figure 3

While it would be tempting to attribute these changes in recreational participation to the presence of the nearby and newly-developed Keystone reservoir, attention must be called to the fact that other factors are also responsible. There are some expectable, and statistically significant relationships between several characteristics of the respondents and the collective changes in recreational behavior exhibited by them (Table 3). Furthermore, it can be shown that the proportion of the population engaging in recreational activities, as well as the participation levels change over time and change with changes in income, age, or life-cycle stage, (average days per participant) and may do so with or without the help of a new reservoir (Tables 4 & 5).

Equipment ownership among the respondents follows the same general pattern. Many people did not exhibit any changes at all in equipment ownership; some decreased the amount of equipment for water-based activities, and some increased ownership only for non-water-recreation activities (Figure 4). Only about one-quarter of the respondents indicated that they had increased the number of water-based activities for which they were equipped.

Keystone's Impact in the Study Area: Summary

It seems fair to say that for the study area as a whole Keystone's impact was relatively modest. A relatively small proportion of the sample as a whole and only a slightly larger portion of the recreationists indicated that Keystone had been influential in their recreational life. Nor were there wholesale changes in recreation behavior or equipment ownership, and the conclusion that those that occurred might derive from Keystone would have to be tempered by the knowledge that the changes might have occurred without Keystone as a result of general shifts in socio-economic character and recreational aspirations in the population. Then too, some decreases in equipment ownership and recreational participation may realistically follow from the loss of hunting and stream fishing resources which

TABLE 3. RESULTS OF CHI-SQUARE TESTS OF ASSOCIATION BETWEEN CHANGES IN RECREATION BEHAVIOR AND SOCIO-ECONOMIC

Type of Change in Recreation Participation:	Occupation	Occupation Change 1960-1970	Leisure Time	Leisure Time Change, 1960-1970	Life Cycle Stage	Life Cycle Change, 1960-1970
Increase	.05	NS	.05	.05	.01	.001
Decrease	.01	NS	.05	.05	.001	.01
Mixed	NS	NS	NS	.05	.01	.001

TABLE 4. SOCIO-ECONOMIC CHARACTERISTICS AND PARTICIPATION IN SELECTED OUTDOOR RECREATION ACTIVITIES, UNITED STATES

	Swimming		Fishing		Boating	
	% Partic.	Days/Partic.	% Partic.	Days/Partic.	% Partic.	Days/Partic.
Ages						
12-17 yrs.	84	23	44	8	38	7
18-24 yrs.	74	13	33	6	35	6
25-44 yrs.	55	11	32	7	25	6
45-64 yrs.	26	10	26	8	18	7
65 +	6	10	11	9	6	6
Incomes Under						
3000	21	11	21	8	9	5
3-5999	45	12	30	8	22	6
6000-7999	55	13	32	7	26	6
8000-9999	63	15	36	9	34	7
10000-14999	64	17	35	7	36	8
15000-24999	72	19	31	8	38	8
25000 +	68	20	33	8	30	7
Family Characteristics						
Persons with						
Children Under 6	56	11	32	7	26	7
Children, 6-11 yrs.	51	11	31	7	23	7
Others	45	16	29	8	24	6

Bureau of Outdoor Recreation, The 1965 Survey of Outdoor Recreation Activities, Washington, U.S. Department of Interior, 1972.

TABLE 5. CHANGES IN RECREATION PARTICIPATION, 1960-1965, UNITED STATES

	Percent Participating		Average Days/Participant	
	1960	1965	1960	1965
Swimming	45	48	11.5	14.3
Water Skiing	6	6	5.1	6.6
Boating	22	24	5.5	6.5
Camping	8	10	5.7	6.9
Fishing	29	30	6.8	7.6

Bureau of Outdoor Recreation, Selected Outdoor Recreation Statistics, 1971, U.S. Department of Interior, Washington, D. C., 1971, p. 39.

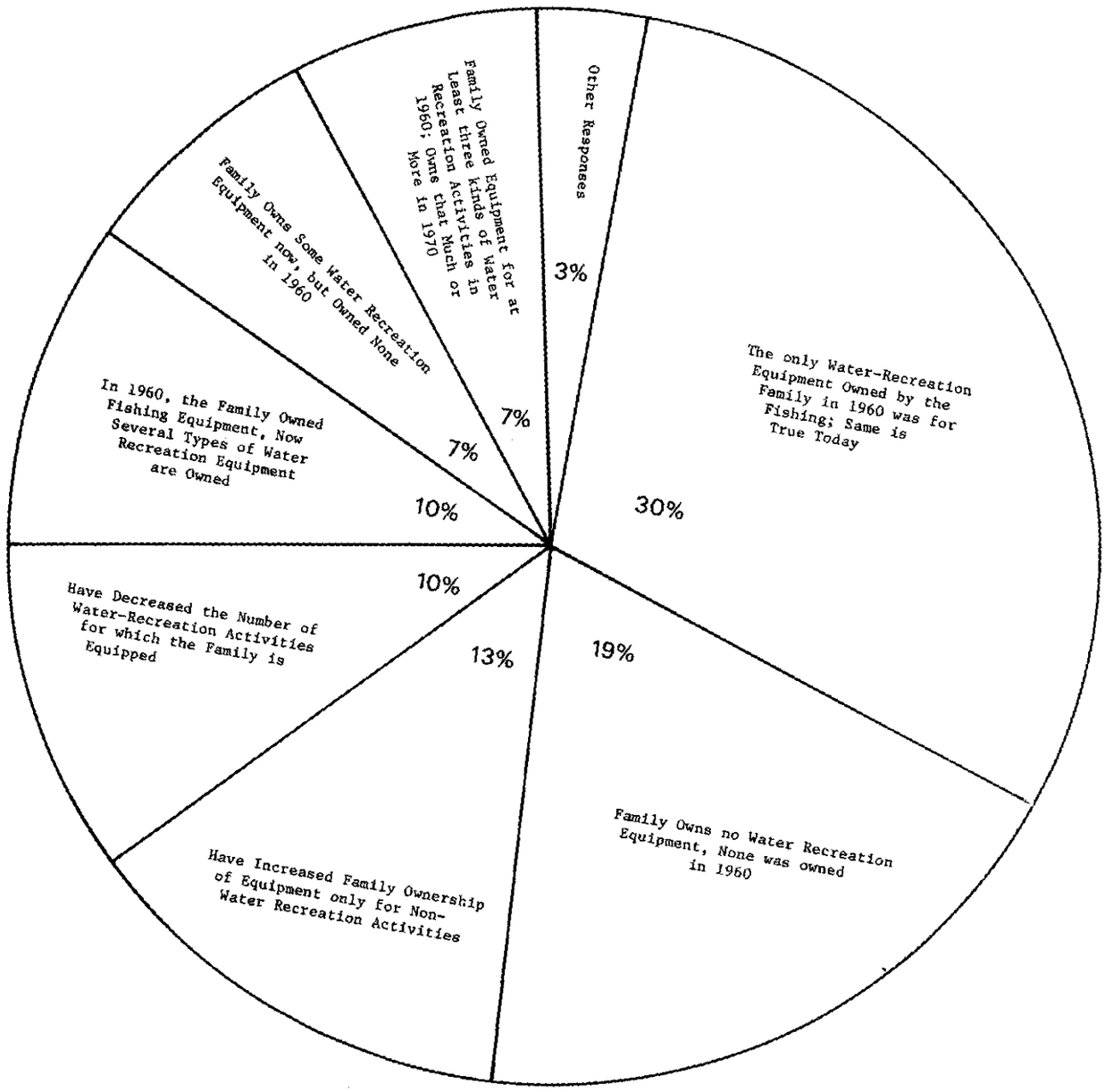

Other Responses
3%
The only Water-Recreation Equipment Owned by the Family in 1960 was for Fishing; Same is True Today
30%
Family Owns no Water Recreation Equipment, None was owned in 1960
19%
Have Increased Family Ownership of Equipment only for Non-Water Recreation Activities
13%
Have Decreased the Number of Water-Recreation Activities for which the Family is Equipped
10%
In 1960, the Family Owned Fishing Equipment, Now Several Types of Water Recreation Equipment are Owned
10%
Family Owns Some Water Recreation Equipment now, but Owned None in 1960
7%
Family Owned Equipment for at Least three kinds of Water Recreation Activities in 1960; Owns that Much or More in 1970
7%

Figure 4

accompanied the development of the lake. It is clear that whatever the impact of Keystone, it was not generally felt throughout the study region.

CHAPTER 3

DISTANCE AND THE IMPACT OF KEYSTONE

There are highly significant differences (Chi-Square is significant at the .001 level of probability) between reported impacts from Keystone and the distance zones which have been drawn around the reservoir (Table 6). As one moves furhter away from the recreation areas developed in association with the Keystone project, the proportion of those indicating a Keystone influence on their recreational life decreases regardless of the impact measure (Figures 5, 6, 7, 8). This is also true when indirect measures, such as changes in general recreation behavior and equipment ownership changes, are examined (Table 7 and Figure 9, 10, 11). There can be no doubt that distance has a very critical effect upon the extent of impact.

In general there is a very steep distance decay function with regard to the recreational impact of Keystone Reservoir. That is, measured impact drops off quite rapidly with increasing distance from the reservoir. Indeed, for most direct measures of impact, the proportion of the respondents who report behavior changes resulting from the new reservoir is reduced by one-half or more, beyond the first ten mile ring, and suffers a decrease of similar magnitude between the thirty and sixty mile zones (Figure 5-8). Therefore, it seems reasonable to say that impact is negligible beyond the sixtieth mile regardless of the measure used to estimate it. The distance decay function for the indirect measures of recreational impact is not nearly so steep, nor does the value of the variable drop so close to zero in the farthest zone (Figure 9-11). Presumably this is because the indirect measures are sensitive not only to changes in recreation opportunities, but also to changes in the socio-economic character of the respondents and general changes in leisure time preferences.

TABLE 6. MEASURES OF KEYSTONE IMPACT, PERCENTAGE OF TOTAL RESPONDENTS BY ZONES

	Zone 1 0-10 Miles	Zone 2 11-30 Miles	Zone 3 31-60 Miles	Zone 4 61-90 Miles	All Zones
Percentage Responding that...					
"Keystone stimulated greater participation"	40%	13%	7%	1%	25%
"Keystone caused shift in recreation location, but no increase in participation"	15%	13%	5%	1%	
"Keystone is now our favorite recreational area for water-based activities"	41%	21%	7%	1%	6%
Keystone is most-frequently-visited-area by					
Fishermen	78%	37%	13%	2%	21%
Boaters	68%	34%	12%	1%	28%
Swimmers	43%	19%	11%	1%	25%
N=	154	252	336	458	

THE PROPORTION OF THE SAMPLE WHO REPORTED EITHER A SHIFT IN LOCATION OF RECREATION ACTIVITY OR INCREASED RECREATION ACTIVITY AS A RESULT OF KEYSTONE

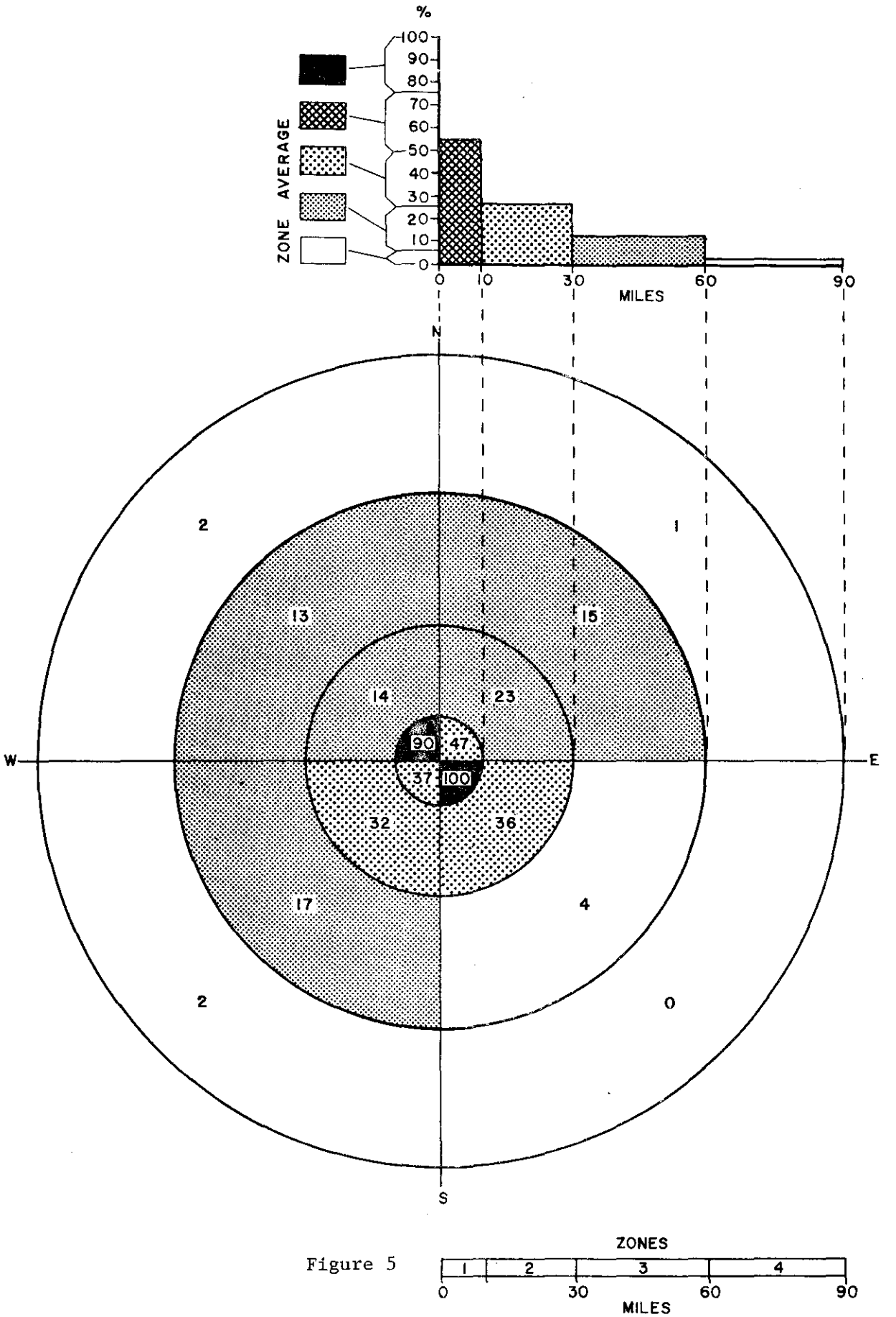


Figure 5

THE PROPORTION OF RESPONDENTS REPORTING THAT KEYSTONE HAD SOME EFFECT ON THEIR RECREATIONAL BEHAVIOR

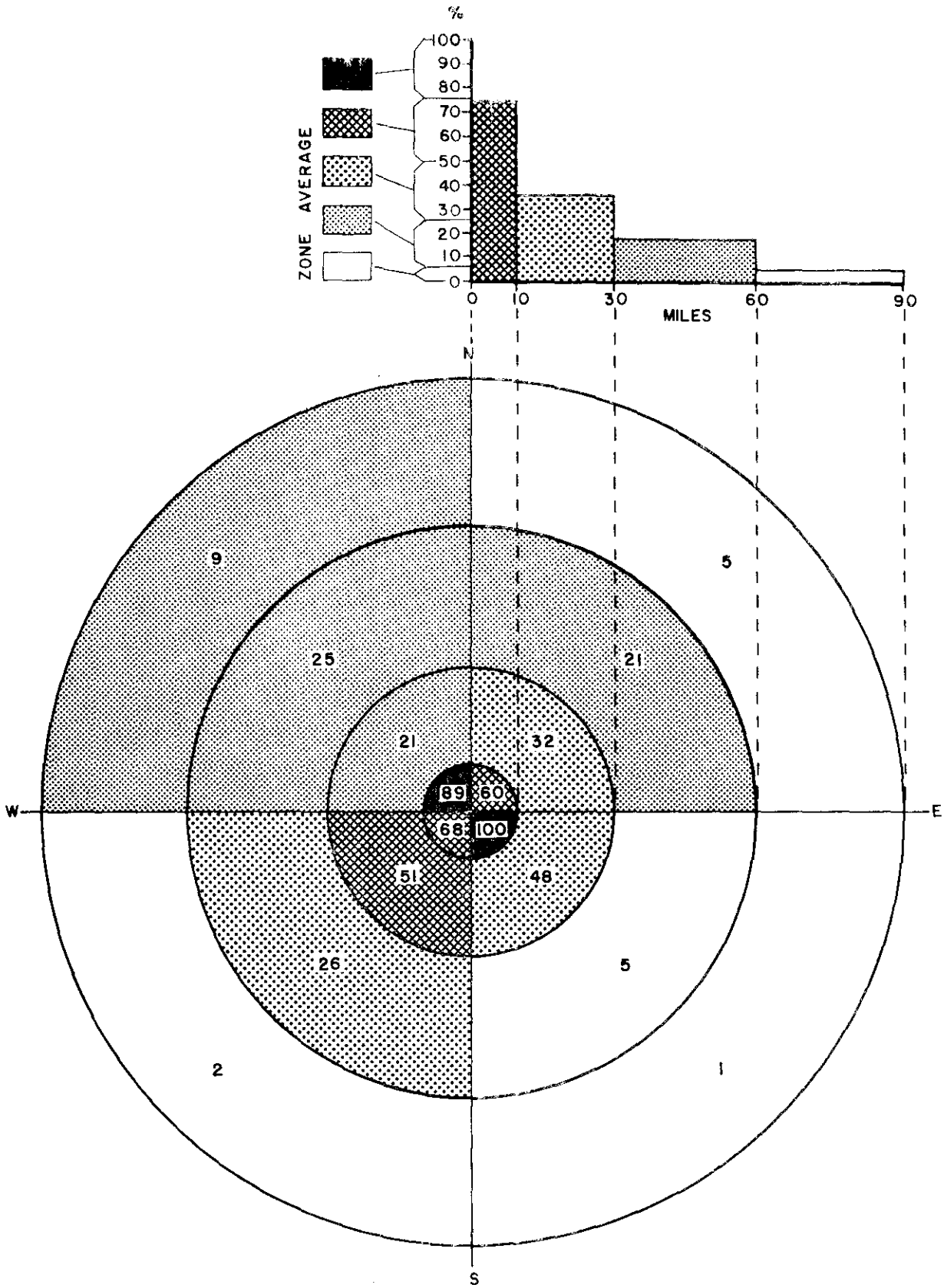


Figure 6

THE PROPORTION OF RECREATIONISTS WHICH REPORTED KEYSTONE AS THEIR FAVORITE AREA IN 1970

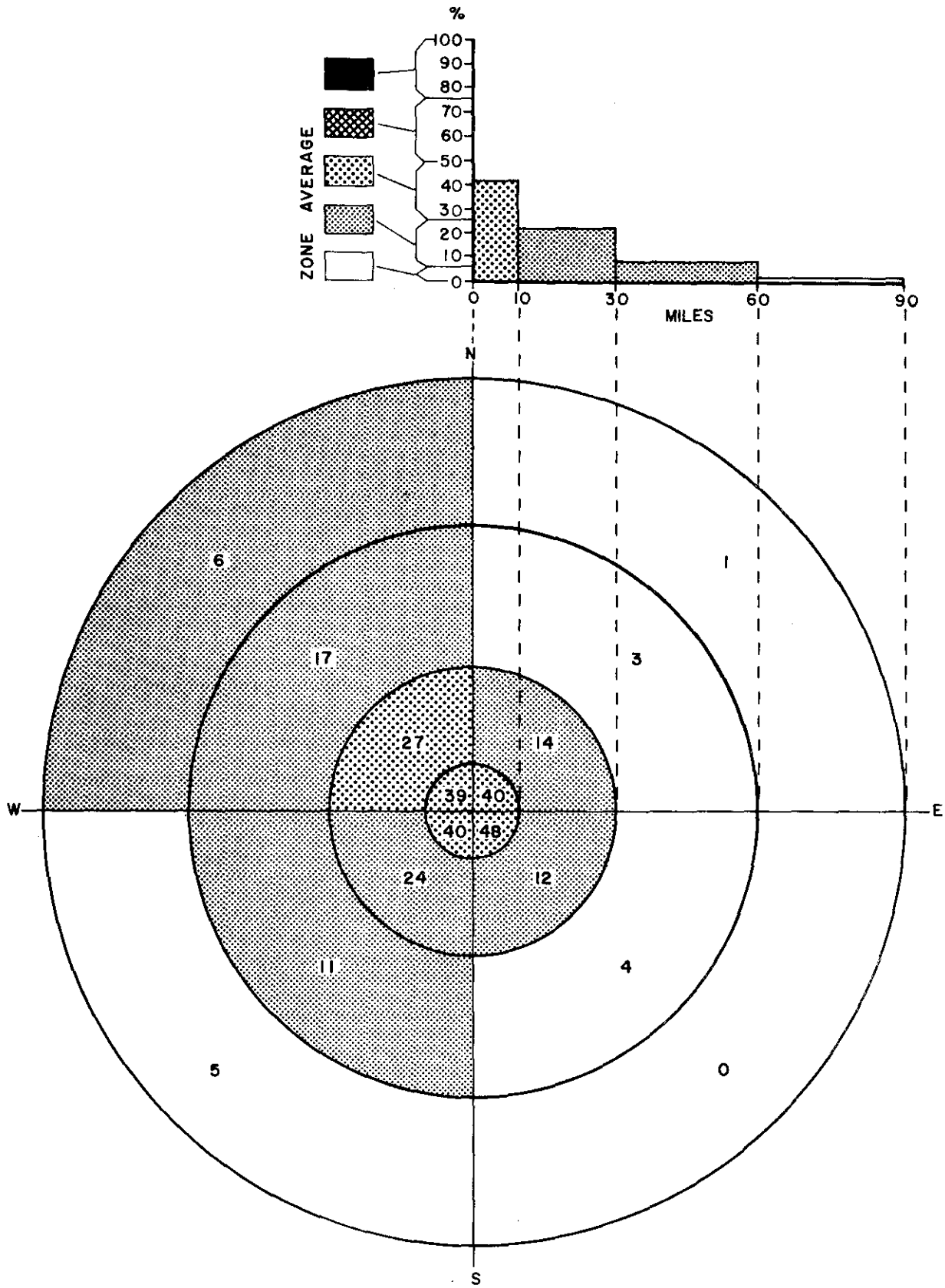


Figure 7

THE PROPORTION OF BOATERS WHICH REPORTED KEYSTONE AS THEIR MOST FREQUENTLY VISITED AREA IN 1970

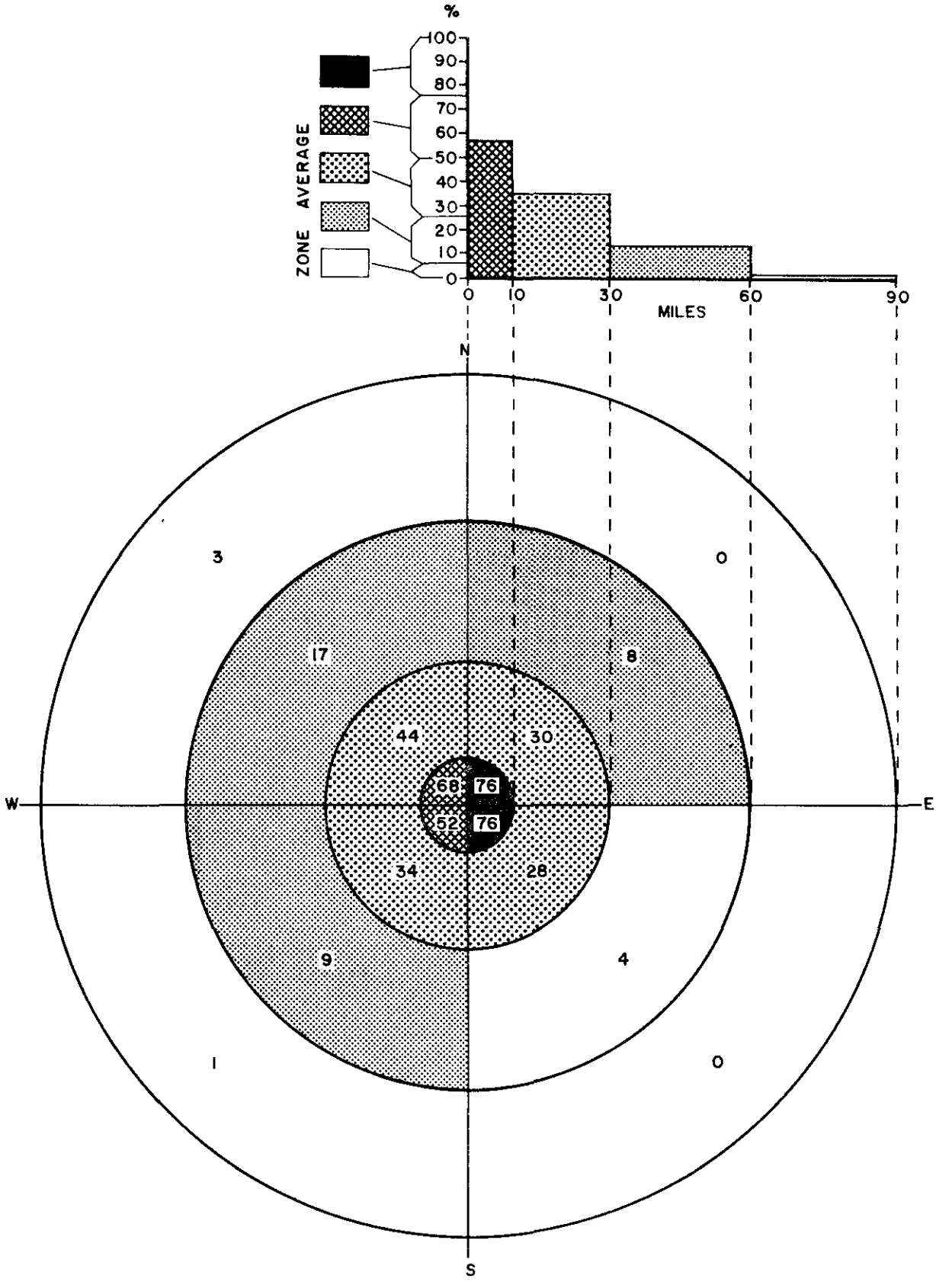


Figure 8

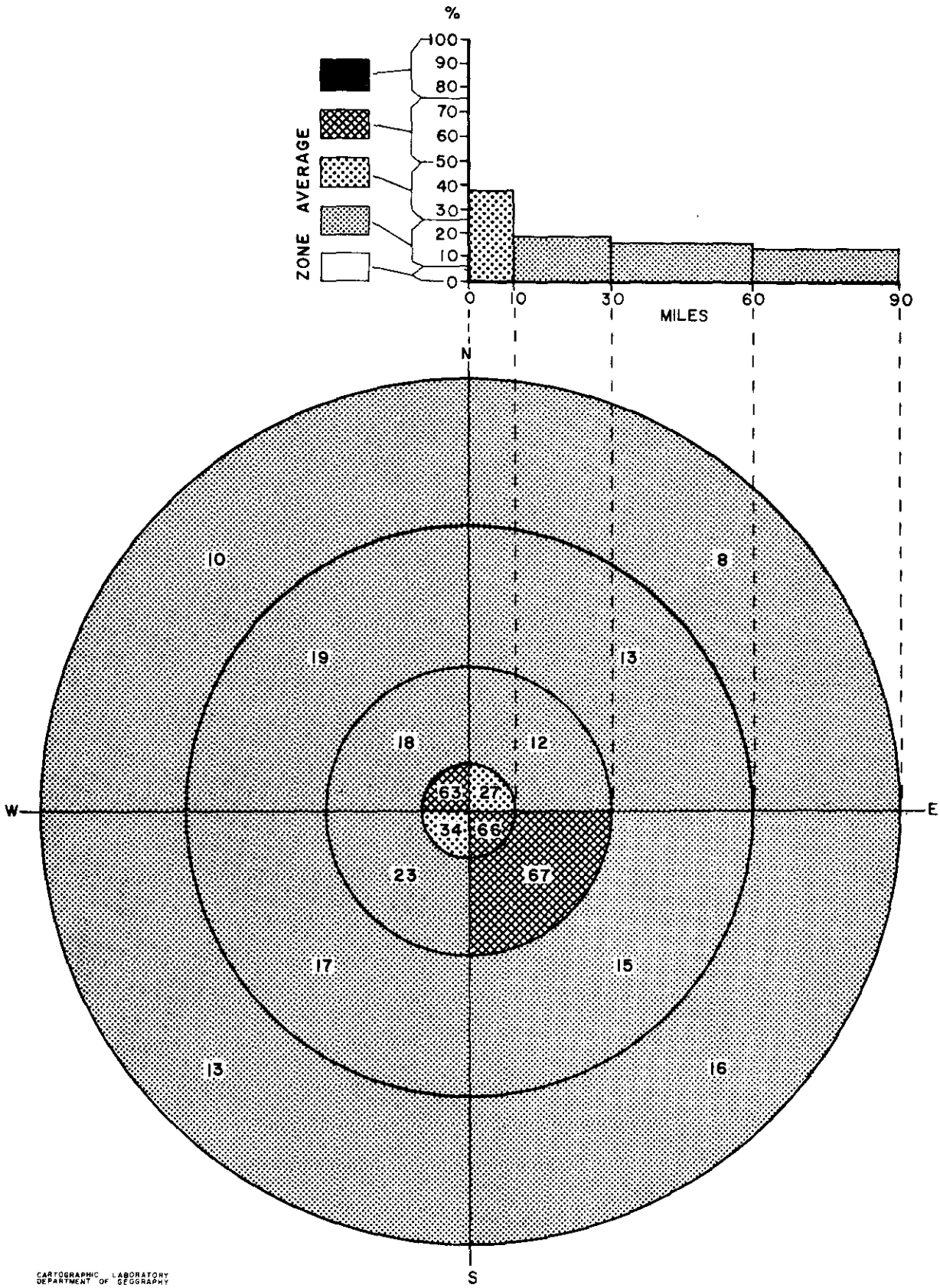
TABLE 7. INDIRECT MEASURES OF KEYSTONE IMPACT PERCENT OF TOTAL RESPONDENTS BY ZONES

	Zone 1	Zone 2	Zone 3	Zone 4	All Zones
Percent Responding...					
Major increase in participation in one or more water-based recreational activities*	38	18	16	13	18
Major decrease in participation in one or more water-oriented recreational activities*	9	13	14	17	14
Increase in equipment ownership for one or more water-based recreation activities*	22	14	11	8	12
N=	154	252	336	458	1204

*Includes the following activites: swimming, boating fishing, water-skiing.

A major increase is defined as more than ten occasions per year.

THE PROPORTION OF THE SAMPLE WHO REPORTED INCREASED PARTICIPATION IN ONE OR MORE WATER-BASED ACTIVITIES BETWEEN 1960 AND 1970



CARTOGRAPHIC LABORATORY DEPARTMENT OF GEOGRAPHY
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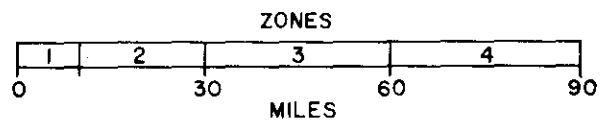
Figure 9



THE PROPORTION OF RESPONDENTS WHICH REPORTED A DECREASE IN RECREATION PARTICIPATION BETWEEN 1960 AND 1970

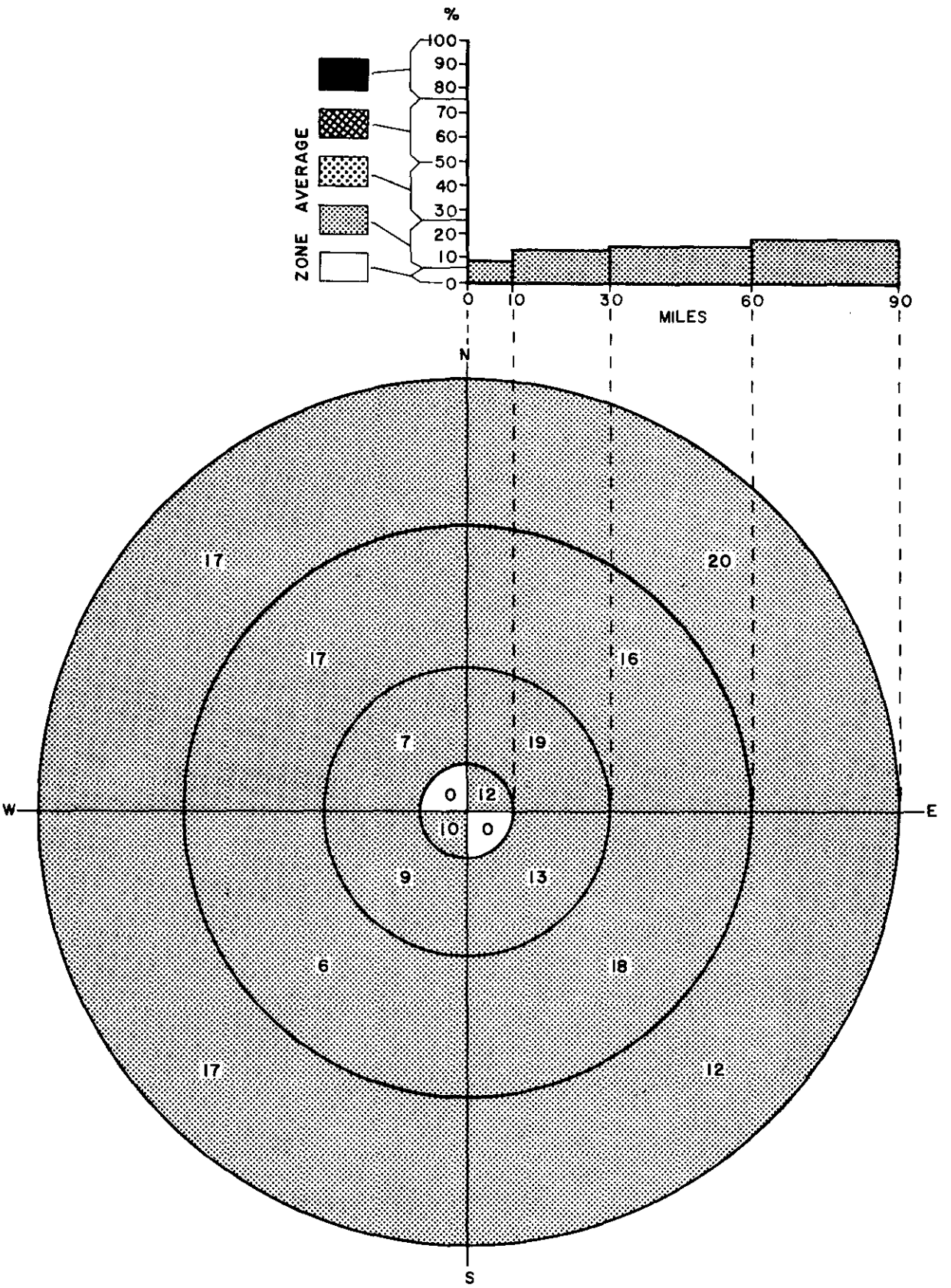


Figure 10

THE PROPORTION OF RESPONDENTS REPORTING AN INCREASE IN OWNERSHIP OF EQUIPMENT FOR WATER-BASED ACTIVITIES DURING 1960 TO 1970

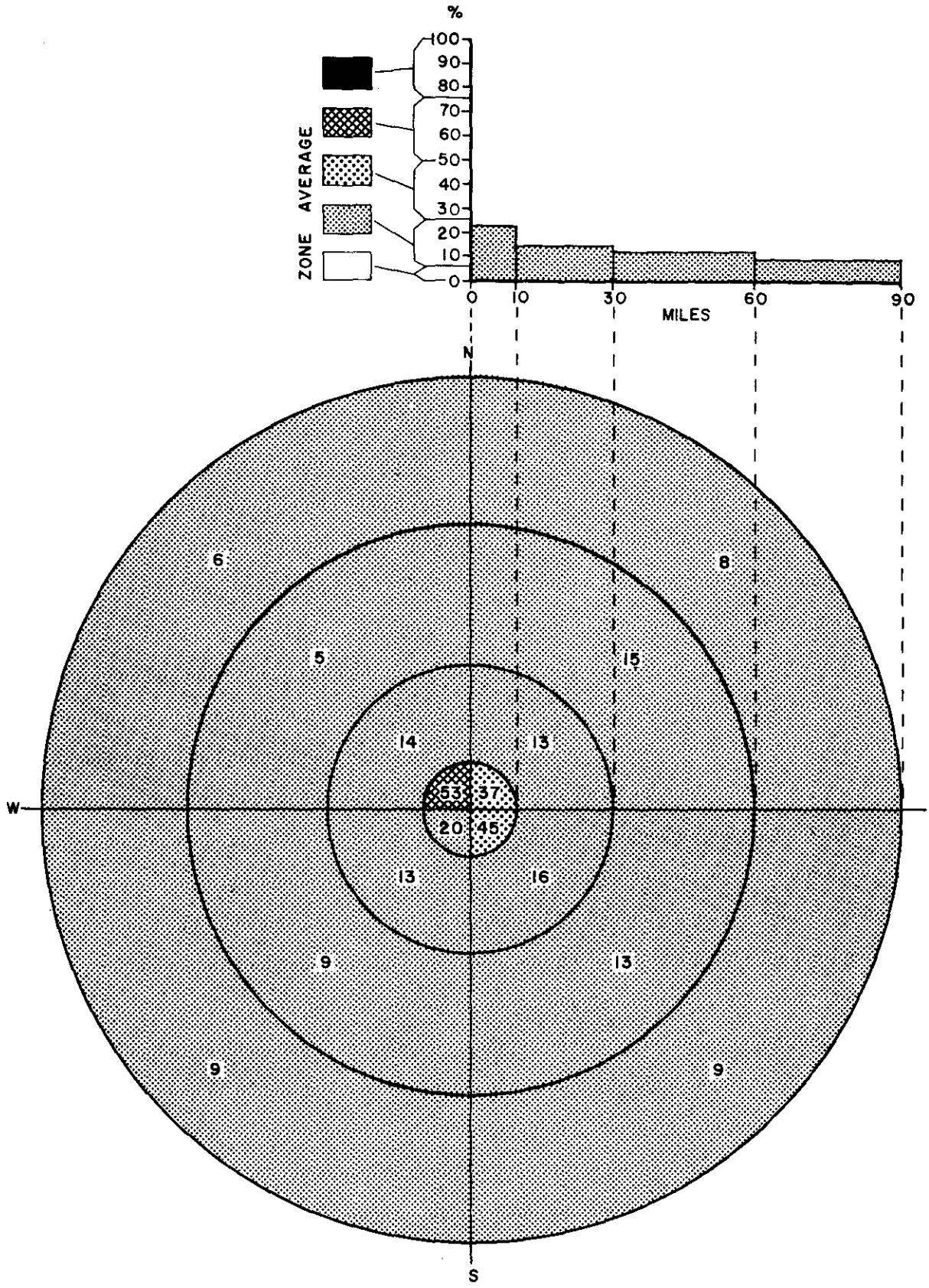


Figure 11

CHAPTER 4

IMPACT ON RECREATION BEHAVIOR: SIGNIFICANCE TO LOCATIONAL STRATEGIES

If equality criteria (e.g. Proportion of total population affected) are to replace efficiency criteria (e.g. number of visits generated) in the evaluation of water resource project plans, present notions regarding the role of distance will have to be altered. (Table 8) This will in turn result in changes in locational strategies for water-based investments.

Under current and proposed federal guidelines for analyzing benefits, no specific procedures for delimiting the boundary of impact is spelled out. This shortcoming exists in spite of considerable research into the relationships between distance traveled and visitation generation (Clawson, Palmer, Volk). In practice two methods are used: predictions are made based upon past visitation patterns at analogous facilities in the vicinty, or where these "comparable figures" are not available, population is estimated within an arbitrarily defined "zone of influence" or "market area" (usually 50 to 100 miles) and national or regional participation rates are used to facilitate an estimate of future visitation.

At most large reservoirs in Oklahoma, the proportion of total visitations coming from each distance zone increases with increasing distance to about thirty miles, and then declines until 120 miles is reached (beyond that point only a very small proportion (1%) of total visitation originates.)

Utilization of this knowledge in making plans for water resources investments would produce plans which favored development of relatively large-capacity relatively widely scattered developments.

Our findings show a relatively steeper slope as far as those people who are affected in some way by the development of a major reservoir are concerned. As previously pointed out, only very small proportions of the populations beyond sixty miles experienced any sort of impact from the development of Lake Keystone.

TABLE 8. EFFICIENCY AND EQUALITY

Efficiency Criteria	ZONES 1	2	3	4	Total
Proportion of Total Visitation from each zone N = 1280	10	37	28	22	100
Equality Criteria					
Proportion of total participants from each zone N = 380	33	44	22	11	100

Intervening Opportunities

As noted earlier, there are a number of other comparable reservoirs located to the east and southeast of Keystone (Figure 12). From inspection of Figures 5-11; it would appear likely that the Keystone impact is affected by their presence; with the fall-off of impact with increasing distance exaggerated to the east and southeast. Comparison of the zones beyond thirty miles from Keystone for the reservoir-rich southeast quadrant and the northwest quadrant where there are no similar reservoirs, indicates that there are significantly different levels of impact as measured by each of the variables (chi-quares are significant at the .01 leve in all instances). In fact, in most of the sampled communities which are closer to other major reservoirs than they are to Keystone there is little if any Keystone impact experienced (Figure 13); and it is also true that among the communities which are closer than sixty miles to Keystone and which indicate little or no Keystone impact, most are closer to other reservoirs. It appears that most recreationists prefer to stick with a known area rather than experiment with a new and unfamiliar one.

Summary

The following are the major findings of this study:

1. Relatively few (about one-fourth) of the persons in the study area as a whole acknowledge that Keystone has had any significance on their recreational life;

2. Even among recreationists, fewer than half in the study area indicate that they have experienced any impact at all from the new facility;

3. The extent of the impact is severely restricted in areal terms; beyond a one-hour's drive, fewer than one in twenty of those surveyed reported that Keystone has had any sort of effect on their recreational lives.

4. When competing opportunities exist the impact is considerably less, falling to near-zero approximately forty miles from the reservoir.

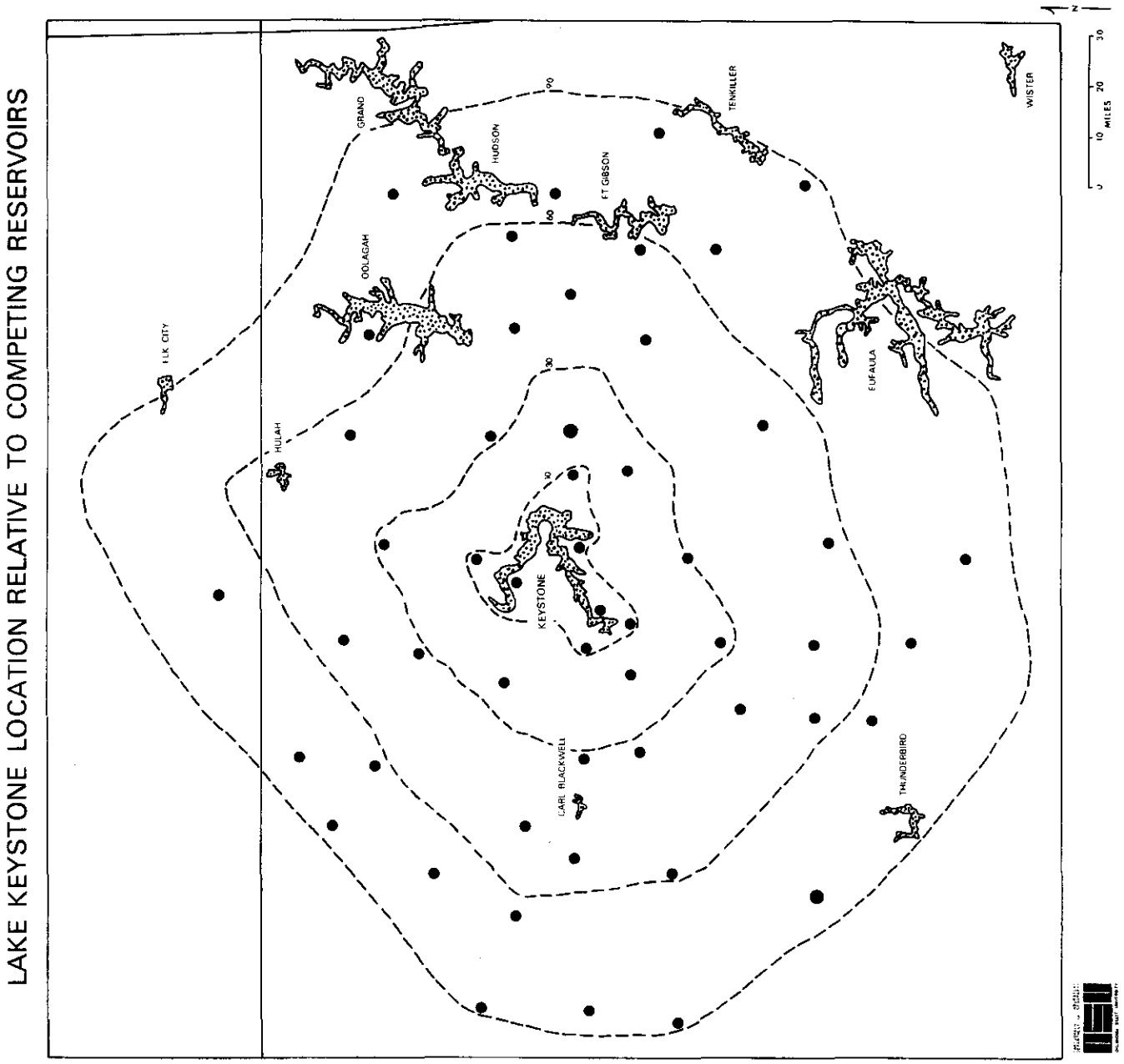
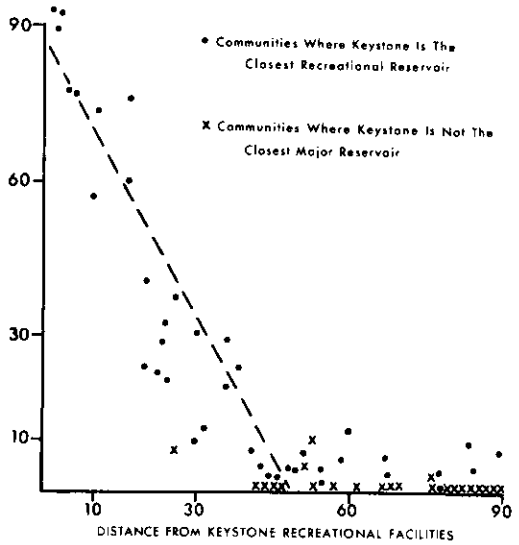
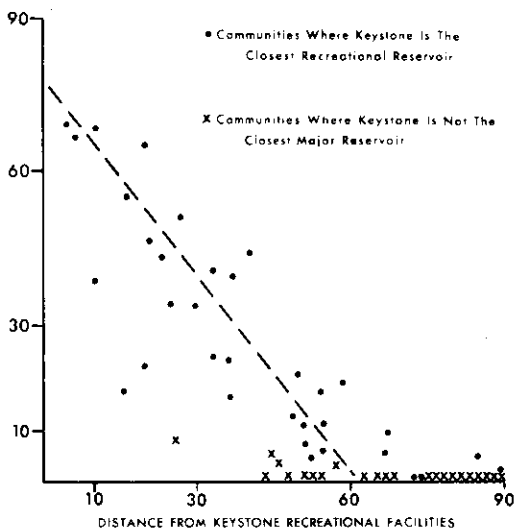

LAKE KEYSTONE LOCATION RELATIVE TO COMPETING RESERVOIRS
ELK CITY
HULAH
OOLAGAH
GRAND
HUDSON
FT GIBSON
TENKILLER
WISTER
EUFAULA
KEYSTONE
CARL BLACKWELL
THUNDERBIRD
70
80
90
10
30
0
10
20
30
MILES
N

Figure 12

THE PROPORTION OF BOATERS AT EACH SAMPLE SITE WHO INDICATE THAT KEYSTONE IS THEIR MOST FREQUENTLY VISITED AREA.



PROPORTION OF RESPONDENTS AT EACH SAMPLE SITE WHO INDICATE THAT THEY HAVE EITHER SWITCHED RECREATION AREAS OR INCREASED PARTICIPATION AS A RESULT OF KEYSTONE'S DEVELOPMENT.



THE PROPORTION OF RECREATIONISTS AT EACH SAMPLE SITE WHO INDICATE THAT KEYSTONE IS THEIR FAVORITE RECREATION AREA.

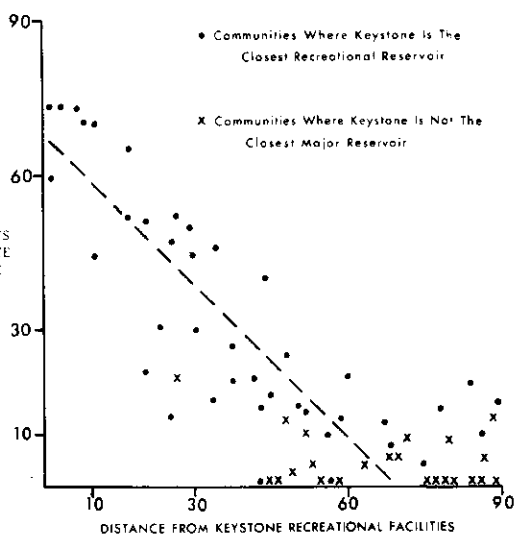


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Figure 13

This relationship suggests that if future planning is to accept the proposition that more equitable distribution of facilities is needed, then it follows that a more dense network of recreation facilities will be required than that suggested by the "supposed" patterns of visitation which currently prevail.

Mannford: A Case Study

Since distance from the recreational resource is so important, the Mannford, Oklahoma, situation is of special interest. Here one would expect a near total recreational impact from the development of Keystone. For during the early sixties, the town site of Mannford was moved to avoid innunation by Lake Keystone. The residents were relocated on higher ground near the shore of Lake Keystone. In the spring of 1971, an intensive survey of eighty-eight residents who had lived in Mannford before, during and since the development of Keystone (this represents 25% of the 1960 population of Mannford which was 358.) were surveyed with regard to their recreation behavior during this period. Though the sample exhibited an overall increase of approximately 19% in total recreation occasions during the period, the increases were not concsistent among all activities surveyed. Boating occasions nearly tripled during the period while fishing and swimming experienced a moderate increase and both hunting and camping activity decreased (Table 9).

The sample had been designed to identify age-specific changes. Increases in total participation were greatest among those who were under 30 years; moderate changes occurred among those who were 30 and 49 years in 1971 (Table 10). There was a decrease in total participation among those who were over 50 years in 1971. Camping and hunting exhibited declines in both over-thirty age groups. Boating increased among all age groups while swimming increased only among the middle group. Fishing exhibited an even more mixed pattern - large increases among the under 30 group, some decrease in the middle group and a nearly stable situation among the older residents of Mannford.

TABLE 9. CHANGES A RECREATIONAL BEHAVIOR, MANNFORD, OKLAHOMA

	OCCASIONS PER CAPITA		
	1960	1970	% CHANGE
Swimming	10.3	11.8	15%
Boating	3.6	10.6	193%
Fishing	10.2	11.1	9%
Camping	2.6	2.1	-21%
Hiking	2		-38%
TOTAL			+19%

N=88

TABLE 10. RECREATION BEHAVIOR IN MANNFORD, OKLAHOMA

MEAN ANNUAL RECREATION OCCASIONS PER CAPITA

	Under 30 Years			30 to 49 Years			50 and Over Years		
	1960	1971	Change	1960	1971	Change	1960	1971	Change
Swimming	12.9	12.4	-.5	11.0	15.6	+4.6	6.9	7.3	+.4
Boating	1.8	10.9	+9.1	2.6	8.3	+5.7	6.5	12.8	+6.3
Fishing	5.1	8.6	+3.5	9.5	8.2	-1.3	16.2	16.7	+.5
Camping	.6	3.1	+2.5	2.1	1.2	-.9	5.2	2.0	-3.2
Hunting	4.7	7.3	+2.6	4.7	3.1	-1.6	11.0	2.3	-8.7
Total Outdoor Activities	25.2	42.4	+17.2	30.	36.4	+6.4	45.9	41.1	-4.8

PERCENT OF RESPONDENTS OWNING EQUIPMENT

	Under 30 Years			30 to 49 Years			50 and Over		
	1960	1971	Direction of Change	1960	1971	Direction of Change	1960	1971	Direction of Change
Guns	38	31	-	.43	.33	-	31	24	-
Camping	10	45	+	.13	.43	+	7	28	+
Boating	0	24	+	.10	.50	+	14	59	+
Other Fishing	45	72	+	.73	.87	+	62	72	+
N =		29			30			29	

The largest proportion of respondents indicated that their favorite and most visited recreation areas in 1960 were either the Cimarron or Arkansas rivers. (Table 11) Lake Heyburn (about fifteen miles from Mannford) also ranked highly in pre-Keystone days. With the new facility came a considerable realignment of recreation resource preferances and selection, indicating clearly the extent to which enhancement of opportunities caused shifts in behavior.

TABLE 11. RESPONDENTS' HIGH-RANKING CHOICES FOR FAVORITE RECREATION AREAS

	Under 30	30-49 Years	50 and Over	Total Sample
1960	L. Heyburn	Ft. Gibson	Cimarron R.*	Cimarron R.*
	Cimmarron R.*	Grand Lake	Arkansas R.*	L. Heyburn
	L. Tenkiller	L. Heyburn	L. Spavinaw	Arkansas R.*
1970	New Mannford*K	Salt Creek N.*K	Salt Creek N.*K	Salt Creek N.*K
	Old Mannford*K	Old Mannford* K	New Mannford* K	New Mannford* K
	Salt Creek N.*K	New Mannford* K	City Lake* K	Old Mannford* K

RESPONDENTS' HIGH-RANKING AREAS IN TERMS OF FREQUENCY OF VISITATION

	Under 30	30-49 Years	50 and Over	Total Sample
1960	Cimarron R.*	Cimarron R.*	Cimarron R.*	Cimarron R.*
	L. Heyburn	Grand Lake	Arkansas R.*	Arkansas R.*
	Arkansas R.*	Heyburn L.	Grand Lake	L. Heyburn
1970	New Mannford*K	Old Mannford*K	Salt Creek N.*K	New Mannford*K
	Old Mannford*K	New Mannford*K	New Mannford* K	Old Mannford*K
	Salt Creek N.*K	Salt Creek N.*K	Old Mannford* K	Salt Creek N.*K

*Within ten miles of Mannford

K - A Lake Keystone Recreation Area

CHAPTER 5

SIGNIFICANCE OF THE FINDINGS TO WATER RESOURCES PLANNING

The impact of recreational resources development has been understood to a large extent in the context of feasibility studies for federally supported water resources developments. Under these circumstances, emphasis has been placed upon determining the benefits, especially economic benefits that derive from the expected or monitored recreational use of various types of public works projects. The procedures recommended for identifying these benefits are well-known and have been institutionalized in elaborate statements of official procedures used by federal agencies (U.S. Senate Document 97; Water Resources Council, 1962, 1965, and 1971). The assessment of recreation benefits consist of two procedures; prediction of visitation to the new facility and assessing the benefits. Under current practice the visitation part of the equation is calculated by totaling the population of the surrounding area (often within 100 miles). The size of the area is sometimes based upon experience with other reservoirs in similar settings, or dependent expectations derived from estimates of the market for such a facility. The determination of anticipated annual visitation is made for the life of the project. Using an arbitrary value per visit (which typically ranges from $.75 to $9.00 depending upon the uniqueness of the facility) total annual benefits are then computed.

Several criticisms of this approach relate to the validity of its tacit assumptions from an economic point of view (Kalter, et al, and Cicchetti et al, 1969, 1972). A major shortcoming is the "incorrect separation" of price (and/or value) and numbers of visitors.

In addition, there is a further incorrect assumption that as resources are developed more participation will be generated regardless of the physical capacity

of facilities, and the available alternative uses for leisure time. Also, little consideration is given to the opportunity costs involved in the permanent destruction of a recreational resource such as wetlands or stream fisheries. Finally, insufficient attention is given to the fact that anticipated attendance represents net benefits for the new facility, not taking into account the loss of recreation benefits to hunters, stream fishermen, and the possible reduction in visitation at other nearby recreation facilities.

The research described here serves to support at least some of these criticisms directed at current evaluative procedures. A substantial number of persons in the study area actually decreased their participation - for them the reservoir may have been a "bane rather than a boon," for opportunities for the particular kind of recreation in which they frequently participated may have been decreased. Another group reacted to the new facility by changing the location of their participation without increasing the level of participation. For these people, the benefits of Keystone were perhaps two-fold: on the one hand they presumably profited by lowering travel costs (time); or they may have benefited to the extent that they now have a superior recreational resource closer to them or at least within a short enough distance for them to realize a benefit. Another group, albeit a small one, clearly initiated and increased their participation in water-based recreation, apparently as a direct result of the increased access to opportunities or the increased quality of opportunities which Keystone provides.

A Broader View of Benefits

It is the principle investigators' view that planning should be concerned not only with efficiency as measured by economic benefits (Freeman), but also by measures of equality in terms of provision of opportunities. This is a view consistent with the intent of the Land and Water Conservation Act (1965)

> "The purposes of this act are to assist in preserving, developing and assuring accessibility to all citizens of the United States..."

The recreational behavior of relatively few people is affected by the presence of Lake Keystone. This finding coupled with the finding that impacts which are measured are also found to be highly localized, suggests that considerably more attention needs to be given to the question of whether or not we are providing and assuring accessibility to all citizens.

Future practices of evaluation should be consistent with the goal of insuring that all who want to participate in water-based activities have the opportunity. In order to accomplish this it may be necessary to reduce our reliance on large-scale reservoir projects to satisfy regional recreational needs, or at least seek to locate them in such a way as to have maximum impact on the largest number of people, rather than just attempting to maximize the number of total visits.

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