DEMAND FOR AND ECONOMIC IMPACT OF OUTDOOR RECREATION AT LAKE TENKILLER

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DEMAND FOR AND ECONOMIC IMPACT OF OUTDOOR RECREATION AT LAKE TENKILLER

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CHAPTER I

INTRODUCTION

The General Problem

Lake Tenkiller has been a popular area for recreationists since its completion in 1953 and is one of the most intensively used lakes for recreation of any lake in Oklahoma. The high rate of recreation use at the lake has caused conflicts between recreation and the other functions. Flood control and hydroelectric power generation cause fluctuations in the water level which is detrimental, to some extent, to recreation. However, Lake Tenkiller was justified on the basis of benefits from flood control and hydroelectric power. Recreation and municipal water supply were not included as purposes in determining benefits, but were by-products of the project.

Recreation does not currently compete with the municipal water supply purpose. However, water quality may deteriorate sufficiently in the future, without proper recreation management, which would cause a conflict between water supply and recreation. Problems may also arise as the quantity of water committed to water supply increases in the future. The water in Lake Tenkiller is of very high quality and is preferred by municipalities and industries as their primary water supply. Increased urbanization and industrialization could lead to competition between water supply and the other purposes.

loudly and resulted in political maneuvering [9] and several impact studies [1, 19, pp. 22-32]. The impacts of fluctuating water level, as it affects recreation, differs on various lakes, making it necessary to analyze each lake separately.

Maintaining the environmental integrity of the Lake Tenkiller recreation area also is of considerable importance. Intensive use of the recreation facilities without proper management will result in the erosion of soil on the shores of the lake. Sediment and other polluting materials are a by-product of such uncontrolled use. As the quality of the water is reduced, water supply and recreation become competitive with each other. In addition, deterioration of the recreation area surrounding the lake reduces the quality of the recreational experience, thus reducing the value associated with the recreation purpose.

Objectives of the Study

The general objective of the study was to estimate the demand for and the economic impact of selected water-based recreational activities at Lake Tenkiller. The specific objectives of the study were:

1) To determine the socio-economic characteristics of recreation users at Lake Tenkiller, by occupation, work week, education, income, mode of transportation, miles traveled, size of group, length of visit, type of trip and other classifications.
2) To determine the expenditure patterns of recreationists at Lake Tenkiller and to develop demand curves for lake associated outdoor recreational activities.

There is, therefore, a potentially competitive situation among the four uses of water: flood control, power generation, water supply and recreation. If resources are to be allocated efficiently between competing uses, the benefits forthcoming from each use must be determined. The benefits resulting from flood control, power generation, and water supply are normally readily available and a matter of public record. The purpose of this study is to determine the benefits arising from recreation, how recreation interacts with the other purposes, and how to minimize the conflicts between recreation and the other uses of the lake.

Considerable research has been undertaken to determine the demand for and the economic impact of recreation. In a critique of recent developments in outdoor recreation, Kalter stated that:

> Although conceptual and empirical difficulties have inhibited the empirical estimation of recreation demand functions, the search for meaningful substitute approaches to provide economic planning data has not been successful. Other methods have not been able to adequately consider all the factors relevant to the demand for and the economic value of recreation; nor have they been able to distinguish between the different values associated with different types and qualities of recreation experience. [11, p. 157]

While there is no generally accepted "best" method of estimating the value of outdoor recreation, several alternative methods have been used [17].

Fluctuating lake level and low drawdown of the water resulting from power generation and flood control compete with a generally stable conservation pool best suited for recreation at Lake Tenkiller. Because flood control is given the immeasurable benefit of saving human life, it is not contested. However, power generation has been contested

3) To determine the economic impact on the local economy of recreationists using Lake Tenkiller.

4) To analyze recreational management problems of the Lake Tenkiller complex and to present some alternatives that maintain the environmental integrity of the area.

Recreation planners have long realized that various socio-economic characteristics of recreationists affect their participation in various recreational pursuits and their expenditure patterns. The determination of selected socio-economic characteristics of recreationists using Lake Tenkiller was needed to analyze the impact, if any, of these characteristics on expenditure patterns and participation in various recreational activities. This information should be useful in estimating future economic benefits based on existing or expected socio-economic characteristics of recreationists using a particular lake.

The determination of expenditure patterns of recreationists at Lake Tenkiller was an important part of this study: first, for determining the impact of various demand shifters or socio-economic characteristics; and second, for determining the economic impact on the local economy. Expenditure information should also be useful to public recreation agencies in making better informed decisions regarding future development of recreational facilities.

Income, output, and employment multipliers were used to determine the economic impact on recreation on the local economy. These multipliers were the result of several input-output studies previously done for areas where recreation is of considerable importance to the local economies. This information is useful to local government

administrators and planners in estimating the benefits to be gained from development of recreation.

As outdoor recreation becomes more important in an area's economy, an increasing number of conflicts between various groups of recreationists results unless efforts are made to minimize these conflicts through proper management of recreational facilities. If public agencies are to properly manage public use areas with limited operational and maintenance funds, it is imperative that present and potential conflicts among recreationists using the areas be determined, and steps taken to eliminate or minimize conflicts.

Area of Study

The study area was Tenkiller Ferry Lake in Cherokee and Sequoyah Counties in east-central Oklahoma (Figure 1). Construction of the lake was completed in 1952 by the U. S. Army Corps of Engineers. The lake is operated by the Corps as a multi-purpose reservoir [25]. Initial purposes of the reservoir were flood control and power generation. The lake now also is used for water supply and recreation.

While recreation was not an original official purpose, the lake is a very popular area for both local residents and people traveling a considerable distance to enjoy the surroundings. The lake is in a natural scenic area with sheer cliffs at the lake's edge. The lake is located in the center of the rugged Cookson Hills, which are rich in folklore and history. The vegetation and cover of the rugged hills are much the same today as in years past when outlaws fled to the hills for protection and refuge from the law.

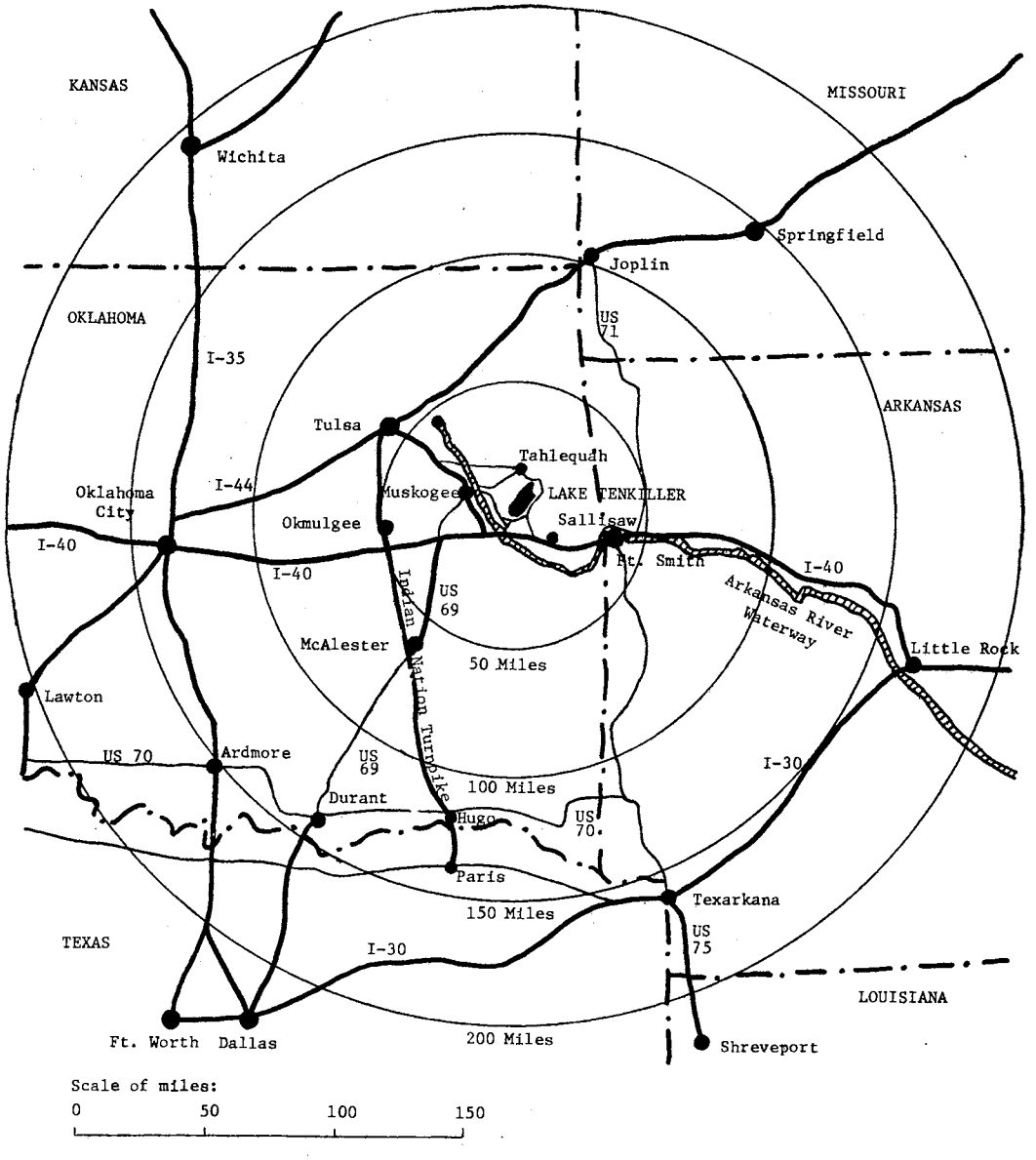

Figure 1: Location of Lake Tenkiller and Travel Distance Zones

The nearby city of Tahlequah, 15 miles north of Lake Tenkiller, is rich in Indian history and is the site of the historic Capital building of the Cherokee Nation. Just south of Tahlequah is the site of Tsa-La-Gi, an authentic re-creation of the Cherokee life style in Georgia during the 1700's before their trek over the Trail of Tears to Oklahoma. Nearby Ft. Gibson is the site of the old Fort Gibson stockade and the Fort Gibson National Cemetary.

The clear water of the lake can be attributed to the heavily wooded drainage basin and the numerous underground springs. Skin divers from all over the United States come to enjoy the deep, clear water of Lake Tenkiller. Many divers and other recreationists contend Lake Tenkiller has the clearest water of any inland lake in the nation, with diving depths of 150 to 200 feet.

Lake Tenkiller has 12,500 surface acres and 130 miles of shoreline at the top of the power pool (630 feet mean sea level). There are 18 public use areas, including three state parks and one city park. All areas have boat launching ramps, picnic and camping facilities and restroom facilities (Figure 2).

Organization of Remainder of Thesis

The remainder of the thesis is organized into five chapters. The various procedures and review of literature used in the study will be presented in Chapter II. Presentation of data related to outdoor recreation at Lake Tenkiller is presented in Chapter III. The value of recreation and its impact on the local economy is evaluated in Chapter IV. A discussion of outdoor recreational management problems and some

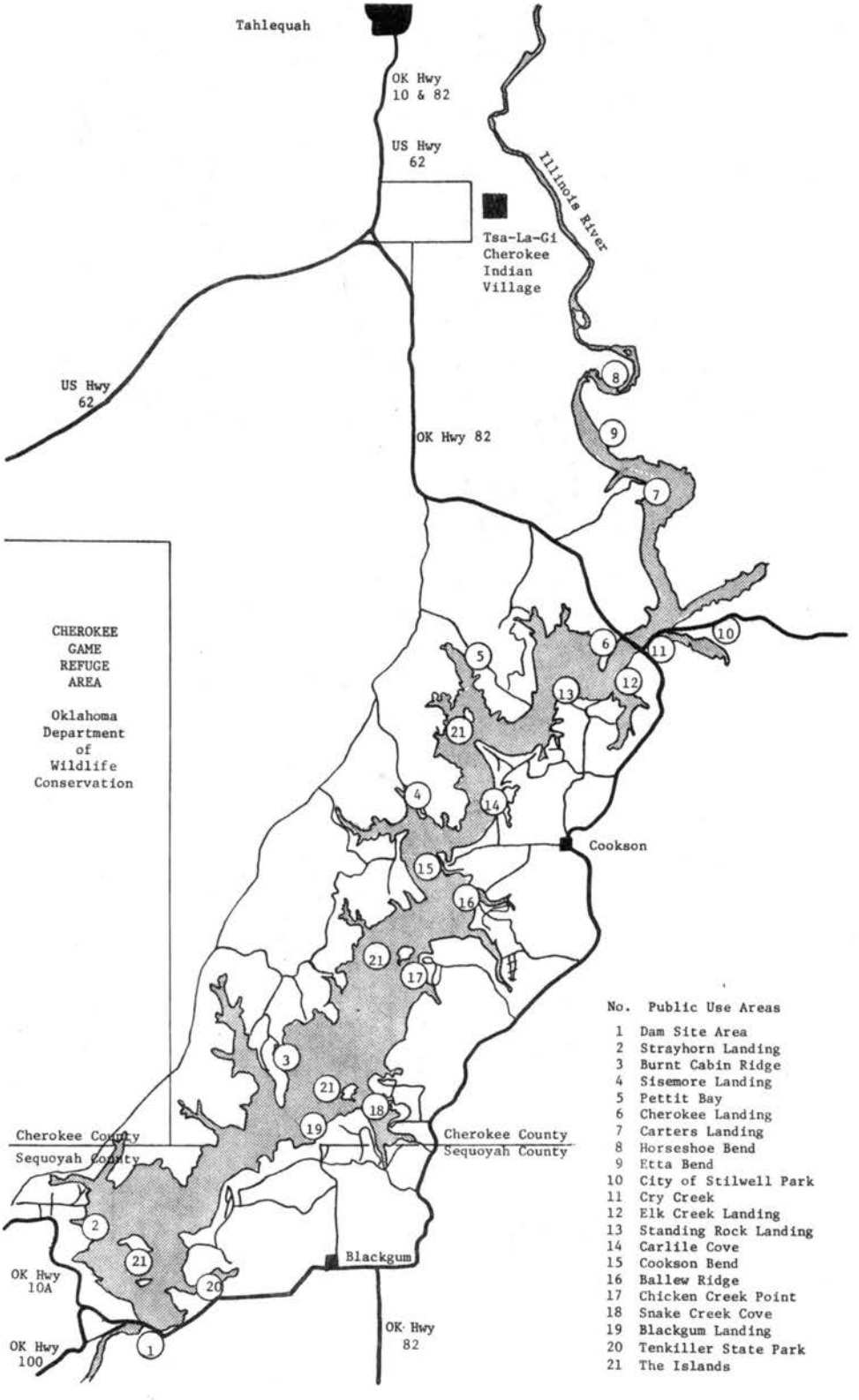

Figure 2: Public Use Areas Around Lake Tenkiller

possible solutions are presented in Chapter V. The summary and conclusions are presented in Chapter VI.

CHAPTER II

PROCEDURE AND REVIEW OF LITERATURE

Sources of Data

The impact and demand for recreation analyses required several types of information which were obtained from various sources, such as state and national publications, from the Tulsa District of the U. S. Army Corps of Engineers, and from the use of questionnaires. Information from the Corps of Engineers consisted of lake recreational attendance, information regarding concession operations, and daily water level since 1955. Questionnaires were developed to obtain information from recreationists using Lake Tenkiller, from concession operators on the lake, and from local businessmen with operations off the lake. Copies of these questionnaires are in the Appendix.

Recreation attendance figures are available by month and year since January, 1953. Attendance figures are important in determining the benefits generated to the local economy, particularly when correlated with recreationists' expenditure data. The most important and obvious use of the data was to estimate economic benefits to the local economy. A twelve month moving average was applied to the data to determine if the summer vacation period was becoming more or less important in relation to the annual attendance figures; i.e. has there been a change in the seasonal pattern of recreational attendance over

the years? The attendance information reflects past trends and is useful to recreation agencies when planning facilities to meet projected future demand.

Seven concessionaires have lease agreements with the Corps of Engineers to operate marinas on Lake Tenkiller. Information available from the Corps was combined with information obtained from the concessionaires.

Recreationists were interviewed as they participated in various recreational activities around the lake. Information was obtained for place of residence, distance traveled and driving time to Lake Tenkiller. Various questions regarding socio-economic characteristics, such as income, age, education, occupation, and expenditures were asked. Information was obtained on the size of the party and length of stay, and investment in recreational equipment. Each recreationist interviewed was asked to comment on any problems he had encountered regarding the present recreation management, and on suggestions for improvements.

Political pressures have been brought to bear concerning the fluctuating water level due to power generation. Also strong differences of opinion have been voiced in the public media on charging fees at public use areas. During the interviews, recreationists were asked if fluctuating water level affected their recreational enjoyment. They also were asked to comment on the charging of user fees in the improved public use areas.

Concessionaire information was obtained on annual sales, type of business, number of employees and payroll, trend of sales over the past several years, major management problems, seasonal nature of business,

effects of fluctuating water level on business, and information on boat storage facilities. This information was supplemented with data obtained from the Corps of Engineers. Local businessmen around the lake also were interviewed, using the concessionaire questionnaire with the exception of Section 8.

Analysis of Recreational Data

The empirical data collected for this study were from various sources and in various forms. In some cases it was necessary to condense existing data to present it in a more manageable form. The various types and sources of data used in the study and the procedure for analysis are discussed below.

Data from the recreationists' questionnaire provided the bulk of the information for the study. Expenditures for the recreation trip were estimated within given ranges. A value was assigned to each range representing the average of the range. The trip expenditure data were obtained in two parts: expenditures in the local area, and, non-vehicular expenditures on the road between home and Lake Tenkiller.

A factor of $.07 per mile was used to determine vehicle costs. Recreationists' expenditures were classified as follows: transportation in area (including gas and oil for boat); lodging, groceries and meals; and miscellaneous.

Total visitor days per group were determined by multiplying length of visit in days times the number of people in the group. Expenditures per visitor day then were determined by dividing total variable expenditures by the number of visitor days.

Data also were obtained regarding investment in recreational equipment, by type of equipment and by place of purchase. Investment by type of equipment was calculated to determine the monetary importance of various recreational activities based on investment data. Investment by place of purchase was calculated to determine how much of the economic benefit from such investment was being received by the local economy; i.e., where the major economic impact of investment in recreation equipment is being received.

Information regarding educational attainment, income, and occupation for the respondents was tabulated and compared to the distribution existing in Cherokee and Sequoyah Counties, in the State of Oklahoma and in the State of Arkansas [27]. Other data tabulated and presented included type of trip, type of group, and mode of transportation.

Data obtained from the concessionaires include gross sales, employment, and payroll. Several comparisons were made between concessionaires on the lake and other businesses nearby. These comparisons include average gross sales, ratio of employment to sales, ratio of payroll to sales. Relocation costs due to fluctuating water levels were also calculated for floating facilities of lake concessionaires.

Relocation Costs Due to Fluctuating Water Level

Concessionaires with floating facilities must adjust to fluctuating water levels. They must be prepared to relocate their facilities as the water level rises or falls. The frequency of relocation and the associated monetary costs were determined through personal interviews with individual concessionaires and from information in Corps of Engineers' records. Each concessionaire's "schedule of costs" was

combined into a composite "schedule of costs" for all concessionaires. This schedule of costs reflected the actual monetary costs of moving facilities at various water levels. By coordinating the "schedule of costs" with water level, relocation costs suffered by concessionaires on the lake due to fluctuating water levels were determined.

Economic Impact on the Local Economy

Annual visitation estimates and estimated expenditures per visitor day provide the basic data needed to estimate outdoor recreation benefits and the economic impact on the local economy. Two generally accepted techniques have been used to estimate outdoor recreation benefits and/or the economic impact: demand analyses and input-output models. Demand analyses utilizing recreationists' expenditure and participation data provides some indication of the "value" of outdoor recreation. Input-output models, using several multipliers, can be used to determine direct, indirect, and induced effects of recreation expenditures on the local economy.

Recreation Demand Curves

Several methods have been advanced by recreation economists to estimate recreation benefits using estimated demand curves or schedules. This technique is useful for benefit determination, and also for evaluating the implications of various policy decisions regarding user fees and other means of rationing the use of heavily impacted recreation areas.

Demand for a good or service is defined as the various quantities of the good or service per unit of time that consumers will take off

the market at all possible alternative prices, other things being equal or constant. The quantity of a good or service taken normally varies inversely with price. Thus the demand schedule, or demand curve, is normally downward sloping to the right. Demand refers to an entire demand schedule or demand curve and is a maximum concept representing the maximum quantities per unit of time that consumers will take at various prices. At a given price, consumers will take smaller quantities if necessary, but cannot be induced to take more than those shown by the demand curve. Conversely, the demand curve can be viewed as showing the maximum prices consumers will pay for different quantities per unit of time. They will pay no more but can easily be induced to pay less for each of the various quantities shown by the demand curve [13, p. 31].

Market prices, in the traditional sense, are not available for outdoor recreational activities, making the use of "proxy" prices necessary. Different researchers have advocated the use of different types of expenditures to serve as a "proxy" for price. Once the demand curve has been obtained, various methods also have been used to determine the recreation benefits.

Trice and Wood [23] made one of the earlier attempts to estimate a demand curve where costs of travel to and from a recreational area served as a proxy for price. They used a fixed cost per mile to determine the value of the recreation experience, thus causing the differences in costs per visitor day to be a function of distance traveled. To measure the benefits of the recreational area, they made use of the consumer surplus concept which defines "benefits" to be the difference between the amount the consumer would have been willing to pay and the

amount actually paid. Trice and Wood's measure of recreational benefits was defined as that area between the median costs for all recreationists and the costs associated with recreationists in the 90th percentile.

Clawson [3] expanded on the Trice and Wood method and used concentric distance zones to obtain demand curves for several national parks. He determined the number of visits forthcoming from each travel zone per 100,000 population and used travel costs from each zone as the price proxy.

Clawson used the demand curves obtained to determine the impact various levels of user fees would have on visitation rates for each zone. To do this, two assumptions were necessary: (1) users of an area would view increases in entrance fees rationally, i.e, they would view such increases similar to other increases in costs of visiting the area; and (2) the experience of users in one distance zone provides a measure of what people in other distance zones would do if costs in money and time were the same.

Gray and Anderson [7] obtained information from a sample of the recreationists on distances traveled for recreational purposes, number of people in each party, costs over and above normal living expenses, and the maximum amounts the recreationists would have been willing to spend. Travel costs were determined at a rate of nine cents per mile for the round trip and totaled with other costs, including depreciated value of recreational equipment. A market demand curve was plotted from the data where the party with the highest cost per visitor day (ordinate axis) was plotted with respect to the number of visitor days

spent by the first two parties. Points for all parties were plotted, resulting in a curve downward sloping and to the right.

In a Utah boating demand study, the price proxy was composed of travel costs to and from the recreation site plus expenditures incurred at the site. Depreciation costs of recreational equipment used during the trip were not included as they were considered to be fixed costs. Data obtained by personal interviews were aggregated and averaged for individuals in each of several specified travel zones. These averages represented the average expenditures per boating day per capita and the average number of per capita boating days per time period. Using regression techniques, an average individual demand curve was obtained which was used to estimate the average number of boating trips the average boater would take when faced with various prices. The aggregate demand schedule was obtained by multiplying the average demand curve by the sum of the boat population within the area of all the travel zones [28].

Each of the demand estimation methods will result in different values for outdoor recreation at Lake Tenkiller. The consumer surplus method was chosen as the appropriate method to measure the recreational benefits. Consumer surplus is the difference between the actual price paid for a good and the price the consumer would have been willing to pay rather than go without the good or service.

Two methods were used to estimate the consumer surplus: the Trice-Wood and the Clawson methods. The Trice-Wood method was used where the consumer surplus is the difference between the median costs of all recreationists and the costs associated with the 90th percentile. Clawson's method used concentric distance zones, and average demand

curves were determined for each travel zone. The average costs for recreationists in the greatest distance zone from Lake Tenkiller were used as the maximum benefits. Consumer surplus benefits were calculated for each travel zone from the costs associated with the most distant zone. The benefits from each of the zones were summed to determine the total consumer benefits.

Another school of thought exists which suggests that the recreation experience is worth at least the cost associated with the experience. Reflecting back on the "maximum concept" of a demand curve, a recreationist will pay some maximum amount, but will also be willing to pay less. This assumes the individual is in an equilibrium position, i.e. he was not forced into the situation and would willingly make the same decision again at a later date. Thus the experience is worth "at least" the recreational related expenditures.

Actual expenditure data were used to determine the minimum value of the recreation experience at Lake Tenkiller. This value was used as a "benchmark," or means of comparison, when calculating consumer surplus benefits.

Input-Output Analysis

Expenditures of recreationists provide an estimate of the direct impact, but do not take into account the indirect effects on the local economy. Input-output analysis is used to determine the total impact of expenditures in the local economy. These indirect effects, or "secondary benefits," vary from area to area depending on the interdependency between the various sectors of the economy in question. For example, as a new industry locates in an area, or as an established

business increases output, the initial impact likely will be the number of employees hired. As more employees are hired, more services are demanded from other sectors in the economy who in turn must hire additional employees to provide the increased services. As the service sector provides more services, more goods are demanded from other sectors, which in turn demand more goods and services from still other sectors. The reverberations will continue until the economy adjusts completely to the initial change. Repercussions of the initial impact are included in the indirect effect [5].

The value of the respective multipliers is the direct and indirect effect divided by the direct or initial impact. The magnitude of the multiplier value is dependent on the interdependence of the various sectors within the economy. In a well developed economy the interdependence between the various sectors is high with the various sectors being able to supply the needs or demands of each other, thus minimizing the need for imports into the area. Imports are commonly referred to as "leakages" and reduce the magnitude of the multiplier value.

The input-output model, and thus the value of multipliers, is based upon two fundamental assumptions. The most restrictive assumption is that the input-output coefficients are fixed. This implies that technology remains constant, no external economies or diseconomies exist, and substitution possibilities due to changes in relative prices or availability of new material are not considered [2]. This assumption is realistic in the short run, but technological and relative price changes cause the actual relationship to change over time.

The second assumption of the input-output model is that there are no errors of aggregation in combining industries into sectors. This

assumption implies that the coefficients for a sector are representative of the industries within that sector. Conclusions drawn from the analysis exemplify the average conditions of the industries within the sector. The more sectors included in the model, the less chance that errors of aggregation will arise.

Input-output multipliers are used to determine what effect a change in demand for goods and services from a particular sector will have on total output, employment and income. The output multiplier measures the amount of output resulting from a one dollar change in final demand for products of a particular sector.

The income multiplier measures the total change in income throughout the economy resulting from a one dollar change in income in a sector. The basis of the income multiplier is that a certain amount of income is generated with each change in output. The direct income effect is the amount of each dollar of output which goes to households in the form of income either as wages or salaries, proprietor's income or rent income. The direct and indirect income effects, measured by the income multiplier, are the total changes in income as a result of a one dollar change in output of the economy.

The employment multiplier is defined as the change in employment due to a one unit change in the labor force of a particular sector. The basic assumption underlying employment multipliers is that there is a linear relationship between employment and output in a sector. This relationship does not hold in some sectors as technology has allowed labor productivity to increase causing output to increase faster than employment. Sectors with underemployed resources or unused capacity will also cause the employment multiplier to be overstated.

Until recently, input-output studies did not contain a recreation sector. Recreation related industries typically have been aggregated into the service sector. In a study of the Oklahoma economy the following industries were included in the service sector: (a) hotels and lodging places; (b) personal service; (c) miscellaneous business services; (d) auto repair and services; (e) motion pictures; (f) amusements, recreation services; (g) medical services; and (h) other professional services [5, 15].

If the economic impact resulting from outdoor recreation is to be estimated, the multiplier associated with the service sector provides the best estimate. The analysis may, however, violate the second assumption of the input-output model as errors of aggregation may exist. Service sector multipliers represent the average conditions of all industries combined in the service sector and may not be representative of a particular industry. In the absence of a recreation sector, the multipliers associated with the service sector probably provides the best estimate of the impact related to the recreation industry. Doeksen's input-output analysis of the Oklahoma economy developed the following multipliers for the service sector: income, 1.58; employment, 1.33; and output, 1.76.

In a later study, the Oklahoma economy was divided into three relatively homogenous districts, and an economic structure analysis was conducted for each district [6]. Cherokee and Sequoyah Counties were located in District I, as designated by the study. A separate recreation sector was not developed; recreation was included in the service sector. The service sector multipliers were as follows: income, 1.22; employment, 1.43; and output, 1.28.

A 17 sector input-output model which included recreation as one of the sectors was developed for the Kiamichi Economic Development District encompassing seven counties in southeastern Oklahoma [18]. The area is very similar to the Cherokee-Sequoyah County area in that the study area is part of the Ozark region and generally considered to be an area of high unemployment and underemployment and generally low per capita incomes. Type I and II multipliers were developed for the seven county area. Type I multipliers reflect the direct and indirect effects on the regional economy while Type II multipliers reflect the direct, indirect, and induced effects. The difference between the two sets of multipliers is that the Type II coefficients are computed with the household sector endogenous to the regional economy; i.e., the effects of household (family) expenditures are included in the input-output model. In a small region, Type II multipliers are normally significantly greater than Type I multipliers. The magnitude of the two types of multipliers tends to converge as the size of the economy increases. The recreation multipliers developed for the seven county area were: income, (I) 1.07; (II) 1.77; employment, (I) 1.10, (II) 1.59; and output, (I) 1.18, (II) 2.20 [18, pp. 25,27].

In a study of the economy of Walworth County, Wisconsin, Kalter and Lord [12] developed multipliers for recreation exports. The economy of Walworth County is possibly more fully developed than the economy of the Cherokee-Sequoyah County area, leading to a greater independence between sectors. The multipliers developed are as follows: income, 1.52; employment, 1.50; and output, 1.62.

In another study, Strang used an input-output model to determine the economic structure and sector independence of Door County,

Wisconsin. The objective of the study was "to measure the positive economic impact of the outdoor recreation industry through tourism on an area dependent on its water resources as a major attraction " [22, p. 2]. Strang derived an output multiplier (community multiplier) of 2.17 when considering the total sales generated in the community as the result of tourist expenditures. The report also indicated that community leaders can determine how to make the most from a given resource base by merely analyzing the interdependency coefficients between sectors. A low interdependency coefficient between sectors may suggest the need for community leaders to seek new industry to fill the void in one of the sectors; thus increasing the interdependency between sectors and decreasing imports. This action could be expected to increase the multiplier values for both sectors.

It is obvious that each region has multipliers of different magnitudes as different levels of interaction between sectors exist in each economy (Table I). In addition, changing interactions between sectors has possibly changed the magnitude of the multipliers developed in each of the input-output studies since completion of the respective studies. Since no input-output analysis of the Lake Tenkiller area has been done, the appropriate multipliers for impact analyses were estimated, based on results of studies in similar geographic and socio-economic areas. The multipliers chosen represent the average of the Type I and Type II multipliers developed for the Kiamichi Economic Development District. With the close proximity of Ft. Smith, Tahlequah, Muskogee, and Sallisaw, the multipliers can be expected to exceed those developed for District I [6], but less than those developed for the

Oklahoma economy [5, 15]. The multipliers selected for the impact analysis of the Tenkiller area are: income, 1.42; employment, 1.34; and output, 1.69.

TABLE I

ECONOMIC MULTIPLIERS OF VARIOUS STUDY AREAS

	[5,15]	[6]	[18(I)]	[18(II)]	[12]	[22]	Tenkiller Area
Income	1.58	1.22	1.07	1.77	1.52	--	1.42
Employment	1.33	1.43	1.10	1.59	1.50	--	1.34
Output	1.76	1.28	1.18	2.20	1.62	2.17	1.69

Management and Environmental Considerations

The information for the analysis of outdoor recreation management at Lake Tenkiller was obtained from several sources. Lake officials openly discussed many management problems they had encountered in recreation management. Concessionaires and recreationists discussed what they felt to be recreation management problems around the lake as well as possible solutions to these problems. In addition to the information obtained through personal interviews with lake officials, concessionaires, and recreationists, the researcher observed many of the problems of management first-hand while visiting the lake during the course of the study. In addition, recreationists discussed their

feelings regarding user fees at public use areas as well as the impact of fluctuating water level on their recreational enjoyment at Lake Tenkiller.

Such information should be useful to those involved in the management of recreation areas, as well as those involved in long range planning to meet the needs or demand for recreation facilities in the future. Recreation managers, planners, and other personnel have done rather well during the past 20 years meeting the needs resulting from the increased participation in outdoor recreation by the U. S. public. The recent crunch of ever increasing numbers of recreationists, however, has caused recreation personnel many new problems. While numerous recreational opportunities and related facilities have been made available to recreationists, adequate long range planning and foresight has not always been exercised.

The large increases in the number of people visiting public recreation areas has taken its toll on several accounts. The quality of the recreation experience has been reduced for users as more and more people crowd into already over-crowded areas. Too many people in an area intensifies problems of littering, vandalism, and accidents, as well as personal conflicts. Overuse, or in many instances, misuse, has led to the deterioration of the natural environment, resulting in a lower level, or decline in, the quality of the total recreation experience. Loss of esthetics through trampling and erosion, anxiety factors associated with noise and congestion, and deterioration of the natural environment are only a few of the problems recreation personnel must deal with in managing and maintaining recreation areas.

These and other problems will be discussed in Chapter V. Possible solutions and alternatives will be advanced when possible.

CHAPTER III

RECREATIONAL USE OF LAKE TENKILLER FACILITIES

Recreationists' Data

Various socio-economic characteristics are assumed to have an impact on a person's participation in outdoor recreation. The role of these various characteristics as they relate to participation in outdoor recreation at Lake Tenkiller is presented in the following text. Recreationists' expenditure and participation patterns, as well as their observations relating to outdoor recreation management of public use facilities at the lake are also presented.

Education

Persons with more education participated in outdoor recreational activities at Lake Tenkiller at a higher rate than those with less education. Approximately 94 percent of the household heads had at least a high school diploma (Table II). This compares with 52 percent for all residents in the State of Oklahoma, 39 percent for the State of Arkansas, 38 percent for Cherokee County, and 37 percent for Sequoyah County.

Income

Income of recreationists is a major factor affecting participation in outdoor recreation. Approximately 77 percent of the respondents

TABLE II

EDUCATIONAL ATTAINMENT OF RECREATIONISTS SURVEYED AT LAKE TENKILLER COMPARED WITH U.S. CENSUS DATA

(1972 Survey Data)

Education	Recreationists In Study	Cherokee County	Sequoyah County	State of Oklahoma	State of Arkansas
		(All Figures in Percent)			
None	--	3.1	3.4	1.4	2.5
1- 6	--	25.6[a]	25.1[a]	11.7	20.1
7-11	5.66	33.8[b]	34.9[b]	35.4	38.1
12	48.11	16.1	22.7	26.8	23.5
13-15	29.25	10.2	8.2	12.1	7.9
B.S.	10.38			6.5	4.4
M.S.	4.72	11.2	5.8		
Ph.D.	1.89			6.1	3.6

[a]Value represents grade range 1-7.

[b]Value represents grade range 8-11.

Source: U.S. Department of Commerce, Bureau of the Census, U.S. Census of Population, 1970, General Social and Economic Characteristics. Washington: Government Printing Office, 1970.

reported annual household incomes of $9,000 and above (Table III). This compares with 41 percent for residents of the State of Oklahoma, 22 percent for the State of Arkansas, and 23 percent for both Cherokee and Sequoyah Counties. The higher participation rate of those with higher incomes is further illustrated by the average household income figures where the recreationists had an average household income of $12,400 compared to $9,110 for all the residents of the State of Oklahoma, $5,235 for the State of Arkansas, $6,238 for Sequoyah County, and $6,218 for Cherokee County.

Occupation

Based on data obtained from the respondents, people in some occupations are likely to have heavier rates of participation in outdoor recreational activities. A person whose occupational classification is professional, manager, official, or craftsman is likely to partitic-ipate more heavily in outdoor recreation than a person classified as sales, clerical, laborer, or operative (Table IV). Working environment, as well as discretionary time and income, are probably the critical factors. Professionals, managers, and officials are in higher income brackets as a rule. Craftsmen, while not as highly paid, conform to a 40 hour week, leaving considerable time for other activities. Crafts-men also work indoors and have a greater need for outdoor recreation. Sales and clerical workers are probably faced with income restraints and are unable to participate as heavily in outdoor recreation. Labor-ers and operators are more inclined to perform physical labor outdoors and have less need or desire for outdoor recreation, irrespective of income.

TABLE III

FAMILY INCOMES OF RECREATIONISTS SURVEYED AT LAKE TENKILLER COMPARED WITH U.S. CENSUS DATA

(1972 Survey Data)

Income	Recreationists In Study	Cherokee County	Sequoyah County	State of Oklahoma	State of Arkansas
Dollars		(All Figures in Percent)			
- 3,000	4.76	26.8	26.2	15.6	26.7
3- 4,999	3.81	24.4	18.7	13.9	19.5
5- 6,999	4.76	16.2	19.4	15.0	18.0
7- 8.999	9.52	9.9	12.9	14.9	14.2
9-11,999	30.48	10.9	13.2	17.2	12.4
12-14,999	16.19	5.8	6.1	10.4	5.0
15-19,999	25.71				
20-29,999	4.76	5.9	3.7	13.0	4.2
30,000+	0				
Total	100.00	100.0	100.0	100.0	100.0
Median	$9-11,999[a]	$4870	$5433	$7725	$5401
Mean	$12,400[b]	$6219	$6238	$9110	$6235

[a]Responses to the questionnaires were within the ranges shown in the left-hand column; the median fell within the given range.

[b]Ranges were assigned a value corresponding to the average of the extremes of the range.

Source: U.S. Department of Commerce, Bureau of the Census, U.S. Census of Population, 1970, General Social and Economic Characteristics, Washington: Government Printing Office, 1970.

TABLE IV

OCCUPATIONAL CLASSIFICATIONS OF RECREATIONISTS SURVEYED AT LAKE TENKILLER COMPARED WITH U.S. CENSUS DATA

(1972 Survey Data)

Occupation	Recreationists In Study		Cherokee County	Sequoyah County	State of Oklahoma	State of Oklahoma
	a	b				
	(All Figures in Percent)					
Professional	17.9	20.2	16.4	9.4	14.1	10.8
Manager, Official	16.0	18.1	8.4	7.2	9.6	8.6
Sales; Clerical	6.6	7.5	19.1	15.7	24.2	19.6
Craftsman	22.6	25.5	12.9	17.6	14.2	13.8
Laborer; Operative	12.3	13.8	19.3	32.6	19.0	26.9
Service Worker	10.4	11.7	17.9	4.2	14.2	13.0
Farmer; Farm Worker	2.8	3.2	5.9	13.2	4.7	7.3
Not Employed	1.9	--	--	--	--	--
Retired	4.7	--	--	--	--	--
Student	4.7	--	--	--	--	--
Total	100.0	100.0	100.0	100.0	100.0	100.0

[a]Based on 106 observations.

[b]Based on 94 observations (last 3 classifications were dropped to make data consistent with Census Data).

Source: U.S. Department of Commerce, Bureau of the Census, U.S. Census of Population, 1970, General Social and Economic Characteristics. Washington: Government Printing Office, 1970.

Investment in Recreational Equipment

Investment in recreational equipment provides a substantial element of the total economic impact of outdoor recreation. Based on the study, the average investment per group of recreationists was approximately $2,900.

Recreationists surveyed at Lake Tenkiller planned to recreate at the lake an average of 5.75 days per unit or group. Combined with an average size group of 4.72 people, each group contributed an average of approximately 27 visitor days for the trip to the lake's annual recreational attendance. Annually, the same group of recreationists recreate an average of 75 visitor days per group at Lake Tenkiller.

Based on this group's visitation effect, the 1972 annual attendance of 3,095,700 represents approximately 41,400 recreation units. Using $2,900 as the estimate of recreation investment per group and 41,400 recreation units, Lake Tenkiller attracted a total investment in recreation equipment of approximately $120 million in 1972. Obviously, this equipment was likely used at other recreational areas and for more than one year.

Investment by type of equipment provides some insight into the types of recreational activities and the associated equipment that provide the greatest economic impact from the recreation equipment investment segment. Investment in boats, motors, and trailers constitute the largest single group of expenditures with 43.5 percent of total investment (Table V). The major portion of the data can be allocated to either boating or camping. Boating and related activities accounts for 45.6 percent of the investment while camping accounts for 53.1 percent.

TABLE V

INVESTMENT IN RECREATIONAL EQUIPMENT BY TYPE OF EQUIPMENT FOR 101 RECREATION GROUPS SURVEYED AT LAKE TENKILLER

(1972 Survey Data)

	Investment		
Recreation Equipment	Total	Average Per Group	% of Total Investment
Boat, Motor, Trailer	$127,585	$1,263	43.5
Pickup Camper	59,503	589	20.3
Camper Trailers	59,210	586	20.2
Motor Home	20,261	201	6.9
Other Travel Vehicles	6,550	65	2.2
Tents	4,547	45	1.6
Motor Bike	3,085	31	1.1
Camping Equipment	5,549	55	1.9
Skiing Equipment	5,195	51	1.8
Fishing Equipment	620	6	0.2
Diving Equipment	500	5	0.2
Miscellaneous	805	8	0.3
Totals	$293,410	$2,905	100.0

Investment data in recreational equipment by place of purchase are presented in Table VI. Only 4.5 percent of the recreation equipment was purchased in the lake area. It can be further noted that Oklahoma City and Tulsa accounted for 81.6 percent of the recreation investment expenditures in Oklahoma while Ft. Smith received 91.8 percent of the recreation investment expenditures in Arkansas. Given a total investment of $91 million, the investment impact is distributed as follows: Oklahoma City (25.6 percent), 30.7 million; Tulsa (23 percent), 27.6 million; Ft. Smith (14.7 percent), $17.6 million; and the Lake Tenkiller area (4.5 percent), $5.4 million.

Investment in recreation equipment in use at Lake Tenkiller obviously occurred over a period of several years. A large portion of the equipment is relatively new which is consistent to the rapid increase in outdoor recreation in recent years. Based on personal observations of the interviewers, an average age of five years was assumed for the recreational equipment. Spreading the investment impact over a five year time span yields an average annual investment impact as follows: Oklahoma City, $6.1 million; Tulsa, $5.5 million; Ft. Smith, $3.5 million; and the Lake Tenkiller area, $1.1 million.

Participation in Recreational Activities

Data on recreational activities of the respondents of the study while vacationing at Lake Tenkiller are presented in Table VII. The general absence of the term "camping activity" in Table VII needs to be explained. The original intent of the study was to derive the demand for water based sports. It was late in the course of the study when the close and inseparable relationship between camping

TABLE VI

RECREATIONAL EQUIPMENT INVESTMENT ACCORDING TO PLACE OF PURCHASE FOR 101 RECREATION GROUPS SURVEYED AT LAKE TENKILLER

(1972 Survey Data)

Place of Purchase	Investment			
	Dollars	Dollars	Percent	Percent
Oklahoma				
Lake Area	13,189		4.50	
Oklahoma City	75,147		25.62	
Tulsa	67,338		22.96	
Enid	12,750		4.35	
Other Areas in Oklahoma	6,165		2.10	
Total (Oklahoma)		174,589		59.53
Arkansas				
Ft. Smith	43,170		14.72	
Other Areas in Arkansas	3,350		1.31	
Total (Arkansas)		47,020		16.03
Kansas		2,400		0.82
Texas		31,090		10.60
Missouri		250		0.09
Tennessee		12,390		4.22
California		19,671		6.71
Other States		5,850		1.99
Totals		293,260		100.00

TABLE VII

PARTICIPATION RATES FOR VARIOUS ACTIVITIES AT SELECTED PUBLIC USE AREAS ON LAKE TENKILLER

(1972 Survey Data)

Activity	Number Participating	Most Favored[a]	% Most Favored[b]	Percent Participation[c]
Swimming	329	66	20.1	83.7
Relaxation	242	164	67.8	61.6
Fishing	226	51	22.6	57.5
Pleasure Boating	221	19	8.6	56.2
Water Skiing	204	96	47.1	51.9
Sunbathing	161	1	0.6	41.0
Cycling	60	2	3.3	15.3
Hiking	46	0	0	11.7
Nature Study	38	2	5.3	9.7
Scuba Diving	29	6	20.7	7.4
Other	10	0	0	2.5

[a]Summation of column exceeds 393 as several respondents indicated more than one "most favored" activity.

[b]"Most Favored" divided by "number participating."

[c]"Number Participating" divided by total responses of 393.

and water based sports at Lake Tenkiller was discovered. Approximately 93 percent of the respondent groups had some form of camping equipment. Whether camping was a major activity, or merely a "means to an end" was not determined in this study.

The activity with the greatest degree of participation was swimming with approximately 84 percent of the respondents engaging in the activity while 20 percent of those participating in swimming indicated swimming was their "most favored" activity.

Relaxation was second, based on 62 percent participation. However, relaxation was the "most favored" by 68 percent (the highest) of those indicating relaxation was one of the reasons they came to Lake Tenkiller. The significance of these figures is hard to assess as relaxation means different things to different people. To some it may mean communing with nature; to others, the opportunity to leave their work behind and enjoy their family; while to others, it may merely mean a change of pace or life style.

Regardless of one's interpretation of relaxation, it can be assumed with a relatively high degree of certainty that participation in various other activities such as swimming, boating, and skiing, may figure heavily in a recreationist's concept of relaxation. Thus the relative importance of relaxation as compared to other activities may be somewhat overstated. However, several respondents did indicate that "sitting around" and "enjoying the surroundings" was their only activity and their only reason for coming to Lake Tenkiller.

Based on total participation, other activities in order of importance are fishing, pleasure boating, and water skiing. Using "most favored" as the indicator of importance, water skiing is the most

important of the three and is second only to relaxation. The relative importance and level of participation of the remaining activities can be assessed by examining Table VII.

Expenditures of Recreationists

Recreation groups at Lake Tenkiller spend an average of $64.72 per visit in the local area. This converts to $2.39 per visitor day added to the local economy. These expenditures are for transportation in the area (includes gas and oil for boats, motorcycles, etc.), lodging, groceries and meals, and other miscellaneous items (Table VIII).

TABLE VIII

DISTRIBUTION OF RECREATIONAL EXPENDITURES IN THE LAKE TENKILLER AREA

(Based on 1972 Survey)

Category	Expenditures		
	Percent of Total	$/Visit	$/Visitor Day
Transportation	8.1	5.25	.19
Lodging	3.1	1.97	.07
Groceries and/or Meals	60.3	39.06	1.44
Miscellaneous	28.5	18.45	.68
Total	100.0	$64.72	$2.39

Respondents were also asked the amount of money spent at home in preparation for the trip as well as stops for snacks, bait, etc. on their way to the lake (excludes gas and oil). These expenditures added to expenditures in the area bring the expenditures per visit for an average group to $89.41 and expenditures per visitor day to $3.30.

To determine the cost of the total trip, round-trip mileage costs were added to bring the average group expenditures per visit to $115.53 or $4.26 per visitor day. This value does not include an allocation of the amortized investment costs in recreation equipment. To allocate investment costs, annual recreational attendance for all recreation areas would be needed. During the interviews, only the recreational visitations for Lake Tenkiller were obtained, as the major thrust of this study was toward Lake Tenkiller recreation.

Round trip mileage costs were estimated using a cost of seven cents per mile. While this value appears low when compared to the typical 10 or 12 cents per mile quoted as total automobile driving costs, it is intended to reflect only the variable driving costs associated with the trip.

Distance Traveled and Expenditures by Travel Zone

Respondents of the study traveled an average of 187 miles (one way) to visit Lake Tenkiller. Based on the results of the survey, the major impact as related to annual visitor days is not people from the local area, but rather from areas in excess of 50 miles away. Respondents within 50 miles of Lake Tenkiller made up only 13 percent of the respondent groups and contributed only 14.9 percent of the total annual

visitor days of recreational use (Table IX). Respondents from 300 or more miles made up 10.2 percent of the respondent groups but only 4.3 percent of the annual visitation of the lake. The relatively high proportion of visitor days from zones II and IV can be attributed to the large population bases of Tulsa and Oklahoma City within the respective zones.

TABLE IX

EXPENDITURES AND VISITATION BY TRAVEL ZONES FOR RECREATIONISTS AT LAKE TENKILLER

(1972 Survey Data)

Miles	% of Respondent Groups	Ave. Expenditures per Visitor Day	Ave. Annual Visitor Days Per Group	Distribution of Visitor Days	% Distribution of Visitor Days
0- 49	13.0	$1.42	85.7	11.1	14.9
50- 99	32.4	2.80	82.4	26.7	35.7
100-149	7.4	2.72	79.5	5.9	7.9
150-199	29.6	2.72	80.0	23.7	31.7
200-299	7.4	2.94	55.3	4.1	5.5
300+	10.2	19.57	31.5	3.2	4.3
	100.0	$ 4.30[a]	--	74.7	100.0

[a]Weighted Average

Type of Trip

Data on the type of trip of the recreationists provides considerable evidence that recreational use at Lake Tenkiller is heavily

weighted toward vacation groups rather than single day visits. Approximately 42 percent of the respondents were on a major annual vacation, 30 percent on a 2-3 day outing, only 8 percent visiting for 24 hours or less, and 20 percent for other lengths of time. A large proportion of those under "other" were recreating at the lake for periods of time ranging from four days to a week but were not on a major annual vacation.

Type of Group

Family units are the predominant type of users of recreational facilities at Lake Tenkiller. Results of the study indicate that approximately 82 percent of the recreationists were part of a family group, 16 percent were family and friends, and 3 percent were with a group of friends. This information lends support to the information on type of trip where only 8 percent of the groups were on outings of 24 hours or less. It appears reasonable to expect recreation trips of over one day to be largely family oriented.

Mode of Travel

The heavy use of Lake Tenkiller by boaters and campers is indicated by the data on "mode of travel." Approximately 57 percent of the respondents had some type of mobile camping facilities: 40 percent had pickup campers, 7 percent had mobile campers, and 10 percent had car-camper trailer combinations. Many of the remaining 43 percent with only cars had tents that were set up around the lake (Table X). Eighty-three percent of those coming to Lake Tenkiller by car only had tents and were camping in the campgrounds around the lake. Assuming

each group with camping equipment was camping at Lake Tenkiller, 93 percent of all respondent groups interviewed were camping.

A substantial number of recreationists interviewed had boats. Sixty-one percent of the groups interviewed indicated they had a boat at the lake and had either pulled their boat from home or stored their boat at a local marina. While the actual percentage breakdown by mode of transportation can be determined from Table X, it should be explained that of the 64 percent of those with a car-trailer combination and a boat, all but one had boats stored in the marinas on the lake. The other group had two cars, one pulling the trailer and the other car pulling the boat.

TABLE X

BOAT AND CAMPER CONCENTRATION AT LAKE TENKILLER BY MODE OF TRAVEL

Mode of Travel	Total Responses	Total Boats	With Boats	Total Tents	With Tents
		(All Figures in Percent)			
Car	43	29	67	36	83
Car-Trailer	10	7	64	2	18
Pickup Camper	40	22	54	6	14
Mobile Camper	7	4	57	2	29
Totals	100	62	--	46	--

State of Residence

The major portion of the respondents of the study were from Oklahoma and Arkansas. The state of residence of the recreationists interviewed were as follows: Oklahoma, 71 percent; Arkansas, 17 percent; and other states, 12 percent. The majority of those from Oklahoma resided in the Oklahoma City or Tulsa vicinity while the majority of those from Arkansas were from the Ft. Smith area.

Problems Encountered by Recreationists and Suggested Improvements

Recreationists were asked to indicate what they felt to be sources of problems in the Lake Tenkiller recreation complex. Two-thirds of those interviewed mentioned some problems. Noise was the major complaint of the respondents with 28 percent of all complaints received (Table XI). Of those complaining, 47 percent complained about the noise.

The major contributors to the noise problem were "motorcycles," which received the second highest number of complaints, with 17.5 percent of all complaints. Other sources of noise problems were fireworks, barking dogs, loud stereos and radios playing late at night, and "loud partying" into the early hours.

Ranking third in number of complaints registered were "dirty toilet facilities," receiving 16 percent. While many of the complaints were due to insufficient cleaning and maintenance during periods of heavy use, some complaints were due to the odor that is normally associated with open-pit outdoor toilets.

TABLE XI

PROBLEM AREAS AT LAKE TENKILLER AS INDICATED BY RECREATIONISTS

(1972 Survey Data)

Problem Areas[a]	Responses	Frequency of Responses	
		Percent[b]	Percent[c]
Noise	34	28.33	47.22
Motorcycles	21	17.50	29.17
Dirty Toilet Facilities	19	15.83	26.39
Insufficient Security Patrol	10	8.33	13.89
Littering	7	5.83	9.72
Trash Collection and/or Facilities	6	5.00	8.33
Skunks, Coons	6	5.00	8.33
Rocky Swimming Beaches	4	3.33	5.56
More Drinking Water (Potable?)	4	3.33	5.56
Unchained Dogs	3	2.50	4.17
Reckless Boaters	2	1.67	2.78
Safety - Fast Traffic	2	1.67	2.78
Flies - Insects	2	1.67	2.78
Total Problems Suggested	120	100.00	--

[a]Based on 108 usable responses, 72 mention various problems while 36 had encountered no problems.

[b]Based on 120 problems suggested.

[c]Based on 72 respondents encountering problems.

Insufficient security patrol received 8 percent of all complaints registered. While a few of the respondents felt additional patrolling was needed late at night, the largest share of the complaints relating to additional patrolling were aimed at more intensive patrolling to control motorcyclists.

Respondents were asked what improvements or changes were needed in the current recreation management to enhance the recreational qualities of Lake Tenkiller. Three-fourths of those interviewed responded with suggestions for improvement of the recreational complex. "Electricity at the campsite" received 16 percent of the total suggestions made and was suggested by 32 percent of those extending suggestions (Table XII).

"More camping areas" and "hot-cold showers" were each suggested by 24 percent of those extending suggestions and 18 percent of all recreationists interviewed. "Water hookups at campsites" received 11 percent of total suggestions offered and was suggested by 20 percent of those making suggestions. "More and better restrooms" and "more picnic tables" each received approximately 9 percent of the total suggestions and was mentioned by 18 percent of those offering suggestions. "More water hydrants" received 6 percent of the total suggestions and was suggested by 11 percent of those with suggestions. Other problems and suggested improvements can be ascertained by examining Tables XI and XII. Further discussion of problems and suggested improvements will be presented in the recreation management chapter.

TABLE XII

SUGGESTED IMPROVEMENTS FOR THE LAKE TENKILLER AREA AS INDICATED BY RECREATIONISTS

(1972 Survey Data)

Suggested Improvements[a]	Responses	Frequency of Responses	
		Percent[b]	Percent[c]
Electricity at Campsites	25	16.78	31.65
Hot-Cold Showers	19	12.75	24.05
More Camping Areas	19	12.75	24.05
Water Hookups at Campsites	16	10.74	20.25
More and Better Rest Rooms	14	9.40	17.72
More Picnic Tables	14	9.40	17.72
More Water Hydrants	9	6.04	11.39
More Concrete Pads	7	4.70	8.86
More Swimming Areas	5	3.36	6.33
Better Fishing	4	2.68	5.06
More Access Roads	3	2.01	3.80
More Boat Launching Ramps	3	2.01	3.80
Better Means to Display Permits	3	2.01	3.80
Playground for Children	2	1.34	2.53
Sewer Drops	2	1.34	2.53
Others[d]	4	2.68	5.06
Total Suggestions[a]	149	100.00	100.00

[a]Based on 106 usable responses, 79 suggested various improvements while 27 were satisfied with the present surroundings.

[b]Based on 149 suggestions.

[c]Based on 79 respondents with suggestions.

[d]Suggestions mentioned once were: Firewood made available, more nature trails, sand needed on beaches, and public telephones needed.

Concessionaire and Business Data

Concessionaires operating on the lake and retail business operators off the lake were interviewed to gain further insight on the economic impact of recreation on the local economy surrounding Lake Tenkiller. The focal point of the recreationists' expenditures is the local businesses which provide goods and services needed by the recreating public. These expenditures become gross receipts of the businessmen and in turn are used to purchase more goods, pay employees' salaries, and hopefully, yield a satisfactory profit and return on investment to the entrepreneur.

Average gross receipts for 1971 of concession operations on the lake were $79,150, while the average gross receipts of off-lake businesses were $102,700 (Table XIII). The gross receipts of both groups are relatively small and require a relatively high mark-up on goods and services sold if the business enterprises are to yield a satisfactory rate of return.

Most of the businesses in the Lake Tenkiller area serving recreationists were small, family operated concerns and hired only a few non-family employees. Concession operators provided employment for an average of 1.7 full time employees in addition to available family labor and businesses off the lake provided employment for an average of only .63 full time employees (Table XIII).

Both business groups also provided part time summer employment for local high school and college students. Concession operators hired an average of 10.3 man months of part time employment or about 2.6 employees for a period of four months. Off-lake businesses hired

TABLE XIII

COMPARISON OF DATA BETWEEN CONCESSIONAIRES AND OFF-LAKE BUSINESSES IN LAKE TENKILLER AREA

(Based on 1972 Survey Data)

	Gross Receipts[a]	Full Time[a]		Part Time[a]	Payroll[a]
	Dollars	Employees	Work-Months[b]	Work-Months[b]	Dollars[b]
Lake Concessionaires[c]	79,150	1.71	20.6	10.3	12,460
Off-Lake Business	102,700	0.63	7.5	6.5	5,560

[a]Figures represent averages, based on seven concessionaires and eight private businesses.

[b]Work-month is defined as employment for one employee for a period of one month.

[c]Information obtained from the Corps of Engineers and through personal interviews with concessionaires under Corps of Engineers contract. This does not include Pine Creek (Tenkiller State Park) or Burnt Cabin Ridge (State Park).

an average of 6.5 man months of labor, or about 1.6 employees for the four month period.

Combining full time and part time employment, concession operators hired an average of 30.9 man months of employment annually while private businessmen hired an average of 14 man work months of employment. Concession operators provided an average annual payroll of $12,460, representing approximately 16 percent of gross receipts while off-lake businesses provided an average annual payroll of $5,560, representing approximately 5.4 percent of gross receipts.

The gross receipts of concessionaires represented a higher proportion of services to goods sold than do those of the off-lake businesses. This was evident by the higher level of employment and payroll to sales exhibited by the concession operations. Much of the concessionaire's business involved servicing boats and motors, bait and tackle sales, and other small item sales. Since concessionaires provided a more labor intensive service, a dollar's worth of gross receipts had less leakage and thus a greater multiplier effect on the local economy. The off-lake businesses generally sold a higher proportion of goods that must be imported into the area than do the concession operations. Thus a higher percentage of the gross receipts dollar likely was lost through "leakage" from cost of goods imported.

Recreation Attendance at Lake Tenkiller

Annual Attendance

Recreation attendance at Lake Tenkiller was 3,095,700 visitor days in 1972. That figure represented a 25 percent average annual increase

since 1967. Partially offsetting the 25 percent annual increase since 1967 is the fact that the 1971 attendance was slightly less than a previous high in 1959. A graphic illustration of the recreation attendance pattern at Lake Tenkiller from 1953 to 1972 is presented in Figure 3.

It is interesting to note the 33 percent average increase in attendance from 1953 to 1959, then the general decline until 1967 when attendance began to increase again. A partial and probable explanation for the visitor pattern at Lake Tenkiller is the competitive impact of the construction of other major lakes within 100 miles of the lake since 1951. Lakes constructed in 1951 or later are listed in Table XIV according to distance, size of lake (surface acres), and date of completion.

Corps of Engineers personnel indicated that a period of 1-3 years is required after a lake is completed before adequate recreational facilities are developed. Using the middle of the range, it would be reasonable to expect two years to elapse before a new, nearby lake would compete for people previously recreating at Lake Tenkiller.

With the exception of Ft. Gibson Lake, which was completed the year after Lake Tenkiller, no lakes were completed within 100 miles of Lake Tenkiller until 1963. Lake Tenkiller apparently filled a void as attendance increased at a rapid rate through 1959. With an economic recession in the early 1960's, the number of visitor days at Lake Tenkiller decreased. Attendance at the lake started to increase again in 1965 and 1966, even with the completion of Oologah in 1963.

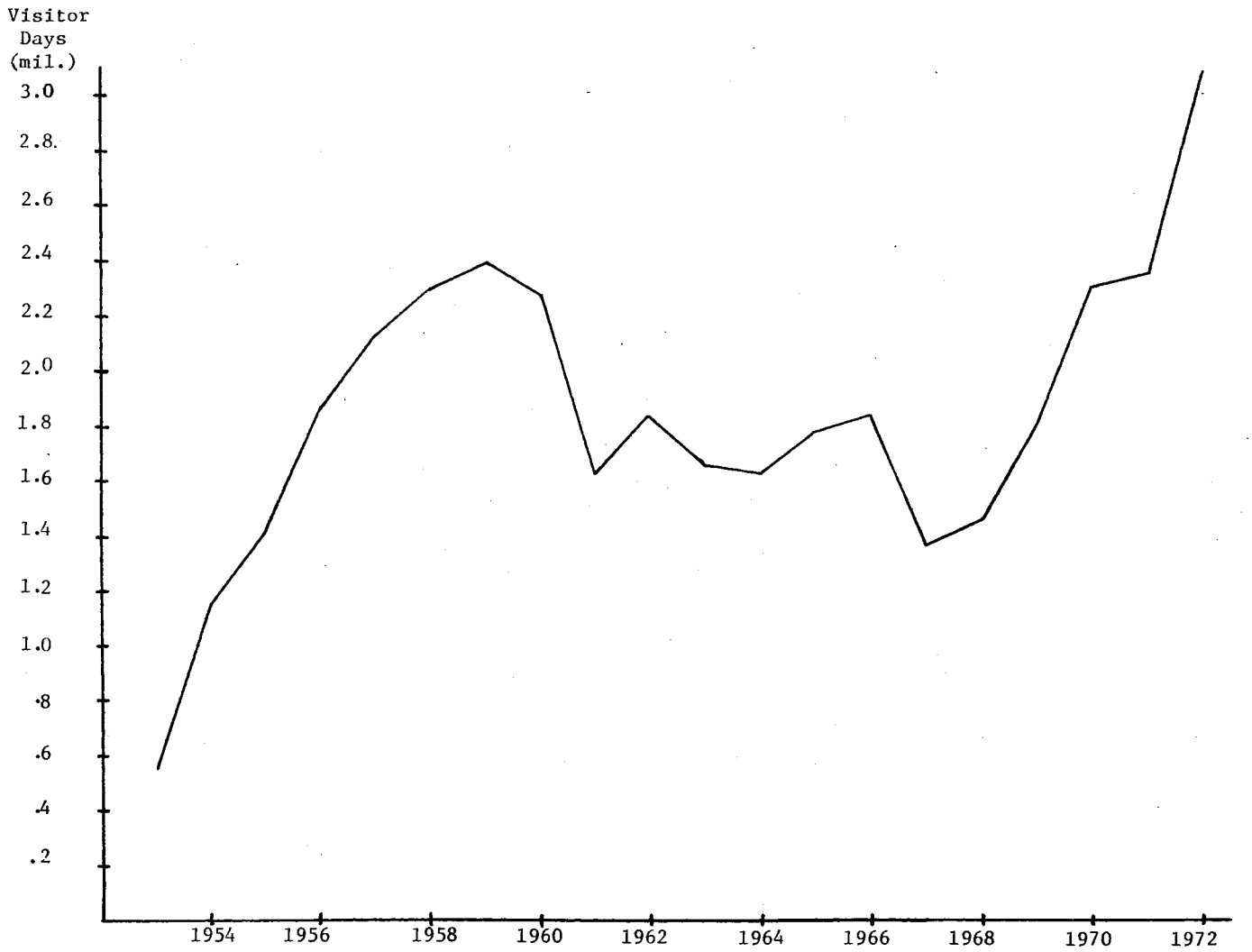

Figure 3: Annual Visitor Days of Recreation Attendance at Lake Tenkiller, 1953-1972

TABLE XIV

LAKES WITHIN 100 MILES OF LAKE TENKILLER BY DATE OF COMPLETION AND SURFACE ACRES

Lake	Date Completed	Surface Acres
0-50 Miles		
Ft. Gibson	1953	19,900
Markham Ferry	1964	10,900
Webbers Falls	1970	10,800
50-100 Miles		
Oologah	1963	29,500
Dardanelle	1965	34,300
Eufaula	1965	102,500
Keystone	1965	26,300
Broken Bow	1968	14,200
Ozark	1970	10,600
Robert S. Kerr	1970	44,000

Source: U.S. Army Corps of Engineers, Southwestern Division, Water Resources Development - Oklahoma, Dallas, Texas, January, 1971.

Three large lakes were completed in 1965: Dardanelle (Arkansas), Eufaula (Oklahoma), and Keystone (Oklahoma). Two years later in 1967, the number of visitor days at Lake Tenkiller dropped to its lowest point since 1954. The completion of Broken Bow Lake in 1968 and three lakes in 1970 (Webbers Falls, Robert S. Kerr, and Ozark) suggests that the rate of increase at Lake Tenkiller will be reduced, if not reversed, for the time period, 1971-1973. However, while the rate of increase in visitor days in 1971 was reduced, visitor days at Lake Tenkiller for 1972 made a dramatic increase, offsetting the 1971 attendance figures, and nullifying the "competitive effect" theory (Figure 3).

Two factors contributing to this behavior are roads and development of recreational facilities. Broken Bow Lake lies at the outer edge of the 100 mile boundary and is located in an area lacking a well developed highway system. The highway system leading to the lake consists of narrow and winding two-lane highways, thus making both travel time and safety critical factors.

Numerous lakes which were part of the Arkansas Navigation System were completed in recent years. Numerous demands were placed on county and state road building funds as highways and roads had to be modified or rerouted to accomodate the lakes and navigation channel. Improvement of existing roads and building of new roads providing access to present and potential recreation areas around the new lakes receive lower priority than do roads critical to the existing local travel patterns.

Recreation facilities around the numerous new lakes have not been added by the state and federal agencies at the usual pace, violating

the previous assumption of two years needed for development of recreational facilities around new lakes. Slow development of new facilities coupled with inadequate roads has not allowed the recently completed lakes to compete very intensively with Lake Tenkiller. Depending on the "uniqueness" of Lake Tenkiller, it is not unreasonable to expect the annual recreation attendance at Lake Tenkiller to stabilize, or decrease, once adequate recreation facilities and access roads have been developed around the recently completed lakes on the Arkansas Waterway.

Monthly Attendance

Outdoor recreation attendance at Lake Tenkiller is very seasonal with approximately 57 percent occurring during the four month period of May through August, and 75 percent during the six month period of April through September. Recreation planners have long been faced with the dilemma of providing sufficient facilities for peak use periods and having the facilities remain essentially idle for the balance of the year.

A twelve month centered moving average index was developed using monthly recreation attendance data for selected time periods using the 1955-71 years inclusive. Using the index values developed, each month's percentage share of the annual attendance was determined (Table XV).

While these figures point out the high concentration of attendance for the summer months over the nineteen year period since 1955, the "tourist season" concentration of visitations has become even more pronounced for the more recent time period.

TABLE XV

MONTHLY RECREATION ATTENDANCE PATTERNS AT LAKE TENKILLER FOR SELECTED TIME PERIODS, 1955-1971

Month	1955-1971	1955-1963	1963-1971	Change Between Two Time Periods
	(All Figures are in Percent)			
January	2.8	3.0	2.7	- 8.8
February	3.6	3.9	3.2	-16.9
March	5.2	5.5	4.8	-12.9
April	8.2	9.3	7.0	-24.9
May	12.3	12.0	12.6	+ 5.2
June	14.6	14.3	14.9	+ 4.5
July	15.8	14.2	17.4	+22.5
August	14.2	13.2	15.2	+15.6
September	9.3	9.2	9.4	+ 2.5
October	4.9	6.2	5.6	-19.6
November	4.9	5.5	4.3	-22.8
December	3.4	3.9	2.9	-24.8
Total	100.0	100.0	100.0	0

The most significant changes in the monthly attendance patterns were for July, which increased from 14.3 percent of the total annual attendance of 17.4 percent, an increase of 22.5 percent; and August which increased from 13.2 percent to 15.2 percent, an increase of 15.6 percent. These increases come during an already critical period of peak use and only serve to increase the peak use dilemma recreation management personnel are facing. The figures above are graphically illustrated in Figure 4.

Water Level Fluctuations During Recreation Season

A fluctuating water level at Lake Tenkiller has been of primary concern to recreationists using the lake, area businessmen, and

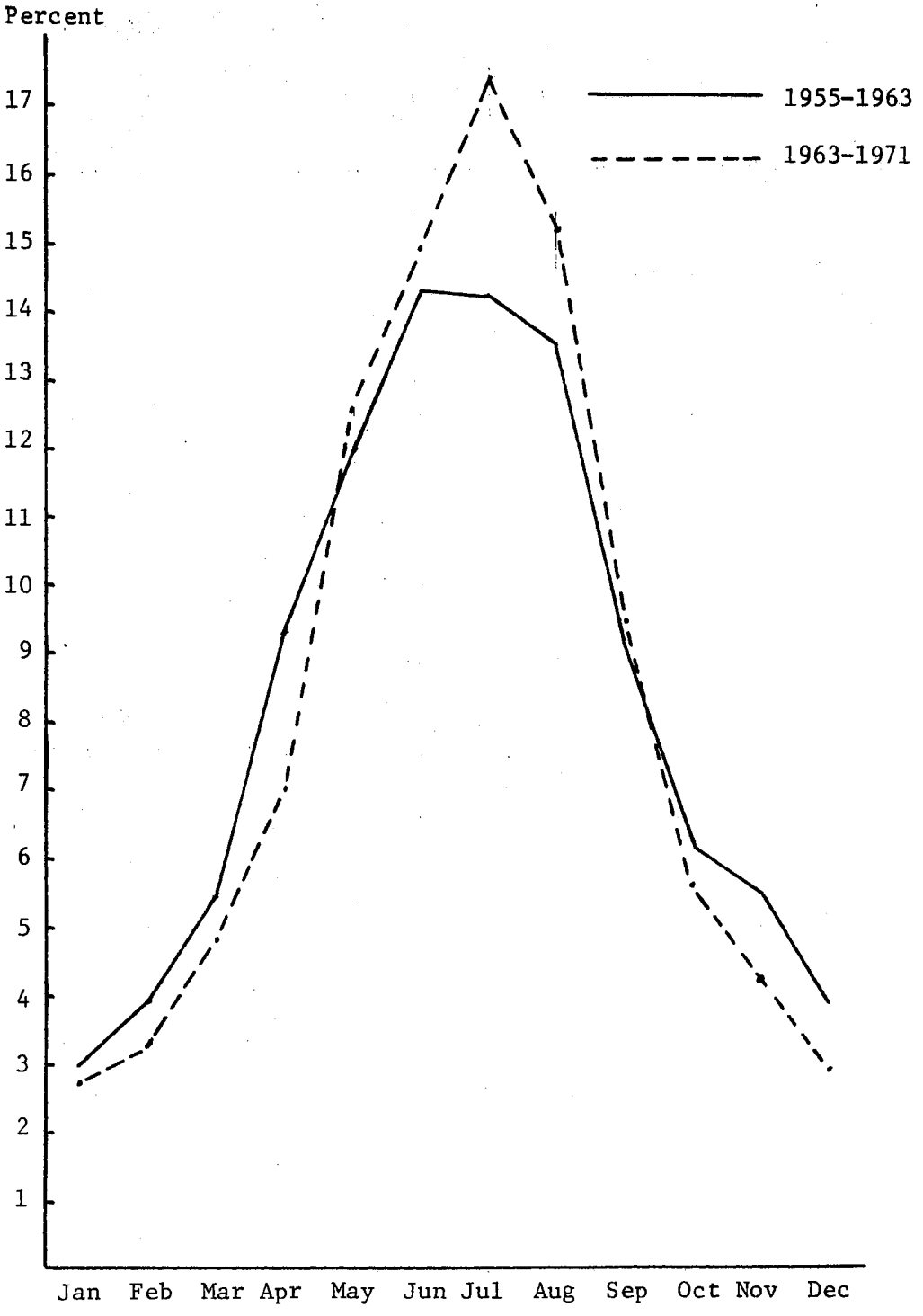

Figure 4: Monthly Percentages of Average Annual Visitations for Selected Time Periods, Lake Tenkiller, 1955-1963 and 1963-1971.

concessionaires on the lake. While the monthly fluctuations are of some concern, the critical concern is the general decline in water level over the five month period, May through September.

Recreationists were asked if they had any observations on pool fluctuations as it related to their recreational enjoyment. Eighty percent of the recreationists indicated they had encountered no problems as a result of low water level. Fifteen percent indicated low water level degraded their recreational experience and five percent had no comment.

Given the recent political pressures to reduce water level fluctuations due to power generation, it is interesting their dissatisfaction regarding low water levels. However, the water level was not at a critical level while the surveys were being taken (June-July 1972), leading one to assume that the level of dissatisfaction would increase as the level of the lake was lowered later in the summer.

Many of the 15 percent indicating dissatisfaction with low water levels registered more than one complaint or problem as a result of the low lake level. The associated problems mentioned and the frequency of mention were as follows:

swimming areas	31%
skiing	25%
beaching boats (rocks)	19%
boat docks	19%
poor fishing	18%
swimmers-boaters intermingled	13%
won't come back if level gets too low	13%

Corps of Engineers personnel have cleared many of the beach areas of numerous rocks that are prevalent around the lake. This clearing

normally occurs during the winter months which is the slack season for the labor force. The new improved areas are then graded, or smoothed to prevent erosion. However, the lake is normally lowest during late summer, causing the improved beach areas to be high and dry, and leaving only rocky and unimproved beach areas along the shoreline of the lake.

The resulting rocky and muddy shoreline is undesirable for swimming, especially small children whose major activity is wading. The rocks on the lake bottom cause many toes to be stubbed. Also, due to lack of sandy beaches, high participation in swimming and other water contact sports often causes the water to be murky and muddy along the shoreline, thus, reducing the quality of the activity. The rocky lake bottom is also hazardous to skiers coming into shore at high rates of speed. People attempting to beach their boats along the shoreline also run the risk of striking submerged rocks and damaging the boat or causing personal injury.

Several respondents blamed the low lake level for poor fishing. While it is impossible to determine the reason fish weren't biting, biologists indicate there is no adverse relationship between water level fluctuations and fish population [14]. The ability of fish to reproduce is so vast and enormous that it would be nearly impossible for normal water fluctuations to have a negative effect on total fish population.

It is possible the fish become somewhat disoriented and possibly change locations during sudden fluctuations of the lake level. This may account for the small catches fishermen often bring home during periods of low lake levels or rapid changes in the lake level.

Several recreationists responded that swimmers and boaters become intermingled at low lake levels. Many of the boat launching ramps and swimming beaches are located in coves around the lake. The quiet, placid water associated with coves provide an ideal location for both boat ramps and swimming. However, the coves are often substantially reduced in size at low lake levels, causing intermingling of boaters and swimmers.

The controversy between fluctuating water level and recreation has been going on for years. Concession operators on Grand Lake and other businessmen around the lake caused an outcry in 1952 that low water level was making their operations very difficult and expensive (16, pp. 13-18]. The low drawdown in 1953 and 1954 intensified the opposition from resort owners who finally took their complaints directly to the state legislature.

During the controversy over the Grand Lake water level a legislative committee held hearings in the town of Grove to listen to the complaints of resort owners and the position of the Grand River Dam Authority officials. State senator Raymond Gary was the Chairman of the committee and became interested in the problem. During his campaign for the office of governor, he promised the people around the lake that he would try to work something out that would solve the problem. Shortly after his election, Governor Gary made his promises good. He initiated a financing effort to build alternative electric generation facilities that would relieve the pressure on the hydrogeneration facilities at the lake. In addition, he appointed members to the Grand River Dam Authority that were sympathetic to the problems

of the resort owners. The policy on Grand Lake has been modified over the years and, except during extreme flooding, the water level is held within a narrow range.

A measure of the extent of the month-to-month fluctuations in water level on Lake Tenkiller was shown in a recent Corps of Engineers study [15]. The average difference between successive monthly elevations for May through September was a decrease of 4.0 feet.

Average lake elevation decreased from 632.6 feet (MSL) in May to 621.1 feet (MSL) in September. A standard deviation about the average lake elevation decreased from 12.0 feet in May to 6.8 feet in September. The average lake elevation and the standard deviation about the average lake elevation for the five month period is as follows:

Month	Average Lake Elevation (ft., msl)	Std. Dev. about Average Lake Elevation (ft.)
May	632.6	12.0
June	630.2	10.9
July	626.1	6.4
August	622.5	7.6
September	621.1	6.8

The results of the Corps of Engineers study indicate that for the month of May the average lake elevation is 632 feet (MSL), with approximately two-thirds of the observations (one standard deviation) falling within 12 feet of the mean. Thus, based on past history, approximately two-thirds of the average monthly lake elevations fall between 644.6 feet and 620.6 feet (632.6 ft. $\pm$ 12.0 ft.) for the month of May. If the range is increased to include 95 percent of the observations (two standard deviations), the range extends from 656.6 feet to 608.6 feet.

While the recreationists, businessmen, and concessionaires can "live with" the average water levels for the respective months, the actual water levels are often extremely critical to all involved, especially since lake elevations of 620 feet (MSL) and below are considered critical. The average lake elevation by month for May through September, and the ranges associated with one and two standard deviations about the average water level are presented in Table XVI. A graphic illustration is presented in Figure 5.

The monthly reservoir elevations since 1955 are presented in the appendix. The figures included in the appendix are the high for the month, the low for the month, the average elevation for the month and the range for the month.

TABLE XVI

AVERAGE LAKE ELEVATION BY MONTH AND RANGES ASSOCIATED WITH ONE AND TWO STANDARD DEVIATIONS

Month	Average	One Std. Dev.		Two Std. Dev.	
		High	Low	High	Low
May	632.6	644.6	620.6	656.6	608.6
June	630.2	641.0	619.4	651.8	608.6
July	626.1	632.5	619.7	638.9	613.3
Aug.	622.5	630.1	614.9	637.7	607.3
Sept.	621.1	627.9	614.3	634.7	607.5

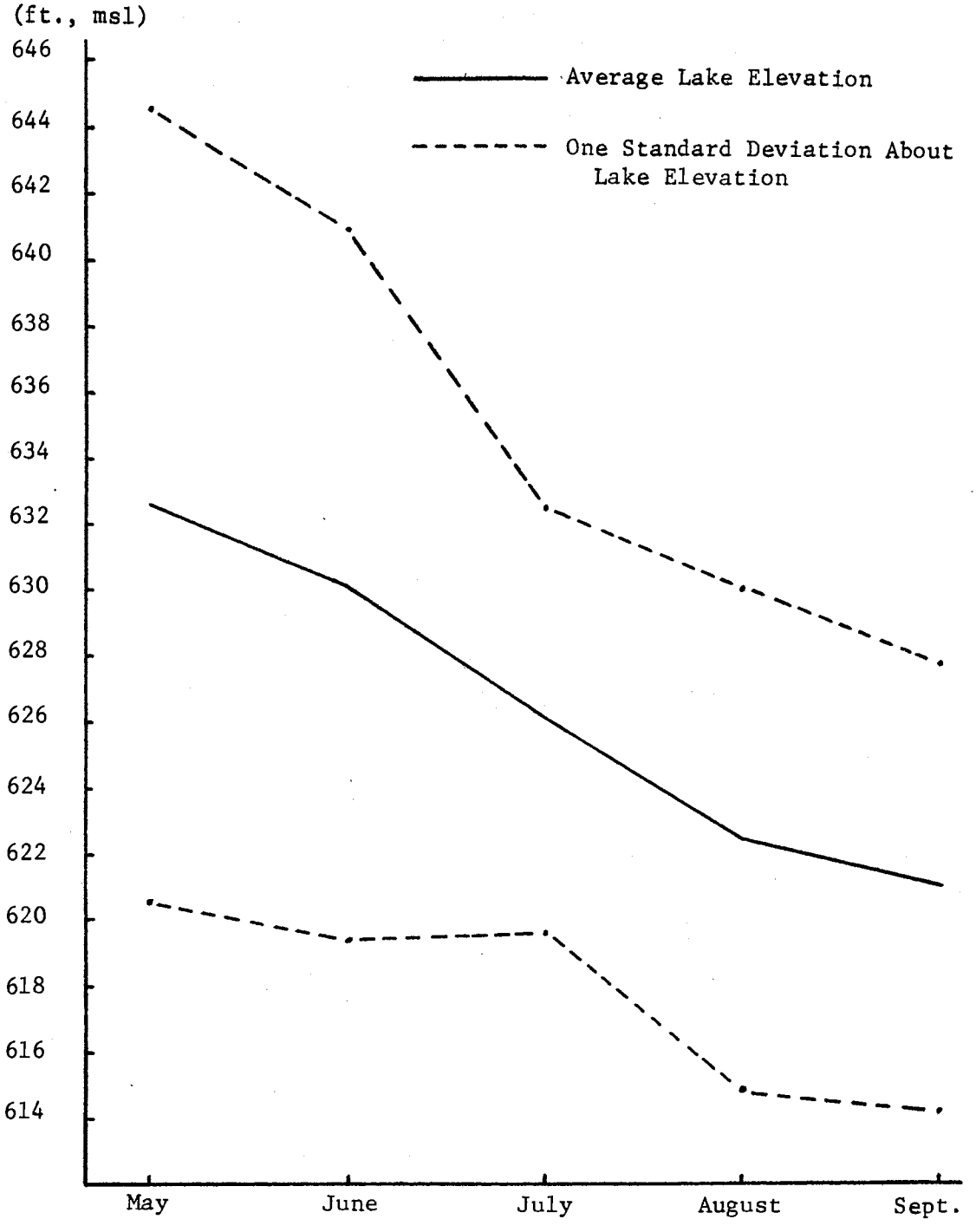

Figure 5: Average Lake Elevation and Standard Deviation About Average Lake Elevation for Specified Months, Lake Tenkiller

Relocation Costs

Concessionaires operating water-borne facilities such as boat marinas and heated fishing docks on Lake Tenkiller must relocate their facilities as water level rises or falls. The frequency of relocation, i.e. whether the facilities must be relocated every foot, two feet, four feet, etc., is largely dependent on the physical characteristics of the lake floor under the facilities involved. That is, if the slope of the lake floor is steep, the facilities can rise and fall a greater distance with the water level before it is necessary to move the facilities further away from, or closer to, the shoreline (Situation A, Figure 6). When steep slopes exist under the facility, the only adjustments necessary to counter changing water levels are to shorten or lengthen the tie down cables that attach the water-borne facility to heavy anchors lying on the lake bottom. If gradual slopes exist the cables must be untied from the underwater anchors and retied to other anchors, either further out into the lake or closer to shore, depending on whether the water is rising or falling (Situation B, Figure 6). The slope of the lake bottom under most of the concession operations differs at varying water depths. The concessionaires experience few relocation problems within given ranges where steep slopes exist. Outside some given range the frequency of relocation will increase as the slope of the lake bottom becomes less steep. As the steepness of the lake bottom changes, so does the frequency and difficulty of relocation, and thus, the expense of relocation.

The relocation expenses concessionaires experience as they adjust to changing water level are presented in Table XVII. The expenses

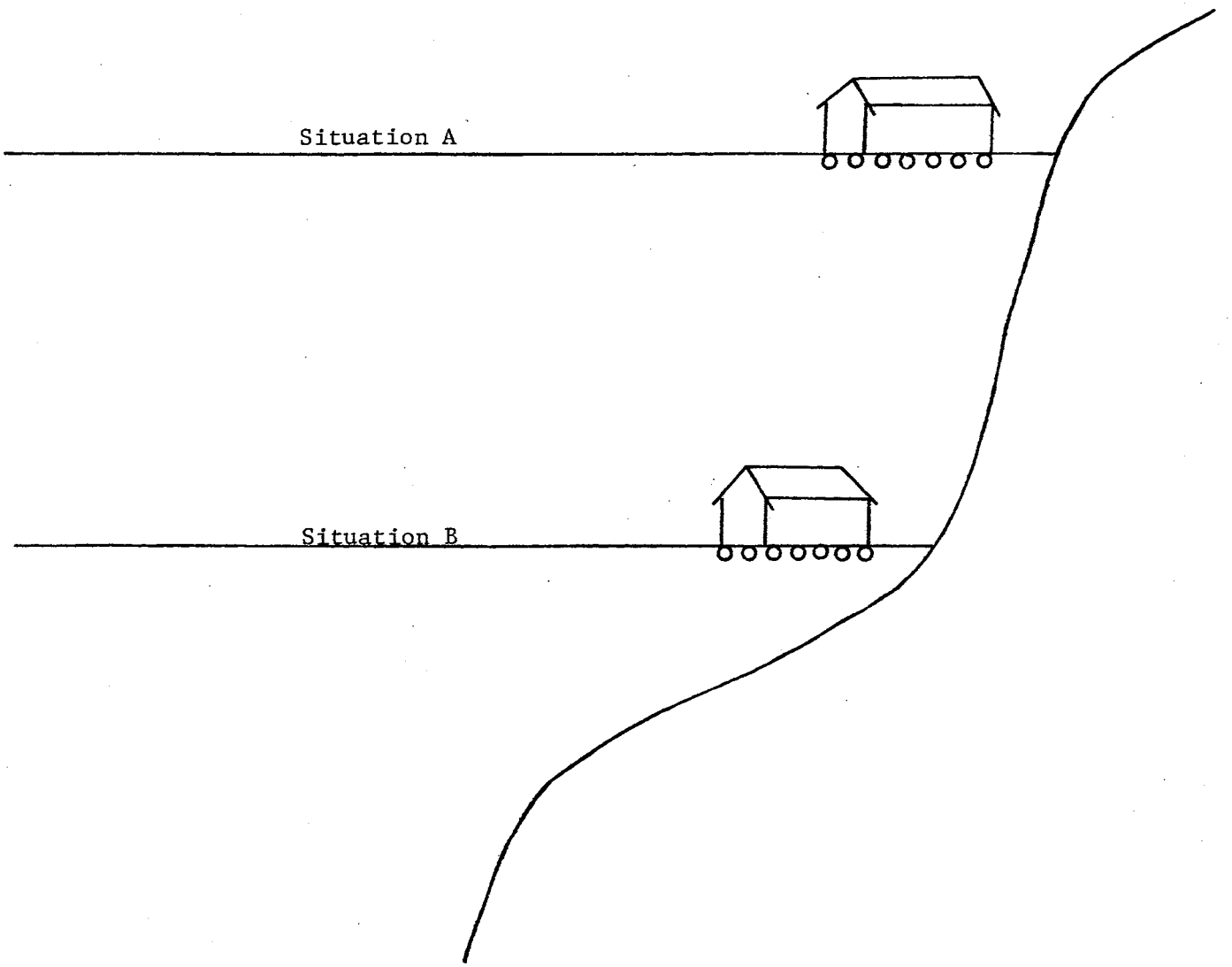

Figure 6: Graphic Illustration of Relocation Problems Associated with Slope of Shoreline

TABLE XVII

ESTIMATED COST OF RELOCATING FLOATING FACILITIES ON LAKE TENKILLER AT VARIOUS LAKE ELEVATIONS

Water Level	Total Cost	Carter's Landing	Cookson Bend	Elk Creek	Petit Bay	Six-Shooter	Snake Creek	Stray Horn
645	$350		50	50	100	150		
644	175	25	--	--	--	--	50	100
643	350	--	50	50	100	150	--	--
642	200	50	--	--	--	--	50	100
641	250	--	50	50	--	150	--	--
640	175	25	--	--	--	--	50	100
639	350	--	50	50	100	150	--	--
638	175	25	--	--	--	--	50	100
637	250	--	50	50	--	150	--	--
636	175	25	--	--	--	--	50	100
635	250	--	50	50	100	150	--	--
634	175	25	--	--	--	--	50	100
633	250	--	50	50	--	150	--	--
632	--	--	--	--	--	--	--	--
631	275	--	--	25	100	150	--	--
630	--	--	--	--	--	--	--	--
629	--	--	--	--	--	--	--	--
628	--	--	--	--	--	--	--	--
627	--	--	--	--	--	--	--	--
626	--	--	--	--	--	--	--	--
625	--	--	--	--	--	--	--	--
624	900	100	--	--	--	600	200	--
623	450	--	100	250	100	--	--	--
622	275	25	--	--	--	150	100	--
621	50	--	50	--	--	--	--	--
620	225	25	--	--	--	150	50	--
619	225	--	50	75	100	--	--	--
618	225	25	--	--	--	150	50	--
617[b]	50	--	50	Dry	--	--	--	--
616	225	25	--	--	--	150	50	--
615	150	--	50	--	100	--	--	--
614	225	25	--	--	--	150	50	--
613[c]	950	--	50	--	Dry	--	--	900
612	225	25	--	--	--	150	50	--
611	50	--	50	--	--	--	--	--
610	225	25	--	--	--	150	50	--

[a] Tenkiller Ferry Lake Economic Impact Study, 1972. Estimates are based on information supplied by the Corps of Engineers and personal interviews with concessionaires.

[b] The water-borne facilities at Elk Creek Landing are inoperable at water elevations of 617 feet (MSL) and below.

[c] The water-borne facilities at Petit Bay are inoperable at water elevations of 613 feet (MSL) and below.

listed are the concessionaires' estimates of the costs of relocation. The actual costs per relocation and the frequency of relocation depend on several factors. If the lake level is changing rapidly, timeliness becomes critical and additional labor may be needed. Availability of additional labor influences costs of relocation. Based on concessionaires' responses, more labor is available during the summer months when high school and college students are home and available for employment.

Another factor of importance is the total expected change in water level. While the water level generally is expected to fall slowly, heavy rains in the basin area upstream have in the past raised the water level as much as six feet in twenty four hours, twelve feet in three days, and thirty seven feet over a fifteen day period of time. While rapid increases are inherent in the flood control function of Lake Tenkiller, close attention to the area weather reports allows the concessionaires to anticipate large and rapid rises in the water level. If the concessionaire has reason to believe a large rise in water level will occur, he can "over-adjust" and accomplish two or more moves at once.

The accumulated relocation costs of the seven concessions at Lake Tenkiller with Corps of Engineers leases also are presented in Table XVII. The concessions are anchored to fluctuate between 630 feet (MSL) and 625 feet (MSL) with no relocation costs. However, if the water level drops to 624 feet (MSL), total costs of $900 are incurred. If the water level drops to 623 feet (MSL), an additional $450 for relocation is encountered.

Using the cost schedule in Table XVII, the relocation costs for 1972 can be approximated. Use of the cost figures in Table XVII should

be limited to 1972 as the figures represent the approximate relocation costs of the present set of facilities at present levels of wages and other associated costs. In the absence of facility data for the past time periods, an approximation can be made if one is willing to assume a constant rate of adding additional facilities over the 20 year period of time from 1953 to 1972. More specifically, assume the facilities on the lake in 1953 were one-twentieth (5 percent) of those in 1972, and thus, 5 percent of the costs shown in Table XVII (assuming the present level of wages and associated costs). Accordingly, 1954 would represent 10 percent of the present costs and so forth with relocation costs for 1971 equaling 95 percent (19 x 5%) and 1972 relocation costs equal to 100 percent. After the relocation costs in Table XVII have been adjusted for each of the nineteen years, the annual relocation costs for the life of the lake can be approximated by applying the derived cost figures to actual water level data.

Using the cost figures in Table XVII and daily water levels supplied by the Corps of Engineers, the approximate annual relocation costs in 1972 for the seven concessions under Corps lease on Lake Tenkiller are $9450 (Table XVIII).

TABLE XVIII

CONCESSIONAIRES' RELOCATION COSTS BY MONTH, 1972

Month	Water Level	Increment Costs	Total Cost
	(ft., msl)	(dollars)	(dollars)
January	632-629		275
February	629-625		none
March	625-622	(900 + 450 + 275)	1625
April	622-621		50
	621-629	(50 + 275 + 450 + 900)	1675
May	629-631		275
	631-628		none
June	628-626		none
July	626-631		275
	631-628		none
August	628-622	(900 + 450 + 275)	1625
September	622-619	(50 + 225 + 225)	500
October	619-618		225
	618-620	(225 + 225)	450
November	620-633	(50 + 275 + 450 + 900 + 275 + 250)	2200
December	633-631		275
Total Costs for Year			9450

CHAPTER IV

ESTIMATION OF RECREATION DEMAND AND ECONOMIC IMPACT

Demand for Recreation at Lake Tenkiller

The quantity of a particular recreational activity demanded by an individual depends upon the price he must pay, the prices of alternative recreational pursuits, his income level, and his time limitations. Assuming a given income level, given time limitations, and prices of alternatives constant, a downward sloping schedule of alternative price-quantity combinations generally describes consumers' behavior [17, p. 70].

Prior to participating in the recreational experience at Lake Tenkiller, each participant likely evaluated his expected satisfaction and the expected costs, given his income and time constraints. His participation in recreation at Lake Tenkiller is evidence that expected returns were equal to or greater than expected costs. Presumably, a specific participation rate at a given price or cost may be interpreted as a point on an individual's demand schedule.

The determination of the demand schedule for each participant would require additional evidence where alternative price-quantity combinations are determined, holding available time, income level, and prices of alternatives constant. Opinions of recreationists as to expected participation at alternative prices would provide estimates

of their demand schedule, but there would be uncertainty associated with the actual decisions.

A representative or average individual demand schedule was estimated from the price-quantity combinations for each participant. The price or cost of participation was used as the independent variable. The number of annual visitor days at Lake Tenkiller was used as the dependent variable. The choice of price for the independent variable and quantity for the dependent variable means that the time spent recreating at the lake is dependent on the cost of participation. Other factors, such as time and available alternatives, also affect participation rates but would be extremely difficult to determine and quantify.

Recreation Demand Curves

Using linear regression, average individual and market demand curves were determined. An exponential equation of the general form $Y = AX^b$ was used to estimate an average individual demand curve for all recreationists at Lake Tenkiller. Demand curves were also estimated for recreationists from each of the concentric distance zones.

This equation was converted to logarithms for the regression analysis and then converted back to the exponential form for plotting the demand curves. This procedure permitted the use of linear regression techniques for nonlinear data and resulted in curvilinear demand curves.

The estimated equation for the average demand schedule for the recreation experience of all respondents, using costs per visitor day (P) as the independent variable and the annual number of visitor days at Lake Tenkiller (Q) as the dependent variable, was:

$$\log Q = 1.96219 - .59345 \log P \qquad 4.1$$

In exponential form the equation was:

$$Q = 91.662\ P^{-.59345} \qquad 4.2$$

The coefficient of determination (R^2) for equation 4.1 was .3137 and $S_{\hat{b}} = .1064$.

Exponential equations of the form used in the analysis have a constant elasticity of demand equal to the value of the exponent. The estimated elasticity of demand with respect to price for the demand curve is -0.59345 for the total recreation experience.

The demand curve derived represents an average group of 4.72 individuals recreating at Lake Tenkiller. Each group represents 15.83 visitor days. The average individual demand curve indicated by equation 4.3 was determined by dividing the average group demand curve in equation 4.2 by 4.72 individuals per group.

$$Q = 19.420\ P^{-.59345} \qquad 4.3$$

The estimated market demand curve is derived by aggregating the individual demand curves for all individuals that constitute the market. Total recreational attendance recorded at Lake Tenkiller in 1972 was 3,095,700 visitor days. Each "average individual" demand curve represents 15.83 visitor days at the lake. By dividing 3,095,700 visitor days by 15.83 visitor days it was estimated that 195,560 average individuals participated in outdoor recreation at Lake Tenkiller in 1972. The expansion of the average individual demand curve (equation 4.3) by the number of participants provided an estimate of the market demand curve indicated in equation 4.4.

$$Q = 3,797,775\ P^{-.59345} \qquad 4.4$$

Estimation of Benefits

Two alternative methods of estimating consumer surplus benefits were used. In addition, actual recreational expenditures were used as a means of comparison.

Trice-Wood Method

The consumer surplus benefits were determined by multiplying the surplus value (90th percentile cost minus median cost) by the number of participants. The 90th percentile value was $6.67 per visitor day and the median value was $2.00, leaving a net benefit of $4.67 per visitor day. Based on the estimated 3,095,700 visitor days at Lake Tenkiller in 1972, the annual value of the recreation experience was $14,456,919.

Concentric Travel Zone Method

The use of concentric travel zones requires an estimation of the number of visitor days attributed to each zone and the mean value of recreation expenditures by the participants in each zone (Table IX, Chapter III). Total visitor days from each travel zone were estimated using the 1972 annual attendance and the percentage distribution of annual visitor days by travel zone. Using this method, estimated consumer surplus benefits of recreation at Lake Tenkiller in 1972 were $21,510,075 (Table XIX).

Recreation Expenditure Method

Expenditures in the pursuit of recreation constitue a minimum value for the total recreational experience. The minimum value of

the recreation experience at Lake Tenkiller may be overstated because some of the expenditures would have been spent in other recreational pursuits if the lake had not existed, thus over-estimating the "value added" as a result of the lake's existence [18, p. 224]. Total estimated recreation expenditures spent by all participants for the total recreation experience around Lake Tenkiller totaled $10,186,424 (Table XX). Estimated visitor days in each travel zone were multiplied by the estimated expenditures per visitor day for recreationists in the respective travel zones.

TABLE XIX

CONSUMER SURPLUS BENEFITS BY TRAVEL ZONE AND TOTAL FOR LAKE TENKILLER RECREATIONISTS

(Based on 1972 Survey)

Zone	Expenditures Per Visitor Day	Consumer Surplus Per Visitor Days	Visitor Days	Consumer Surplus Per Zone
I	$ 1.42	$8.82	460,021	$4,057,385
II	2.80	7.44	1,106,713	8,233,945
III	2.72	7.52	243,941	1,834,436
IV	2.72	7.52	981,956	7,384,309
V	10.24	0	303,069	0
Totals	--	--	3,095,700	$21,510,075

TABLE XX

TOTAL RECREATION EXPENDITURES BY TRAVEL ZONE
FOR LAKE TENKILLER RECREATIONISTS

(Based on 1972 Data)

Zone	Expenditures/ Visitor Day	Visitor Days	Total Expenditures
	(dollars)		
I	1.42	460,021	653,230
II	2.80	1,106,713	3,098,796
III	2.72	243,941	663,520
IV	2.72	981,956	2,670,920
V	10.24	303,069	3,103,427
Totals	--	3,095,700	$10,189,893

The value of the total recreation experience at Lake Tenkiller ranges from approximately $10.2 million to $21.5 million dollars, depending on the method used to determine the benefits. The "Total Expenditure Method," while criticized by some researchers for overestimating the benefits attributable to the lake, provides the lowest estimate of the three methods.

The "Trice-Wood Method" yielded a value of approximately $14.5 million as compared to $21.5 million computed using Clawson's "Concentric Travel Zone Method." Both methods estimate consumer surplus benefits and have a common weakness. The maximum value, normally associated with the most distant travel zone, is of critical importance when estimating the consumer surplus for each of the other zones. An error in the estimation of the "maximum" value will result in incorrect estimates of benefits in each of the other zones.

Input-Output Analysis and the Local Economy

Based on the results of the study, recreationists at Lake Tenkiller spent an average of $2.39 per visitor day in the Lake Tenkiller area while visiting at the lake. Using the 1972 attendance estimate of 3,095,700 visitor days, the local economy around Lake Tenkiller received a direct impact of $7.4 million from recreationists using the lake. Based on the survey, an estimated $1.1 million has been spent annually in the local economy for recreation investment items, such as boats, motors, fishing equipment, etc.

The reverberations of this direct impact of $8.5 million is felt throughout the local economy through indirect and induced effects. An input-output model of the local economy would provide the best estimate of the multiplier values measuring the total impact on the local economy. However, the structure of the two county economy has not been analyzed with an input-output model. Thus it was necessary to estimate the magnitude of the appropriate multipliers using multipliers developed for other areas of similar geographic and socio-economic characteristics. The multipliers selected to represent the economy of the Lake Tenkiller area were: output, 1.69; income, 1.42; and employment, 1.34. Limitations associated with the use of the above multipliers were discussed in Chapter II.

Output multipliers measure the effect on regional output of a one dollar change in demand for goods and services of a particular sector. The recreation sector output multiplier is 1.69, which means that $1.00 in final demand for recreation goods and services will result in a $1.59 increase in regional output. Estimated annual

recreation expenditures of $8.5 million in the local area result in a $14.4 million increase in regional output.

Income multipliers measure the total regional change in income resulting from a one dollar change in income within a sector. The recreation sector income multiplier of 1.42 was used. This is interpreted to mean that a one dollar increase in income in the recreation sector will generate $1.42 of income throughout the region. However, an actual study of the economy would be needed to determine percentage of gross receipts allocated to wages and salaries and profits, which are all reflected in the income multipliers.

A rough approximation can be done by estimating the number of employees in recreation related business and their salaries. According to 1970 census information, 1,260 persons in Cherokee and Sequoyah Counties were employed in the following industry groups: eating and drinking places; business and repair services; hotels and other personal services; and entertainment and recreation services. The average value of wages and salaries for 1970 in the two county area was $2,823. Based on a six percent annual increase, estimated average wages and salaries in 1972 are $3,172. Informed estimates are that approximately one-half of the employees in these four industry groups are recreation related. This means a total of 630 employees are earning an estimated average annual salary of $3,172, a total of $1,998,360. Using the income multiplier of 1.42, the estimated income effect from recreation is $2.8 million in the regional economy.

Employment multipliers measure the change in regional employment resulting from a one unit change in the labor force of a particular sector. Employment multipliers are calculated under the assumption of

a linear relationship between employment and output. The relationship is expressed through employment/output ratios that reflect the number of employees per million dollars output of a sector.

The recreation sector employment multiplier used was 1.34. This means that employment of 100 persons in the recreation sector eventually results in 34 additional persons employed in other sectors in the economy. Actual study of the economic structure of the Lake Tenkiller area would be needed to estimate the number of employees per million dollars output of the recreation sector before estimates of absolute employment benefits could be determined. A rough estimate of the employment impact is provided by multiplying the 630 employees indicated in the income section by the 1.34 employment multiplier. Thus, recreation provides a total employment impact of 844 employees in the two county area, or the creation of 214 additional jobs in other sectors of the local economy.

CHAPTER V

RECREATION MANAGEMENT AND ENVIRONMENTAL CONSIDERATIONS

Problem Areas and Suggested Improvements

The total recreational experience means different things to different people. One person's source of enjoyment, or fulfillment, may prove to be a point of contention for someone else. When people with completely opposite viewpoints find themselves in a common setting, feelings of animosity and anxiety become evident. Such was found to be the case at many of the Lake Tenkiller recreation areas where problems of noise, congestion, and overuse exist during periods of heavy use, such as weekends and holidays.

Opposing Viewpoints

The most apparent example of opposing viewpoints among recreationists at Lake Tenkiller is the controversy raging between users and non-users of motorcycles. Diametric viewpoints regarding the total recreational experience are at the root of the controversy between the two groups. Both groups go to the lake to relax and get away from the urban or city setting. One group's concept of relaxation and recreation is an atmosphere of quiet, solitude, and serenity; while the other group's concept of relaxation and recreation is one of "letting

go" and participating in activities normally suppressed in densely populated areas.

The need for designated motorcycles areas is critical to the total recreation experience of everyone involved at Lake Tenkiller. Anti-cyclists are annoyed at the cyclists for the inconveniences and discomforts they are being caused while the cyclists and their proponents are annoyed that anyone could be so "narrow-minded" that they cannot appreciate the right of the cyclist to use his motorcycle when and where he pleases. Corps of Engineers Rangers are caught in the middle of the conflict as they try to enforce the rules. Differences in interpretation of lake rules and regulations by each of the three groups, as well as the difficulty of enforcement, only serve to further aggrevate the problem.

The rangers are unable to constantly patrol all of the recreation areas, making enforcement difficult. As a case in point; motorcycles are supposed to keep to the roads, out of the campsites and off the grassed areas adjacent to the lake. When rangers aren't patrolling the immediate area, many of the cyclists, both young and old, ride where they please with almost total disregard to posted regulations.

Interpretation difficulties arise when some of the following questions surface: What constitutes a nuisance? When is a motorcycle too loud? When is a cyclist not acting in a safe manner? In which areas <u>are</u> cycles not allowed and in which areas <u>should</u> they not be allowed? These are all questions which can have different interpretations, depending on one's viewpoint.

There is a real need for designated areas for motorcycles. Approximately 15 percent of the respondents of the study ride cycles at

Lake Tenkiller and consider motorcycling to be a legitimate activity, or means of recreating, while at the lake. The general absence of designated riding areas leaves the cyclists with few alternatives other than riding up and down heavily traveled highways, access roads around the campsites, and grassed areas near the lake.

While the noise of motorcycles is an annoyance to many of the recreationists, safety is an even more serious consideration. In a typical public use area, small children are engaged in various activities and are often unaware of the need to watch for oncoming cars and cycles on the access roads and beaches. Many of the young cyclists are equally absorbed in their own activity and forget the need to watch out for others. As long as cyclists continue to use the same public use areas as being used for other recreational activities the threat of serious injury exists.

Areas need to be designated where motorcyclists are allowed to ride. These areas need to be located away from the main recreation areas and located to minimize damage to both the terrain and the natural environment. Once the areas have been established and made available to motorcycle enthusiasts the appropriate rules must be determined, specifically defined, and strictly enforced.

Based on discussions with recreationists at Lake Tenkiller and personal observations, this action may cause some dissatisfaction with a few, but should increase the quality of the recreation experience at the lake. Motorcyclists would have a place to ride their cycles and recreate in their own way, thus increasing their recreational enjoyment. Noise, congestion, and safety problems around the campsites and beach areas would be reduced in the absence of cycles, thus enhancing

the recreational experience of those opposed to motorcycles at the public use areas adjacent to the lake.

Modern Camping Needs

Recreationists are becoming more sophisticated in their efforts to relax and recreate outdoors, bringing the conveniences of home to the lake or wherever they go to recreate. Many of the newer models of mobile campers, motor homes, and pickup campers illustrate the demand for conveniences while relaxing out-of-doors. Most public use areas are not supplying sufficient numbers of modern accomodations needed to facilitate the rapid increase in this new camping style.

If the sophisticated camper is to be tolerated and accomodated without deterioration to the environment, paved access roads for him to drive on and concrete pads to park on are "absolute musts." Water and electricity at each campsite is also needed. Electricity is needed to run the air conditioner and other conveniences available in his home away from home. The recreationist's alternative is to run the self-contained power unit which is often noisy and adds exhaust pollution to the air. Water is necessary for household chores, such as cooking and washing dishes, as well as supplying water for bathing. Once water has been made available at each camp site, sewer drops are critically needed to minimize the amount of waste water allowed to run out on the ground, through other campsites and into the lake.

Part of the reason for the recent upsurge in numbers of recreationists taking the conveniences of home with them is the almost total absence of facilities at the lake which they consider to constitute the

absolute minimum. Most of the recreationists are accustomed to the cleanliness of their own bathrooms, and many violently oppose the use of open pit toilets and the offensive odor and flies normally associated with them. The Corps has constructed several improved restrooms (water-borne flush toilets) in a few of the heavily used public use areas, but more are needed.

The construction of these new toilet facilities are a move in the right direction, but the facilities often prove to be inadequate on heavy use weekends. Public agencies cannot be expected to meet peak use demands. However, sufficient personnel should be employed to maintain the cleanliness of public restrooms during periods of peak use. As more restrooms are constructed, serious consideration should be given to including hot-cold showers. A large portion of the recreationists consider daily bathing to be an important habit. Cleanliness is to be practiced by the family while away from home in much the same manner as if they were at home.

The above represents a brief summary of some of the current problems and needs at the Lake Tenkiller recreation complex. Partial solutions were advanced in some instances. Before proper long range solutions can be determined, several policy questions or issues must be faced. In addition, long range recreational trends, both regional and national, must be evaluated. The following section is addressed to this problem.

Developing Trends Related to Outdoor Recreation

On the national scene, several trends are noteworthy. Higher incomes and the much discussed four day work week can be expected to

enhance the frequency of participation in outdoor recreation. People will have both the needed time and the financial means necessary for more outdoor recreation. Increased education and awareness encourages people to travel and encounter more experiences; to become more worldly, so to speak. Some contend that zero population growth will reduce the need for outdoor recreation. Recreation is usually thought of as a family oriented activity, leading planners to believe that as family size decreases, so will the need for public use recreation facilities.

Quite the contrary, however, can be expected. Family size has been decreasing over the last 20 years as recreation participation has increased. The key to increased participation has been the increased degree of urbanization, higher incomes, and increased amounts of leisure time. Smaller family size tends to increase discretionary income and time, thus promoting the present rising trend in outdoor recreational pursuits. Smaller family size reduces the commitment of income for child rearing and allows the income to be spent for other purposes. In addition, smaller family size makes coordination of the family's activities easier. The planning of a trip is much easier since there are less chances for conflicts to arise within the family.

Smaller families will also reduce the length of the "family rearing" span for the parents. Once the children are away from home, the parents may be able to take vacations during the non-summer months, easing the seasonality problem resulting from weather and institutional patterns.

These are only a few of the noteworthy trends on the national level having an impact on recreation attendance at the lake. Because

Lake Tenkiller is considered somewhat "unique" in nature, its national popularity is likely to increase.

Several trends on the local area are also noteworthy. Metropolitan areas, such as Ft. Smith, Tulsa, Oklahoma City, and Muskogee, are major urban areas and are within less than three hours driving time of the lake. Increased urbanization can be expected, thus increasing the population and income base of the people within the respective cities.

Completion of the Arkansas River Waterway is expected to encourage industries to locate along the waterway. While the number of industries to eventually locate along the waterway is difficult to project, each industry locating on the waterway will contribute to the income and employment of the area. The increased numbers of employees with higher levels of income will increase the recreational impact on Lake Tenkiller.

An increased population base within reasonably close proximity of Lake Tenkiller may tend to "spread out the recreation season." People that reside near a lake or recreation area are more apt to use the area on a year-round basis as compared to those living a long distance away and using the lake once a year. As the population base increases in the area, the number of people inclined to use the lake year-round also increases, thus spreading out the recreation visitations over the entire year.

Improved four lane highways have reduced travel time from Tulsa, Oklahoma City, and Ft. Smith. Highway I-40 between Oklahoma City and Muskogee is near completion and has already reduced travel time between the two points. Completion of I-40 from Ft. Smith west has drastically reduced travel time between Lake Tenkiller and the Ft.

Smith SMA area. Use of the Muskogee Turnpike between Tulsa and Muskogee has reduced the distance by about one-fourth and the driving time by one-half, allowing Tulsans to be at the lake within an hour and twenty minutes.

These improvements represent only the major highways that provide people from major metropolitan areas greater safety, shorter driving time, and a more enjoyable overall recreational experience. In the immediate lake area, a perimeter road now exists around Lake Tenkiller. Highways 82 and 100 run along the south, east and north side of the lake. Most access roads between the highway and the public use areas on the lake are paved. A graveled county road runs along the western edge of the lake and current plans of the county commissioners are to pave that road in the near future. Paving of this segment of the perimeter road, as well as paving all access roads should relieve much of the present congestion along the eastern edge of the lake.

Several subdivisions are located in the Lake Tenkiller area. Home owners in the various subdivisions include people working in Ft. Smith and Muskogee, retired couples, and people with second homes. The nearness of the lake combined with the beauty of the countryside has attracted many retired people and individuals desiring to build a second home. These individuals are unique in their contribution to recreation visitations at the lake. Retired people have low participation rates in active type activities such as skiing, and participate mostly in passive activities, such as sightseeing, birdwatching, and possibly a small amount of camping. Retired couples, however, also provide a base point for their children and grandchildren, allowing them to combine visiting and outdoor recreation while on vacation or on a weekend

outing. Recreation groups of this type do not participate heavily in activities such as camping, but rather in water contact sports and picnicing.

The same participation patterns apply to people with second homes near Lake Tenkiller. Whether they bring their family, or friends, they have no need for camping facilities as inexpensive lodging is already available. Their main uses of the lake are for picnics and water contact sports such as boating, skiing, fishing, and swimming.

Numerous lakes are scattered throughout Eastern Oklahoma and Western Arkansas with a large number of the lakes being completed in recent years as part of the Arkansas River Waterway. These lakes are complementary up to a point, as the network of lakes in Eastern Oklahoma attracts recreationists to the general area. Lake Tenkiller apparently is considered the best of the entire network. The actual competition is difficult to access as recreation attendance continues to increase at Lake Tenkiller, even with the completion of new lakes. Lack of sufficient roads and facilities at nearby lakes may help explain this phenomenon for the present time period. The uniqueness of Lake Tenkiller will be tested as roads and facilities to other lakes are developed. If Lake Tenkiller provides a truly unique recreation experience, attendance at the lake will not be adversely affected as many recreationists will go elsewhere only during periods of peak use.

Because of Lake Tenkiller's beauty and uniqueness, the potential for overuse and abuse is great. Policies need to be undertaken to determine an optimal level of recreation development for Lake Tenkiller. These policies need to be considered in light of expected levels of development of other lakes in the area.

One potential source of needed overall long range planning is the proposed "Oklahoma Unit of the National Recreation Area System [19]. The proposed action includes about 84,700 surface acres of water and 105,900 acres of surrounding lands in the Ft. Gibson, Webbers Falls, Robert S. Kerr, and Tenkiller Ferry Lakes areas. The plan also includes 1464 acre Greenleaf Lake State Park, 40,000 acres of federally owned land on the site of Camp Gruber (former military installation), and 32,000 acres of state owned lands managed by the Oklahoma Department of Wildlife Conservation (Cherokee Wildlife Refuge and hunting area).

Construction would include eleven new public use areas, 52 miles of motor bike trails, 25 miles of bicycle trails, 60 miles of hiking trails, and 32 miles of nature trails. Group camps would be provided with cooking facilities, tent platforms, and various athletic facilities. Playground equipment would be provided for the young visitors. Implementation of the Oklahoma National Recreation Area plan would solve many of the current problems as well as provide an organized and coordinated long range water-based recreation plan for the area.

Meeting Future Recreation Needs

Recreation attendance at Lake Tenkiller can be expected to continue to increase in the future. The uniqueness and attractability of the lake, combined with an improved highway system, will continue to draw people to Lake Tenkiller, rather than their going to other lakes in the area.

Increased numbers of recreationists with higher income, more leisure time, and ever increasing tastes and preferences can be

expected at Lake Tenkiller and the surrounding area in the forseeable future. Sufficient facilities in adequate quantities must be provided if damages to the environment are to be avoided.

Buffers of trees and shrubbery could be provided to reduce noise and congestion in heavily impacted areas. Improved access roads would help to more evenly distribute people among all public use areas, relieving many of the overuse problems associated with the more popular areas. Corps of Engineer Rangers could provide a valuable source of information to recreationists about the relative congestion and crowding in the various public use areas, enabling individuals to use less impacted areas.

Recreation personnel need to develop guidelines outlining the type of recreation experience to be provided at Lake Tenkiller, as well as the expected capacity of the various recreation areas. Development of facilities should conform to an overall plan developed to coordinate the development of recreation at all lakes in the area. A comprehensive plan would allow some maximum level of recreation development subject to the other functions and purposes at each of the lakes. Recreation facilities should then be developed and managed accordingly.

Conflicting recreation activities should be separated to enhance the recreation experience of people coming to Lake Tenkiller. The most obvious need for zoning, or designated areas, is the separation of motorcycles from recreationists at the public use areas. Other potential areas of conflict include skiing versus swimming, fishing, diving or boating; boating versus fishing or swimming; and fishing versus swimming and diving. While conflicts of this type are not serious now,

they likely will be as the intensity of use increases and the absence of zoning continues.

Consideration should be given to maintaining and improving the natural cover and vegetation of the recreation areas. Heavy impacted areas need to be closed off, or rotated occasionally, and allowed to rest. In some instances, the area may have deteriorated to the point that revegetation is necessary. As added recreational facilities and access roads are developed around the lake, shifting of visitors away from the heavier impacted areas will allow those areas an opportunity to recover their original cover and natural beauty.

The use of user fees is one alternative for protecting heavily impacted areas by rationing recreation attendance. One possibility would be charging user fees on weekends and holidays, and allowing these facilities to be used without charge during the weekdays. Varying levels of fees could also be charged discriminating between current intensively used areas and lesser used areas.

Public agencies charged with the responsibility of managing recreation areas should move toward a policy of charging user fees sufficient to cover operation and maintenance costs. In this study, approximately 95 percent of the visitors surveyed indicated they were willing to pay a nominal user fee, provided the fee was used to maintain and improve the recreation facilities. Other studies have reported similar results [1]. Recreationists are demanding more improved facilities, such as flush toilets, showers, and electrical hookups and are willing to help defray part of the expenses public agencies incur in providing these improved facilities.

Lake Tenkiller currently provides a high quality recreation experience and every effort should be made to maintain the high quality recreational experience and the natural beauty of the lake area for future users. Hopefully, many of these suggestions can be implemented in the near future to assist in meeting the increased recreational demands being placed on the recreational areas at Lake Tenkiller.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Summary

The general objective of the study was to estimate the demand for and the economic impact of outdoor recreation at Lake Tenkiller. Specific objectives were: (1) to determine the socio-economic and other characteristics of recreationists at Lake Tenkiller; (2) to determine the expenditure patterns of recreationists; (3) to determine the economic impact of recreation on the local economy; and, (4) to analyze management problems associated with the Lake Tenkiller recreation complex.

The need for the study arose from the increasing importance of outdoor recreation at multi-purpose federal lakes, even though recreation may not have been an original purpose of the project. Benefits of the recreation purpose must be estimated if recreation facilities and development are to receive equal consideration in future planning and expenditures at these lakes. In this study, benefits were estimated using consumer surplus and input-output analysis. The consumer surplus technique is used to estimate the benefits of recreation experience at Lake Tenkiller. Input-output analysis is used to estimate the benefits of recreation expenditures to the local economy.

Lake Tenkiller was selected as the area of study for three reasons: (1) the high quality recreation experience associated with the lake;

(2) the possible conflict between the various purposes of the lake; and (3) the lake is located in an area of generally high unemployment and underemployment and low per capita income.

Recreation is not an officially recognized purpose at Lake Tenkiller although the lake is one of the heaviest used lakes in Oklahoma. Benefits were estimated to help justify consideration of recreation as a purpose in future planning and appropriation of funds for improved recreation facilities.

The impact of fluctuating lake level on the recreation sector caused by power generation and flood control was evaluated. Opinions of recreationists, concessionaires, and other private businessmen around the lake were obtained, as well as the monetary costs associated with a fluctuating water level.

Maintenance of the environmental integrity of the Lake Tenkiller recreation area must be emphasized. The lake is currently a very popular and heavily used recreation area because of the natural beauty of the area. However, overuse and abuse may eventually reduce the quality and value of the recreation experience if proper management and sufficient operational and maintenance funds are not provided.

Data were obtained from: (a) recreationists, (b) concessionaires and other local businessmen, (c) Corps of Engineers, and (d) various publications. Recreationists provided data on recreation expenditures, various socio-economic characteristics, miles traveled and driving time required, length of visit and number in party, problems encountered and suggested improvements. Concessionaires and other local businessmen provided information on sales, employment, various management problems, and information on boat storage facilities. Corps of Engineers

personnel provided information on recreation attendance, water level, and other data. Other information was obtained from various published sources. This information included previous recreation and recreation related studies, input-output analysis, and various state and federal publications.

Recreationists using Lake Tenkiller on the average were better educated and had higher incomes than their counterparts. Approximately 94 percent of the household heads of the study had at least a high school diploma, compared with 52 percent for the State of Oklahoma and 39 percent for the State of Arkansas. Respondents of the study had an average household income of $12,400, compared to $9,110 for the State of Oklahoma and $5,235 for the nearby State of Arkansas.

Occupations of the respondents were compared to the occupational distribution shown in recent census data. Occupational classifications of professional, manager, official, or craftsman visited the lake more frequently than sales, clerical, laborer, or operative.

Respondents of the study had an average investment per group of approximately $2,900. Each group stays an average of 75 visitor days annually at Lake Tenkiller. Based on current attendance figures, 41,400 recreation groups with a total recreation investment of approximately $120 million visited Lake Tenkiller in 1972. Assuming the recreation equipment was purchased over a five year period, the annual investment impact was distributed as follows: Oklahoma City, $6.1 million; Tulsa, $5.5 million; Ft. Smith, $3.5 million; and the Lake Tenkiller area, $1.1 million.

Recreationists surveyed at Lake Tenkiller planned to stay at the lake an average of 5.75 days during their visit with an average size

group of 4.72 people, or an average of 27 visitor days. Annually, the same group stays an average of 74.7 visitor days per group at Lake Tenkiller. Swimming, relaxation, skiing, pleasure boating, camping, and sunbathing receive the heaviest participation of recreationists while at the lake.

The group spent an average of $64.72 per visit in the local area, or $2.39 per visitor day. These expenditures were distributed as follows: transportation, 8.1 percent; lodging, 3.1 percent; groceries and meals, 60.3 percent; and miscellaneous, 28.5 percent. The total trip cost an average of $115.53 per group, or $4.26 per visitor day. This includes round trip mileage at seven cents per mile which is intended to reflect only the variable driving costs.

Recreation attendance is made up largely of family oriented groups who stay at the lake in excess of 24 hours. The importance of recreation at Lake Tenkiller is illustrated by the miles traveled by recreationists coming to the lake. Approximately two-thirds of the Lake Tenkiller recreationists reside in zones II (50-99 miles) and IV (150-199 miles). Oklahoma City and Tulsa SMSA's are contained within the respective zones.

Noise was the major complaint of the respondents with motorcycles and loud partying being the two most mentioned sources. Dirty toilet facilities also received numerous complaints. Insufficient cleaning and maintenance during periods of heavy use and the odor associated with open-pit toilets were the basis of the complaints. Some also indicated more patrolling was needed, especially late at night.

Various changes, or needed improvements, for the Lake Tenkiller recreation complex were suggested by the respondents. Almost all

suggestions were for improved camping facilities. Water and electricity at present campsites, as well as needed additional campsites; more and better restrooms with hot-cold showers; more picnic tables; and more drinking water hydrants constituted approximately 80 percent of all suggestions received.

Average annual gross receipts of concession operators on the lake are $79,150, while the average annual gross receipts of off-lake businesses are $102,700. Concession operations are more labor intensive and provide employment for 1.7 full time employees in addition to available family labor while off-lake business provide employment for .63 full time employees. Combining full time and part time employment, each concession operation provides an average annual payroll of $12,460 (16 percent of gross receipts) as compared to the off-lake business payrolls of $5,560 (5.4 percent of gross receipts) per business firm.

Recreation attendance at Lake Tenkiller in 1972 was 3,095,700 visitor days. There has been an average annual increase in visitor days of 25 percent since 1967. This increase occured in spite of the completion of numerous lakes along and supporting the Arkansas River Navigation channel. However, development of adequate recreation facilities and access roads has not kept pace with the completion of new lakes. Once needed roads and facilities are developed, the recreation attendance at Lake Tenkiller may stabilize or decrease.

The "peak use dilemma" faced by recreation planners and managers has intensified in recent years at Lake Tenkiller as the intensity of the "tourist season" has increased. In each of the summer months, May through September, percentage of annual attendance has increased in recent years when comparing the two time periods: 1955-1963; 1963-1971.

July and August were the two big gainers, gaining 22.5 and 15.6 percent respectfully.

Lake level fluctuations did not appear to be an area of concern for recreationists. However, the surveys were taken at a time when the lake was at an optimal level, leading one to believe the number of complaints would increase if the lake had been approaching a critical level. The resulting rocky and muddy shoreline is the major complaint associated with low lake levels. The quality of the swimming activity is reduced in addition to the hazards faced by boaters and skiers. While fishermen contend the fluctuating lake level reduces the fish population, biologists indicate that no such relationship exists.

Concessionaires operating floating facilities must relocate those facilities as water level rises or falls, encountering monetary costs when water fluctuations occur outside some given range. The facilities are so located that no monetary costs are associated with adjustments between 630 feet (msl) and 625 feet (msl). The actual costs encountered outside this range depend upon the availability of labor, total expected change, and how rapidly the lake level is changing. Estimated relocation costs in 1972 for the seven concessions operating under Corps lease on Lake Tenkiller was $9450.

Recreation Demand Relationships

An average demand schedule of the form $Q = AP^b$ was estimated using price-quantity combinations for each respondent. Expenditures per visitor day was used as the independent variable (P) and annual visitor days at Lake Tenkiller was the dependent variable (Q). The equation

was converted to logarithms to permit the use of linear regression techniques for non-linear data and resulted in curvilinear demand curves.

The resulting equation, in exponential form was:

$$Q = 91.662\ P^{-.59345} \qquad 6.1$$

The demand curve (6.1) represents an average group of 4.72 individuals. An average individual curve was estimated, dividing equation 6.1 by 4.72. The resulting average individual demand curve is:

$$Q = 19.420\ P^{-.59345} \qquad 6.2$$

Individual demand curves were aggregated to derive an estimated market demand curve. An "average individual" represents 15.82 annual visitor days. The annual attendance in 1972 of 3,095,700 represents 195,560 average individuals. Expansion of the average individual demand curve yields the following estimated market demand curve:

$$Q = 3,797,775\ P^{-.59345} \qquad 6.3$$

Estimation of Benefits

Two types of benefits were estimated: benefits attributable to Lake Tenkiller and the economic benefits to the local economy. Benefits attributable to Lake Tenkiller were estimated using actual recreation expenditures as well as two methods of computing consumer surplus benefits. Actual recreation expenditures were estimated at $10.2 million; the Trice-Wood Method provided an estimate of $14.5 million; and the Concentric Travel Zone Method, an estimate of $21.5 million for recreation impact.

Input-output analysis was used to measure the impact of recreation expenditures on the local economy. The structure of the Lake Tenkiller area economy has not been analyzed, making it necessary to estimate the magnitude of the appropriate multipliers, based on other areas with similar geographic and socio-economic characteristics. Multipliers selected to represent the local economy are: output, 1.69; income, 1.42; and employment, 1.34. Estimated annual recreation expenditures of $8.5 million in the local area result in $14.4 million increase in regional output, $2.8 million increase in wages and salaries, and employment for 844 employees.

Recreation Management Considerations

The total recreation experience means different things to different people, creating the possibility of recreationists engaging in non-compatable activities in the same recreation area. Motorcyclists are currently creating problems for many of the other recreationists. The threat of serious injury will continue to exist as long as cyclists participate in the same public use areas as being used for other recreational activities. A potential conflict exists between swimming and boating as attendance pressures become more intense. Many of the boat launching ramps and swimming areas are located in coves, forcing the two groups into the same general area.

The environmental integrity of the area is being threatened as insufficient facilities exist to accomodate the heavy recreation use. Several "overflow" areas have been designated to handle the crowds on peak use weekends. The serious problem is the lack of proper facilities to accomodate the large number of mobile camper facilities.

More concrete pads and electrical hookups at the campsites are critically needed. If water hookups are added, sewer drops also should be installed. Open pit toilets and the absence of shower facilities are also objectionable to many of the recreationists.

The need for additional and improved facilities becomes more apparent as several trends can be noted that suggest a continuation of the present trend in outdoor recreation. On the national level, the four day work week will make every weekend a three day weekend, thus more time for traveling. Increased levels of education and awareness tend to increase one's demand for outdoor recreation. Increased levels of income will provide more people with the financial means needed to recreate away from home. Reduced family size reduces the number of potential family conflicts, allowing more "non-committed" weekends for the family. In addition, smaller families should suggest higher levels of discretionary income left over to do other things.

On the regional level, industrialization along the Arkansas River Waterway will attract new people and create new jobs, increasing both the local population base and income level, thereby increasing the number of potential recreationists. Improved highways have led to increased participation and will lead to still further increases as more people become aware of the increased recreational opportunities available to them within a few hours driving time. The population of three nearby metropolitan areas, Ft. Smith, Tulsa, and Oklahoma City, is increasing at a rapid rate, which will mean even greater recreation pressures at Lake Tenkiller. Establishment of rural water districts has enhanced the development of subdivisions in the lake area. These

subdivisions are made up largely of permanent homes for retired couples and second homes for people living considerable distances from the lake.

Conclusions and Implications

The recreation facilities at Lake Tenkiller are used largely by people outside the area. Two factors account for this situation. First, the uniqueness of the entire Ozark region must be experienced to be appreciated. While the area is classified as a poverty area, most of the countryside remains untouched and in its native state, providing the recreationist a satisfying "back-to-nature" type of experience. Second, the lack of a sufficient population base in the local area causes the lake usage to be heavily weighted toward outsiders. Moreover, the local people are already living in the environment other people are coming to experience for a day or two at a time. In addition, ample water-based recreation opportunities exist in the area; thus Lake Tenkiller is not "unique" to the local people.

The majority of the people born and raised in the area do not fully realize the value of their environment. This has been illustrated by the lack of foresight and planning in many of the housing and business developments. If the unique environmental quality is to be maintained, areawide zoning and land use controls should be enacted.

Lake Tenkiller recreation facilities cannot be managed as a separate entity, but should be operated as part of a total recreation complex made up of other lakes in the area. Recreation attendance in the general area where Lake Tenkiller is found will increase, but the question of which lake remains to be answered. The adoption and

implementation of the "Oklahoma National Recreation Area System" would do much to meet increased recreational needs.

Need for Further Research

Further research is needed to determine the extent of the shifting demands of recreationists and ways to meet these demands. For example, larger numbers of mobile campers are using the public use areas. Only recently have public agencies begun to make a real effort to meet the needs of these types of recreationists. Efforts must be made to quickly determine these needs and to find alternative ways of providing facilities and use areas.

A follow-up research study should explore the interactions of both water and related land based recreational activities. In Oklahoma, at least, it appears that camping around large lakes is a fast growing trend, with considerable economic impact. In light of these current and emerging trends it may be impossible to separate the demand for or economic impact of land and water based recreational activities.

Efforts should also be made to interview recreationists for selected periods throughout the year. If recreationists were interviewed during all seasons of the year, the researcher should be able to determine the extent of any differences in socio-economic characteristics and place of residence between recreationists using the lake during the winter and those using the lake in the peak use summer period.

Finally, a much more detailed study of off-lake recreational related businesses is needed. The full extent of interactions between

businesses, such as motels, restaurants, and service stations near the lake, and recreationists using the lake, should be determined in future recreation impact studies.

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APPENDIXES

RECREATIONIST'S ON-SITE QUESTIONNAIRE CONFIDENTIAL

LAKE TENKILLER WATER-BASED RECREATION STUDY

Departments of Economics and Agricultural Economics
Oklahoma State University
Stillwater, Oklahoma 74074

Summer 1972

Section 1. (General Information)

Date: _____ Time: _____ Location: _____

Interviewer: _____

Weather Data:

(1.01) 1. Sunshine 2. Cloudy 3. Windy 4. Rain

(1.02) 1. Cool (45-64°) 2. Warm (65-84°) 3. Hot (85+°)

Section 2. (Personal Data)

(2.01) Age: 1. <14 2. 14-17 3. 18-24 4. 25-34
5. 35-49 6. 50-64 7. 65+

(2.02) Relation to Head _____

(2.03) Marital Status
1. Single 2. Married

(2.04) Occupation:
1. Professional
2. Manager; Official
3. Sales; Clerical
4. Craftsman
5. Laborer; Operative
6. Service Worker
7. Farmer or Farm Worker
8. Not Employed
9. Retired
10. Student

(2.05) Average Hours Worked Per Week _____

(2.06) Education
1. None 4. 12 (High school) 7. M.S.
2. 1-6 5. 13-15 8. Ph.D.
3. 7-11 6. B.S. 9. Technical

(2.07) Total Household Income Per Year
1. <$3,000 4. $7-8,999 7. $15-19,999
2. $3-4,999 5. $9-11,999 8. $20-29,999
3. $5-6,999 6. $12-14,999 9. $30,000+

(2.08) Weeks Paid Vacation _____
(or taken, if self-employed)

Section 3. (Trip Data)

(3.01) Home Town: _____

(3.02) Miles: _____

(3.03) Driving Time: _____

(3.04) Type of Trip:
1. Major Annual Vacation
2. Overnite Trip
3. One-Day Outing
4. 2-3 Day Outing
5. Other _____

(3.05) Number of People in Party _____

(3.06) Type of Group
1. Family (relatives)
2. Family & Friends
3. Group of Friends
4. Organized Group
5. Other _____

(3.07) Time Spent at Tenkiller This Visit _____

(3.08) Are you a frequent user of Tenkiller Lake facilities?
1. Yes
2. No

(3.09) If yes, when did you first use Lake Tenkiller? _____(yr.)

(3.10) Mode of Travel
1. Car
2. Car-Trailer
3. Pick-up Camper
4. Mobile Camper
5. Cycle
6. Bus
7. Train
8. Air

(3.11) Average Travel Expenditures to and from Lake Tenkiller Area (exclude gas and oil)
1. <$10
2. $10-19.99
3. $20-49.99
4. $50-89.99
5. $90-149.99
6. $150-199.99
7. $200+

(3.12) Expenditures at Lake Tenkiller for This Visit
1. <$10
2. $10-19.99
3. $20-49.99
4. $50-89.99
5. $90-149.99
6. $150-199.99
7. $200+

(3.13) Percentage of Tenkiller Area Cost
1. Transportation in area _____%
2. Lodging _____%
3. Meals and groceries _____%
4. Misc. (rentals, purchases, amusements, etc.) _____%

(3.14) What factors limit the time you spend recreating at Lake Tenkiller? (Rank in order of significance if more than one)
_____ 1. Time
_____ 2. Money
_____ 3. Distance (from home)
_____ 4. Crowding in Recreation Area
_____ 5. Other _____
_____ 6. No Opinion

Section 4. (Frequency and Distribution of Visits to Lake Tenkiller During the Year)

		Frequency	Ave. Length of Visit			Frequency	Ave. Length of Visit
(4.01)	Jan.	_____	_____	(4.07)	July	_____	_____
(4.02)	Feb.	_____	_____	(4.08)	Aug.	_____	_____
(4.03)	Mar.	_____	_____	(4.09)	Sept.	_____	_____
(4.04)	Apr.	_____	_____	(4.10)	Oct.	_____	_____
(4.05)	May	_____	_____	(4.11)	Nov.	_____	_____
(4.06)	June	_____	_____	(4.12)	Dec.	_____	_____

Section 5. (Recreational Equipment and Investment)

	Item	Approx. Cost	When Purchased	Where Purchased
(5.01)	Boat (Length _____)			
(5.02)	Motor (____H.P.)			
(5.03)	Boat Trailer			
(5.04)	Skiing Equipment			
(5.05)	Tent			
(5.06)	Camper Trailer			
(5.07)	Tent Trailer			
(5.08)	Pick-up Trailer			
(5.09)	Motor Home			
(5.10)	Other _____			
(5.11)	Other _____			

Section 6. (Boat and Trailer Storage)

(6.01) Where is boat stored or parked?
1. Home 2. Lake Area 3. Other _____

(6.02) Cost of Boat Storage (monthly rate)
1. None
2. <$5
3. $5-9.99
4. $10-14.99
5. $15-19.99
6. $20-29.99
7. $30 or greater

How is the boat storage rental rate determined? _____

_____

(6.03) Where is camper trailer stored or parked?
1. Home 2. Lake Area 3. Other _____

(6.04) Cost of Camper Trailer Storage
1. None
2. <$5
3. $5-9.99
4. $10-14.99
5. $15-19.99
6. $20-29.99
7. $30 or greater

How is the trailer storage rental rate determined? _____

_____

Section 7. (Site Preferences and Opinion)

(7.01) Reason Selected Lake Tenkiller for Recreation Visit
1. Closest to Home
2. Most Beautiful Area
3. Other _____
4. Other _____

(7.02) How did you first learn about the facilities at Lake Tenkiller?
1. T.V. Advertising
2. Radio Advertising
3. Newspaper Advertising
4. Travel Magazine
5. Road Map
6. Boat and Travel Show
7. Relative
8. Friend
9. Other _____

(7.03) What would you like to see done to improve Lake Tenkiller recreation area?
1. More Boat Launching Ramps
2. More Camping Areas
3. More Swimming Areas
4. Better Fishing
5. More Access Roads
6. Other _____
7. Other _____

(7.04) Which of the following do you consider to be problems at Lake Tenkiller?

1. Littering
2. Insufficient Trash Collection and/or Trash Facilities
3. Dirty Toilet Facilities
4. Maintenance of Grassed Areas
5. Noise Problems Due to Loud Vehicles
6. Safety Problems Due to Fast Traffic
7. Dust from Roads
8. Insufficient Security Patrol
9. Other _____

(7.05) Have you any observations on pool fluctuation of Lake Tenkiller as it relates to your recreational enjoyment? _____

_____

_____

(7.06) (Only for those in Corps non-fee camping areas)

Would you be willing to pay a nominal user fee if used for maintenance and improvement of facilities?

1. Yes _____ 2. No _____ 3. Comments _____

_____

_____

(7.07) (Only for those in Corps fee camping areas)

Do you object to paying the $1.00 per night fee for the camping site you are occupying?

1. Yes _____ 2. No _____ 3. Comments _____

_____

_____

Section 8. (Participation Data)

In the table below:
In column (a) place the age of each person in your group.
In column (b) indicate the sex of each person listed.
In the remainder of the columns check the activities participated in by each person in your group at this lake.

		1	2	3	4	5	6	7	8	9	10	11	12	13	
	Person	Age	Sex M	Sex F	Fishing	Pleasure Boating	Water Skiing	Swim-ming	Sun Bathing	Hiking	Cycling	Nature Study	Scuba Diving	Relax-ation	Other
	Exam-ple	52	✓		(✓)	✓		✓							
(7.01)	1st														
(7.02)	2nd														
(7.03)	3rd														
(7.04)	4th														
(7.05)	5th														
(7.06)	6th														

(7.07) Circle one check mark for each person indicating the activity most enjoyed by that individual. (See example)

BUSINESS QUESTIONNAIRE CONFIDENTIAL

LAKE TENKILLER WATER-BASED RECREATION STUDY

Departments of Economics and Agricultural Economics
Oklahoma State University
Stillwater, Oklahoma 74074

Summer 1972

Date: _____ Time: _____ Interviewer: _____

Name of Business: _____

Address: _____

Section 1. (General Information)

(1.01) Location of Business

1. On U.S. Highway
2. On State Highway
3. On Access Road
4. On Lake or Shore

(1.02) Miles from Lake

1. Immediate Area
2. Less than 1 mile
3. 1-2 miles
4. 2-3 miles
5. 3-5 miles
6. 5-10 miles
7. 10-15 miles
8. Over 15 miles

(1.03) Type of Business (Rank top three in order of significance)

____ 1. Lodging
____ 2. Restaurant - Convenience
____ 3. Restaurant - Sit down
____ 4. Tavern
____ 5. Service Station
____ 6. Food Store
____ 7. Marina (full-service)
____ 8. Boat Rental
____ 9. Boat Storage
____ 10. Boat Sales
____ 11. Boat Repair
____ 12. Retail Water Sports Equipment
____ 13. Retail Fishing Equipment
____ 14. Fishing Bait - Tackle
____ 15. Package Liquor
____ 16. Package 3.2 Beer
____ 17. Real Estate
____ 18. Open Fishing Dock
____ 19. Closed Fishing Dock
____ 20. Boat Docks
____ 21. Snacks, Beverages, etc.

(1.04) Person Interviewed

1. Owner-Operator
2. Manager
3. Lessee
4. Other _____

(1.05) Is this business operated under a concession contract with the Corps of Engineers?

1. Yes
2. No

(1.06) How long has operator owned or operated business? _____(yr.)

(1.07) Did present owner start this business originally?

1. Yes
2. No

(1.08) Age of Business _____

(1.09) Occupation Before Operating This Business _____

(1.10) Reason for Establishing This Business _____

Section 2. (Owner's Investment Data)

(2.01) Value of land at start of business $_____

(2.02) Original investment in buildings and improvements $_____

(2.03) Subsequent investment in improvements $_____

(2.04) Current investment in inventory $_____

(2.05) Estimated market value of land and improvements (exclude inventory) $_____

Section 3. (Business Sales and Operational Data)

(3.01) Gross Sales Volume

1. Under $5,000
2. 5,000-9,999
3. 10,000-14,999
4. 15,000-24,999
5. 25,000-49,999
6. 50,000-74,999
7. 75,000-99,999
8. 100,000-124,999
9. 125,000-149,999
10. 150,000-199,999
11. 200,000-249,999
12. 250,000-350,000
13. Over $350,000

(3.02) Percent of Total Gross Sales Resulting from Services _____%

(3.03) Percent of Total Gross Sales Resulting from Sale of Goods _____%

(3.04) Trend of Sales Volume

1. Growing Rapidly (over 10%)
2. Growing Slowly (0-9%)
3. Steady
4. Declining Slowly (2-5%)
5. Declining Rapidly (5% or more)

Comments: _____

_____

_____

(3.05) Means of Advertisement

1. None
2. Newspaper
3. Radio
4. TV
5. Outdoor Signs
6. Direct Mail
7. Word of Mouth
8. Other _____
9. Other _____

(3.06) Major Management Problems

_____ 1. Inability to get and retain good help
_____ 2. Vandalism
_____ 3. Seasonality
_____ 4. Uncertainty of weather
_____ 5. Fluctuating water level in lake
_____ 6. Other _____

(Rank in order of significance if more than one)

Section 4. (Employment Data)

(4.01) Full time _____ (4.03) Payroll/yr. _____

(4.02) Part time _____ (4.04) Payroll/yr. _____

Section 5. (Seasonal Nature of Business)

			1	2	3	4
			Jan.-Mar.	Apr.-June	July-Sept.	Oct.-Nov.
(5.01)	% of Annual Sales					
(5.02)	% of Sales Made to Persons Using Lake					
(5.03)	No. of	Full time				
(5.04)	Employees	Part time				

(5.05) Indicate Months Open

1. Jan. 2. Feb. 3. Mar. 4. Apr. 5. May 6. June
7. July 8. Aug. 9. Sept. 10. Oct. 11. Nov. 12. Dec.
13. Year-round

Section 6. (Effect of Changes in Water Level)
(630' power pool)

Changes in Gross Receipts Resulting from Fluctuating Water Level

			Changes in Gross Receipts (estimates)								
			decreases					increases			
			1 30%+	2 20-30%	3 10-19%	4 5-9%	5 ±5%	6 5-9%	7 10-19%	8 20-30%	9 +30%
6.01	612	16' low									
6.02	616	12' low									
6.03	620	8' low									
6.04	624	4' low									
6.05	628-632	normal									
6.06	636	4' high									
6.07	640	8' high									
6.08	644	12' high									
6.09	648	16' high									

Increased Expenditures Resulting from Fluctuating Water Level

			Changes in Expenses (estimates)								
			decreases					increases			
			1 0-$49	2 $50-99	3 $100-199	4 $200-299	5 $300-449	6 $450-599	7 $600-899	8 $900-1199	9 $1200+
6.10	612	16' low									
6.11	616	12' low									
6.12	620	8' low									
6.13	624	4' low									
6.14	628-632	normal									
6.15	636	4' high									
6.16	640	8' high									
6.17	644	12' high									
6.18	648	16' high									

Discussion: _____

Section 7. (Boat Storage)

	1	2	3	4	5	6	7	8	9	10	11	12	13
										Occupancy Level			
Unit	Date Built	Type: Wet or Dry	Mate-rials	Length	Width	No. Stalls	Constr. Costs	Annual Main. Costs	Rental Rates	Jan.-Mar.	Apr.-June	July-Sept.	Oct.-Dec.
#1													
#2													
#3													
#4													
#5													
#6													
#7													
#8													

Construction Materials (Code for column 3 above)

1. Wood 2. Metal 3. Concrete Blocks 4. Wood--Tin 5. Metal-Tin 6. Other _____

How are boat storage rental rates determined? _____

(Relationship to Lake Levels)

Do people remove boats when lake level goes down?

1. yes 2. no Comments _____

Percentage of Boats in Storage from Vicinity of:

Tulsa _____% Oklahoma City _____% Ft. Smith _____%

Muskogee _____% Local Other _____% Other _____%

Section 8. (For Lake Concessionaires)

1. How much did it cost you to move your boat docks and related facilities because of fluctuating lake levels in:

   1970 $_____

   1971 $_____

   so far this year $_____

2. How many times did you have to move your boat docks and related facilities because of fluctuating lake levels in:

   1970 $_____

   1971 $_____

   so far this year $_____

3. What other expenses have you incurred as a result of fluctuating lake levels in

	Cost	Explanation
1970	_____	_____
	_____	_____
	_____	_____
1971	_____	_____
	_____	_____
	_____	_____
so far this year	_____	_____
	_____	_____
	_____	_____

TABLE XXI

WATER LEVEL FLUCTUATIONS BY MONTH 1955-1972

		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1955	High	607.43	619.12	629.11	628.92	630.66	631.35	630.08	628.50	624.97	623.22	622.62	618.74
	Low	602.99	607.52	619.40	627.72	627.97	629.62	628.57	625.11	622.71	622.68	618.82	616.56
	Range	4.44	11.60	9.71	1.20	2.69	1.73	1.51	3.39	2.26	.54	3.80	2.18
	Aver.	605.87	611.44	623.25	628.48	628.80	630.11	629.56	627.04	623.67	623.03	620.42	617.73
1956	High	616.53	611.98	611.34	610.83	619.97	624.44	624.87	624.70	622.95	621.58	620.83	619.88
	Low	612.19	611.11	610.41	610.01	611.19	620.27	624.51	622.96	621.92	620.76	619.93	618.60
	Range	4.34	.87	.93	.82	8.78	4.17	.36	1.74	1.03	.82	.90	1.28
	Aver.	614.45	611.42	611.14	610.32	615.30	622.90	624.76	623.97	622.25	621.14	620.49	619.06
1957	High	620.02	626.63	628.54	640.70	661.26	666.33	659.20	632.30	631.20	627.99	628.03	626.64
	Low	618.03	621.02	626.99	627.92	627.96	659.75	631.57	630.82	628.14	626.60	625.77	624.03
	Range	1.99	5.61	1.55	12.78	33.30	6.58	27.63	1.48	3.06	1.39	2.26	2.61
	Aver.	618.84	624.13	627.80	632.64	638.86	663.33	642.59	631.65	630.30	627.48	626.93	625.03
1958	High	625.62	625.82	628.45	628.32	630.32	633.03	636.76	632.46	630.96	626.36	625.21	625.30
	Low	622.69	622.59	623.99	627.38	628.10	630.46	631.94	630.88	626.50	624.76	623.68	621.93
	Range	2.93	3.23	4.46	.94	2.22	2.57	4.82	1.58	4.46	1.60	1.53	3.37
	Aver.	624.30	624.66	626.51	627.93	629.07	631.38	632.99	631.92	629.06	625.68	624.44	623.90
1959	High	621.85	619.02	623.02	624.76	630.17	631.09	631.83	631.13	627.27	631.70	631.47	627.77
	Low	618.97	617.07	617.31	621.92	621.74	629.04	628.42	627.36	626.62	626.55	626.95	626.00
	Range	2.88	1.95	5.71	2.84	8.43	2.05	3.41	3.77	.65	5.15	4.52	1.77
	Aver.	620.50	617.53	621.38	623.73	625.66	630.34	629.43	628.78	626.90	629.45	628.08	626.65
1960	High	628.13	626.33	624.84	625.68	637.02	632.13	634.38	632.27	630.01	627.00	625.40	627.29
	Low	626.55	622.38	620.71	623.15	626.25	630.54	628.30	630.12	627.14	625.47	624.81	624.40
	Range	1.58	3.95	4.13	2.53	11.77	1.59	6.08	2.15	2.87	1.53	.59	2.89
	Aver.	627.40	624.53	622.92	624.45	632.64	631.58	630.31	631.17	628.72	626.13	625.01	626.07
1961	High	626.54	623.88	626.97	627.03	649.30	643.00	637.11	634.11	630.44	627.81	628.58	628.37
	Low	623.82	623.04	623.87	625.53	625.84	631.41	631.26	630.53	627.43	627.36	627.32	626.04
	Range	2.72	.84	3.10	1.50	23.46	11.59	5.85	3.58	3.01	.45	1.26	2.33
	Aver.	624.96	623.43	625.96	626.14	642.88	633.49	632.81	632.03	629.31	627.56	627.80	627.61

TABLE XXI (Continued)

		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1962	High	626.31	626.25	626.22	627.59	627.66	628.70	628.68	627.80	626.56	626.57	626.87	624.94
	Low	625.06	623.04	623.47	625.33	626.52	626.96	628.35	626.55	624.72	624.80	624.82	622.38
	Range	1.25	3.21	2.75	2.26	1.14	1.74	.33	3.25	1.84	1.77	2.05	2.56
	Aver.	625.65	624.57	624.23	626.33	627.15	628.13	628.52	628.44	625.74	625.81	626.61	623.35
1963	High	622.64	620.97	616.91	617.62	618.82	619.20	619.18	619.01	619.18	618.85	618.04	617.32
	Low	621.06	616.29	616.10	616.41	617.64	618.92	618.84	618.78	618.80	618.09	617.34	616.05
	Range	1.58	3.68	.81	1.21	1.18	.28	.34	.23	.38	.76	.70	1.27
	Aver.	622.04	618.62	616.61	616.74	617.98	619.09	619.05	618.92	619.04	618.54	617.65	616.62
1964	High	616.03	615.35	616.46	620.54	624.05	623.94	623.97	621.57	622.25	622.44	621.76	621.69
	Low	615.37	614.43	614.27	616.47	620.57	623.33	621.66	619.80	620.88	621.50	620.97	618.17
	Range	.66	.92	2.19	4.07	3.48	.61	2.31	1.77	1.37	.94	.79	3.52
	Aver.	615.73	614.98	615.30	619.04	622.73	623.65	622.98	620.52	621.43	622.12	621.32	619.86
1965	High	623.11	624.67	626.46	634.96	629.04	628.27	627.32	622.13	619.07	617.38	616.99	617.19
	Low	618.07	623.21	624.19	624.97	628.14	627.45	622.14	618.70	617.42	616.95	616.86	616.67
	Range	5.04	1.46	2.27	9.99	.90	.82	5.18	3.43	1.65	.43	.13	.52
	Aver.	620.88	624.05	625.82	631.20	628.57	627.81	624.78	620.16	618.30	617.12	616.94	616.93
1966	High	619.81	629.78	628.61	631.14	630.27	628.75	625.55	621.90	619.81	617.07	614.79	612.78
	Low	617.35	619.25	627.15	625.32	628.99	625.67	622.00	619.94	617.10	614.82	612.92	611.09
	Range	2.46	10.53	1.46	5.82	1.29	3.08	3.55	1.96	2.71	2.25	1.87	1.69
	Aver.	619.41	625.67	627.83	626.91	629.73	627.54	623.83	620.69	618.31	615.71	613.89	611.66
1967	High	611.12	610.01	610.85	617.69	623.67	624.31	625.60	625.21	623.04	622.48	625.75	629.76
	Low	609.72	609.71	610.01	610.87	617.80	623.71	624.43	623.09	622.11	621.68	623.00	624.18
	Range	1.40	.30	.84	6.82	5.87	.60	1.17	2.12	.93	.80	2.75	5.58
	Aver.	610.53	609.93	610.39	613.82	621.38	623.93	625.34	624.32	622.61	621.94	625.08	626.34
1968	High	629.44	634.74	637.82	631.16	633.09	633.07	632.98	631.28	629.34	627.10	631.41	637.30
	Low	624.43	626.33	626.03	629.21	628.09	632.24	631.31	629.34	627.13	626.19	625.96	631.08
	Range	5.01	8.41	11.79	1.95	5.00	.83	1.67	1.94	2.21	.91	5.45	6.22
	Aver.	626.45	630.75	630.22	630.20	630.50	632.49	632.38	630.74	628.02	626.55	627.03	632.53
1968	High	637.55	637.91	632.18	631.87	630.44	630.25	630.31	628.35	624.70	625.94	625.99	624.54
	Low	629.93	627.33	625.90	626.55	629.01	628.86	628.48	624.81	622.07	621.51	624.61	622.49
	Range	7.62	10.58	6.28	5.32	1.43	1.39	1.83	3.54	2.63	4.43	1.38	2.05
	Aver.	632.79	630.95	627.72	628.34	629.81	629.40	629.51	626.68	623.15	624.08	625.53	623.17

TABLE XXI (Continued)

		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1970	High	623.53	621.75	626.81	633.42	641.25	633.23	632.18	626.94	629.60	641.53	640.85	633.25
	Low	621.26	620.06	620.16	626.50	632.57	632.26	627.10	622.96	622.82	629.92	633.37	629.13
	Range	2.27	1.69	6.65	6.92	8.68	.97	5.08	3.98	6.78	11.61	7.48	4.12
	Aver.	622.17	620.63	623.30	628.13	636.60	632.74	630.13	624.90	624.54	634.34	635.61	630.91
1971	High	630.43	627.15	627.01	625.03	627.32	627.35	624.98	622.75	620.59	622.14	622.16	632.49
	Low	627.56	623.05	625.19	622.24	622.59	625.08	622.76	620.64	619.55	619.14	621.68	621.98
	Range	2.87	4.10	1.82	2.79	4.73	2.27	2.22	2.11	1.04	3.00	.48	10.51
	Aver.	629.58	624.76	626.44	623.32	624.69	626.61	623.71	622.05	620.13	621.49	621.93	628.25
1972	High	632.03	628.48	624.75	628.79	631.24	627.90	630.68	628.32	622.31	620.41	632.69	632.59
	Low	628.75	625.09	621.96	620.87	627.96	625.52	626.32	622.25	619.06	618.27	620.42	630.83
	Range	3.28	3.39	2.79	7.92	3.28	2.38	4.36	6.07	3.25	2.14	12.27	1.76
	Aver.	630.41	626.49	623.13	623.40	629.83	626.74	629.08	625.30	620.68	619.52	628.62	631.71

VITA

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