

STATISTICAL ESTIMATION OF DEMAND FOR
SELECTED RECREATIONAL ACTIVITIES

By

JOHN G. MCNEELY, JR.

Bachelor of Science
Texas Agricultural and Mechanical College
College Station, Texas
1962

Master of Science
New Mexico State University
University Park, New Mexico
1963

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
DOCTOR OF PHILOSOPHY
May, 1969

OKLAHOMA
STATE UNIVERSITY
LIBRARY
SEP 29 1969

STATISTICAL ESTIMATION OF DEMAND FOR
SELECTED RECREATIONAL ACTIVITIES

Thesis Approved:

Daniel D. Badger

Thesis Adviser

Rev. P. Stakley

Neil R. Cook

Richard H. Lettich

Odell L. Walker

D. D. Durham

Dean of the Graduate College

724966

ACKNOWLEDGMENTS

Sincere appreciation is extended to Dr. Daniel D. Badger, Graduate Committee Chairman, for his counsel, encouragement, understanding, patience, and time throughout the course of my graduate program. Special thanks are also due to Dr. Neil R. Cook, Dr. Leo V. Blakley, Dr. Odell L. Walker, and Dr. Richard H. Leftwich, members of my graduate committee, for their constructive criticism and comments during the preparation of the dissertation.

I am indebted to Dr. James S. Plaxico, Head of the Department of Agricultural Economics and to the Agricultural Economics Department for providing me the opportunity to continue graduate work and for making this study possible.

Appreciation is also extended to the city officials from Duncan, Oklahoma, members of the Lakes Staff, and the concession operators. Without the encouragement and assistance from Mayor Nolen Fuqua, Lakes Manager, Raymond Beck and his family, Theron Gapp, City Clerk, and Robert Brown of Soil Conservation Service, the data would not have been forthcoming.

I am indebted to Miss Pat Cundiff and other members of the departmental statistical lab for their help with the many computations necessary for the study. Thanks are also extended to Mrs. Carol Ann Mitchell for typing several drafts of the thesis and to Mrs. Carolyn Hackett, Mrs. Judy Eley, Mrs. Phyllis Carruth, and Mrs. Bonnie Garner for typing the final draft.

Finally, my wife, Judi, deserves much credit for her encouragement and patience as well as for her typing and clerical assistance.

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION	1
The General Problem	1
Objectives of the Study	7
Area of the Study	8
Organization of Remainder of Dissertation	11
II. REVIEW OF METHODOLOGICAL LITERATURE	12
Evaluation of Methods	13
Market Value Methods	13
User Expenditures Method	16
Cost of Facilities Method.	17
Aggregative Methods.	17
Demand Schedule Methods.	19
Miscellaneous Methods.	22
Use of Demand Curves to Derive Recreational Benefits.	24
Summary	28
III. PROCEDURE	30
Data Collection Procedure	30
Collection of Lake Attendance Data	30
Obtaining Data Through Use of Questionnaires	31
Collection of Additional Data.	34
Procedures for the Analysis of the Data	35
Lake Attendance Data	35
Questionnaire Data	36
Procedure for Determining Yearly Per Capita Recreation Attendance Data.	39
Procedure for Estimation of Demand Curves	41
Analysis of Management Considerations	43

TABLE OF CONTENTS (Continued)

Chapter	Page
IV. ANALYSIS OF DATA RELATING TO OUTDOOR RECREATION	45
Lake Attendance Data	45
Recreation Activities and Distance Traveled	52
Annual Use of Season Permits	53
Population in the Travel Zones	58
User Days of Recreation Activities Per Capita.	59
Socio-Economic Characteristics of the Recreationists	62
Income	62
Age of Recreationists	65
Education	66
Summary	68
V. ESTIMATION OF THE DEMAND FOR SELECTED RECREATIONAL ACTIVITIES.	70
The Demand for Recreation.	70
Individual and Market Demand Curves.	72
Individual Demand Curves For Fishing and Water Skiing	73
Market Demand Curves For Fishing and Water Skiing	75
Estimation of Recreational Benefits from Demand Curves	80
Monopoly Revenue Method	80
Consumer's Surplus Method	83
Consumer's Surplus Estimates from Market Demand Curves	84
Consumer's Surplus Estimates from Individual Demand Curves	87
Effects of Changes in User Fees on Recreation	
Attendance and Revenue.	88
Summary	92
VI. OUTDOOR RECREATION MANAGEMENT	95
Current Management Practices	96
Recreation Income	97
Recreation Expenditures	100
Recreation Policy	102
Recreational Problems of Policy and Management	103
Recreational Goals.	104
Additional Facilities	105
Maintenance of Facilities	106
Publicity	107
Seasonal Attendance	110
Fluctuating Water Levels	111
Zoning	111
Swimming Policy	113
Summary	114

TABLE OF CONTENTS (Continued)

Chapter	Page
VII. SUMMARY AND CONCLUSIONS	115
Summary	115
The Data Analysis	116
The Demand Analysis	117
Recreational Management Analysis	120
Conclusions	120
Need for Future Research	121
LITERATURE CITED	123
APPENDICES	125

LIST OF TABLES

Table	Page
I. Activities Available and Fees Charged at the Duncan Lakes Recreation Complex, 1955-1965	46
II. Number of Permits Sold for Activities Available at the Duncan Lakes Recreation Complex, 1955-1965	48
III. Total Recreational Fee Income Received at the Duncan Lakes Recreation Complex, 1955-1965	49
IV. Number and Percentage of Recreationists from Each Distance Zone Purchasing Each Type of Recreational Permit, Duncan Lakes Recreation Complex, 1965	51
V. Average Number User Days Each Type of Season Permit is Used by Cabin Owners and Other Recreationists, and Pooled Mean	54
VI. User Days of Fishing for Each of the Seven Distance Zones and the Total for the Duncan Lakes Recreation Complex, 1965	55
VII. User Days of Water Skiing for Each of the Seven Distance Zones and the Total for the Duncan Lakes Recreation Complex, 1965	56
VIII. User Days Barge and Boat Use for Each of the Seven Distance Zones and the Total for the Duncan Lakes Recreation Complex, 1965.	57
IX. Population Estimates for Six Concentric Distance Zones Described About the Duncan Lakes Recreation Complex, 1960 and 1965	60
X. Per Capita User Days of Recreation by Activity for Each Distance Zone and the Oklahoma Portion of the Zone at the Duncan Lakes Recreation Complex, 1965	61
XI. Percentage Distributions of Family Incomes of Those Surveyed for this Study Compared with Data for State of Oklahoma and for Stephens County	64

LIST OF TABLES (Continued)

Table	Page
XII. Percentage Distributions of Family Incomes of Recreationists Surveyed by Type of Permit Purchased, Duncan Lakes Recreation Complex, 1965	64
XIII. Percentage Distributions of the Ages of Recreationists Surveyed by Type of Permit Purchased, Duncan Lakes Recreation Complex, 1965	66
XIV. Percentage Distributions of the Education of Recreationists Surveyed for This Study Compared with Data for the State of Oklahoma and for Stephens County	67
XV. Percentage Distributions of the Education of Recreationists Surveyed by Type of Permit Purchased, Duncan Lakes Recreation Complex, 1965	68
XVI. Total Number of Different Recreationists Fishing at the Duncan Lakes Recreation Complex, 1965	77
XVII. Total Number Recreationists Water Skiing at the Duncan Lakes Recreation Complex, 1965.	77
XVIII. Average Cost per User Day and Total User Days by Zones, Duncan Lakes Recreation Complex, 1965	78
XIX. Estimation of Recreational Benefits for Fishing and Water Skiing Using the Monopoly Revenue Method and the Single Unit Value Method	82
XX. User Day and Associated Prices on the Demand Schedules for Fishing and Water Skiing at the Duncan Lakes Recreation Complex.	85
XXI. Consumer's Surplus Estimation of Recreational Benefits from Market Demand Curves for Fishing and Water Skiing at the Duncan Lakes Recreation Complex, 1965	86
XXII. Consumer's Surplus Estimates of Recreational Benefits from Average Individual Demand Curves for Fishing and Water Skiing at the Duncan Lakes Recreation Complex, 1965	88
XXIII. Estimated Attendance for Fishing, Utilizing Three Different Levels of Daily Fishing User Fees, Duncan Lakes Recreation Complex, 1965	90

LIST OF TABLES (Continued)

Table	Page
XXIV. Estimated Attendance for Water Skiing, Utilizing Three Different Levels of Daily Water Skiing User Fees, Duncan Lakes Recreation Complex, 1965	91
XXV. Annual Income From Recreational Activities at the Duncan Lakes Recreation Complex, By Fiscal Years, 1958-1966. . .	100
XXVI. Annual Expenses for the Duncan Lakes Recreation Complex, By Fiscal Years, 1958-1966	101

LIST OF FIGURES

Figure	Page
1. Location of Four City Owned Lakes in the Wildhorse Creek Watershed, City of Duncan, Stephens County, Oklahoma . . .	10
2. Graphical Illustration of Consumer's Surplus.	26
3. Concentric Travel Zones About the Duncan Lakes Recreational Complex	37
4. Average Individual Demand Curve for Fishing	74
5. Average Individual Demand Curve for Water Skiing	74
6. Market Demand Curve for Fishing	79
7. Market Demand Curve for Water Skiing	79

CHAPTER I

INTRODUCTION

The General Problem

The opportunities for outdoor recreation are becoming increasingly scarce. Not long ago, people could travel short distances and find areas suitable for engaging in outdoor recreational activities at very little cost. On most private lands, no admission or user fees were charged for fishing, hunting, hiking, camping, swimming, and other leisure-time activities. There was no admission charge to most State and Federal recreational areas. Today, this free-use concept is rare.

People who once worked long hours outdoors in a predominately rural America did not require many specialized outdoor recreational facilities. In today's increasingly urbanized society, people are spending more hours participating in outdoor recreational activities as the time spent in outdoor occupations decreases. Outdoor recreation has rapidly changed from a free good (a gift of nature) to an economic good that commands a price in the market. Other factors having a major influence on the increasing demand for outdoor recreation are rising per capita incomes, increased leisure time (shorter work-week and/or longer vacations), and increasingly better transportation facilities. The increasing population and increasing numbers of retired persons participating in outdoor recreational activities also create pressures on existing outdoor recreational facilities.

Because of these and other factors, the demand for outdoor recreational facilities has rapidly increased to the point where many of the existing facilities are currently overused, especially during vacation periods and on holidays. Even with the addition of many new outdoor recreational facilities in recent years, neither the public nor private sector have been able to keep up with the ever increasing demand for such facilities.

Many of the outdoor recreational activities in the United States occur on publicly owned facilities: federal and state parks, forests, lakes and other recreational areas, and also municipal and county owned facilities. The main reasons for government ownership of these facilities is that very few individuals or groups could raise the capital necessary to operate and maintain large recreation areas and reservoirs.

In recent years, federal purchases of land for recreational use have been negligible. However, federal agencies which are involved in water resource development such as the Soil Conservation Service, the Bureau of Reclamation and the Corps of Engineers, have been building reservoirs at a very rapid rate in recent years. Until recently, these reservoirs were primarily justified on the basis of benefits from purposes such as flood control, hydroelectric power, irrigation and municipal water supply. Recreation was not included as a purpose in determining benefits but was a by-product of water resource projects constructed for other purposes.

The first legislation to recognize recreation as a purpose of federally sponsored projects was the Flood Control Act of 1944 [1, pp. 887-907]. This act specified that the Corps of Engineers was authorized to construct and maintain recreational facilities at reservoirs built by this agency.

Several attempts were made during the early and middle 1950's to pass legislation making the evaluation of recreational benefits an integral part of project planning [2]. Opponents of such measures to include recreational benefits in project planning argued that some projects would be approved which otherwise would not be justified. Thus, competition would increase for construction funds and lead to delays for those seeking relief from flood problems. Another argument, and perhaps the most relevant, was that "no generally accepted technique for determining the economic value of recreation use has yet been devised" [4, p. 2].

The difference between the demand for outdoor recreational opportunities and supply of these opportunities has continued to widen in the 1950's and the 1960's. Increasing public pressure for more outdoor recreation facilities resulted in the creation of "Mission 66" by the National Park Service in 1956 and the Forest Service's "Operation Outdoors" in 1957. These two agencies recognized the possibility of greater recreational use of the land they administered. Thus, "Mission 66" and "Operation Outdoors" were designed to completely reappraise the respective agency's goals to attain that end.

The pressure on the members of Congress became sufficient in 1958 for the passage of an Act (Public Law 85-470) establishing the Outdoor Recreation Resources Review Commission (ORRRC). The mission of this group was essentially threefold:

To determine the outdoor recreation wants and needs of the American people now and what they will want in the years 1976 and 2000.

To determine the recreation resources of the Nation available to satisfy those needs now and in the years 1976 and 2000.

To determine what policies and programs should be recommended to insure that the needs of the present and future are adequately and efficiently met [5, p. 2].

Senate Document 97 (Second Session, 87th Congress) established standards and procedures for the four agencies involved in water and related land resources: the Departments of the Army; Agriculture; Health, Education and Welfare; and Interior [6]. Two key statements in this document are:

- (1) The basic objective in the formulation of plans is to provide the best use, or combination of uses, of water and related land resources to meet all foreseeable short and long-term needs [6, p. 1].
- (2) Full consideration shall be given to the opportunity and need for outdoor recreational and fish and wildlife enhancement in comprehensive planning for water and related land use and development, and project formulation and evaluation [6, pp. 5-6].

Key personnel in both the executive and legislative branches of the federal government have recognized that provision of outdoor recreation facilities adds to the welfare of the citizens of this nation. The Outdoor Recreation Act of 1963 [7] promoted coordination of federal and state programs involving outdoor recreation. The Land and Water Conservation Fund Act of 1965 [8] created a treasury fund that is available to the states on a matching basis. This act is important because it recognizes that the states must take the lead in national outdoor recreation development. The Federal Water Projects Recreation Act [9] establishes that full consideration will be given to recreation and to fish and wildlife enhancement as project purposes in federal water resources projects. This act encourages non-federal administration of the recreation and wildlife features of these projects with up to 50 percent of the costs of the facilities borne by the federal government. Planning with respect to the recreational potential of any project is to be coordinated

with existing and planned federal, state, and local public recreational developments.

The elevation of outdoor recreation from a by-product of federal resource development projects to a position where it is considered on an equal basis with other project purposes is a major step forward in solving the problem of shortages of outdoor recreation facilities. But, in its attempts to overcome one problem, the federal government is faced with another problem. This problem concerns the economics of outdoor recreation. Any federal water or land resource project must be economically justified before it will be approved. The economic benefits of each project purpose must be at least equal to or greater than the costs. However, recreation has certain characteristics that make measurement of its economic benefits very difficult.

There has been a general absence of market prices for most recreational activities. Thus, research must be undertaken so that values may be derived or estimated from simulated market conditions. In addition, there have been very few accurate estimates of recreational use of facilities (with the exception of several improved methods of counting developed by the Forest Service and National Park Service). In other words, recreational market prices as well as the quantity of recreation consumed by the public is almost totally unknown. Also, the effects of socio-economic variables such as income, age, population, and leisure on recreation use are not totally known.

These problems point to the need for increased knowledge about outdoor recreation. The ORRRC made the following recommendation concerning needed recreation research in its report to the President and Congress:

Recommendation 14-1: A systematic and continuing program of research is needed to provide the basis for wise decisions and sound management [5, p. 183].

This commission listed three categories of research that should be carried out in a continuing manner: (1) data collection, inventory, and factfinding; (2) applied management research; and (3) fundamental research [5, p. 184].

One of the most urgent research needs is for more knowledge about the direct benefit that individuals derive from outdoor recreation Information of this nature is important, for it should plan an important part in decisions allocating resources to outdoor recreation Public outdoor recreation is not generally sold for a price. Therefore, since there is no adequate dollar measure of the worth of recreation experiences at public sites, there is great difficulty in judging the primary direct benefits that accrue to people engaging in outdoor recreation, and hence in knowing how to allocate resources among the competing uses In view of these questions, Federal agencies have sought for a number of years to devise methods of measuring the value to the individual of publicly provided outdoor recreation [15, pp. 184-185].

The preceding discussion has alluded to several problems characteristic of outdoor recreation. Aside from the physical problem of inadequate facilities to meet the recreational needs of the American public, a general problem confronting public and private groups providing these facilities has been a lack of knowledge concerning costs and returns from recreational facilities. Resources cannot be allocated efficiently without knowledge of the economic benefits forthcoming from the various purposes for which they can be used.

This study was directly concerned with research that should provide answers to questions concerning outdoor recreation benefits. Information was obtained on prices paid by recreationists, the number of user days they participated in the selected activities, effects of socioeconomic variables on recreation use, and some management problems of

a municipally operated recreational facility. Primary consideration was given to research concerning the economics of outdoor recreation with emphasis on the demand aspects.

Objectives of the Study

The general objective of the study was to estimate the demand for selected water-based recreational activities. The specific objectives of the study were:

1. To apply appropriate economic models and methodological procedures applicable to recreation demand analysis.
2. To assemble primary and secondary data on population, miles traveled, money spent, incomes, hours worked, and other variables needed to estimate the demand for outdoor recreation.
3. To estimate demand for selected recreational activities from which projections will be made as to the number of visitors using the facilities in the Wildhorse Creek Watershed.
4. To analyze management problems of the municipally owned recreational complex and to present some recommendations to overcome these problems.

Several economic models have been proposed by researchers for use in analyzing the demand for outdoor recreation. Most of these have not been tested and the others have been tested partially only. This study was devoted to testing these models to determine their feasibility as research tools for outdoor recreation. In addition, methodological procedures were developed that were unique to this study. These techniques should prove useful, with slight modification, for other outdoor recreation demand research.

The assembly of relevant primary and secondary data is important for any research study. It is especially important in an outdoor recreation study due to the primary data that must be obtained. Thus, the

collecting and reporting of these data represented a significant portion of this study.

The estimation of demand relationships for fishing and water skiing activities were also an important part of the study. These demand estimates should be useful to public and private agencies. By knowing more about the nature of the demand for the various recreational activities, these groups should be better prepared to make decisions concerning development of outdoor recreational facilities. Also, by using the techniques of demand estimation used in this study, these agencies should be able, with slight modifications, to estimate the demand for various activities at other recreation sites.

The analysis of the management problems of the recreational complex owned by the City of Duncan and the resulting recommendations should provide public agencies with useful information. Long range planning in developing and operating any recreational enterprise is important; however, when public funds are being expended, every effort should be made to ascertain that the recreational facilities are being managed efficiently and for the enjoyment of all recreationists. This means that conflicts between different classes of recreationists (e.g., water skiers and fishermen) should be avoided whenever possible. Proper planning of the various facilities and activities around and on the lakes could eliminate many of these conflicts.

Area of the Study

The area selected for this study includes the four lakes owned by the City of Duncan, Oklahoma, which are in the Wildhorse Creek Watershed. Two of these lakes (Humphrey and Fuqua) were constructed as part

of the Washita River Watershed project which was authorized under the Flood Control Act of 1944. Lake Duncan was built during the 1930's as a federal government work project. Clear Creek Lake was built by the City of Duncan in 1953.

Three of the lakes, Clear Creek with 560 surface acres, Humphrey with 882 surface acres, and Duncan with 400 surface acres were completed and in use for recreational purposes before this study began. The dam for Lake Fuqua (1,500 surface acres) had just been completed at the outset of this study. The lake was opened for recreational use in January, 1967, after this study was essentially completed. Lake Humphrey and Lake Fuqua were constructed primarily for flood prevention with the city paying the cost of raising the height of the dam for municipal water storage and recreational uses. Lake Duncan was originally used for municipal and industrial water supply. Clear Creek Lake was developed primarily for municipal and industrial water supply also.

The City of Duncan and the four lakes in this study are located in Stephens County, in south central Oklahoma (Figure 1). This area was selected for this study for several reasons. First, the three lakes have well-developed outdoor recreational facilities. Second, user fees have been charged on these lakes since 1955. The City of Duncan still had the receipt books used in the issuance of user permits from which valuable empirical data could be obtained. Third, the officials of the City of Duncan encouraged the study from the outset and have cooperated very closely with the researcher in providing needed data.

Recreationists travel from all parts of Oklahoma and from other states to participate in the recreational activities allowed at these lakes. Activities include fishing, boating, water skiing, hunting,

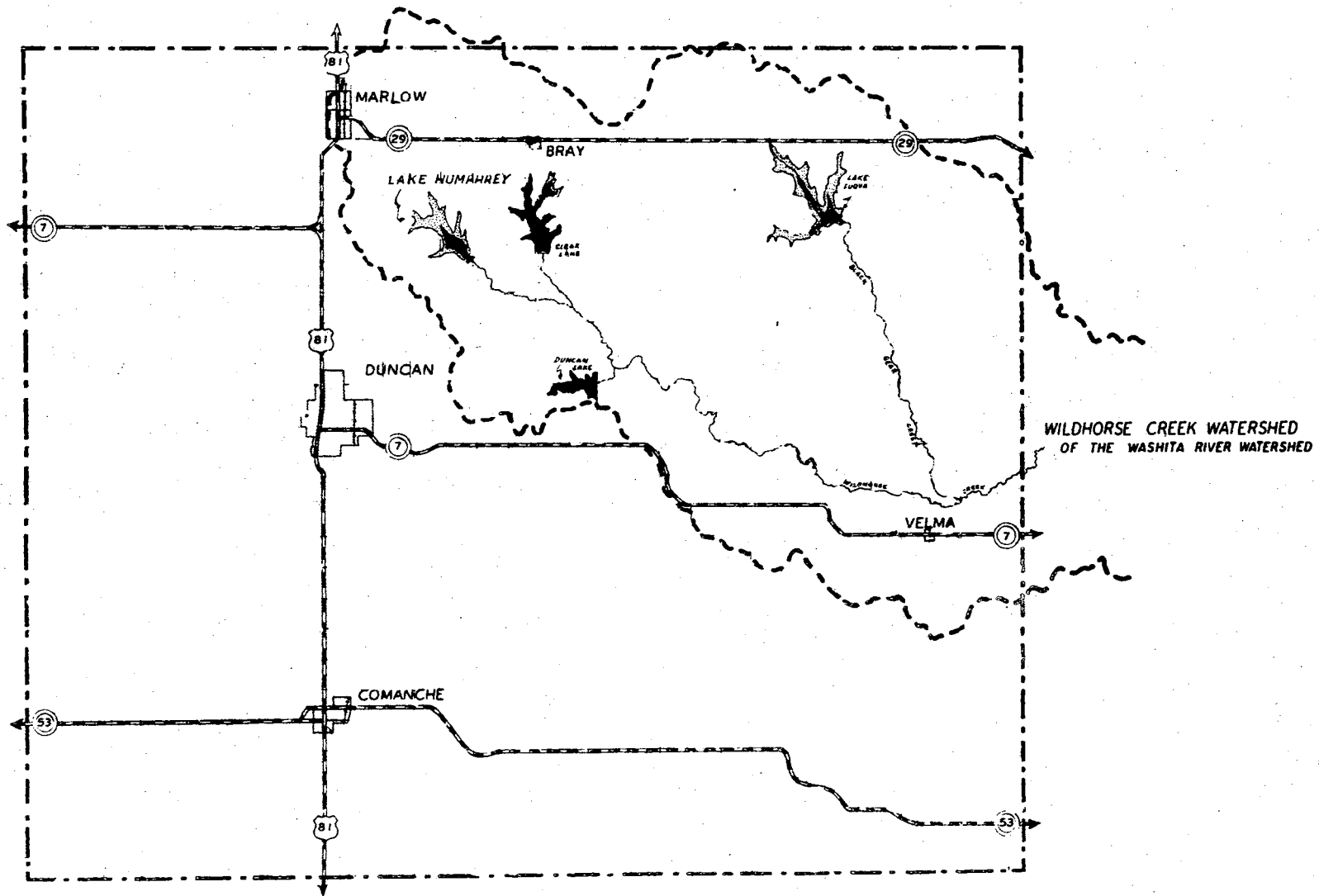


Figure 1. Location of Four City Owned Lakes in the Wildhorse Creek Watershed, City of Duncan, Stephens County, Oklahoma

camping, and picnicking. Fees are charged only for fishing, boating, water skiing, and hunting. Lake lots are also available for lease with the stipulation that the lessee shall construct a cabin of certain standards.

Organization of Remainder of Dissertation

The remainder of the dissertation is devoted to fulfilling the stated objectives presented above. A review of methodological literature is presented and evaluated in Chapter II. The procedures used for data collection and analysis and for the demand curve estimation are discussed in Chapter III. The analysis of the data relating to outdoor recreation at the Duncan lakes complex is presented in Chapter IV. The estimation of demand curves for selected recreational activities and the estimation of recreational benefits from these demand curves are the major emphasis of Chapter V. A discussion of outdoor recreational management problems and some possible solutions is presented in Chapter VI. The summary and conclusions are presented in Chapter VII.

CHAPTER II

REVIEW OF METHODOLOGICAL LITERATURE

The increased emphasis for inclusion of outdoor recreation as a primary purpose of federally sponsored land and water resources projects has created a need for a method to estimate its economic value. An acceptable method to determine the demand for and value of outdoor recreation is required if comparisons are to be made between different uses of a resource. These estimates are also needed to determine the feasibility of a project. It is possible that some projects declared infeasible in the past would have been feasible with accurate estimates of recreational benefits included. Demand estimates would also be useful in helping individuals determine the potential for income from a private recreational enterprise. These estimates would be helpful in selecting the level of user-fees to charge and in determining the facilities that would provide the greatest returns to the operator.

Municipalities and states would also benefit from methodology that would permit accurate estimates of the demand for outdoor recreation. They would be able to allocate their limited recreational budgets more efficiently by knowing which types of recreational facilities were needed most and where these should be located for greatest use.

Several methods for the estimation of the demand for and value of outdoor recreation have been proposed in recent years. These methods were proposed by competent researchers, each of whom had the common

objective of discovering an acceptable way of determining the value of outdoor recreation. Because of data restrictions, very few of the proposed methods have been adequately tested. Also, some of the methods have been discredited because of faulty premises.

Evaluation of Methods

The following is an evaluation and description of the more important methods that have been proposed for outdoor recreation evaluation. In general they may be categorized under six main types:

1. Market value method
2. User expenditures method
3. Cost of facilities method
4. Aggregative methods
5. Demand schedule methods
6. Miscellaneous methods

Market Value Method

The market value method presently is the most widely used method for evaluation of recreation by federal agencies. The following general procedure was specified by the Ad Hoc Water Resources Council [10, pp. 3-9 .] First it was necessary to determine the total annual recreation days of use that the project area would have during its economic life. A recreation day¹ was defined as a "standard unit of use consisting of a visit by one individual to a recreation development or area for

¹This concept is identical to the user day concept used throughout the study.

recreation purposes during any reasonable portion or all of a 24-hour period" [10, p. 3].

Some of the more important factors listed as affecting the use of a particular recreational area were: (1) population within the zone of project influence; (2) proximity of the project to centers of population; (3) socio-economic characteristics of the population such as disposable income, age and mobility; (4) leisure time and recreational habits that reflect changing consumer preferences as indicated by trends in hunting and fishing licenses and sales of recreational equipment; (5) the recreational use potential of the project area as reflected by its ability to provide for uniqueness, diversity, and access; and (6) the availability and attractiveness of existing and potential alternative recreational opportunities.

The total number of days of annual recreation used for the project is multiplied by a single unit value to determine the recreational benefits resulting from the project. The unit value may reflect both the quality of the activity and the degree to which opportunities to engage in a number of activities are provided.

There are two types of outdoor recreational days listed, with a different range of unit-day values for each. The first type of recreation day is called the "general" type. This type, in which the majority of outdoor recreationists will participate, includes activities such as warm water fishing, swimming, picnicking, hiking, sightseeing, most small game hunting, camping, waterskiing and boating. The range in "general" unit-day values is from \$.50 to \$1.50.

The second type of outdoor recreation day is the "specialized" type. This type involves activities in which people have limited

opportunity to participate and which often may involve large personal expense by the user. Examples of these activities are cold water fishing, upland bird and waterfowl hunting, big game hunting, wilderness pack trips and similar types of activities. The range of unit-day values for the "specialized" activities is from \$2.00 to \$6.00.

Federal agency personnel using these single unit value ranges must determine the exact value within the range to evaluate the total recreational benefits for the project. The Soil Conservation Service uses the following guidelines to determine the appropriate value of a user-day.

Underdeveloped Recreational Facilities - Where little, if any basic facilities, other than access, are provided, a value of \$0.50 per visitor per day may be used.

Partially Developed Recreational Facilities - Where limited basic facilities are provided, a value of \$1.00 per visitor day may be used. Examples of such facilities include parking areas, picnicking areas with no cooking facilities or tables, and simple fishing and swimming areas.

Fully Developed Recreational Facilities - Where more extensive facilities are provided, such as parking areas, boating docks, fishing piers, camping, waterskiing, overnight cabins, eating places, picnicking areas with tables and cooking facilities, play areas, and other provisions for a wide variety of recreational opportunities, a value of \$1.50 per visitor day may be used [11, Chapter 9, p. 4] .

Some major criticisms have arisen over results obtained using the market value method. A criticism stated in the ORRRC Report to the President is that valuations of this sort vary directly with visitation [5, p. 185]. Thus, the estimates of benefits do not measure differences in quality of activities at the site. Overcrowding obviously could cause a decline in the quality and thus, the value of the experience for many recreationists. ORRRC concludes that these more or less arbitrary estimates of value in any event rest almost entirely on a "judgment value."

Lerner adds the comment that "this method takes no account of the satisfaction gained by some recreationists over and above the market value..." [12, p. 67]. But he later adds that using the fees charged at private facilities to determine benefits for public areas where little or no fees were charged would bias decisions concerning resource use in favor of public development projects which include recreation as a purpose.

User Expenditures Method

The user expenditures method utilizes the amount that recreationists spend in pursuit of various forms of recreation as an indication of the value of recreation to the user. The main underlying assumption of this method is that recreation is worth at least as much as the recreationist is willing to spend in pursuit of it. Some proponents of this method assume that the total value of the satisfaction from recreation is equal to twice the expenditures of the participants.

The method used for determining the expenditures requires a sample survey of recreationists participating in activities at a specific site to obtain data on travel, cost of recreational equipment (amortized over its useful life) and on-site costs. An average cost per visitor day determined for each activity would represent the value or benefit per visitor day.

One criticism of this method is that recreational benefits would tend to be exaggerated. This is because part of the expenditures incurred by recreationists are not attributable to the recreational site. Thus, recreationists' expenditures do not justify additional

federal spending of a like amount to develop recreational facilities at a particular site.

Expenditures by recreationists are useful in deriving demand curves for recreation. This method will be discussed later.

Cost of Facilities Method

The cost of facilities method uses the costs of developing, operating and maintaining the recreational facilities in a proposed resource development project to represent recreational value. This approach does recognize the need for outdoor recreational facilities, but would not alter the benefit-costs concept used by federal agencies. This is because the benefits and the costs associated with outdoor recreation are one and the same and are therefore equal to each other. Thus, the feasibility of the project likely would not be affected by the inclusion of benefits and costs for outdoor recreation. Consequently, this method tells nothing about the need for recreation in a particular area. Another criticism of the cost of facilities method is that it does not allow for economic comparison of various uses of the resource.

Aggregate Methods

Aggregative methods measure the effect of recreational enterprises on the whole economy. Three methods in this category are: (1) gross volume of business generated; (2) value added by local business; and (3) addition to gross national product.

The gross volume of business generated and the "standard" GNP method described by Lerner [12, p. 60] are essentially the same. They both attempt to measure the direct contribution of the recreation

industry on gross national product. This is accomplished by either an expenditure approach or an income approach, such as the national GNP account. Many problems of double counting arise, since some income or expenditures resulting from recreational activity would have been made even in the absence of recreation. This approach is often used by those who are seeking to show the great impact of the tourist industry on a state or region.

This method has not been used to any extent in benefit-cost analysis. The local effects of a recreational project cannot be separated out to determine the benefits from recreation. Thus, with this approach, it is infeasible to compare the estimates of gross output from recreational activities with benefits from other purposes which may compete for the same resources.

The value added by local business approach is a refinement of the GNP approach. It deducts the cost of production from gross output and thus removes most of the double counting. This approach would provide a better indication of the volume of business within a state or region than would the GNP approach, and would be more useful for comparing similar data for other economic activities. However, some of the same objections of the GNP method are apparent. The main objection is that many of the costs incurred are not for the recreation opportunity as such, but for the provision of other services connected with the use of the recreation opportunity.

A second GNP method reported by Lerner [12, p. 59] is the Ripley method. This method simply divides total GNP for the nation by population to obtain the per capita GNP. Putting this on a daily basis and assuming that leisure time is as constructive as working time, the

portion of GNP resulting from leisure is determined. This method has little if any economic use and thus will not be discussed further.

Demand Schedule Methods

Several methods have been proposed for the purpose of evaluating recreation benefits using estimated demand curves or schedules. This technique appears to have promise for benefit determination. Before these methods are used for fulfilling this aim they must be refined and tested by researchers who have adequate data for a comparative appraisal.

The demand for a good or service is often defined as the various quantities of the good or service which consumers will take from the market at all possible alternative prices in a given time period, other things equal. The quantity of a good or service demanded usually varies inversely with price. The demand schedule, the locus of all combinations of price and quantities of the good or service taken by the consumer, is thus downward sloping to the right. This schedule or curve is a maximum concept representing the maximum quantities of a good or service that consumers will purchase at the various alternative prices in a given time period, given free choice.

Due to the general absence of market prices for outdoor recreational activities, most of the various methods proposed advocate determining the demand curves for outdoor recreation using "proxy" prices such as expenditures. Different methods propose alternative ways of determining the demand curve. Once the demand curve is obtained, various schemes have been used for determining recreation benefits from the curves.

One of the earlier attempts to estimate a demand curve for recreation was made by Trice and Wood [13]. They used costs of travel to

and from a recreational area as a proxy for price. They used a fixed cost per mile to determine the value of recreational benefits and ignored differences in wealth and in tastes and preferences. Thus, the differences in costs per visitor day of enjoying a recreational area resulted from differences in distance traveled. With the demand curve described, Trice and Wood estimated benefits with a consumer's surplus technique. This technique will be discussed in detail in the next section of this chapter.

Clawson used another method to obtain demand curves for outdoor recreation [14, pp. 15-16]. He constructed distance zones around the recreation area in question and then determined the number of visits per 100,000 population from each zone. Costs for each zone were based on travel costs and he made some rather heroic assumptions for other costs.

Clawson considered or developed two types of demand curves: the "total recreation experience" and "the recreation opportunity per se" [14, p. 15]. The total recreation experience is a package deal which includes the whole trip: planning, traveling, visiting an area or areas, and the recollection afterwards. The demand schedule for the recreation opportunity per se applies to the demand for a particular recreation area and can be derived from the demand curve for the total recreation experience.

Clawson made two assumptions that allows estimation of the recreation opportunity per se demand curve: (1) users of an area would view increases in entrance fees rationally - i.e., they would treat such increases similar to any other increase 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. Based on these two assumptions, he determined what different fees would do to visitation rates for each zone.

The results of several outdoor recreation demand research projects have been published since Clawson's and Trice and Wood's earlier efforts. One of these used questionnaires to obtain 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 for each expense item [15, pp. 6-7]. From these data, population bands were delineated in even-width concentric rings about the area and distances were converted to costs at the rate of 9 cents per mile for the round trip. Other costs per day were computed, including depreciated value of recreation equipment.

The plotting of the demand curve from these data was somewhat unique. The party with the highest average cost per visitor day (where costs per day were on the ordinate axis) was plotted with respect to the number of visitor days the party recreated in the area (where visitor days were on the abscissa). Next, the party with the second highest cost per day was plotted against the sum of visitor days spent by the first two parties. Points were plotted for all the parties, resulting in a curve that was downward sloping and to the right.

This procedure was used for both actual and maximum expenses the recreationists indicated they would pay. Estimates of total recreational attendance at the area were applied to the demand curves which resulted from regression techniques. The value of recreation in the area was then estimated by multiplying the costs per visitor day by the total

number of visitor days. The demand curve in this study was used to determine the value of each acre of land in the area for the current visitation rate. The curves were also used to show the effects of an increase in costs on attendance.

Another study attempting to value recreation resources via derived demand schedules was undertaken by Wennergren [16]. His economic model proposed that the travel costs to and from the recreation site plus expenditures incurred at the site constitute the relevant expenditures for valuation. He did not include those expenditures that represent depreciation of recreational equipment used in the recreational experience because he considered them fixed costs.

By aggregating the data obtained by personal interviews for all individuals from each of several specified distance zones, averages were obtained. These averages represented the average expenditures per boating-day per capita and the average number of per capita boating days per time period. By plotting these averages for each distance zone and by use of regression techniques, Wennergren determined a demand schedule called the "average individual demand for the specific site" [16, p. 6]. This schedule was used to estimate the average number of boating trips the average boater would take when faced with various prices. Wennergren then derived an aggregate demand schedule for all boaters by multiplying the average demand curve by the sum of the boat population within the area covered by all the distance zones.

Miscellaneous Methods

Several unique approaches to recreation resource evaluation have been advanced which are somewhat different from the five general types

discussed previously. For example, a method proposed by the Subcommittee on Evaluation Standards to the Inter-Agency Committee on Water Resources involves determining the rise in land or capital values in the area of the recreational development [10, pp. 3-9]. This value is used as a measure of the recreational benefits of the resource.

This approach is straightforward and might be workable if recreation were the only use of the resource. However, this is seldom the case. Also, if one is attempting an ex ante evaluation of a proposed project, an alternate site that is already operational and as closely identical to the proposed site as possible must be found and evaluated. Finding such an alternate site would also present problems. Therefore, this approach has very limited usage.

Another method for evaluation of recreational benefits for a resource uses merit-weighted user days as a choice indicator for government expenditures in recreation resource development. This approach is advanced by Ruth Mack and Sumner Myers who believe that the concept of a user day of recreation by itself is a crude unit of benefit [18, pp. 71-116]. Instead of a user day valued only in monetary terms, a user day weighted in terms of social merit to the user should be used. They assume as an example of a merit-weight that a child's day of picnicking has two to three times as much long-term value as an adult's day.

Mack and Myers point out that governmental agencies do not provide all the outdoor recreational facilities, but do provide a major portion of the recreational resources in forest and wilderness areas and on seashores [18, pp. 71-116]. Assuming that these publicly-provided areas are needed in the cases above, five groups of criteria are listed that should be considered in public decision-making concerning recreation.

The first group concerns policy questions. Such items as the effect of public recreation on private recreation areas should be considered in respect to setting standards. Policies concerning encouragement of recreation development and fee policy are items in this group. The second group concerns quality standards for recreational areas, both public and private. The third group involves the nature of the recreation needed and provided. Some recreational experiences are considered more worthwhile than others, and provision for these would carry more weight. The fourth group concerns distributive justice. If recreation is deemed "good" for people, then all people should have access to it. Thus provision of recreational areas should be made in response to need. Therefore, more weight would be given to areas having inadequate facilities than to projects in areas that already have adequate facilities. The fifth group concerns requirements for future generations. Weights would be devised to take account for these criteria. The merit-weight user day concept would take into consideration all the various criteria by weighting them so that account may be taken of the implications of each criteria.

Use of Demand Curves to Estimate Recreational Benefits

Each of the above mentioned studies have estimated demand curves for outdoor recreation. Each study differed somewhat in the expenditures used as a proxy for price in deriving the demand schedules. The main differences to be observed from these studies were how the demand curves were used for resource evaluation.

After a demand schedule has been estimated for a recreational resource, the next step is to determine how the demand curve will be used to derive the value of (or benefits from) this resource. Several alternative approaches have been proposed and used. One of the simplest approaches is to determine the total area under the derived demand curve and let this represent the total value of the resource for recreational purposes. The reason this approach would not be used for determining benefits for federal spending is because of double counting. The portion under the demand curve representing price times quantity of recreational activities would be spent by the recreationists and in turn would be included as benefits by the federal government.

Another general method of determining recreation resource evaluation from demand schedules is the consumer's surplus method. This concept was first used by Alfred Marshall [17, pp. 103-110]. Consumer's surplus is defined as the "excess of the price which he would be willing to pay rather than go without the thing (a good or service), over that which he actually does pay." The graphical example depicts the user days of recreation per unit of time demanded at various alternative prices. (Fig. 2).

If one accepts the theory of consumer's surplus, then the total value to a recreationist consuming UD_1 days of recreation is OAD_1AP_m . The total cost to this recreationist is OAD_1AP_1 . The consumer's surplus for the recreationist is the difference between total value and total costs, or the triangular area P_1AP_m . A recreationist engaging in UD_2 days of recreation at price OP_2 would obtain a consumer's surplus equal to the area P_2BP_m .

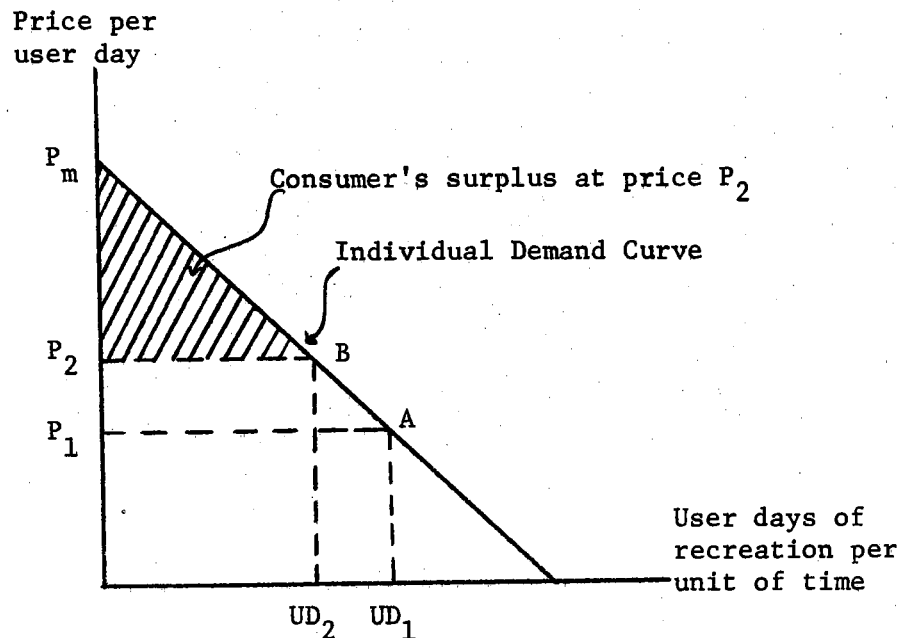


Figure 2. Graphical Illustration of Consumer's Surplus

Trice and Wood used the concept of consumer's surplus in their study [13, pp. 204-206]. They did not have the total visits to each area studied and therefore had to use the median cost of travel per user day as the proxy price for the parties surveyed. They considered consumer's surplus to be the difference between the median cost and the cost for the 90th percentile. Thus, they arrived at a single value of consumer surplus per user day.

Wennergren also used the consumer's surplus concept [16, p. 11]. He derived resource value from the demand curve by obtaining the total surplus value (T_s) for boating in the following way:

$$T_s = \sum_{i=1}^N [A_i - C_i] B_i$$

where: T_s = total surplus for a given boating site

A = the integral of the demand curve at the quantity of boating associated with a given origin or distance category.

i = a given origin or distance category (1 to N)

C = total costs or trips for each origin or distance category

B = number of boats for each origin or distance category

Although the above use of consumer's surplus is similar to the concept presented by Marshall, there may be exception taken to deriving consumer's surplus for the whole boat population from a given distance zone regardless of whether those boat owners went to the particular lake. This would be the same as finding out how many people purchased fishing licenses in a given distance zone from a lake and then determining the consumer's surplus for each person to value the lake for fishing regardless of where they went fishing.

Another way in which the estimated demand curve is used to determine the value of a resource for recreational purposes is called the "Monopoly Revenue Method." The process is essentially that of finding which level of fees a profit maximizing monopolist would charge at a recreation area, given the demand schedule. The fee revenue that would yield the maximum profit to the hypothetical monopolist would be the measure of value of the resource.

Lerner presented another method making use of a derived demand schedule called the "Discriminating Monopoly Revenue Method" [12, pp. 69-75]. Average costs per user day are computed for each distance zone as well as the number of user days per 100,000 population. The demand is then derived where cost per user day is the independent variable and number of user days per 100,000 population is the dependent variable.

An underlying assumption of this approach is that the use of the recreation opportunity by users from one distance zone would be the same as the use made by people from other distance zones if the costs were the same for each zone. With this assumption, a fee could be charged to those residing in the closer zone, which would decrease the attendance in this zone to that of the more distant zone. If that fee were charged the decrease in the number of user days per 100,000 population could be predicted.

The densities (user days per 100,000 population) could be estimated and multiplied by the population of each distance zone to determine the estimated number of user days expected at various fee levels. Then, the total benefits (which Lerner defines as consumer's surplus fee revenue) for each distance zone could be determined by taking the integral of the demand curve between the fee charged and the estimated price at which demand would be equal to zero.

Summary

The methods of recreation resource evaluation discussed in this chapter are the most noteworthy that have been advanced in recent years. Because of the increased emphasis on recreational evaluation, there will probably be many other methods forthcoming in the next few years.

The purpose of this study was to determine the economic benefits from recreational uses of a given resource. The methods which show the most promise for accomplishing this objective are the demand schedule methods. The following chapters are devoted to developing procedures and presenting data for the estimation of demand curves. These procedures have resulted from careful selection of the better characteristics

of the methods discussed in the current chapter. Thus, the approach developed and used in this study for derivation of recreation demand curves was considered to be superior to any single method previously proposed.

After the demand curves were obtained, some of the more realistic methods for deriving benefits from these curves were tested. Finally, these estimates of benefits were compared to determine which method provided the most logical and consistent values.

CHAPTER III

PROCEDURE

The procedure is discussed in four parts in this chapter: (1) the procedure used to obtain relevant empirical data pertinent to outdoor recreation at the Duncan Lake complex; (2) the procedure used to analyze the data; (3) the procedure used in the estimation of the demand curves for selected outdoor recreation activities; and (4) the procedure used to analyze outdoor recreation management practices at the lakes.

Data Collection Procedure

The demand analysis for selected recreational activities of the Duncan, Oklahoma municipal reservoirs required several types of empirical data. The procedures used in obtaining the data depended upon the nature of the data required. The types of data collected and the procedures used in the collection process are discussed below.

Collection of Lake Attendance Data

One of the main reasons for choosing the lakes of Duncan, Oklahoma, for this study was because the city has charged fees for selected recreational activities at their lakes since 1955. Fees are not charged for all recreational activities participated in at the lakes, but are charged for fishing, boating, water skiing, and hunting. Permits for these activities can be purchased on a day-use or yearly basis. Fiscal

year total (July 1 - June 30) sales for each type of permit had been recorded by the city, but calendar year totals had not been kept.

The permit sales receipt books had been saved by the lakes manager in case an audit might be required at some future date. Sales by months were desired to determine seasonal attendance patterns. The tabulation of data from these receipt books for the years 1955 through 1964 provided information concerning the total paid attendance at the lakes by months for each recreation activity.

Although these data were considered to be very important for this analysis, more information was desired concerning origin of the recreationists. Thus, late in 1964, the Duncan City Clerk was asked if the recreation permits receipts could be changed for the year 1965 to include a space for the town of residence (address) of the purchaser of the permit. This change was approved and adopted. This allowed determination of the distance traveled for each recreationist. These permits were also used to obtain a sample of recreationists for the mail questionnaire phase of the study.

Obtaining Data Through Use of Questionnaires

Various types of information were needed from the recreationists. These included the expenses incurred by the recreationists for the various recreational activities, certain socio-economic characteristics of the recreationists, and information on recreational habits. Expenses included such items as travel costs, equipment depreciation costs, additional food costs over home costs if any, fee and license costs, and other costs related to the recreational experience.

Socio-economic characteristics such as income, age, occupation, vacation time, work week, education, and marital status were needed for the recreationists using the Duncan Lakes to determine the effects these variables had on participation. Any correlation between recreationists' habits and their socio-economic characteristics would help to explain differences in attendance patterns at the recreational facilities.

A questionnaire was considered to be the most efficient method of collecting the above types of information. Questionnaires may be used for personal data gathering in several ways, each having certain advantages and disadvantages. For this study, three alternative ways were considered: (1) recreationists could be personally interviewed at the lakes while they participated in the various forms of recreation available on different days during the year; (2) the cabin owners could be personally interviewed at their cabins; and (3) a random sample of the recreationists could be drawn from the permit receipt books and questionnaires could be mailed to them for their completion.

The first alternative was discarded because it was believed that many recreationists resent having to interrupt their activities to answer a lengthy series of questions posed by an interviewer. The second alternative was considered feasible because the cabin owners could be interviewed at their cabins during early morning and evening hours and appointments for interviews could be scheduled if necessary. Also, information concerning costs and recreation habits of the cabin owners was desired.

The third alternative also was deemed feasible. By using a random sample for all recreationists that used the recreational facilities

during a specific period, a cross-section of the recreationists could be obtained. Also, the time and money necessary for a mailed questionnaire is less than that required by personal interviews. In addition, comparisons could be made between answers given by the cabin owners and those obtained from the mailed questionnaires. If there were no significant differences in the answers given, then the data could be pooled.

Several questions concerning cabin costs, maintenance, and usage were added to the questionnaire form used in conjunction with the cabin owner interviews. Except for these questions, the two questionnaires were essentially identical (see Appendix A).

The procedure used for drawing a random sample of persons for the mail survey involved using the permit receipt books which had carbon copies of all permits sold. These books were numbered consecutively and each book contained fifty receipts with the name and address of each permit purchaser. Since all the various types of recreation permits¹ may have been included in each permit book, it was concluded that a sample of every fifth receipt would constitute a random sample of recreationists participating in all activities available.

Lake personnel indicated that a small proportion of the users of the lakes came from distances further than 75 miles. A 100 percent sample of these recreationists was taken. This was in addition to the 20 percent sample taken from the permit books, e.g., every fifth permit

¹Eighteen types of permits may be purchased: 12 varieties of fishing permits, 2 types of skiing permits, 2 types of boating permits, a barge permit, and a quail hunting permit.

was selected plus any of the remaining 80 percent that were purchased by a recreationist residing more than 75 miles from the lakes.

The name, address, and type of recreational activity of each person sampled was written on an index card and these were arranged alphabetically by town of residence. Questionnaires were then sent to all the persons sampled.

The mailed questionnaires were accompanied by a cover letter explaining the general reasons for the study. This letter stressed that answers given would be kept confidential and also stressed the need for accurate answers. A postage-paid business reply envelope was included with each questionnaire mailed. A copy of this letter is presented in Appendix A.

The questionnaires were mailed in batches of 200 to 250 and were sent by both first class and third class mail to see if there was any difference in the response received. No significant difference in the rate of returns was noted. After sufficient time had elapsed for most of the questionnaires to be completed and returned, a sample from those not replying was drawn and a second questionnaire was sent to this subsample. Approximately 300 usable questionnaires were returned from 2,000 questionnaires mailed. This is a 15 percent rate of reply.

Approximately 80 usable questionnaires were obtained from personal interviews of the cabin owners. The data obtained from these questionnaires and appropriate comparisons between the two samples will be presented in the chapters that follow.

Collection of Additional Data

In addition to the data obtained from the permit receipt books and

from the questionnaires, other data were obtained from various sources. Population estimates for each of the several distance zones were obtained from reports of the Bureau of the Census. Information concerning the costs of operating and maintaining the recreational facilities at the lakes and information on revenue received from permit sales and lake lot leases were supplied by several officials and employees of the City of Duncan.

Procedures for the Analysis of the Data

The empirical data collected for this study were initially in an unsophisticated form. Thus, it was necessary, in most cases, for the data to be refined so that it could be used in the study. This section describes the procedures used to convert the raw data into workable data.

Lake Attendance Data

The recreation permit books were tabulated to obtain the number of permits of each type sold and the month in which they were sold for the years 1955 to 1965. The results of these tabulations provided information as to the total monetary sales during the year as well as by months. The number of permits sold and the monetary value for these time intervals for each of the types of permits available were also obtained. For each of the permits sold during 1965, the distance traveled by each person purchasing a permit also was obtained. This information proved to be very useful as an indicator of the distance that recreationists would travel for various recreation activities.

To permit an orderly grouping of the data concerning the distance traveled by the recreationists, concentric circles were drawn from the center of the recreation complex. These circles involved the following travel or distance zones:

Zone 1	0-24 miles
Zone 2	25-49 miles
Zone 3	50-74 miles
Zone 4	75-99 miles
Zone 5	100-149 miles
Zone 6	150-200 miles
Zone 7	200 miles and over

These distance zones were determined by airline mileage to simplify the analysis. This was done because the lake complex is some distance from the nearest highway and more than one route may be used to reach each lake in the complex. These travel zones are indicated in Figure 3.

Questionnaire Data

The three main categories of data obtained from the questionnaires were expenses incurred by the recreationists, socio-economic characteristics of the recreationists, and recreation habits of the recreationists. The expenditures reported for the various activities were separated into three categories: fixed investments, annual costs, and daily costs.

The expenses or costs which were considered fixed were the investments in recreation equipment that recreationists indicated they owned. The equipment investments were converted to annual fixed costs by using a rate of depreciation typical for each of the various types of equipment. The next step was to determine the number of user days the equipment was used during the year, as obtained from the questionnaire. Then, by dividing the annual fixed costs by the user days, the fixed

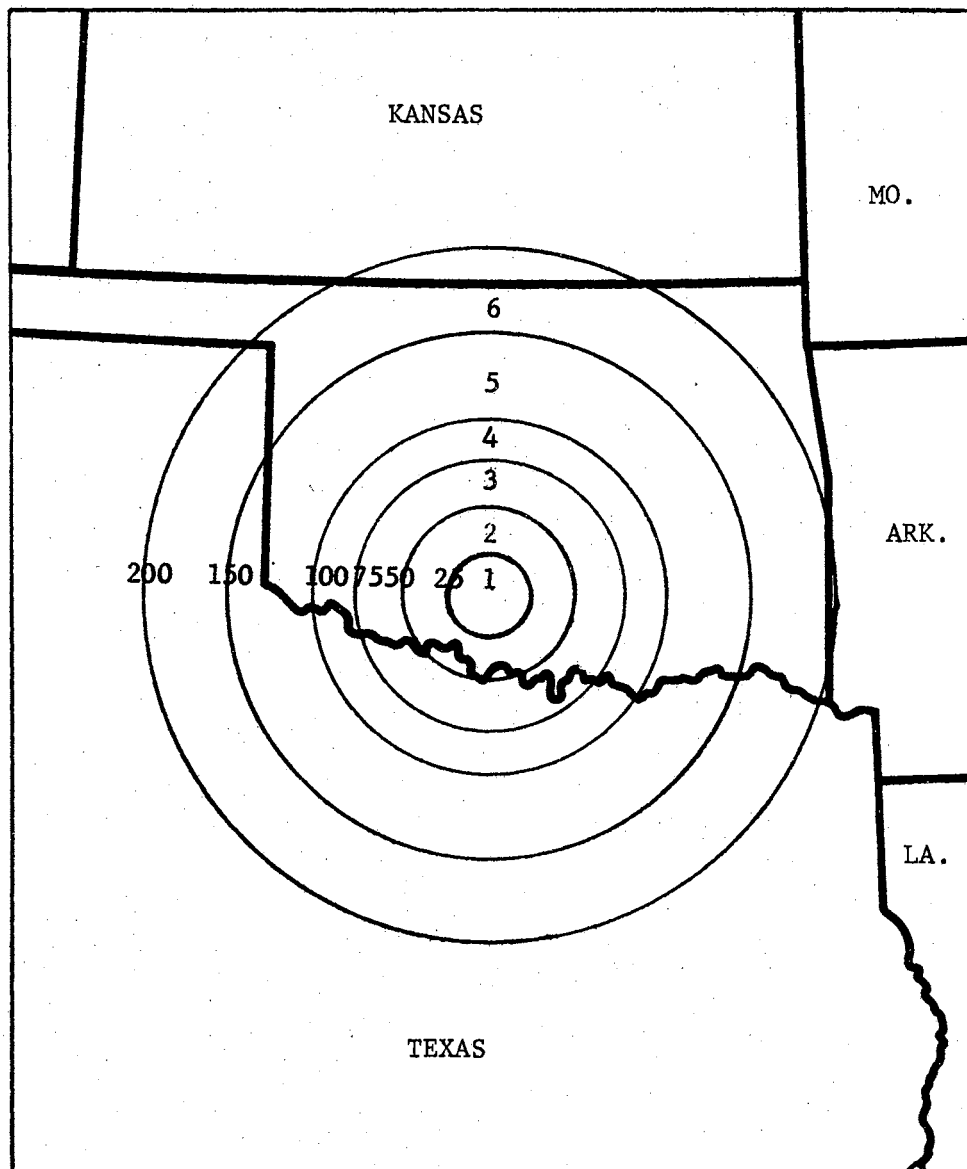


Figure 3. Concentric Travel Zones Around the Duncan Recreation Complex.

costs per day were determined. By aggregating all the various daily fixed costs that were incurred for a given recreation activity, the total daily fixed costs for that activity were determined.

Annual costs differ from fixed costs in that the recreationist has a choice at the beginning of each year as to whether or not he will incur the expense. These expenses would not be incurred if the recreationist decided to forego the activity for a particular year. Examples of annual costs are hunting and fishing licenses, boat insurance, and annual user-fees.

The annual costs were also converted to a cost per user day basis. Since the emphasis of this study was on the Duncan Lake complex, only the annual user-fees incurred at this complex were considered. The total number of user days of the recreation activity consumed during the year at the Duncan complex was divided into the annual user fee to determine the fee cost per day. After completing the conversion of each annual expense into a per user day cost, all the costs that were incurred for each activity were combined to provide the annual cost per user day.

The daily expenses were generally in a per user day form but there were several exceptions. For example, the travel costs for a group of persons using a single vehicle had to be divided by the number of persons in the group to determine the cost per user day. A daily water skiing or boating permit would be treated in a similar fashion. After all daily expenses were converted to costs per user day, the various types of costs applicable to each activity were combined as they were for the fixed and annual costs.

The final step was to add the fixed, annual, and daily costs incurred for each activity to determine the total costs of a user day of that activity. This variable was used in subsequent analyses as the price.

Some of the socio-economic factors determined from the questionnaires were income, age, occupation, days of paid vacation, and average number of hours worked each week. These factors were tabulated individually to determine the general socio-economic characteristics of the recreationists that visited the Duncan Lake complex. In addition, certain of these socio-economic factors were tabulated in conjunction with certain recreational habits of the recreationists. (For example, the income distribution for recreationists who participated in a certain activity at the lake complex was compared with the income distribution of all Oklahoma citizens to determine if there was a difference.)

Procedure for Determining Yearly Per Capita Recreation Attendance

Estimation of the yearly per capita recreation attendance at the Duncan Lake complex involved the following steps: (1) determination of the number of each type of recreation permit sold to residents in each of the seven distance zones; (2) estimation of the number of user days that each of the various season permits were used so that the total number of user days of each activity could be determined; (3) estimation of the population in each of the distance zones; and (4) calculation of the yearly per capita user days for the various recreation activities for each of the seven distance zones, using the results of the first three steps. The procedure used in step 1 to determine the

number of the various types of permits sold by residence zone was explained in the preceding section concerning lake attendance data.

In step 2, the fact that several of the permits were sold on an annual basis necessitated the determination of the average number of user days that each of these types of permits was used. The five types of season permits sold were: (1) family fishing, which is for the husband and wife and children under 16 years of age; (2) single fishing, which is for one person only; (3) water skiing; (4) fishing boat; and (5) fishing barges. An arithmetic mean was used to determine the average number of times each permit was used. These means were computed for both cabin owners and for the recreationists who responded to the mail questionnaire. These two means were then compared to determine if there was a significant difference between the number of times these two groups used the various types of season permits. A test was used for this determination. A nonsignificant difference in the two means indicated that the data could be combined and a pooled mean would be used to indicate the number of user days of an activity that a season permit represented. Once these means were determined, they were used to compute the total number of user days of each activity for recreationists from each of the respective distance zones.

The yearly per capita attendance for the respective travel zones required estimating the population within each of these zones. This information was obtained from U. S. Bureau of the Census population statistics. Township rather than county data were used. If a township was totally included in a travel zone except for a town, then the township population minus the town population was included in that

zone's population. Any township with over half of its area in a travel zone had its total population included in the zone's total.

The fourth and final step for determining the yearly per capita attendance was to divide each travel zone's user day totals by the population with the zone. This was done for each of the recreation activities offered at the Duncan Lakes complex. An example of this procedure is:

$$\text{Per Capita User Days Fishing in Travel Zone I for a Specific Year} = \frac{\text{Total User Days Fishing for Recreationists from Zone I}}{\text{Population in Zone I}}$$

Procedure for Estimation of Demand Curves

The estimation of demand curves for each of the recreation activities involved using the empirical data obtained from the questionnaires. In particular, the data concerning the expenses incurred by the recreationists and the number of user days that they participated during the year were the relevant variables. The determination of these two variables was previously explained in this chapter.

The cost of a user day of a recreational activity was used as the measure of the price variable and the number of user days of the activity taken during the year was used as the quantity variable. Demand curves were determined by using these price and quantity variables.

Each recreationist that participated in a given activity would represent an observation (a point) on a two-dimensional graph. The y-axis would represent the price per user day and the x-axis the number of user days participated in during the year. Then by using linear regression techniques, the demand curve was determined. This curve

would represent an average individual demand curve since it was determined from actual price and quantity data for a large number of persons.

The usual way in which a demand curve is determined is for the quantity taken to be a function of price. This is because price is usually thought to be the independent variable. But, there were some indications that price might be the dependent variable. Therefore, both relationships were tested for comparison purposes.

Since the demand curves obtained for each activity represent the demand of an average individual, these curves must be aggregated for all the individuals recreating at the lakes to determine the market demand curve for that activity. This was accomplished by determining the number of people who participated in each activity at the lakes during the year. It was necessary to determine the average number of daily permits for an activity that a person would purchase during the year. Data from the questionnaires were used to obtain these averages. By dividing the total number of daily permits sold for a given activity by the average number sold to an individual, the number of persons who participated in the activity on a daily basis could be determined. The number of season permits sold for an activity is a direct determination of the number of the persons participating in the activity. Adding the number of individuals purchasing daily permits to the number purchasing season permits provides an estimate of the total number participating in the activity during the year.

Finally, the individual demand curves were added horizontally to determine the market demand curve for the activity. It was necessary to find how many individuals constituted the market. If all permits for an activity were sold on an annual basis, then the number of permits

sold would represent the number of individuals; however, annual permits and daily permits were sold. Therefore, the average number of daily permits that were purchased by individuals from each of the distance zones was determined. These averages were computed from data obtained from the questionnaire. The number of individuals in the market was determined by dividing these averages into the number of daily permits sold to recreationists in each distance zone and adding that value to the number of annual permits sold.

The procedures discussed in this chapter were used for the analysis that is presented in the next two chapters. There are some instances where a more detailed explanation of some of the finer points of a procedure is required.

Analysis of Management Considerations

The information for the analysis of outdoor recreational management was obtained from several sources. City officials openly discussed many of the management problems that had confronted them concerning outdoor recreation. They also allowed access to their books on costs and income from outdoor recreation. Information was also obtained on problems of management from the recreationists. They discussed these problems in personal interviews and on the questionnaires. In addition, the researcher observed many of the problems of management firsthand while visiting the lakes during the process of the study.

These problems were analyzed and possible solutions were advanced whenever appropriate.

The presentation and analysis of the data relating to outdoor recreational activities in the Duncan Lakes Complex are discussed in the following chapter.

CHAPTER IV

ANALYSIS OF DATA RELATING TO OUTDOOR RECREATION

The main categories of empirical data presented in this chapter are: the lake attendance data; the number of permits sold to recreationists from each of the travel zones; the mean number of user days for each of the various season permits; the total number of user days for each activity participated in during 1965; the population and the per capita participation rates of each of the activities by travel zones; and the socio-economic factors of the recreationists who participated in the various recreational activities at the Duncan lake complex.

Lake Attendance Data

The lake attendance data were tabulated from the permit receipt books for the years 1955-1965. Over this period the fees charged for the various activities changed. The lake attendance data were an important part of this study since they represent a continuous stream of information concerning the total demand for the recreational resources at the Duncan City Lakes.

The recreation activities available at the Duncan Lake complex and the fees charged for the years 1955-1965 are presented in Table I. A dashed line indicates that the activity was not available during a particular year.

TABLE I

ACTIVITIES AVAILABLE AND FEES CHARGED AT THE DUNCAN
LAKES RECREATION COMPLEX, 1955-1965

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Fishing Permits											
All Lakes Family Season	---	---	---	---	---	10.00	10.00	10.00	10.00	10.00	10.00
All Lakes Single Season	---	---	---	---	---	7.50	7.50	7.50	7.50	7.50	7.50
All Lakes Daily	---	---	---	---	---	.50	.50	.50	.50	.50	.50
Clear Creek Family Season	7.50	7.50	7.50	7.50	7.50	5.00	5.00	5.00	5.00	5.00	5.00
Clear Creek Single Season	5.00	5.00	5.00	5.00	5.00	3.50	3.50	3.50	3.50	3.50	3.50
Clear Creek Daily	.50	.50	.50	.50	.50	.50	.50	.50	.50	.50	.50
Humphrey Family Season	---	---	---	---	10.00	6.00	6.00	6.00	6.00	6.00	6.00
Humphrey Single Season	---	---	---	---	7.50	4.00	4.00	4.00	4.00	4.00	4.00
Humphrey Daily	---	---	---	---	1.00	.50	.50	.50	.50	.50	.50
Lake Duncan Family Season	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Lake Duncan Single Season	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Lake Duncan Daily	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25	.25
Fishing Boat, and Barge Permits											
Season	---	---	---	---	---	3.50	3.50	3.50	3.50	---	---
Daily	---	---	---	---	---	.50	.50	.50	.50	---	---
All Lakes - Season	---	---	---	---	---	6.00	6.00	6.00	6.00	6.00	6.00
Humphrey Season	---	---	---	---	6.00	4.00	4.00	4.00	4.00	---	---
Clear Creek Season	4.00	4.00	4.00	4.00	---	4.00	4.00	4.00	4.00	---	---
Duncan Season	3.00	3.00	3.00	3.00	---	4.00	4.00	4.00	4.00	---	1.00
All Lakes Daily	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lake Humphrey Barge Permit	---	---	---	---	10.00	8.00	8.00	8.00	8.00	8.00	8.00
Water Skiing Permits											
Clear Creek and Duncan Season	---	---	---	---	---	15.00	15.00	15.00	15.00	15.00	15.00
Clear Creek Season	---	---	---	---	20.00	---	---	---	---	---	---
Lake Duncan Season	---	---	23.00	20.00	15.00	---	---	---	---	---	---
Clear Creek and Duncan Daily	---	---	---	---	---	1.50	1.50	1.50	1.50	1.50	1.50
Clear Creek Daily	---	---	---	---	2.00	---	---	---	---	---	---
Lake Duncan Daily	---	2.00	2.00	2.00	1.50	---	---	---	---	---	---
Hunting Permits											
Quail - Daily	---	---	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Duck - Daily	---	---	.50	.50	.50	.50	.50	.50	.50	.50	.50
Duck - Season	---	---	5.00	5.00	5.00	---	---	---	---	---	---

The permit receipt books were tabulated by months for each activity so that the seasonal aspects of the activities could be observed. The monthly and yearly totals of permit sales and the dollar value of these sales for each of the years from 1955 to 1965 are included in Appendix B.

Summaries of the numbers of permits sold and the total fee revenue received for each activity during these years are presented in Tables II and III, respectively. Duncan Lake and Clear Creek Lake were the only lakes in the Duncan Recreational complex in 1955. Lake Humphrey was opened to the public for recreational purposes in June, 1959.

Water skiing was first allowed in 1956, but only on Duncan Lake. In 1959, when Lake Humphrey was opened, Clear Creek Lake also was opened for water skiing. From 1960 on, water skiing permits were sold for both of these lakes (Clear Creek and Duncan).

Certain changes may be noted in the fees charged for various activities. These changes likely resulted from a combination of: (1) public response to the fees; and (2) the city experimenting with the fees to find the level that would encourage use of the facilities and at the same time minimize overuse. Since 1960, the fees charged have remained essentially the same with only some categories of season fishing boat permits eliminated.

The summary of fee revenue totals by year for each of the four general types of recreational activities for which permits were sold indicates that the attendance at the lakes has not been constant (Table III). During the period from 1955 to 1958, the revenue increased fairly gradually. The total revenue for 1959 was more than double that for 1958. The total income has been decreasing every year since 1959.

TABLE II

NUMBER OF PERMITS SOLD FOR ACTIVITIES AVAILABLE AT THE DUNCAN
LAKES RECREATION COMPLEX, 1955-1965

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Fishing Permits											
All Lakes Family Season	---	---	---	---	---	599	546	457	395	344	239
All Lakes Single Season	---	---	---	---	---	291	262	204	197	203	155
All Lakes Daily	---	---	---	---	---	11,460	9,745	8,643	9,070	7,072	44
Clear Creek Family Season	338	374	308	302	188	43	36	27	48	57	34
Clear Creek Single Season	407	388	346	283	180	41	42	40	72	41	43
Clear Creek Daily	11,650	13,167	12,623	10,320	8,155	3,964	3,289	3,583	4,835	4,060	4,289
Humphrey Family Season	---	---	---	---	856	164	169	147	155	150	142
Humphrey Single Season	---	---	---	---	336	82	115	103	109	122	125
Humphrey Daily	---	---	---	---	7,514	942	793	822	1,229	1,073	6,868
Lake Duncan Family Season	73	72	47	113	---	7	8	8	7	4	3
Lake Duncan Single Season	73	71	24	98	---	6	4	11	8	3	6
Lake Duncan Daily	5,628	5,636	5,364	4,648	3,250	1,524	1,049	1,680	1,801	901	1,055
Fishing Boat and Barge Permits											
Season	---	---	---	---	---	3	1	2	1	---	---
Daily	---	---	---	---	---	36	26	39	62	---	---
All Lakes - Season	---	---	---	---	---	170	152	133	142	283	251
Humphrey Season	---	---	---	---	363	109	91	93	90	---	---
Clear Creek Season	178	189	170	172	---	5	16	14	24	---	---
Duncan Season	24	22	14	25	---	2	---	---	2	---	---
All Lakes Daily	50	112	181	141	817	383	288	307	383	430	363
Lake Humphrey Barge Permit	---	---	---	---	28	51	53	49	53	36	39
Water Skiing Permit											
Clear Creek and Duncan Season	---	---	---	---	---	214	201	199	203	171	168
Clear Creek Season	---	---	---	---	83	---	---	---	---	---	---
Lake Duncan Season	---	---	47	100	28	---	---	---	---	---	---
Clear Creek and Duncan Daily	---	---	---	---	---	1,270	963	1,114	1,348	1,128	1,164
Clear Creek Daily	---	---	---	---	861	---	---	---	---	---	---
Lake Duncan Daily	---	136	860	966	565	---	---	---	---	---	---
Hunting Permits											
Quail - Daily	---	---	150	257	147	134	118	120	189	178	238
Duck - Daily	---	---	151	397	100	---	---	---	---	---	---
Duck - Season	---	---	---	68	32	---	---	---	---	---	---
Senior Citizens	---	---	---	---	---	---	---	---	---	357	187

TABLE III

TOTAL RECREATIONAL FEE INCOME RECEIVED AT THE DUNCAN
LAKES RECREATION COMPLEX, 1955-1965

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Fishing Income											
All Lakes Family Season						5,990.00	5,460.00	4,570.00	3,950.00	3,440.00	2,380.00
All Lakes Single Season						2,182.50	1,965.00	1,530.00	1,477.50	1,522.50	1,162.50
All Lakes Daily						5,730.00	4,872.50	4,321.50	4,535.00	3,510.50	22.00
Clear Creek Family Season	2,535.00	2,805.00	2,310.00	2,265.00	1,410.00	215.00	180.00	135.00	240.00	285.00	170.00
Clear Creek Single Season	2,035.00	1,940.00	1,730.00	1,415.00	900.00	143.50	147.00	140.00	252.00	143.50	150.50
Clear Creek Daily	5,825.00	6,583.50	6,311.50	5,160.00	4,077.50	1,982.00	1,644.50	1,791.50	2,417.50	2,030.00	2,144.50
Humphrey Family Season					8,560.00	984.00	1,014.00	882.00	930.00	900.00	852.00
Humphrey Single Season					2,520.00	328.00	460.00	412.00	436.00	488.00	500.00
Humphrey Daily					7,514.00	471.00	396.50	411.00	614.50	536.50	3,433.50
Lake Duncan Family Season	255.50	252.00	164.50	395.50		24.50	28.00	28.00	24.50	14.00	10.50
Lake Duncan Single Season	182.50	177.50	60.00	245.00		15.00	10.00	27.50	20.00	7.50	15.00
Lake Duncan Daily	1,407.00	1,409.00	1,341.00	1,162.00	812.50	381.00	262.25	420.00	450.25	225.25	255.50
Totals	12,240.00	13,167.00	11,917.00	10,642.50	25,794.00	18,446.50	16,439.75	14,668.50	15,347.25	13,102.75	11,096.00
Fishing Boat and Barge Income											
Season						10.50	3.50	7.00	3.50		
Daily						18.00	13.00	19.50	31.00		
All Lakes - Season						1,020.00	912.00	798.00	852.00	1,415.00	1,250.00
Humphrey Season					2,178.00	436.00	364.00	372.00	360.00		
Clear Creek Season	712.00	756.00	680.00	688.00	-	20.00	64.00	56.00	96.00		
Duncan Season	72.00	66.00	42.00	75.00	-	8.00	-	-	8.00		
All Lakes Daily	50.00	112.00	181.00	141.00	817.00	383.00	288.00	307.00	383.00	430.00	353.00
Lake Humphrey Barge Permit					280.00	408.00	424.00	392.00	424.00	288.00	312.00
Totals	834.00	934.00	903.00	904.00	3,275.00	2,303.50	2,068.50	1,951.50	2,157.00	2,133.00	1,915.00
Water Skiing Income											
Clear Creek and Duncan Season	-	-	-	-	-	3,210.00	3,015.00	2,940.00	3,045.00	2,565.00	2,430.00
Clear Creek Season	-	-	-	-	1,660.00	-	-	-	-	-	-
Lake Duncan Season	-	-	1,081.00	2,000.00	420.00	-	-	-	-	-	-
Clear Creek and Duncan Daily	-	-	-	-	-	1,905.00	1,444.50	1,671.00	2,022.00	1,692.00	1,746.00
Clear Creek Daily	-	-	-	-	1,722.00	-	-	-	-	-	-
Lake Duncan Daily	-	272.00	1,720.00	1,449.00	847.50	-	-	-	-	-	-
Totals	-	272.00	2,801.00	3,449.00	4,649.50	5,115.00	4,459.50	4,611.00	5,067.00	4,527.00	4,176.00
Hunting Income											
Quail - Daily	-	-	150.00	257.00	147.00	134.00	118.00	120.00	189.00	178.00	238.00
Duck - Daily	-	-	75.50	198.50	49.00	-	-	-	-	-	-
Duck - Season	-	-	-	340.00	160.00	-	-	-	-	-	-
Totals	-	-	225.50	795.50	356.00	134.00	118.00	120.00	189.00	178.00	238.00
Grand Totals	13,074.00	14,373.00	15,846.50	15,791.00	34,074.50	25,999.00	23,085.75	21,351.00	22,760.75	19,670.75	17,425.00

The grand opening of Lake Humphrey in 1959 was accompanied by a large amount of local advertising that caused permit sales for that year to reach an all time high. This caused crowded conditions at the lakes and sales dropped back in 1960 to a level that was more typical of the demand for recreation at the lakes. The subsequent decrease in fee revenue from 1959 through 1965 resulted from several factors of which the most important was low lake levels. Another factor was decreasing sales of season fishing permits and increasing sales of daily permits. Apparently many purchasers of the annual fishing permits found that they did not use the lakes enough times to justify the purchase of the yearly permit and therefore switched to daily permits. This has undoubtedly resulted in a loss of revenue to the city.

Another factor that has hurt fishing permit sales has been the policy of giving a season fishing permit to senior citizens (over 65 years of age). This policy was initiated in 1964. These permits provide the same privileges to the senior citizen as the \$7.50 single season fishing permit does. These permits do not have to be renewed. Thus, these permits represent a loss of revenue equivalent to \$2677 in 1964 and \$4080 in 1965. This assumes that all permits issued to senior citizens would have been purchased anyway. Actually, this probably would not have been the case, since several of these permits were issued to both husband and wife. Normally, they would be expected to purchase a \$10 family permit instead of two \$7.50 permits. Also, some of those issued these permits may formally have purchased daily permits. Thus, it is difficult to say that income would fall this much due to the issuing of senior citizen permits, but it had some effect.

TABLE IV

NUMBER AND PERCENTAGE OF RECREATIONISTS FROM EACH DISTANCE ZONE PURCHASING EACH TYPE OF RECREATIONAL PERMIT, DUNCAN LAKES RECREATION COMPLEX, 1965

	Distance Zones														Total No.
	Zone 1		Zone 2		Zone 3		Zone 4		Zone 5		Zone 6		Zone 7		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
<u>All Lakes Fishing</u>															
Family Season	227	95.0	7	2.9	5	2.1	-	-	-	-	-	-	-	-	239
Single Season	151	97.4	3	1.9	1	.7	-	-	-	-	-	-	-	-	155
Daily Season	37	89.1	-	-	2	4.5	-	-	-	-	-	-	5	11.4	44
<u>Clear Creek Lake</u>															
Family Season	25	73.5	5	14.7	4	11.8	-	-	-	-	-	-	-	-	34
Single Season	39	90.7	3	7.0	1	2.3	-	-	-	-	-	-	-	-	43
Daily Season	3974	71.7	639	14.9	428	10.0	17	.4	11	.3	19	.4	101	2.3	4289
<u>Lake Humphrey</u>															
Family Season	115	81.0	12	8.4	12	8.4	-	-	-	-	-	-	3	2.1	142
Single Season	105	84.0	8	6.4	8	6.4	-	-	-	-	3	2.4	1	.8	125
Daily Season	4104	59.8	961	14.0	1471	21.4	37	.5	50	.7	30	.4	215	3.1	6868
<u>Lake Duncan</u>															
Family Season	3	100.0	-	-	-	-	-	-	-	-	-	-	-	-	3
Single Season	6	100.0	-	-	-	-	-	-	-	-	-	-	-	-	6
Daily	934	83.5	58	5.5	39	3.7	3	.3	10	.9	4	.4	7	.7	1055
<u>Skating-Clear Creek-Duncan</u>															
Season	158	94.0	6	3.6	4	2.4	-	-	-	-	-	-	-	-	168
Daily	782	67.2	123	10.6	222	19.1	-	-	4	.3	12	1.0	21	1.8	1164
<u>Fishing Boat Permit</u>															
3 Lakes Season	207	82.5	22	8.8	19	7.6	-	-	-	-	-	-	3	1.2	251
3 Lakes Daily	163	46.3	60	16.5	121	33.3	-	-	4	1.1	5	1.4	5	1.4	363
Daily Quail Permit	207	87.0	7	2.9	24	10.1	-	-	-	-	-	-	-	-	238
Lake Humphrey Barge	35	89.7	3	7.7	1	2.6	-	-	-	-	-	-	-	-	39
<u>Senior Citizen</u>															
	178	95.2	5	2.7	4	2.1	-	-	-	-	-	-	-	-	187

The fluctuations in yearly water skiing revenue since 1960 has not been of the magnitude of that for fishing. Low lake levels probably represent the major factor causing the lower income from water skiing.

Recreation Activities and Distance Traveled

One of the most important variables affecting attendance at a given recreation site is the distance that recreationists must travel to engage in this pastime. The numbers of each type of recreation permit sold to recreationists from the seven distance zones are presented in Table IV. These travel zones are indicated in Figure 3. These data are unique among recreation studies since they not only give the total purchases of each type of permit, but also provide complete information concerning the origin of each recreationist.

A large percentage of the recreationists have residences in Zone 1, the closest travel zone (Table IV). This relationship holds regardless of the type of recreation activity participated in by the recreationists. The percentages for Zone 1 are also higher for season permits for the same activity. This would be expected since local recreationists would be more likely to use the nearby lakes throughout the year than would recreationists located at greater distances.

Zones 2 and 3 have very similar attendance patterns (Table IV). Zone 2 has a slightly higher fishing attendance while Zone 3 has a higher water skiing attendance. These differences are easier to observe when these data are converted to user days as shown in the following section.

The rate of attendance from travel zones 75 miles and further from the lake complex is very low. The fact that Zone 7 has a higher attendance than the next three closer travel zones may seem surprising at

first. But, this zone has a much larger population base because it includes the total population of persons residing 200 or more miles from the lake complex.

Annual Use of Season Permits

The average number of days of use by season permits holders for the selected recreation activities was determined from the questionnaire data. The five major types of season permits sold at the lakes in 1965 were: (1) family fishing; (2) individual fishing; (3) season water skiing; (4) fishing boats; and (5) barges on Lake Humphrey.

An arithmetic mean was used to determine the number of times each permit was used. Means were computed for cabin owners, for other recreationists and for both groups combined (Table V). The individual group means were then tested to determine if they were significantly different. The statistical t' test indicated no difference between the means¹. Therefore, the pooled means were used in the analysis.

The pooled values in Table V were used to determine the average number of user days for each type of season permit. For both types of

¹The null hypothesis tested was $H_0 = \bar{X}_1 - \bar{X}_2 = 0$; and $H_1 = \bar{X}_1 - \bar{X}_2 \neq 0$. Since the observations were not paired and the variances were unequal, the following formula is used to compute t' , where the prime indicates the criterion is not distributed as student's t . $t' = \frac{w_1 t_1 + w_2 t_2}{w_1 + w_2}$ where $w_1 = \frac{s_1^2}{n_1}$, $w_2 = \frac{s_2^2}{n_2}$, and t_1 and t_2 are the values of student's t for $n_1 - 1$ and $n_2 - 1$ degrees of freedom at the selected (.95) level of significance. The value t' corresponds to a tabulated t value.

TABLE V

AVERAGE NUMBER USER DAYS EACH TYPE OF SEASON PERMIT IS USED BY CABIN OWNERS AND OTHER RECREATIONISTS, AND POOLED MEAN

	Fishing Single	Fishing Family	Fishing Boat	Water Skiing	Barge
Cabin Owners	29.750	45.348	30.583	22.429	31.667
Other Recreationists	26.178	41.857	23.723	18.710	20.000
t' value	2.115	2.021	2.037	2.340	2.239
Pooled Mean	27.115	43.431	26.699	19.395	27.000

season fishing permits the pooled averages represent the number of user days that the respective season permits were used. For the other permits, the number of people using a ski boat, fishing boat, or barge were estimated so that average number of user days of a season permit could be estimated. This was because a ski boat, fishing boat, or barge was usually used by more than one person. The number of user days associated with an occasion of water skiing was 6.315. This was determined by an arithmetic mean of the number of people usually water skiing together. This number (6.315) is applied not only to the number of occasions a water skiing permit is used, but also to daily water skiing permits. The average number of people using a fishing boat is 2 persons. This was the estimate given by the lake's caretaker. A barge usually accomodates 3 persons.

By applying these averages to permit sales for 1965, the total number of user days for each type of recreation was estimated for each distance zone and for the lake complex. The results are presented for (1) fishing, (2) water skiing, and (3) fishing boat and barge use, in Tables VI, VII, and VIII, respectively.

TABLE VI

USER DAYS OF FISHING FOR EACH OF THE SEVEN DISTANCE ZONES AND THE TOTAL
FOR THE DUNCAN LAKES RECREATION COMPLEX, 1965

Zone of Residence	Type of Fishing Permit	Permits Sold	User Days Per Permit	Total User Days For Each Type Permit	Total User Days Fishing From Zone	Percent of Lake Total
-Number-						
1	Family Season	370	43.43	16,069.5	37,206.6	83.8
	Single Season	301	27.11	8,161.6		
	Daily	8149	1.00	8,149.0		
	Senior Citizens	178	27.11	4,826.5		
2	Family Season	24	43.43	1,042.3	3,215.5	7.2
	Single Season	14	27.14	379.6		
	Daily	1658	1.00	1,658.0		
	Senior Citizens	5	27.11	135.6		
3	Family Season	21	43.43	912.1	3,231.7	7.3
	Single Season	10	27.11	271.1		
	Daily	1940	1.00	1,940.0		
	Senior Citizens	4	27.11	108.5		
4	Family Season	-	43.43	0.0	57.0	.1
	Single Season	-	27.11	0.0		
	Daily	57	1.00	57.0		
5	Family Season	-	43.43	0.0	71.0	.2
	Single Season	-	27.11	0.0		
	Daily	71	1.00	71.0		
6	Family Season	-	43.43	0.0	134.3	.3
	Single Season	3	27.11	81.3		
	Daily	53	1.00	53.0		
7	Family Season	3	43.43	130.3	498.4	1.1
	Single Season	1	27.11	27.1		
	Daily	328	1.00	328.0		
Total for Lakes					44,401.5	100.0

TABLE VII

USER DAYS OF WATER SKIING FOR EACH OF THE SEVEN DISTANCE ZONES AND THE TOTAL
FOR THE DUNCAN LAKES RECREATION COMPLEX, 1965

Distance Zone	Type of Permit	Permits Sold	Occasions Per Permit	User Days		Total User Days For Each Type Permit	Total User Days Skiing From Zone	Percent of Lake Total - Percent -
				Per Occasion	Number			
1	Season	158	19.39	6.31		19,351.7	24,290.0	86.9
	Daily	782	1.00	6.31		4,938.3		
2	Season	6	19.39	6.31		734.9	1,511.6	5.4
	Daily	123	1.00	6.31		776.7		
3	Season	4	19.39	6.31		489.9	1,891.8	6.8
	Daily	222	1.00	6.31		1,401.9		
4	Season	---	---	---		0.0	0.0	0.0
	Daily	---	---	---		0.0		
5	Season	---	---	---		0.0	25.3	.1
	Daily	4	1.00	6.31		25.3		
6	Season	---	---	---		0.0	75.8	.3
	Daily	12	1.00	6.31		75.8		
7	Season	---	---	---		0.0	132.6	.5
	Daily	21	1.00	6.31		132.6		
Total For Lakes							27,927.0	100.0

TABLE VIII

USER DAYS BARGE AND BOAT USE FOR EACH OF THE SEVEN DISTANCE ZONES AND THE TOTAL
FOR THE DUNCAN LAKES RECREATION COMPLEX, 1965

Distance Zone	Type of Permit	Permits Sold	Occasions Per Permit	User Days Per Occasion	Total User Days For Each Type Permit	Total User Days From Zone	Percent of Lake Total - Percent -
				- Number -			
1	Boat, Season	207	26.7	2	11,053.4		
	Boat, Daily	168	1.0	2	336.0		
	Barge	35	27.0	3	2,835.0	14,224.4	82.2
2	Boat, Season	22	26.7	2	1,174.8		
	Boat, Daily	60	1.0	2	120.0		
	Barge	3	27.0	3	243.0	1,537.8	8.9
3	Boat, Season	19	26.7	2	1,014.6		
	Boat, Daily	121	1.0	2	242.0		
	Barge	1	27.0	3	81.0	1,337.6	7.7
4	Boat, Season	---	---	-	---		
	Boat, Daily	---	---	-	---	0.0	0.0
5	Boat, Season	---	---	-	---		
	Boat, Daily	---	1.0	2	8.0	8.0	.1
6	Boat, Season	---	---	-	---		
	Boat, Daily	5	1.0	2	10.0	10.0	.1
7	Boat, Season	3	26.7	2	160.2		
	Boat, Daily	5	1.0	2	10.0		
Total For Lakes						<u>170.2</u> 17,288.0	<u>1.0</u> 100.0

People traveling 24 miles or less made up nearly 84 percent of the total fishing attendance expressed in user days. Over 98 percent of the fishing use was by persons traveling 74 or fewer miles (within two hours driving time). Thus, the geographic area from which the lake draws most of its fishing enthusiasts is fairly small.

For water skiing, nearly 87 percent of attendance was from 24 miles or less. The results for water skiing were very similar to those obtained for fishing. Over 99 percent of the water skiing attendance was from the first three travel zones.

The attendance distribution for fishing boats and barge usage was also very similar to that for fishing. This was expected since the boat usage was in conjunction with fishing. The percentage of use from the first travel zone was over 82 percent while the percentage from the first three zones together was nearly 99 percent.

The three recreation activities all had a lower use from travel zones 4, 5 and 6 than from zone 7. The population in zone 7 consists of the entire geographic area farther than 200 miles from the Duncan lake complex.

Population in the Travel Zones

Using the 1960 census, population estimates were compiled for each of the first six distance zones. The procedure used for determining these population estimates was discussed in Chapter III. One aspect of the procedure not mentioned, however, was that the proportions of each county's population included in each zone and determined from the 1960 census were applied to 1965 county population estimates. Thus, the

population estimates and the empirical data on attendance from the travel zones were for the same year.

The population estimates for the years 1960 and 1965 for each distance zone are presented in Table IX. Part of Texas is included in five of the zones and part of Arkansas and Kansas are included in Zone 6 (Figure 3). Although the area within each of the distance zones increases as the zones become further removed from the Duncan recreation complex, the populations do not increase accordingly. The population increases for the first three zones, decreases for Zone 4, increases for Zone 5, and decreases for Zone 6. The reason for this fluctuation is that Zones 3 and 5 have major cities within their boundaries while Zone 4 does not. Zone 5 has Dallas and Fort Worth within its boundaries while Zone 6 has Tulsa as its largest city.

User Days of Recreation Activities Per Capita

The data presented in the previous two sections concerning the population and user days of the various recreation activities for each of the distance zones were used to determine user days per capita for these zones. The computations necessary to obtain the per capita consumption for each recreation activity for each zone was determined by dividing the user days of the recreation in each zone by that zone's population.

$$\text{User Days of Recreation Activity Per Person Per Year in Distance Zone} = \frac{\text{User Day of Activity in Zone}}{\text{Population in Zone}}$$

The user days per capita for fishing, water skiing, and boating for each of the seven distance zones are presented in Table X. The population in the Oklahoma portion of the zones was used in addition to the total population in the zones to compute the per capita attendance. It

TABLE IX

POPULATION ESTIMATES FOR SIX CONCENTRIC DISTANCE ZONES DESCRIBED
ABOUT THE DUNCAN LAKES RECREATION COMPLEX, 1960 AND 1965

Distance Zone	1960 ¹					1965				
	Oklahoma	Texas	Kansas	Ark.	Total	Oklahoma ²	Texas ³	Kansas ⁴	Ark. ⁴	Total
Zone 1 (0-24 mi.)	55,167	-			55,167	58,213	-			58,213
Zone 2 (25-49 mi.)	197,014	2,442			199,456	211,578	2,284			213,862
Zone 3 (50-74 mi.)	629,360	148,332			777,692	713,405	132,838			846,243
Zone 4 (75-99 mi.)	237,058	57,005			294,063	229,950	58,962			288,912
Zone 5 (100-149 mi.)	411,282	1,733,395			2,144,677	414,803	1,938,623			2,353,426
Zone 6 (150-199 mi.)	796,673	660,936	76,846	6,157	1,450,617	761,203	709,834	76,846	6,157	1,554,040
Totals	2,236,559	2,602,110	76,846	6,157	4,921,672	2,389,152	2,842,541	76,846	6,157	5,314,696

¹U.S. Department of Commerce, Bureau of the Census, U. S. Census of Population for 1960.

²James D. Tarver, Yearly Population Estimates for Oklahoma Counties for 1961-1966, Unpublished Data obtained from the Department of Sociology, Oklahoma State University.

³Population Research Center, Population Estimates For Texas Counties, April 1, 1965, Department of Sociology, The University of Texas.

⁴The population estimates for Kansas and Arkansas for 1965 were unavailable and, therefore, the 1960 estimates were used. If the populations within zone six of these two states had been somewhat larger, some projection technique would have been used.

TABLE X

PER CAPITA USER DAYS OF RECREATION BY ACTIVITY FOR EACH DISTANCE
ZONE AND THE OKLAHOMA PORTION BY ZONE AT THE DUNCAN LAKES
RECREATION COMPLEX, 1965

Distance Zone	User Days in Zone	Total Population in Zone	Oklahoma Population in Zone	Per Capita User Days in Zone	Per Capita User Days For Oklahoma Portion of Zone
<u>Fishing</u>					
Zone 1	37,206.6	58,213	58,213	.63914	.63914
Zone 2	3,215.5	213,862	211,578	.01504	.01520
Zone 3	3,231.7	846,243	713,405	.00382	.00453
Zone 4	57.0	288,912	229,950	.00020	.00025
Zone 5	71.0	2,353,426	414,803	.00003	.00017
Zone 6	134.3	1,554,040	761,203	.00009	.00018
Zone 7	485.4				
<u>Water Skiing</u>					
Zone 1	24,290.0	58,213	58,213	.41726	.41726
Zone 2	1,511.6	213,862	211,578	.00707	.00714
Zone 3	1,891.8	846,243	713,405	.00223	.00265
Zone 4	0.0	288,912	229,950	.00000	.00000
Zone 5	25.3	2,353,426	414,803	.00001	.00006
Zone 6	75.8	1,554,040	761,203	.00005	.00010
Zone 7	132.6				
<u>Boating</u>					
Zone 1	14,244.4	58,213	58,213	.24435	.24435
Zone 2	1,527.8	213,862	211,578	.00719	.00727
Zone 3	1,337.6	846,243	713,405	.00158	.00187
Zone 4	0.0	288,912	229,950	.00000	.00000
Zone 5	8.0	2,353,426	414,803	.00000	.00002
Zone 6	10.0	1,554,040	761,203	.00001	.00001
Zone 7	170.2				

was found that the attendance from out-of-state was very small in comparison to that from in-state, even where the out-of-state portion of population was greater than the Oklahoma portion.

Per capita use falls greatly after the high intensity of use in the nearest zone for all recreation activities. This information should prove valuable to agencies involved in planning recreational use for resources similar to those in Stephens County.

The fact that some persons travel more than fifty miles to recreate at the Duncan complex is remarkable considering that numerous alternative recreation facilities exist, most of which have no user fees, that are as close or closer to their homes. This occurrence requires study of the competitive nature of the various alternative recreation areas that are available to the recreationists. The reasons why recreationists would travel further to the Duncan complex rather than to closer "free" areas needs to be analyzed.

Socio-Economic Characteristics of the Recreationists

Data on factors that may have an effect upon the recreational attendance of a given site are presented in this section. The extent to which these factors are found to influence recreational habits may be of use for persons and groups involved in planning future recreational developments.

Income

Income of recreationists is a major factor affecting participation of recreational activities. The usual use of the income factor is for predicting future attendance for selected types of recreational

activities. This study compared family incomes of the recreationists surveyed with family incomes of all the people in Oklahoma and all the people in Stephens County. The reason that both Stephens County and Oklahoma incomes were used for comparison with the data was to see if there was any major difference in the three sets of data. Stephens County was used for comparison purposes because the Lakes of Duncan all lie within its boundaries and the majority of the recreationists visiting the lakes reside in that county.

The family income distribution of all the families surveyed are presented in Table XI. The percentage distributions of family incomes for the state of Oklahoma and for Stephens County are also presented in this table. People with higher family incomes tend to visit the Duncan lake complex more than those with lower incomes. Almost 72 percent of those surveyed had a family income of \$5,000 or more. This compares with 37 percent of the family income above \$5,000 for the state and 50 percent for Stephens County.

In this study, people with lower incomes tend to fish and hunt more and water ski less than people with higher incomes (Table XII). Recreationists in the highest income group evidently did not come to the Duncan Lakes Complex just to water ski. Some obviously did water ski, but also fished as well (Table XII). Probably recreationists in the highest income group who only wanted to water ski would go to a larger State or Federal recreational area for that activity.

The quail hunters all came from the lower income levels. An explanation for this might be that persons from the higher income levels probably had private areas where they hunted and where the competition was not as keen for birds as on the public land around the lake complex.

TABLE XI

PERCENTAGE DISTRIBUTIONS OF FAMILY INCOMES OF THOSE SURVEYED FOR THIS STUDY COMPARED WITH DATA FOR THE STATE OF OKLAHOMA AND FOR STEPHENS COUNTY

Income Dollars	The Study	Oklahoma ^a	Stephens County ^a
		- Percent -	
Under 3,000	12.43	42.10	26.38
3,000-3,999	6.07	10.66	11.38
4,000-4,999	9.54	10.22	11.68
5,000-6,999	24.28	17.33	26.74
7,000-9,999	29.19	11.63	15.58
10,000-14,999	11.56	5.45	5.33
15,000 and over	6.94	2.60	2.91
Total	100.00	100.00	100.00

^aBureau of the Census, U. S. Dept. of Commerce, U. S. Census of Population for Oklahoma, General Social and Economic Characteristics, 1960, pp. 164 and 234.

TABLE XII

PERCENTAGE DISTRIBUTIONS OF FAMILY INCOMES OF RECREATIONISTS SURVEYED BY TYPE OF PERMIT PURCHASED, DUNCAN LAKES RECREATION COMPLEX, 1965

Income	Type of Permits Purchased				
	Fishing	Fishing W/Boat	Water Skiing	Water Skiing and Fishing	Quail Hunting
- Percent -					
Under 3,000	16.44	11.11	7.69	1.69	57.14
3,000-3,999	4.11	7.41	11.54	33.39	28.57
4,000-4,999	12.33	9.26	3.85	5.09	14.29
5,000-6,999	26.03	21.30	19.23	30.51	0.00
7,000-9,999	28.08	26.85	30.77	38.98	0.00
10,000-14,999	8.22	15.74	26.92	6.78	0.00
15,000 and over	4.79	8.33	0.00	13.56	0.00
Total	100.00	100.00	100.00	100.00	100.00

Age of Recreationists

Different age groups tend to have different rates of participation in various outdoor recreation activities. The ORRRC reports indicate that age has the greatest influence of all factors on participation rates. [5, p. 27] The older people get, the less they engage in active types of outdoor recreation such as water skiing, mountain climbing, and horseback riding. On the other hand, some outdoor activities seem to maintain fairly steady participation rates for people of all ages. The ORRRC reports indicate fishing, sightseeing, and driving for pleasure are examples of these latter activities. [5, p. 27]

Data obtained from the questionnaires concerning age in relation to the outdoor activities provided at the Lakes of Duncan appeared to concur with the conclusions reached by the ORRRC. The person who responded to the questionnaires in most cases was the head of the family and this was the age reported. Thus, the lower age groups were not reported, although children were included in most cases as members of the recreation party visiting the lakes. The percentage age distributions of those replying to the questionnaires by the category of permits they purchased are presented in Table XIII.

People participating in only fishing seem to be fairly evenly distributed in the age groupings above 25 years of age. Those in the lower ages either had their permits purchased for them by their parents or did not have to purchase permits because they were under 16 years of age.

Persons fishing from boats were concentrated in the 35 and older age groups with the 35-50 age group making up the bulk of these users. A similar distribution was found for water skiing except that the participation for the over 50 age group was much smaller. The low participation

TABLE XIII

PERCENTAGE DISTRIBUTIONS OF THE AGES OF RECREATIONISTS
 SURVEYED BY TYPE OF PERMIT PURCHASED, DUNCAN
 LAKES RECREATION COMPLEX, 1965

Age	The Study	Fishing	Fishing W/Boat	Skiing	Skiing and Fishing
			- percent -		
19 & under	1.73	2.74	.93	0	0
20-24	3.18	3.43	.93	7.69	5.08
25-29	7.81	11.64	3.70	11.54	5.08
30-34	7.23	8.22	3.70	0.00	13.56
35-39	13.87	11.64	12.04	26.92	18.64
40-44	14.16	12.32	11.11	11.54	27.12
45-49	17.34	13.70	21.30	23.08	16.95
50-54	9.54	7.54	12.04	15.38	8.47
55-59	9.25	9.59	12.96	3.85	3.39
60-64	7.80	10.57	9.25	0.00	0.00
65 & over	8.09	8.90	12.04	0.00	1.69
Total	100.00	100.00	100.00	100.00	100.00

rates of the lower age groups again was due to the head of the household answering the questionnaire in nearly all cases. Thus, the data for the 25 years and over groups were the most relevant for determining the role age plays in the participation in outdoor recreation activities.

Education

Data obtained from the questionnaires indicated that persons with more education participate in outdoor recreation activities where fees are charged more than those with less education (Table XIV). Approximately 78 percent of those who purchased permits at the lakes had completed high school. However, only about 40 percent of the population of Stephens County and of the white population of the state had finished high school or further forward schooling.

TABLE XIV

PERCENTAGE DISTRIBUTIONS OF THE EDUCATION OF RECREATIONISTS
 SURVEYED FOR THIS STUDY COMPARED WITH DATA FOR THE
 STATE OF OKLAHOMA AND FOR STEPHENS COUNTY

Education Attainment	The Study	Oklahoma ^a	Stephens County ^b
	- Percent -		
7th Grade or Less	2.02	15.11	14.34
7th to 8th Grade	10.12	24.86	23.27
9th to 11th Grade	10.12	18.08	21.96
Completed High School	34.10	23.69	25.55
1 to 3 years of College	28.32	10.08	8.35
4 or more Years of College	<u>15.32</u>	<u>8.18</u>	<u>6.53</u>
Total	100.00	100.00	100.00

^a Bureau of the Census, U. S. Department of Commerce, U. S. Census of Population for 1960, Oklahoma General Social and Economic Characteristics, Table 47, p. 149.

^b W. Nelson Peach, Richard W. Poole and James D. Tarver, County Building Block Data for Regional Analysis; Oklahoma State University Research Foundation, March, 1965, p. 493.

The educational attainment of recreationists participating in water skiing is higher than that for fishing. (Table XV). Over 90 percent of the water skiers had a high school education or above. Thus, the level of education appears to have a significant effect on the participation in both fishing and water skiing.

The effects of each of the socio-economic variables on participation in the outdoor recreation activities provided at the Duncan lakes complex imply that these characteristics should be considered in recreation planning. If persons with low income levels and low educational attainments do not participate in recreational activities to the same extent as persons with higher incomes and education, planning agencies should take this into consideration in locating and developing facilities.

TABLE XV
 PERCENTAGE DISTRIBUTIONS OF THE EDUCATION OF RECREATIONISTS SURVEYED BY
 TYPE OF PERMIT PURCHASED, DUNCAN LAKES RECREATION COMPLEX, 1965

Educational Attainment	Fishing	Fishing W/Boat	Water Skiing	Skiing & Fishing
6th grade or less	2.74	1.85	0	1.69
7th or 8th Grade	13.02	12.04	3.85	0.00
9th or 11th Grade	9.59	12.04	3.85	8.48
Completed High School	30.82	33.33	38.46	40.68
1 to 3 years of College	26.71	26.85	38.46	33.90
4 or more years of College	<u>17.12</u>	<u>13.89</u>	<u>15.38</u>	<u>15.25</u>
Total	100.00	100.00	100.00	100.00

Recreational facilities could be planned so that they would more nearly suit the population that would use the facilities. This planning would apply to both public and private facilities.

Summary

A large proportion of the recreationists using the Duncan Lakes Recreational Complex travel less than 75 miles to do so. Over 98 percent of the recreationists live less than 75 miles from the lakes and over 80 percent live within 25 miles. Thus, it is apparent that these recreational facilities attract mostly local recreationists.

The recreational use of the Duncan Lakes Complex on a per capita basis also indicates that the bulk of the recreationists reside fairly close to the lakes. The combined number of user days per capita for fishing, water skiing and boating was 1.3 for persons living within 25 miles of the complex. The user days per capita decreased considerably for the next two zones; .03 user days per capita for Zone 2 and .01 user days per capita for Zone 3.

The socio-economic characteristics of the recreationists using the Duncan recreational complex were found to be different from those for all citizens of the state of Oklahoma. Over 72 percent of the recreationists surveyed had a family income of \$5,000 or more, while only 37 percent of the family incomes in the state are this high. It was also found that 78 percent of the recreationists surveyed had completed high school as compared with 40 percent for the state. Therefore, it appears that the recreationists using the Duncan Lakes Complex have higher income and educational levels than is common for the state.

Much of the data presented in this chapter were used in the demand analysis which follows in the next chapter. For example, the data relating to the number of user days of the recreation activities by zones is particularly relevant.

CHAPTER V

ESTIMATION OF THE DEMAND FOR SELECTED RECREATIONAL ACTIVITIES

The Demand for Recreation

The quantity of recreation demanded by an individual will depend upon the price he must pay, his income level, and the prices of alternative recreational pursuits. At a given income level and with prices of alternatives constant, there likely would be a downward sloping schedule of alternative price-quantity combinations consistent with his behavior.

Prior to participating in the recreational experience at the Duncan Lakes complex, each participant must have evaluated his expected satisfaction and the expected prices or costs, given his income restraint. His participation in the particular recreational activity is evidence that expected returns in terms of satisfaction from it were greater than expected costs. Presumably, participation at a price (cost) may be interpreted as a point on an individual's demand schedule.

The delineation of the demand schedule for each participant would require additional evidence. Alternative price-quantity combinations selected when the income level and prices of alternatives were held constant would be required. Opinions of participants as to expected participation at alternative prices could provide estimates, but there

would be uncertainty associated with actual decisions matching opinions on probable actions.

The demand schedule for a representative participant could be estimated under certain assumptions concerning the participants. The first assumption concerns tastes and preferences. If it could be assumed that all participants in a recreational activity such as fishing had the same tastes and preferences with respect to this activity, the existence of different prices (or costs) for individual participants would result in a series of alternative price-quantity combinations on the same demand schedule.

The second assumption concerns the level of income. It is obvious that not all participants have the same income. However, participants within a given income level may also have different costs which would result in a series of alternative price-quantity combinations on a demand schedule for participants with a given income level. A representative demand schedule based on all participants would require the assumption that the average income is about the same for any particular price-quantity combination.

The third assumption concerns the prices of alternatives for the recreational activity. A representative demand schedule based on all participants would require the assumption that the prices of alternatives are about the same for any particular price-quantity combination on the representative demand schedule.

A representative or average individual demand schedule was estimated from the price-quantity combinations for each participant under the assumptions of: (1) homogeneous tastes and preferences of participants; (2) approximately the same income level for each level of

participation; (3) approximately the same prices of alternatives for each level of participation; and (4) different cost or supply conditions for participants at the Duncan Lake complex. The price or cost of participation was used as the dependent variable. The number of user days of the recreational activity was used as the independent variable.

The choice of price for the dependent variable and quantity for the independent variable was arbitrary. However, the price or cost variable used in this study involved both fixed and variable elements which resulted in costs which were dependent on the level of participation. The variable costs for an individual participant at a given location were assumed to be the same per user day regardless of the quantity of recreation taken from the Duncan Lake complex during the year. The fixed costs, on the other hand, would be constant in total dollars, but average fixed costs per day would decrease as the number of user days of the recreational activity increased. The influence of the level of participation on average fixed costs and on the average total costs was the most important reason for selecting quantity as the independent variable.

Individual and Market Demand Curves

Using linear regression analysis, several forms of equations were tested to determine the one that provided the best fit for the empirical data. An exponential equation of the general form $Y = AX^b$ was found to be the most satisfactory for the fishing and water skiing activities. This equation was converted to natural 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.

Individual Demand Curves for Fishing and Water Skiing

The estimated equation for the representative demand schedule for fishing, using cost per user day (P) as the dependent variable and the annual number of user days of fishing (Q) as the independent variable, was:

$$\ln P = 2.54607 - .37539 \ln Q \quad 1.1$$

In exponential form the equation was:

$$P = 12.757 Q^{-.37539} \quad 1.2$$

The coefficient of determination (R^2) for equation 1.1 was .3984 and $S^2_b = .02628$. The means were $\bar{P} = \$5.04$ per user day and $\bar{Q} = 11.91$ user days participation per year. The equation is presented graphically in Figure 4.

Estimates were also obtained for regression equations using quantity as the dependent variable and price or cost as the independent variables. The equations obtained for each activity are presented in Appendix C.

The representative individual demand curve for water skiing was obtained in the same way as for the fishing activity. The estimated equation using cost per user day as the dependent variable and user days per year as the independent variable was:

$$P = 22.468 Q^{-.40728} \quad 1.3$$

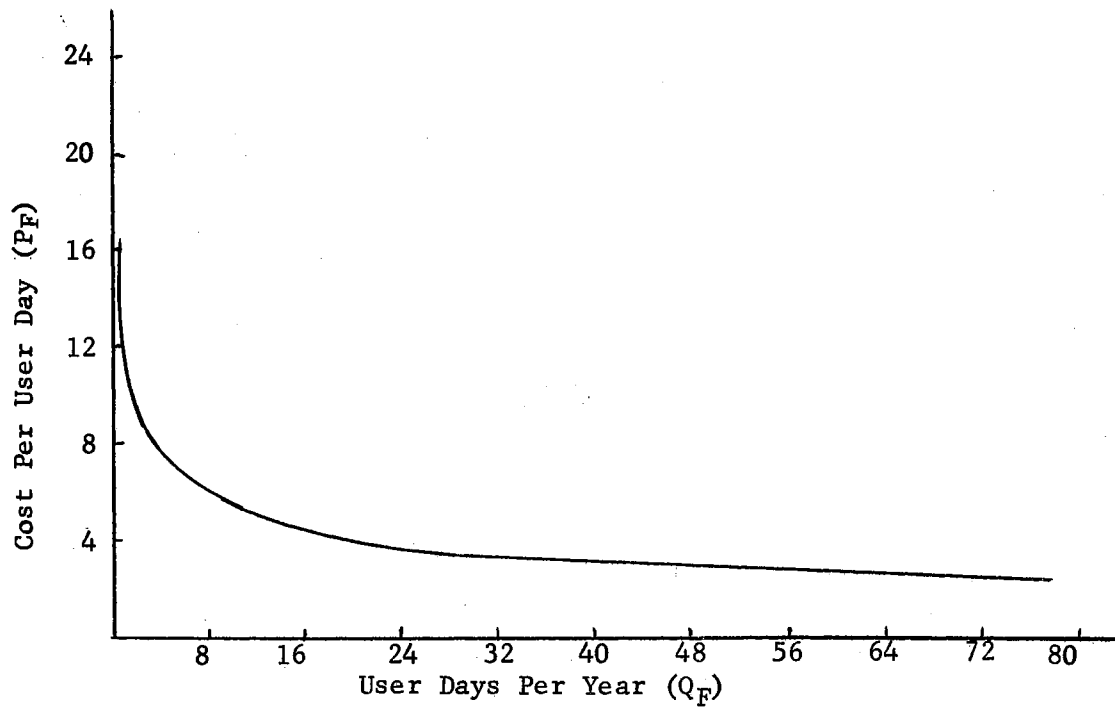


Figure 4. Average Individual Demand Curve for Fishing

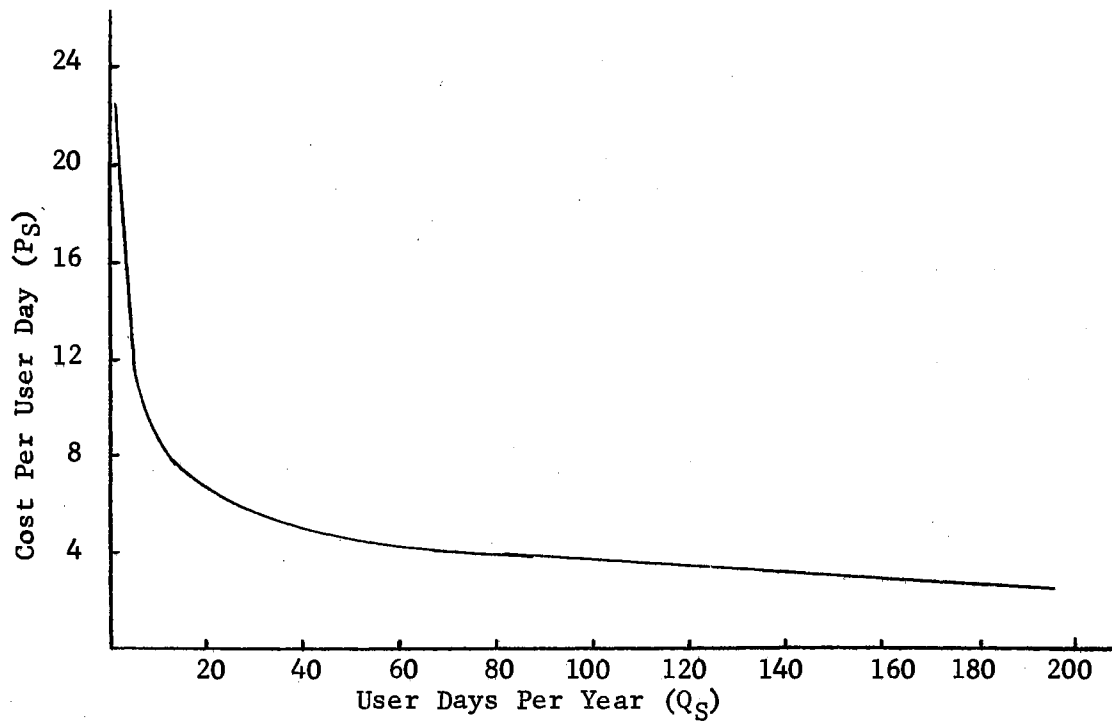


Figure 5. Average Individual Demand Curve for Water Skiing

The coefficient of determination for the equation was $R^2 = .4486$ and the standard error was $S_{\hat{Q}} = .04986$. The means were: $\bar{P} = \$4.80$ and $\bar{Q} = 44.2$. On the average, over six persons use a ski boat during each occasion. Thus, the 44.2 user days of water skiing actually represents approximately 7 occasions per year. Equation 1.3 is presented graphically in Figure 5.

Exponential equations of the form used in the analysis have a constant price flexibility equal to the value of the exponent. Since the inverse of the price flexibility is an estimate of the price elasticity, the form of the equations was changed to reflect the elasticities of demand with respect to price. Equation 1.4 based on equation 1.2, and equation 1.5 based on equation 1.3 are as follows:

$$Q = 882.25 P^{-2.6639} \quad 1.4$$

$$Q = 2082 P^{-2.4553} \quad 1.5$$

The estimated elasticity of demand with respect to price for the individual demand curves were -2.6639 for fishing and -2.4553 for water skiing. Both of these estimates are fairly elastic and are considerably higher than the approximately unitary elasticity estimates obtained for the quantity dependent equations.

Market Demand Curves For Fishing and Water Skiing

The aggregation of individual demand curves into a market demand curve involved estimates of the number of individuals that constituted the market. The present study had an advantage in this respect because the total sales of the various categories of permits was known as a result of the tabulation of the permit receipt books. The market demand

curve was estimated by multiplying the respective quantities of each price on the average individual demand curve by the total number of individuals involved in the recreational activity.

The total number of individuals that made up the market for a given activity at the Duncan Lakes complex was determined from the permit sales for that activity. Each season permit represented one individual or group and the individuals associated with these permits were totaled. The procedure for daily permits was more involved. The estimation of the number of individuals purchasing daily permits required: (1) an estimate of the number of times recreationists from each of the travel zones would, on the average, purchase a daily fishing permit during the year; and (2) total sales of daily permits by zones. Dividing the total sales of daily permits for each travel zone by the average number of times purchased during the year and summing over zones gave an estimate of the number of individuals purchasing daily permits for that activity. The following formula is a summary of this estimation procedure:

$$\begin{array}{l} \text{Number of Individuals} \\ \text{in the Market for the} \\ \text{Recreational Activity} \end{array} = \sum_{i=1}^7 \text{Season Permits}_i + \sum_{i=1}^7 \frac{\text{Daily Permit Sales}_i}{\text{Mean Number of Permits Purchased by an Individual}_i}$$

Using this technique, the number of individuals participating in the fishing and water skiing activities was estimated for 1965 and the results are presented in Tables XVI and XVII respectively.

There were 2,493 individuals participating in the fishing activity and 430 individuals participating in water skiing. The expansion of the average individual demand equations for fishing and water skiing

TABLE XVI

TOTAL NUMBER OF DIFFERENT RECREATIONISTS FISHING AT THE
DUNCAN LAKES RECREATION COMPLEX, 1965

Residence Zone	Average Number of Daily Permits Purchased	Total Number of Daily Permits Sold	Number of Individuals Purchasing Daily Permits	Total Number of Season Permits Sold	Total Individuals From Zone
1	10.3	8,149	793	671	1,464
2	6.5	1,658	254	38	292
3	3.5	1,940	548	31	579
4	3.5	57	16	--	16
5	3.5	71	20	--	20
6	2.0	53	27	3	30
7	3.7	328	<u>88</u>	<u>4</u>	<u>92</u>
Total			1,746	747	2,493

TABLE XVII

TOTAL NUMBER RECREATIONISTS WATER SKIING AT THE
DUNCAN LAKES RECREATION COMPLEX, 1965

Residence Zone	Average Number of Daily Permits Purchased	Total Number of Daily Permits Sold	Number of Individuals Purchasing Daily Permits	Total Number of Season Permits Sold	Total Individuals From Zone
1	6.0	782	130	158	288
2	2.2	123	57	6	63
3	4.0	222	56	4	60
4-7	2.0	37	19	<u>0</u>	<u>19</u>
Total				168	430

(equations 1.2 and 1.3) by the respective number of individuals participating in the activities provided estimates of the market demand equations. The market demand curve for fishing (equation 2.1) and the market demand curve for water skiing (equation 2.2) are as follows:

$$P = 240.25 Q^{-.37539} \quad 2.1$$

$$P = 9,643.3 Q^{-.40728} \quad 2.2$$

Equation 2.1 is presented graphically in Figure 6 and equation 2.2 is presented in Figure 7.

Four points appear on each of the two figures (Figure 6 and 7). These points represent alternative estimates of points on the market demand curve. Each point represents the total number of user days of an activity participated in by recreationists from a particular travel zone and the mean cost per user day as reported in Table XVIII.

TABLE XVIII

AVERAGE COST PER USER DAY AND TOTAL USER DAYS
BY ZONES, DUNCAN LAKES RECREATION COMPLEX, 1965

Travel Zone	Fishing		Water Skiing	
	Average Cost Per User Day Dollars	Number of User Days	Average Cost Per User Day Dollars	Number of User Days
1	\$4.87	37,207	\$4.27	24,290
2	8.71	3,215	5.95	1,512
3	10.43	3,232	6.05	1,892
4-7	17.38	748	22.72	234

The four points lie fairly close to the estimated market demand curve for the fishing activity and with the exception of zones 2 and 3 the four points are close to the market demand curve for water skiing. The

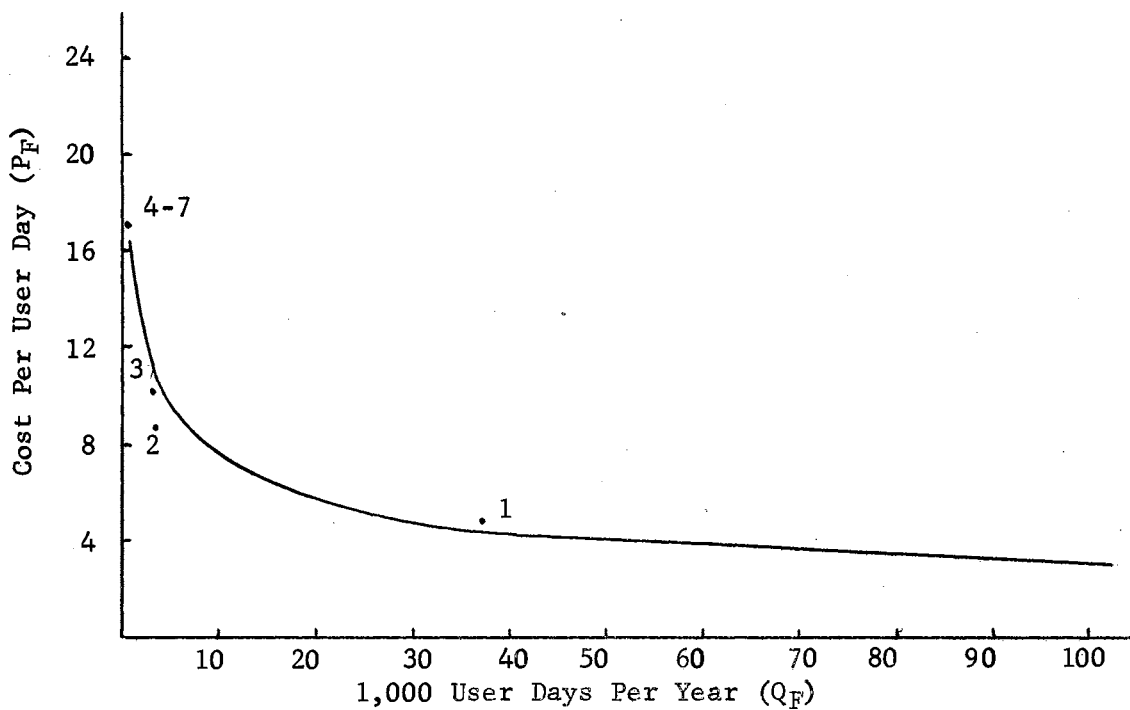


Figure 6. Market Demand Curve for Fishing

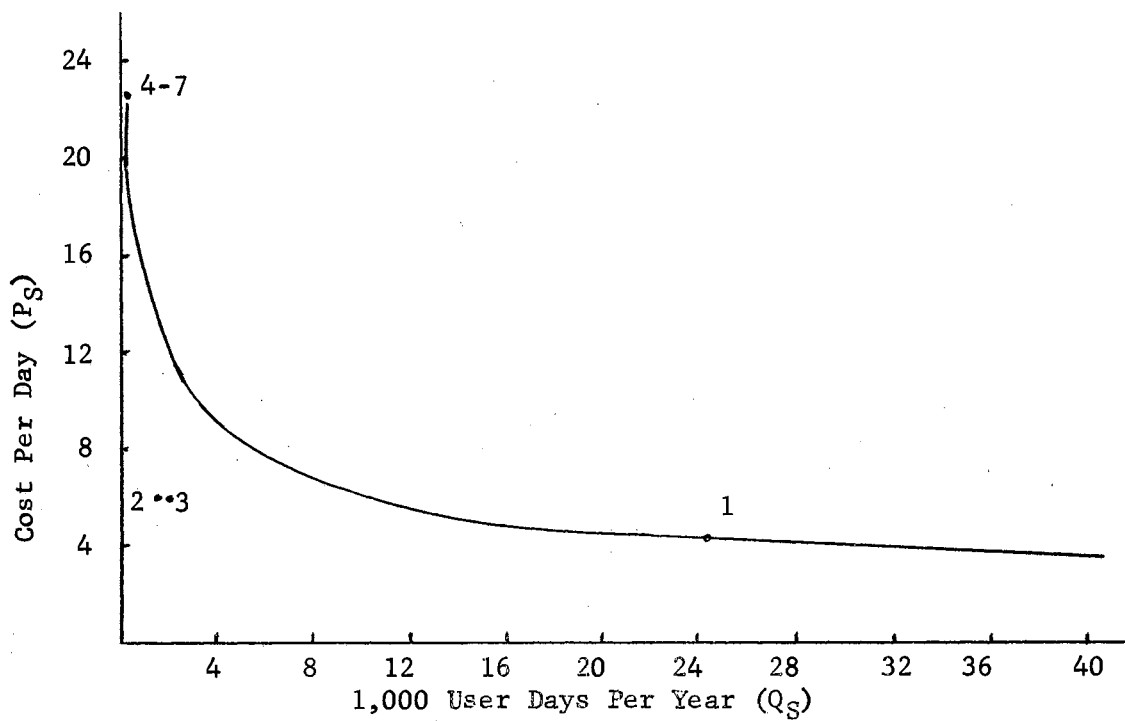


Figure 7. Market Demand Curve for Water Skiing

fact that these points were determined in a different way supports the judgement that a market demand curve could be estimated from the individual demand schedule approach adopted in this study.

Estimation of Recreation Benefits From Demand Curves

Several methods were discussed in Chapter II for determining the benefits accruing to recreationists. This section presents estimates of benefits obtained by using some of those methods.

Monopoly Revenue Method

The demand curves obtained for both the fishing and water skiing activities have constant elasticities of demand which are greater than unity. Those results imply that total revenue would always increase as the number of user days of recreation increases. From the standpoint of the city of Duncan, the demand curves may be assumed to be those faced by a monopolist. With this assumption, benefits may be determined which are equal to the total revenue a monopolist would receive if he were the producer of the recreation opportunities at the Duncan lakes complex.

A monopolist with the objective of profit maximization would take into consideration both costs and revenue. In any given year, the costs of providing the recreational facilities are essentially fixed. Construction costs already have been incurred; labor costs are approximately the same regardless of attendance at the lakes; and cleanup and maintenance costs do not increase proportionately with attendance. Therefore, marginal costs would be approximately zero. Assuming sufficient demand in the area to utilize the lakes, the major limiting

factor on recreational attendance at the lakes would be the capacity of the lakes. Total revenue would be maximum at this point.

The attendance in 1960 was used as the capacity of the lakes. This year represented the first full year that the three lakes were open to the public, and with the exception of 1959 when Lake Humphrey was opened, was the year of greatest receipts. The permit sales for 1960 were converted to user days in the same manner as used for 1965 permit sales. With this procedure the capacities for fishing and water skiing were obtained. The fishing capacity was estimated at approximately 65,000 user days and the water skiing capacity was estimated at approximately 35,000 user days. These capacities were applied to the market demand curves to determine the prices that would be expected at the respective number of user days. The estimates of annual benefits were obtained by multiplying the estimated prices times the capacity number of user days. These estimates are presented in Table XIX.

In addition, for comparison purposes, the benefit evaluation approach currently used by the Soil Conservation Service was applied to the capacity user days of each activity [11, Chap. 9, p. 4]. In this approach a single unit value was assigned to each user day of recreation expected at the lakes. Since, the Soil Conservation Service assigns a single unit value of \$1.50 to fully developed facilities such as those provided at the Duncan lakes complex, a value of \$1.50 was used. The estimates of benefits by this method are also presented in Table XIX.

The estimates of benefits by the Monopoly Revenue Method were twice as large as those estimated by the Single Unit Value approach. This

was expected because the prices used for the Monopoly Revenue Method were more than twice the unit values used.

TABLE XIX

ESTIMATION OF RECREATIONAL BENEFITS FOR FISHING AND WATER SKIING USING THE MONOPOLY REVENUE METHOD AND THE SINGLE UNIT VALUE METHOD

Recreation Activity	Capacity Quantity (User Days)	Monopoly Revenue Method		Single Unit Value Method ^a	
		Price per User Day - Dollars -	Benefits	Unit Value - Dollars -	Benefits
Fishing	65,000	3.75	243,802	1.50	97,500
Water Skiing	35,000	3.74	<u>130,970</u>	1.50	<u>52,500</u>
Total Benefits for Both Activities			374,772		150,000

^aSCS uses interim values to apply equally to all types of recreation. A unit value is assigned to each user day of recreation expected at the recreation facility. A unit value of \$1.50 is suggested for fully developed recreational facilities [11, Chap. 9, p. 4].

The major advantages of these two approaches are their simplicity. The Single Unit Value, as used in this section, takes into consideration the quality of the recreational facilities and considers supply limitations such as capacity. However, it does not consider the demand for the recreational facilities which is a major weakness of the approach.

The Monopoly Revenue Method of benefit estimation does consider the supply limitations and does take into account the price per user day that recreationists have indicated they are willing to pay for that number of user days of the respective activities. But, this method does not take into consideration the differences in the number of user days and prices per user day of recreationists from different residence zones.

Thus, both of these methods have weaknesses but they are useful as benchmarks for comparison with estimates of benefits obtained by other methods.

Consumer's Surplus Methods

Several alternative ways of estimating consumer's surplus from demand curves for the selected outdoor recreational activities were considered. Each of these alternatives rested upon the basic idea that consumer's surplus can be measured by the area under the demand schedule and for the activity.

One major difference in the alternatives depended on whether the "average" individual demand curve was used or whether the aggregate market demand curve was used. Another difference in the alternatives depended on whether a single measure of consumer's surplus was used for all travel zones or whether consumer's surplus was estimated for each zone separately. A third difference was whether the average prices obtained from the questionnaire data for the respective zones were used in the computation of consumer's surplus or whether estimated prices from the demand schedule corresponding to the estimated user days of recreation for the zones was used.

These various alternative ways of estimating consumer's surplus are considered in the following two sections. The first section is devoted to the estimation of consumer's surplus from market demand curves for the recreational activities. The second section estimates consumer's surplus from the "average" individual demand curves.

Consumer's Surplus Estimates from
Market Demand Curves

Consumer's surplus was first estimated from the market demand curves using the average costs per user day as presented in Table XVIII. The procedure was to estimate the consumer's surplus between the average price paid by recreationists of one distance zone and the average price paid by the recreationists from the next zone. This estimate constitutes the benefits (consumer's surplus) for the closer zone. By determining the benefits for each zone, the total consumer's surplus for a given activity was obtained. In general, the procedure involved converting the market demand equations from the $P = AQ^b$ form to the form

$Q = A^{-\frac{1}{b}} P^{\frac{1}{b}}$. Then, the integral of the converted equations was computed as follows:

$$\int_a^b A^{-\frac{1}{b}} P^{\frac{1}{b}} dP$$

where a = average price per user day for the recreation activity for the closer residence zone

and b = average price per user day for the recreation activity for the next closer resident zone.

The consumer's surplus for the closer zone was found by determining

$$\frac{bA^{-\frac{1}{b}}}{1+b} P^{\frac{1}{b} + 1} \Big|_a^b$$

the area between these two prices. The resulting estimates of consumer's surplus for fishing and water skiing are presented in Table XXI. This method is denoted as Method 1 in the table.

In the previous application of the consumer's surplus principle, the average prices paid by recreationists from the various residence

zones as determined from the questionnaires were used. An alternative approach was to use the quantities of user days of a given activity for a given residence zone to determine the price that would be paid per user day based on the market demand curve. The quantities of user days and the resulting prices for fishing and water skiing are presented in Table XX.

TABLE XX

USER DAYS AND ASSOCIATED PRICES ON THE DEMAND SCHEDULES FOR FISHING AND WATER SKIING AT THE DUNCAN LAKES RECREATION COMPLEX, 1965

Residence Zone	Fishing		Water Skiing	
	User Days	Cost Per User Day Dollars	User Day	Cost Per User Day Dollars
1	37,207	3.75	24,290	4.34
2	3,215	11.60	1,512	13.45
3	3,232	11.57	1,892	12.28
4-7	748	20.04	238	28.81

The estimates of consumer's surplus using the prices in Table XX and the same procedure as for Method I are presented in Table XXI as Method 2.

There are two assumptions that are required when using the market demand curves to estimate consumer's surplus from several prices as in Methods 1 and 2. The first assumption is that the consumer's surplus estimate obtained between two prices is associated with a price change and not a zone change. The second assumption is that at each price, all the recreationists are assumed to be confronted by it. For example, the average price for zones 4-7 is arbitrarily assumed to be the maximum price. Thus, no consumer's surplus was estimated for it. But, the

price for zone 3 is assumed to be faced by all recreationists, and the consumer's surplus associated with this change in price (from the zone 4-7 price to the zone 3 price) represents the addition to consumer's surplus because of the price change. Therefore, these two methods (1 and 2) provide estimates of the addition to consumer's surplus as a result of price changes instead of direct estimates of the consumer's surplus for each zone.

TABLE XXI

CONSUMER'S SURPLUS ESTIMATION OF RECREATIONAL BENEFITS FROM
MARKET DEMAND CURVES FOR FISHING AND WATER SKIING AT
THE DUNCAN LAKES RECREATION COMPLEX, 1965

Residence Zone	Method 1		Method 2	
	Fishing	Water Skiing	Fishing	Water Skiing
	- Dollars -			
1	58,278	28,435	81,010	58,494
2	9,900	1,099	-79	-1,986
3	15,280	26,992	13,471	11,350
4-7	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Subtotals	83,458	56,526	94,402	67,858
Total for Both Activities	139,984		162,260	

Method 2 resulted in higher estimates of consumer's surplus for both activities than did Method 1. But, the estimates for travel zones 2 and 3 were higher from Method 1 than those from Method 2. In cases where the average prices may be available for various distance zones but the number of user days may be unavailable, Method 1 could be used. Method 2 would be used if the number of user days from various distance zones were known and costs per user days were not known.

Consumer's Surplus Estimates From Average
Individual Demand Curves

Consumer's surplus estimates were also obtained from the average individual demand curves. The procedure used was somewhat different from that employed for the benefit estimation from market demand curves. Consumer's surplus was estimated as the area under the demand schedule between the average prices per user day for the respective travel zones and the maximum price per user day (the weighted price for Zones (4-7) is considered to be the maximum price). Thus, for each residence zone there was an estimate of consumer's surplus for an average resident from that zone. Multiplying these average individual estimates of consumer's surplus by the number of individuals using the lake complex, the total consumer's surplus for the zone for the activity was obtained. These estimates of consumer's surplus are presented in Table XXII under Method 3.

An alternative approach was employed which used the area under the average individual demand curve between the mean price per user day paid by all recreationists engaging in the activity and the maximum price per user day. This provides one estimate of consumer's surplus for all recreationists participating in the recreational activity at the lake complex. Multiplying this estimate by the number of individuals from the respective zones recreating at the lake complex provides the total estimate of consumer's surplus for the zones. These estimates are presented in Table XXII under Method 4.

Method 3 estimates of benefits were smaller than Method 4 estimates for all zones except the first for both recreational activities. Method 3 also had the smallest total benefit estimates for both activities.

TABLE XXII

CONSUMER'S SURPLUS ESTIMATES OF RECREATIONAL BENEFITS FROM AVERAGE
INDIVIDUAL DEMAND CURVES FOR FISHING AND WATER SKIING
AT THE DUNCAN LAKES RECREATION COMPLEX, 1965

Zone	Number of Individuals	Method 3		Method 4	
		Individual Consumer's Surplus	Zones Consumer's Surplus	Individual Consumer's Surplus	Zone's Total Consumer's Surplus
		- Dollars -		- Dollars -	
Fishing					
1	1,468	33.47	48,998	31.27	45,770
2	292	9.88	2,888	31.27	9,136
3	579	6.14	3,549	31.27	18,088
4-7	158	0	<u>0</u>	31.27	<u>4,958</u>
Subtotal			55,435		77,947
Water Skiing					
1	288	131.70	37,930	104.55	30,110
2	63	54.45	4,123	104.55	6,587
3	60	62.89	3,773	104.55	6,273
4-7	19	0	<u>0</u>	104.55	<u>1,986</u>
			45,826		45,956
Total for Both Activites			101,261		123,903

Effects of Changes in User Fees On Recreation
Attendance and Revenue

The effects of raising or lowering of user fees and the resulting attendance were estimated from the demand curves obtained for fishing and water skiing. The user fees are only a small portion of the total costs per user day of a recreation activity. Thus, an implicit assumption that had to be made was that the recreationist would view the change in the user fee rationally. This implies that he would react in a similar

manner to an increase or decrease in the user fee as he would to a change in any of the other costs that were incurred for the day of recreation.

The average costs per user day for each of the distance zones for fishing was used as the current price for that zone. The daily user fee for fishing was 50 cents. Persons purchasing season fishing permits may have used their permits enough times to decrease their user day permit costs below this amount. But for this analysis, it was assumed that all fishing permits were of the daily variety. The daily user fees were varied from a \$.25 increase to a \$.25 decrease. The number of user days attendance from each of the travel zones were computed for the new and existing prices, using equation 1.2, where price was the dependent variable. After the quantities associated with the various prices were determined, they were expanded to obtain the market quantities. The results of these computations are presented in Table XXIII.

Applying the total user days estimated to each of the three different user fee levels, the recreational revenue that the City of Duncan would expect at these rates was determined:

- 1) At the \$.25 fishing user fees, the income would be \$12,608.
- 2) At the \$.50 fishing user fees, the income would be \$22,325.
- 3) At the \$.75 fishing user fees, the income would be \$29,907.

It should be apparent that the city would not want to decrease user fees for fishing if it wanted to maintain its current level of receipts from the sale of fishing permits. Decreasing the user fee would decrease income from fishing permit sales. Alternatively the city could increase the fee and increase its income.

A similar analysis was used for water skiing. The average costs per user day of water skiing for each of the residence zones were used

TABLE XXIII

ESTIMATED ATTENDANCE FOR FISHING, UTILIZING THREE DIFFERENT
LEVELS OF DAILY FISHING USER FEES, DUNCAN LAKES
RECREATION COMPLEX, 1965

Travel Zone	Fishing Fee	Cost Per User Day	Average Individual Yearly Attendance	Annual Market Attendance
	- Dollars -		- User Days -	
1	.25	4.62	14.96	37,295
2	.25	8.46	2.99	7,454
3	.25	10.18	1.82	4,537
4-7	.25	17.13	.46	<u>1,147</u>
Total				50,433
1	.50	4.87	13.00	32,409
2	.50	8.71	2.76	6,881
3	.50	10.43	1.71	4,263
4-7	.50	17.38	.44	<u>1,097</u>
Total				44,650
1	.75	5.12	11.38	28,370
2	.75	8.96	2.56	6,382
3	.75	10.68	1.61	4,104
4-7	.75	17.63	.42	<u>1,047</u>
Total				39,903

to represent the current prices. These were also determined from the data obtained from the questionnaire. One slight difference in procedure was needed since slightly over six persons used each ski boat. Thus, by dividing the daily water skiing user fees used by this number of persons, the fee cost per user day was determined. The prices and attendance estimated at user fees of \$1.00, \$1.50 and \$2.00 are presented in Table XXIV.

TABLE XXIV

ESTIMATED ATTENDANCE FOR WATER SKIING, UTILIZING THREE DIFFERENT LEVELS OF DAILY WATER SKIING USER FEES, DUNCAN LAKES RECREATION COMPLEX, 1965

Travel Zone	Daily Water Skiing Fees	Cost Per User Day	Average Individual Yearly Attendance	Annual Market Attendance
	- Dollars -		- User Days -	
1	1.00	4.11	44.44	19,074
2	1.00	5.79	10.47	4,494
3	1.00	5.89	6.70	2,876
4-7	1.00	22.56	1.90	<u>815</u>
Total				27,259
1	1.50	4.27	42.69	18,322
2	1.50	5.95	10.24	4,395
3	1.50	6.05	6.58	2,824
4-7	1.50	22.72	1.88	<u>807</u>
Total				26,348
1	2.00	4.43	41.04	17,614
2	2.00	6.11	10.02	4,300
3	2.00	6.21	6.44	2,764
4-7	2.00	22.88	1.86	<u>798</u>
Total				25,476

The City of Duncan would receive the following amounts from the estimated user fees and attendance rates:

- 1) At \$1.00 per day for water skiing (fee cost per user day = \$.16), income would be \$4,316.
- 2) At \$1.50 per day for water skiing (fee cost per user day = \$.24), income would be \$6,258.
- 3) At \$2.00 per day for water skiing (fee cost per user day = \$.32), income would be \$8,068.

Identical conclusions could be drawn from this analysis for water skiing at that for fishing. A rate increase would increase income from water skiing permit sales to the City even with the reduced attendance.

Although the City may not want to increase the fees for these two activities, it is important that they be aware of the effect of fee changes. If the City wished to increase lake revenue to pay for additional recreational facilities, it could raise the fees as indicated in Tables XXIII and XXIV. This would increase revenue by \$7,582 for fishing, and \$1,870 for water skiing, for a total increase of \$9,452.

Summary

Demand schedules for a representative or average individual were estimated from the price-quantity combinations for each participant under the assumptions of: (1) homogeneous tastes and preferences of the participants; (2) approximately the same income level for each level of participation; (3) approximately the same prices of alternatives for each level of participation, and (4) different cost or supply conditions for participants at the Duncan lake complex. The price or cost of participation was used as the dependent variable and the number of user days of the recreational activity was used as the independent variable.

Linear regression analysis was used to estimate the demand curves for the fishing and water skiing activities. An exponential equation converted to natural logarithms provided the most satisfactory results. This permitted the use of linear regression techniques for nonlinear data and resulted in curvilinear demand curves. The estimated elasticity of demand with respect to price for the individual demand curves were

-2.6639 for fishing and -2.4553 for water skiing. Both of these estimates are fairly elastic.

Market demand curves were obtained for the two activities by estimating the number of individuals that constituted the market for each activity. The aggregation of this number of individual demand curves provided the estimate of the market demand curves.

The individual and market demand curves were used to test several methods of estimating the recreational benefits received by the recreationists for a specific recreational resource. The methods tested were: the monopoly revenue method; the single unit value method; and four consumer's surplus methods. The estimates of recreational benefits ranged from a high of \$375,000 for the monopoly revenue method to a low of \$101,000 for one of the consumer's surplus methods.

The consumer's surplus method denoted Method 3, which obtains estimates of recreational benefits from the individual demand curves, was considered to be the most workable method. This method allows for differences in consumer's surplus for residents from the various zones and also requires fewer simplifying assumptions than the methods which employed the market demand curves. The benefits estimated by Method 1 were the lowest obtained. But, the expected level of benefits was unknown and therefore, any of the estimates could be correct.

The average individual demand curves were also used to estimate the changes in attendance and the resulting changes in recreational revenue due to increases and decreases in fee levels. Although the demand elasticities were greater than unity for both activities, it was found that recreational revenue would increase by nearly \$10,000 when

fee levels were increased. Recreational revenue would decrease by a similar amount for fee decreases. The fact that user fees make up only a small portion of the total expenses of the recreationists was the reason that fee increases did not decrease recreational revenue.

CHAPTER VI

OUTDOOR RECREATION MANAGEMENT

The Duncan Lakes recreational complex differs from a privately owned recreational site in several ways. First, the complex does not have to be a profit making enterprise as would a private concern. Second, the citizens of Duncan have some influence on decisions made concerning the level of fees charged and the facilities provided at the lakes. This is because Duncan voters elect the officials who make these decisions concerning the recreational complex. Because of this reason the management decisions for the complex may differ in some instances from the way a private area would be managed.

A major difference between the municipal recreational facilities owned by the City of Duncan and comparable private facilities is the fact that recreation is only one of the uses of the Duncan lake complex. Other uses of the lakes include flood protection and municipal and industrial water supply. In most cases, these other uses take priority over recreational uses of the resources. The result is that lake levels fluctuate more than if recreation were the only use of the lakes.

Present management practices at the Duncan lakes complex as well as existing and potential problems of management are discussed in this chapter. Alternative actions that might be employed are advanced as possibilities for eliminating some of the problems. These alternatives are not the only ones that exist, nor are they advanced as being the

"best" alternatives. They are suggested merely as "possible" alternatives that might help to eliminate some of the problems affecting the operation of this or a similarly owned recreational complex.

Current Management Practices

Recreational planning and decision making involves council members and members of the Duncan Fish and Game Commission. The city manager is responsible for working with the above personnel and with the lakes' manager and his three assistants in implementing these decisions. The lakes' manager makes most of the every day decisions on his own. These include care and maintenance of several miles of roads and fences as well as fishing piers, picnic and camping areas, and other city owned lake improvements. In addition, the lake manager and his staff are responsible for mowing and keeping the grounds free from litter. They patrol the lakes to insure that only permit purchasers use the lake and maintain a fish hatchery to keep the lakes stocked with game fish. These men perform many other chores to maintain the recreational facilities at the lakes.

Decisions concerning the addition of new facilities and improvements at the lakes are approved by the City Manager. These additions may be suggested by the lakes' manager or they may originate with the City Council or Fish and Game Commission. In most cases, the lake staff will do the work needed to provide the additions. For certain tasks, other city employees and equipment are used to supplement the lake staff and their equipment. Work on the roads at the lakes is usually done by the city road crew. A member of the city police department helps in patrolling the lakes during the peak season.

An accounting of the city of Duncan's recreational costs and income will help in providing a basis for determining if the current management practices are adequate. The cost and income data were obtained for the years 1958 through 1965. This information was available on a fiscal year basis (July 1-June 30). The income data differ from those tabulated for this study in the following ways: (1) fiscal calendar year rather than years and (2) certain items of income that were included in the city figures were not included in the data tabulated by the researcher.

Recreation Income

Two categories of income from the recreational facilities at the lakes are listed in the city clerk's office. The first is hunting and fishing revenue. The second is lake income, which includes water skiing and boating permit revenue and lease income from cabin lots and concession rights.

Lake lots have been available for leasing on the three lakes in the Duncan complex since 1958. Presently, 204 out of 305 available lots are leased. This includes 147 of 161 lots on Lake Humphrey; 47 of 70 lots on Lake Clear Creek, and 10 of 74 lots on Lake Duncan. Until May 1, 1964 the lease fee for a cabin or cottage lot was \$10 per year. All lease contracts were set up for a primary term of ten years renewable annually.

Renewal of the contract depends upon the lessee fulfilling the following conditions: (1) the lessee must erect a cottage and not more than two necessary outbuildings on the site within one year of the date of the lease; (2) the cottage and outbuildings must be constructed according to plans submitted to and approved by the Duncan Fish and

Game Commission; (3) septic tanks and sanitary facilities must be constructed according to plans approved by the State Health Department; (4) the lake lot must be used for camping, recreational and residential purposes, and for no other purposes during the term of the lease; (5) no business of any kind can be conducted on the premises of the lot; and (6) the lessee must keep the premises of the lot in a strictly sanitary condition and free from rubbish or garbage.

If the lessee fails to fulfill any of the terms of the lease, the city has the right to terminate the lease after giving the lessee 60 days notice of the terms he has violated. If the lessee does not correct the violations in the 60 days, the lease can be terminated and the lessee is required to remove all improvements from the lot.

Unfortunately the above rules have not been enforced, and some lots and cabins have become a blight to the area in which located.

Any lessee whose initial ten year contract expired after May 1, 1964 must pay \$20 annually for the lot thereafter. New lot holders and purchasers of existing cabin sites after that date also had the lease fee raised to the higher figure. Thus, income from cabin site leases would be expected to increase in 1964 and 1965. The city clerk estimated that in 1966 approximately one-third of the leases were for \$20 and the remainder were for \$10.

There are several reasons why one-third of the lots were not leased in 1965. The large number of vacant lots at Lake Duncan is due to the fact that this lake is the least scenic of the three lakes studied. It is the oldest and smallest lake in the complex and has accumulated a large amount of silt during its lifetime. The lake level is usually quite low due to water pumped from it for the Sunray

D-X refinery. It also has the least amount of recreational improvement of any lake in the complex. Generally, the vacant lots on Clear Creek Lake and Lake Humphrey are those that have not been leased because they are less desirable, i.e., in less desirable locations generally. Most of the unleased lots do not have a clear view of the lake. A few of the lots would require large amounts of landscaping to make them suitable for a cabin.

The concession stands on the three lakes were constructed by the city of Duncan. Two of these, at Lake Clear Creek and Lake Humphrey, are leased to private individuals. The third, at Duncan Lake is operated by the family of the caretaker in charge of that lake under an arrangement with the city. The concessioner at Clear Creek pays \$15 per month for the concession rights while the concessioner at Lake Humphrey pays \$25 a month. Thus, the city receives \$480 yearly income from the two concessioners.

The fiscal year totals for fishing and hunting and for lake income are presented in Table XXV. As indicated earlier, revenue from the lakes has declined from the peak in 1959 because of the low lake levels.

Hunting and fishing income reached a maximum in 1959 and since then has decreased through 1966. Water skiing and boating permits were sold during 1958-1960 and cabin sites and concession rights were leased. It is evident that revenue from these sources were not separated prior to 1961 but combined with the hunting and fishing income. The trend for both categories of income since 1961 has been downward. Hunting and fishing income has declined due to decreasing participation in these activities. The lake income has declined because of decreasing participation in water skiing and boating. Concession and cabin site lease revenue has remained essentially constant from year to year. Very low

lake levels in 1965 and 1966 are blamed for the extremely low incomes from both categories during these years.

TABLE XXV

ANNUAL INCOME FROM RECREATIONAL ACTIVITIES AT THE DUNCAN
LAKES RECREATION COMPLEX, BY FISCAL YEARS, 1958-1966

Fiscal Year	Hunting and Fishing Income	Lake Income	Total
1958	\$20,266.42	\$ 26.25	\$20,292.67
1959	31,004.25	-	31,004.25
1960	24,877.56	-	24,877.56
1961	17,681.00	8,441.34	26,122.34
1962	14,716.50	7,919.40	22,635.90
1963	14,924.65	7,942.50	22,867.15
1964	14,982.25	7,059.35	22,041.60
1965	12,113.35	6,295.33	18,408.68
1966	9,970.29	5,186.25	15,156.54

Recreational Expenditures

Expenditures incurred by the City of Duncan for facilities related to outdoor recreation on the lakes were obtained from city records in the same form (fiscal years) as the income data. Expenses of the lakes are paid out of two types of funds: (1) the hunting and fishing fund which is made up of money collected from the sale of hunting and fishing permits and (2) a general lakes fund.

The hunting and fishing fund is used for construction, improvement and maintenance of all facilities related to hunting and fishing on the lakes. This includes roads, docks, concession costs, vehicle and

equipment costs used by the lake staff, and materials costs. The concessioner at each of the three lakes is paid \$81 per month for selling the lake permits, or a total of \$2,916 a year for this service.

Four full time employees on the lake staff are paid out of the general fund. In addition, some summer labor is hired and paid from this fund. Other expenses paid from this fund usually are for speciality items such as a city owned boat for patrolling the lakes.

TABLE XXVI

ANNUAL EXPENSES FOR THE DUNCAN LAKES RECREATION COMPLEX,
BY FISCAL YEARS, 1958-1966

Fiscal Year	Expenses Paid From Hunting & Fishing Fund	Expenses Paid From General Lakes Fund	Total
	(Dollars)		
1958	\$18,755.14	\$ 7,090.00	\$25,845.14
1959	27,011.40	6,947.50	33,958.90
1960	30,431.66	7,820.75	38,252.41
1961	17,480.06	13,266.75	30,746.81
1962	14,520.00	13,755.56	28,295.56
1963	11,809.49	17,748.85	29,558.34
1964	14,919.27	17,270.79	31,190.06
1965	12,981.00	16,858.00	29,839.00
1966	12,540.00	17,331.00	29,871.00

The outdoor recreation expenses incurred by the city exceeds revenue from permits sales and leases of outdoor recreational facilities. Hunting and fishing income have equaled expenses paid from the hunting and fishing fund on the average over the nine year period. But, the city has supplemented the difference between lake income and the

general lakes' expenses by an average of \$8,360 per year since 1958. Expenses paid from the general lakes' fund have exceeded the lakes income by \$75,241 over the nine year period. Expenses from the general lakes fund are mainly for wages and salaries. The city would have to incur some of these expenses even in the absence of outdoor recreation, since someone would be needed at each of the lakes to protect the City's interests in the reservoirs' other purposes, namely, municipal and industrial water supply. In addition, the city is also accumulating a sizeable amount of recreational assets at the lakes in return for the expenditures. These assets include homes for the caretakers, concession stands, boat docks, picnic facilities, several miles of roads and fences, etc.

Recreational Policy

The officials and citizens of Duncan are proud of the lakes and the recreational opportunities they provide. These lakes are an example of what a community can do when the citizens work together. Officials from other municipalities all over the state, as well as people from Federal and State agencies, have traveled to Duncan to observe the lakes and recreational facilities. Many other cities have followed Duncan's lead and are copying its efforts.

The city of Duncan appears to be maintaining a policy that will give its own citizens the maximum benefits from the recreational resources. The emphasis is not on maximizing revenue from permit sales, nor is it on maximizing attendance. This policy is apparent by the small amount of advertising that has been used by the city.

The city of Duncan did undertake a large promotional effort prior to the grand opening of Lake Humphrey. Signs were placed at strategic intersections. The newspapers, radio, and television helped to promote the new lake. As a result, the opening day permit sales were sufficient to pay for the elaborate concession stand that had been constructed at the lake.

Since then, the city has allowed the signs to deteriorate to the point that they are almost unreadable. A brochure has been printed that has a map and permit prices, but it could be more eye-appealing and more informative. And in all, the city seems to rely most heavily on word-of-mouth advertising to maintain attendance.

Initially, permits were sold by merchants in Duncan, in addition to selling them at the lakes and at the city hall. This policy was discontinued after several years due to bookkeeping problems and permits are presently sold only at the concession stands and at city hall. It is possible that this change in policy may have had some effect on attendance, but it would be difficult to say how much.

Recreational Problems of Policy and Management

Numerous problems confront the city of Duncan concerning outdoor recreation. Many of these problems were readily observable and others were pointed out by recreationists responding to the questionnaire. These problems may be categorized as follows:

1. Recreational goals.
2. Additional facilities.
3. Maintenance of facilities.
4. Publicity.
5. Seasonal attendance.

6. Fluctuating water levels.
7. Zoning.
8. Swimming policy.

These problems and some alternatives are discussed in the following subsections. Again, the author wishes to restate that these alternatives may not provide the optimum solution. Some steps do need to be taken to improve the recreational image of the complex. This will become increasingly important as newer recreational areas are opened and begin to attract current users of the Duncan recreational complex.

Recreational Goals

The city of Duncan's goals or objectives concerning outdoor recreation must be defined prior to a discussion of any other problems. Certain objectives minimize some of the problems to be discussed, and at the same time may increase the effects of other problems. As an example, it is assumed the city's objective is to maximize revenue from the sale of recreation permits, most of the problems mentioned above would be important and would require some action towards solution. If instead, the city's goals are to collect only enough revenue to meet operation and maintenance costs of the recreation complex, problems such as advertising assume only minor importance.

The citizens of Duncan were assumed to want reasonable recreation fees, nice facilities, and an uncrowded rate of attendance. The city of Duncan was assumed to be trying to collect sufficient revenue to meet current operation and maintenance expenses plus some surplus for improvement. The income and expenditures data for the Duncan lakes complex indicated that the assumed objective of the city had not been

attained in any year. This implies that some measures need to be taken for the city to increase its revenue from recreation. These measures should be such that they will minimize violations of the following assumed objectives of the citizens of Duncan:

1. The City of Duncan considers the best interests of its citizens for all decisions concerning the recreational uses of the lake complex.
2. The City of Duncan strives to collect sufficient recreational revenue to meet operation and maintenance costs plus some additional revenue for improvements.
3. The City of Duncan takes both of the above objectives into consideration when making its decisions concerning outdoor recreation and tries to reach a compromise that will satisfy both simultaneously.

Additional Facilities

Presently on the three older lakes (Lake Fuqua is excluded from this analysis) in the Duncan recreation complex, only one side of each lake is developed. This has been necessitated in part because the developed side of the lakes is also the side where the concession stands are located. The permits are sold at the concession stands and therefore facilities such as boat launching ramps, picnicking facilities and fishing piers have been built adjacent to the concession stand areas.

The other sides of these lakes need similar improvements as well as improved camping facilities (fireplaces, toilets, etc.) . More recreationists could be enticed to the currently unused areas around the lakes and attendance could thus be increased without overcrowding. These underdeveloped areas initially should have graveled roads parallel to the lakes approximately the same distance from the shore as the roads on the developed sides of the lakes. Then, graveled spur roads could

be constructed to points at selected intervals. Trash barrels, charcoal braziers, and picnic tables could be placed at these points. At one or two of the nicest spots on each lake, more facilities could be provided for larger group gatherings. In addition, one or more comfort stations could be situated at strategic intervals along each of these roads. Many campers, picnickers, and fishermen like to get away from the crowds to enjoy their outings. In time, if these areas prove popular, the roads might be paved and other improvements such as shelters and fishing piers could be added.

Maintenance of Facilities

Several complaints concerning general maintenance of the recreational facilities were given by questionnaire respondents. These complaints or suggestions for improvement included the need for continual repairs of fishing piers, docks and walk-ways, more frequent mowing of the lake front grass areas, and other types of general up-keep of the grounds and facilities.

The main problem is that the number of lake personnel is not sufficient to do all the needed maintenance during the peak-use summer season. At least one additional full-time man is needed, or else several high school and/or college students should be hired during the peak period in the summer. The City may have to find some way to increase the recreational income from the lakes to justify hiring the additional summer help.

The lake personnel do spend considerable time on maintenance of existing facilities as well as on construction of new facilities. In addition, they maintain a fish hatchery and patrol the lakes.

Publicity

Inadequate publicizing of the recreational resources at the Duncan lakes complex appears to be primarily one of lack of concern. Aside from a few weather-beaten signs, a brochure that is poorly distributed, and some newspaper articles from time to time, the major form of publicity is by word-of-mouth. More advertising is needed, if for nothing more, to direct new Duncan citizens to the lakes. The recreation complex is not identified on the official state highway map. Thus, potential recreationists have a very limited chance of discovering that the recreational complex exists.

The city of Duncan likely could increase the revenue from the recreation complex with a fairly small publicity expenditure. This publicity probably would increase attendance for both present and newly-developed facilities. The city could develop several types of publicity on a continuing basis. Permanent colorful signs could be placed at strategic points on U. S. 81 and State Highway 7 to direct and inform recreationists of the recreational opportunities at the Duncan lakes. A small colorful brochure giving pertinent information about the recreation activities offered at the lakes could be printed. The recreation complex should be depicted on the official state highway map and the local newspaper could publicize the lakes at least once a week. Other forms of publicity such as radio and TV spots could be used from time to time.

The construction of large signs to be located near the main highways at intersections leading to one or more of the lakes is very important. These signs could tell about the activities available and perhaps the costs for permits. They should be easily seen and well maintained.

Roads leading into the lake areas are routed on section roads and involve several changes in direction. Thus, additional signs giving directions to the various lakes in the complex should be placed at the places where the potential recreationist might become lost. These signs should be kept in good condition.

A small color brochure describing the recreational activities at the lakes, fees, directions to the lakes, and other promotional information could be designed and produced in large quantities. All hotels, motels, cafes, service stations and other places of business in the area could be encouraged to display these in a prominent place, such as near the cash register, so that any interested person could have one. The businesses could also be encouraged to keep these brochures displayed for distribution continually be replenishing their stocks as they run low. Businesses in nearby towns might also be asked to display the brochures.

The brochures would inform people passing through the area of the opportunities available at the recreation complex. They might not stop at the lakes on their first trip, but might do so on subsequent trips to the area. The businessmen should be well aware of the income potential resulting from increased numbers of recreationists to the area. Thus, it should be an easy matter to get these businesses to keep the brochures where they are available to interested persons. The city's main duty thereafter would be to keep replenishing the stocks of these brochures. A possible way to do this might be to enlist the help of the city police department and possibly the local game ranger. These men could stock the brochures during the course of their normal rounds.

A name should be selected for the recreational complex. Getting the State Highway Department to show the location on the official highway map probably could be accomplished. It is possible that a letter to the State Highway Department from the town council would be sufficient.

The local paper could help publicize the recreational complex by featuring pictures and write-ups of people catching nice strings of fish or obtaining their limit of quail or ducks during the hunting seasons. Also, feature articles about particularly outstanding facilities at the lakes would help. There are several nice year-round homes and some unusual cabins that would make an interesting pictorial story. The paper could feature one article a week about the lakes the year around.

There are numerous other ways in which the lakes can be publicized. The Chamber of Commerce could play a large role in these efforts. For example, they could sponsor events such as: (1) fishing contests at the lakes one or more times during the year; (2) boat races and boat shows; and (3) camping clinics at the lakes to provide tips on camping. Many other types of activities could be sponsored at the lakes that would increase its popularity. Examples are grade school and high school class picnics, family and class reunions, and Boy Scout activities. Easter sunrise services and Easter egg hunts would have a beautiful setting at the lakes.

In summary the lakes could be publicized in many ways. Most of the ways discussed would aid in increasing attendance. New facilities could be added to keep up with the growing popularity of the lakes.

Seasonal Attendance

The seasonality of attendance for various recreational activities creates certain problems. Provision of adequate facilities to meet the peak season's needs means that these facilities will be underutilized during the off season. Concessioners have adequate business during the peak season and often have to hire additional help during these periods. During the off-season they must stay open to serve only a few people. If this fluctuation in attendance could be smoothed somewhat, a better utilization of recreational facilities and resources could be achieved.

A possible way to smooth fluctuation in attendance might be to charge higher fees during peak use periods and lower fees during slack periods. This is recommended for daily permits only, with season permit prices remaining the same. Using the fishing activity as an example, the following fee charges might be used. The current daily fishing permit costs \$.50 per person. This could be called the regular or normal rate and it would apply to seasons where attendance is moderate. Another rate, called a peak rate of \$.75 per day, would be charged for periods of high attendance such as spring and summer weekends and holidays. Finally, a slack rate of \$.25 would be charged for periods of low attendance such as fall and winter week days. A similar procedure could be instigated for the other outdoor recreational activities. Even quail and duck hunting, which is already seasonal in nature, could have a higher daily charge for the first days of the season as well as for weekend hunting days.

These fee changes would probably increase revenue. It was shown in Chapter V that it is possible to increase recreational revenue to

to the city by raising the user fees (Tables XXI and XXII). Varying fees would be expected to increase revenue for this reason, and in addition for the reason that lower fees during low intensity use periods also increase revenue.

Fluctuating Water Levels

Due to the multiple uses of the reservoirs that make up the Duncan lake complex, the lake levels have fluctuated considerably. Municipal and industrial uses have priority over the recreational uses of the lakes. During years of below average rainfall, the lake levels often fall several feet below their normal levels due to the combination of negligible amounts of runoff in the watershed and use of the water by the city and refinery. The muddy shorelines and reduced surface area of the lakes tends to reduce attendance.

There is little that the city can do to eliminate the low lake levels during dry years. But, there are a few possibilities that might help in maintaining attendance. The lakes are interconnected by pipelines. The city could maintain one lake's level and pump water from the others to do this. Receding shorelines could be seeded with a plant species that would be more attractive than the exposed lake bottom as well as provide fish food when the lake level is raised from rainfall runoff. The shorelines could have moss, debris, and brush removed when the lake levels are down to provide a better appearance and probably better fishing.

Zoning

Certain activities should be separated or zoned from other activities. At present, some areas on Lake Clear Creek are off limits

to water skiing, but available for fishing. If swimming were provided at certain spots on the lakes, these should be separated from boating activities by ropes or buoys.

The problems of zoning that have been observed involve land uses. Camping and picnicking are presently on shore areas in front of cabins. This detracts from the cabin owners' facilities and causes other problems as well. There are no restroom facilities or camping or picnicking facilities between the cabin lots and the lake shore. As a result, the recreationists build makeshift outhouses near the lake shore and usually leave the area untidy when they leave. A proposed solution would be to zone the lakefront between the cabins and the shoreline to exclude camping and picnicking. If the lakes were zoned in this manner, the zoning should be enforced. The improvement of other areas around the lakes for picnicking and camping should provide sufficient additional areas for these activities during peak periods of use.

Another zoning problem relates to several dilapidated unsightly cabins and trashy, poorly-maintained lake lots which exist because the lot lease regulations have not been enforced. Some of the cabins are in a very rundown condition and will require a complete renovation to bring them up to an acceptable standard. Some of the lots have half finished cabins or unsightly piles of building materials on them. The city should enforce the conditions of the lease agreement by having the cabins finished within a year. If the lessee did not comply, the city should terminate the lease. This would allow other interested persons a chance to lease the lots and build a cabin.

Swimming Policy

The principal problem concerning recreation activities relates to swimming. Swimming is not allowed at any of the lakes in the recreation complex. Signs are posted which state that a \$20 fine will be imposed on persons swimming in the lakes. But, water skiing is allowed at two of the lakes and it is very hard to separate swimming from water skiing. The city enforces the 'no swimming' policy on Lake Humphrey where skiing is not allowed and on the other lakes when people swim too far out in the lakes. Otherwise, swimming is mostly condoned or ignored, even though officially illegal.

The swimming issue should be settled with a clear-cut policy. Realistically, water skiing and swimming are activities that are hard to separate. Most groups participating in the skiing activity include small children that have nothing to do but swim or play in the water. Also, since skiing is a taxing sport, swimming is a pleasant way to rest between trips behind the boat. In addition, many campers and picnickers who are non-skiers would probably like to swim during their outings. Many of the respondents to the questionnaire indicate a preference to having swimming areas added to the facilities at the lake complex.

A proposed solution to this problem might be to delineate several areas for swimming on Lake Clear Creek. These areas could be marked off by buoys and rope and would be used only for swimming. Persons swimming elsewhere would be fined. Clear Creek Lake is ideal for swimming because of its naturally sandy beaches and because it is the most popular skiing lake. Several spots on the lake are suitable for these swimming

areas. Picnic and camping facilities could be provided in conjunction with these swimming areas. This would solve the swimming controversy, and at the same time increase recreational attendance at the lakes.

Summary

The foregoing discussion of problems is based on personal observation, comments from the questionnaires, and conversations with users of the lakes' recreational facilities. Probably other problems have been overlooked. The proposed solutions are those of the author, and he is cognizant that some of the proposed solutions might create additional problems. These proposed solutions should be looked upon as a constructive effort to aid the city of Duncan with ideas and observations of an 'outsider' who has only their best interests in mind. Hopefully the comments in this chapter will be taken in this light and not as criticism of this forward-looking, progressive community that has done so well in the area of outdoor recreation.

CHAPTER VII

SUMMARY AND CONCLUSIONS

Summary

The general objective of the study was to estimate the demand for selected water-based recreational activities. Specific objectives were: (1) to apply appropriate economic models and methodological procedures applicable to recreation demand analysis; (2) to assemble primary and secondary data needed to estimate the demand for outdoor recreation; (3) to estimate the demand for selected recreational activities by persons using the facilities at the Duncan recreational complex; and (4) to analyze management problems of the municipally-owned recreational complex.

The need for the study arose from the increasing importance that has been given to the provision of outdoor recreational facilities in recent years by both public and private groups. Research techniques to determine the demand for, and economic benefits of, recreational resources are needed by these groups.

The Duncan Lakes recreation complex was selected as the study area: (1) because of the well-developed recreational facilities for which user fees have been charged for several years, and (2) because of the encouragement received from officials of the City of Duncan.

Attendance data were obtained from permit receipt books kept by the City of Duncan. Data relating to the expenditures incurred by recreationists for recreational purposes and to socio-economic characteristics

and recreational habits of the recreationists were obtained by use of questionnaires. Some additional data were obtained from secondary sources.

Several economic models had been proposed by researchers for estimating recreational benefits. Some of these models were tested to determine their feasibility as research tools for outdoor recreation. In addition, procedures were developed that were unique to the present study which should prove useful, with slight modification, for other outdoor recreation research.

Estimates of demand relationships for fishing and water skiing activities were an important part of the study. These estimates should be useful to public and private groups interested in the provision of outdoor recreational facilities. By using the techniques of demand estimation used in this study, these groups should be able to estimate the demand for various activities at other recreational sites.

The analysis of the management problems existing at the Duncan Lake complex and possible solutions to these problems should provide public and private groups with useful information applicable to most recreational areas. Knowing about these problems and their possible solutions should help these groups avoid them.

The Data Analysis

The categories of data analyzed were: (1) the lake attendance data; (2) permit sales to recreationists by zones; (3) the average annual use of season permits; (4) yearly totals of user days for each recreational activity; (5) per capita participation rates by activity by zone; and (6) analysis of socio-economic factors of recreationists. Much of this

analysis was simply a process of collection, tabulation and comparison with secondary data.

Over 80 percent of all recreationists using the recreational complex lived within 25 miles of the area, and over 98 percent live within 75 miles. This implies that most recreationists are not prone to travel more than 75 miles for recreational facilities of this type.

Per capita attendance by recreationists from the residence zones also emphasized that the local recreationists made up the bulk of the total attendance at the lakes. Participation per person per year from Zone 1 for the fishing, water skiing and boating activities combined was over 1.3 user days. This compares with .03 and .01 user days per person per year for these activities for residents from Zones 2 and 3, respectively. Per capita participation decreases to essentially zero for zones further than 75 miles from the lakes.

The income levels of recreationists using the Duncan lakes complex were considerably higher than those for Oklahoma and those for Stephens County. Almost 72 percent of the recreationists surveyed had family incomes of \$5,000 or more, while only 37 percent of the families in the state had incomes of this level. Education was another socio-economic characteristic of the recreationists that was found to influence recreational participation rates. Approximately 78 percent of those who purchased permits at the lakes had completed high school, while only 40 percent of the population of Oklahoma had attained this level.

The Demand Analysis

The purpose of the demand analysis was to estimate the schedule of price-quantity combinations that are typical for an average recreationist

engaging in selected recreational activities at the Duncan Lakes recreational complex. Once these demand schedules were determined, they were used to test several methods of benefit estimation. The recreational expenditures data and data relating to individual recreationists' participation in fishing and water skiing activities were used to estimate the demand curves. Linear regression techniques were employed for this estimation. Demand curves were obtained for an "average" individual for fishing and water skiing. It was assumed that the recreationists had homogeneous tastes and preferences, approximately the same level of income for each level of participation, and approximately the same prices for alternative types of recreational activities. Both demand curves exhibited constant price elasticities of demand that were fairly high. The estimated elasticities of demand, with respect to price, were -2.6639 for fishing, and -2.4553 for water skiing.

The number of individuals that constituted the market for each activity was estimated and market demand curves were obtained by horizontal addition of this number of average individual demand curves. The market demand curves have the same elasticities of demand as the individual demand curves.

The individual and market demand curves both provided a sound basis for testing various methods of benefit estimation. The results of these estimates are not considered to be conclusive evidence supporting any particular method. But, there are certain implications that may be drawn concerning the methods.

The Monopoly Revenue Method and Single Unit Value Method could both be rejected on the grounds that they ignore the effects of differences in residences of the recreationists using the recreational facilities.

The main attribute of both of these methods is their simplicity. Their use would be limited to cases where unsophisticated estimates of benefits would suffice.

The consumer's surplus methods of benefit estimation for recreational resources were considered to be an improvement over other methods discussed. But, there were certain differences between these methods which resulted in different estimates of consumer's surplus. The first two methods tested obtained estimates of consumer's surplus from the market demand curves and required several additional assumptions that were not needed for the estimates obtained from individual demand curves. The market demand curve estimates were larger (\$140,000 and \$162,000 for Methods 1 and 2 respectively, compared to \$101,000 and \$124,000 for Methods 3 and 4 respectively) and would increase the chances of a proposed project's approval. But, it would seem that the method which required the least number of simplifying assumptions would be the most valid one to use. Thus, the methods using the average individual demand curves to estimate consumer's surplus were considered to be the most appropriate.

If a choice were to be made between Methods 3 and 4, Method 3 would be selected because separate estimates of the consumer's surplus for an individual from each residence zone were obtained with it. Method 4 assigns the same estimate of consumer's surplus to all individuals irregardless of the zone of residence. Thus, a recreationist from one residence zone would have the identical consumer's surplus as a recreationist from any other zone.

The individual demand curves were also used to estimate differences in attendance resulting from raising and lowering the permit fees for selected activities. Raising the fees resulted in an estimated increase

in revenue to the city of \$9,392, while lowering them reduced recreational revenue by \$11,659.

Recreational Management Analysis

Numerous recreational management problems were evident at the Duncan recreational complex. Many of these were considered as being typical of most recreational enterprises; however, some were unique to the Duncan complex. Essentially, the management problems encountered concerned: (1) recreational goals; (2) recreational facilities; (3) maintenance; (4) publicity; (5) seasonal attendance; (6) fluctuating water levels; (7) zoning; and (8) swimming policy. Problems concerning recreational facilities, publicity, and maintenance were essentially caused by the need for additional amounts of each category. Increased publicity was viewed as one of the most important needs for the city to consider. Problems involving recreational goals, zoning, and swimming policy could be solved by having the city establish definite policies and enforcing them. The remaining problems required special attention. Fluctuating water levels will always be a critical problem, although judicious selection of cabin sites, and areas for fishing piers and docks, as well as planting of grasses when the lake level is lowered could alleviate many points of conflict. Seasonal attendance was a problem requiring varying prices for its elimination.

Conclusions

The estimation of demand curves for selected recreational activities for a recreational resource is possible using the techniques presented in this study. Agencies interested in the estimation of economic

benefits resulting from recreational resources should be able to utilize these procedures.

The large differences in attendance rates by persons from different residence zones indicates that the area of influence of the recreational resource studied is fairly small. This information, in conjunction with the information concerning the socio-economic characteristics of the recreationists, also should be valuable to planning agencies in estimating expected attendance rates at proposed facilities.

The results obtained and reported in this study were mainly for developing and testing of empirical techniques. The most important contribution of this study is to provide a basis for comparison of various "demand" procedures for other researchers, and to present a different approach to estimation of demand curves for outdoor recreational activities.

Need for Further Research

Additional research is needed in measuring the demand for and benefits from resources used for outdoor recreation. This study developed some guidelines from the socio-economic characteristics of outdoor recreationists. However, this study was based on a fairly small sample of the total population of recreationists using the recreational facilities studied. Additional research is needed to substantiate these findings. Since much of the analysis used data relating to one particular year and for one small recreational area, additional data should be obtained to determine if the relationships found are applicable to other areas and for subsequent time periods.

Additional research should be focused on estimating demand schedules for other types of recreational activities, as well as for fishing and water skiing. If the relationships determined in the present study are validated by other researchers, this would give additional significance to the study.

The present study was expected to delve into the reasons why attendance had fallen during the past several years. Low lake levels were thought to be the principal cause for the decreasing attendance. The researcher hoped to obtain data concerning the level of the lakes and resulting surface acreage in selected time periods. These data are available in the State, but did not become available when needed. Thus, this relationship could not be determined. This would be a prime research effort, and could have valuable implications for future demand estimates, particularly on Corps of Engineer reservoirs. If a relationship could be found between surface acres of water and recreation attendance, a valuable predictor for outdoor recreation participation would be established.

Finally, the suggested solutions to each of the management problems proposed should be tested. The effects of positive action in each case would have a bearing upon when to use these tools of management.

LITERATURE CITED

1. U. S. Statutes at Large. Public Law 534. Vol. 58, Part I. Washington, D. C.: U. S. Government Printing Office, 1945, pp. 887-907.
2. U. S. Congress, Senate. S. 1164 and S. 1221. 85th Congress, 1st Session, 1957.
3. Evaluation of Recreational Benefits from Reservoirs. Hearings Before a Senate Subcommittee of the Committee on Public Works, U. S. Senate, 85th Congress, 1st Session, 1957.
4. U. S. Congress. Senate Calendar No. 249. Report 250, Part 2. 85th Congress, 1st Session, 1957. "Minority Report," by Senators Cotton and Hruska.
5. Outdoor Recreation Resources Review Commission. Outdoor Recreation For America, A Report to the President and to the Congress. Washington, D. C.: U. S. Government Printing Office, 1962.
6. U. S. Congress. Senate Document No. 97. Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources. Washington, D. C.: U. S. Government Printing Office, 1962.
7. U. S. Statutes at Large. Public Law 88-29. Vol. 77. Washington, D. C.: U. S. Government Printing Office, 1964, pp. 49-50.
8. U. S. Statutes at Large. Public Law 88-29. Vol. 78. "Land and Water Conservation Fund Act of 1965." Washington, D. C.: U. S. Government Printing Office, 1965, pp. 897-904.
9. U. S. Statutes at Large. Public Law 89-72. Vol. 79. "Federal Water Project Recreation Act." Washington, D. C.: U. S. Government Printing Office, 1966, pp. 213-218.
10. Ad Hoc Water Resources Council. "Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources." Supplement No. 1. Evaluation Standards for Primary Outdoor Recreation Benefits. Washington, D. C., June 4, 1964.
11. Soil Conservation Service, U. S. Department of Agriculture. Economics Guide for Watershed Protection and Flood Prevention. Washington D. C., March, 1964.

12. Lerner, Lionel. "Quantitative Indices of Recreational Values," Water Resources and Economic Development of the West - Economics in Outdoor Recreation Policy. Report No. 11, edited by Stephen C. Smith, University of Nevada, Reno, August, 1962.
13. Trice, Andrew H., and Samuel E. Wood. "Measurement of Recreation Benefits." Journal of Land Economics, Volume 34, No. 3, August, 1958.
14. Clawson, Marion. Methods of Measuring the Demand for and Value of Outdoor Recreation. Resources for the Future. Reprint No. 10. Washington D. C., April, 1958.
15. Gray, James R., and L. Wayne Anderson. Recreation Economics in South-Central New Mexico. Experiment Station Bulletin 488. Las Cruces: New Mexico State University, May, 1964.
16. Wennergren, E. Boyd. Value of Water for Boating Recreation. Bulletin 453, Utah Agricultural Experiment Station. Logan: Utah State University, June, 1965.
17. Marshall, Alfred. Principles of Economics. Eighth Edition. London: Macmillan and Company, Ltd., Reprinted 1956.
18. Dorfman, Robert, editor. Measuring Benefits of Government Investments. "Outdoor Recreation," by Ruth P. Mack and Summer Myers. Washington D. C.: The Brookings Institution, 1965, pp. 71-100.

A P P E N D I C E S

APPENDIX A

Dept. of Agricultural Economics
Oklahoma State University
Stillwater, Oklahoma

in cooperation with
THE CITY OF DUNCAN, OKLAHOMA

Dear Sir:

The Department of Agricultural Economics at Oklahoma State University is cooperating with the City of Duncan on a study of the recreational use of the City owned Lakes. This research project, using information obtained from questionnaires, is being made for the following reasons.

(1) The results of the study will assist the City planners in determining what facilities and/or services if any are lacking on these lakes and also what facilities to provide on Lake Fuqua. Future users of the facilities at the lakes will thus have the advantage of a wider variety of recreational activities.

(2) Your answers will help to determine the economic impact on the economy of Duncan and Stephens County resulting from people using the "Lakes of Duncan" for outdoor recreation purposes. This economic information will allow the development of a method to estimate the benefits resulting from a lake used for outdoor recreational purposes.

We hope that you will complete the questionnaire and return it to us in the enclosed self-addressed envelope. The information will be combined with information from other people who use the "Lakes of Duncan". Thus, we assure you that the answers you give will be kept confidential.

We feel that the "Lakes of Duncan" are an asset to Stephens County and hope that with the accurate information we receive from you and others, the City will be encouraged to provide even more facilities for your recreation pleasure. As these lakes in Stephens County improve, other cities likely will follow Duncan's example and develop their lakes for recreation.

Thank you for your help.

Sincerely yours,

John McNeely
Department of Agricultural
Economics

JM/lid

C O N F I D E N T I A L

RECREATION SURVEY
 DEPARTMENT OF AGRICULTURAL ECONOMICS
 OKLAHOMA AGRICULTURAL EXPERIMENT STATION
 STILLWATER, OKLAHOMA
 in cooperation with
 CITY OF DUNCAN, OKLA.

1. General Information:

- a) Where is your home? _____ town _____ state
- b) How much driving time and how many miles is it from your home to the city of Duncan, Oklahoma lakes? _____ hours _____ minutes _____ miles
- c) How many persons usually accompany you when visiting the Duncan City lakes? adults: Male _____ Female _____ Children: Male _____ Female _____
- d) What is the usual time you spend on recreation during each visit to these lakes? days _____ hours _____
- e) Is this your first visit to the "Lakes of Duncan"? yes _____ no _____
- f) If no, how many times during the past year did you visit these lakes? _____
- g) Do you plan to return to this area on future visits? yes _____ no _____
- h) If yes, how many times each year do you plan to visit this area? _____
- i) Is your visit to the City of Duncan Lakes (1) the primary purpose of your trip? _____, (2) combined with a visit of friends and relatives? _____ or (3) combined with a trip to other areas? _____
- j) What other recreation areas did you visit during the past 12 months?

<u>Area Visited</u>	<u>No. of Times</u>	<u>Avg. time spent (days, hrs.)</u>
Most _____	_____	_____
2nd most _____	_____	_____
3rd most _____	_____	_____
4th most _____	_____	_____

- k) What days of the week do you most often come to the lake?

- l) Of all the times you visited the lake(s) during the year, how would you say your visits were distributed as to how many in each part of the year? Jan.-Mar. _____, April-June _____, July-Sept. _____, Oct.-Dec. _____

2. Types of Recreation:

- a) What type(s) of recreation permit(s) have you purchased for the use of the City of Duncan Lakes during the past 12 months? Beside each you indicate purchase of, please list the number of this type of permit you purchased in a years time for daily permits and/or the number of times each year you used the lakes for each type of season permit.

	Number of Times		Number of Times
Fishing, daily permit	____, _____	Water-skiing, daily	____, _____
Fishing, season permit	____, _____	Water-skiing, season	____, _____
Fishing, season family	____, _____	Lake Barge, season	____, _____
Fishing, boat, daily	____, _____	Daily Quail permit	____, _____
Fishing boat, season	____, _____	Daily duck permit	____, _____

- b) What other outdoor recreation activities do you participate in while visiting the Duncan City Lakes? Camping _____
Picnicking _____, others (list _____)
(Note: These might include swimming, hunting, horseback riding etc.)
- c) Would you participate in any other types of outdoor recreation if facilities were available? yes _____ no _____. If yes, what types? _____
- d) What outdoor recreation activity did you participate in here or elsewhere most, second most, third most, fourth most, etc., during the past 12 months?

<u>Recreation Activity</u>	<u>No. of Times</u>
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____

- e) What are your reasons for selecting the Duncan City Lake area for recreational purposes? _____

- f) What outdoor recreation facilities do you feel are lacking on the City of Duncan Lakes, that if added, would increase the number of times you visit the lakes each year?
1. _____ 2. _____
3. _____ 4. _____

3. Investments in Recreational Equipment and Expenditures for Recreation:

- a) Approximately what is your original investment in the following:
- | | <u>Cost</u> |
|---------------------------------|-------------|
| 1. Fishing tackle and equipment | _____ |
| 2. Boat and motor. | _____ |
| 3. Bait (yearly expense). | _____ |

- | | <u>Cost</u> |
|--|-------------|
| 4. Water skiing equipment | _____ |
| 5. 12 months gas, oil and maintenance for boat & motor | _____ |
| 6. Camping equipment. | _____ |
| 7. Hunting equipment. | _____ |
| 8. Other (please list) _____ | _____ |
| 9. _____ | _____ |
- b) What type of license did you purchase during the past year?
 Fishing _____ Hunting _____ Combination _____ Out of State _____

- c) Please list the actual amount you spent on each of the following if they apply to you while visiting the Duncan City Lakes. This should be the expense you had for a day's recreation and should represent an average or usual day.

- | | <u>Per Day Cost</u> |
|-----------------------------|---------------------|
| 1. Lodging cost | _____ |
| 2. Food and refreshments | _____ |
| 3. Equipment rental, if any | _____ |
| 4. Other daily expenses | _____ |
| 5. (please list) | _____ |
- d) How much more per day per person do you spend for food and refreshments while on an outdoor recreation trip than would spend at home? _____
- e) If you stay overnight at the Duncan City Lakes, what type of facility do you stay in? Tent _____ tent trailer _____ pickup camper _____ lake cabin _____ other (list) _____

4. Personal Data Section:

It is important for the analysis that you answer these questions. Again we stress that this information is confidential and will be averaged with information obtained from other people.

- a) What is your age? _____
- b) Are you married? _____
- c) Sex: Male _____ Female _____
- d) Number in your immediate family? _____
- e) What is your occupation? _____
- f) Are you (1) self-employed? _____ or (2) working for someone else? _____
- g) How many hours do you work (average) each week? _____
- h) How many weeks of paid vacation per year do you get, or if self-employed, how many weeks do you take? _____
- i) How many grades of school have you finished? (1 thru 12) _____
- j) What other schooling have you had? (College, secretarial, business, technical, etc.) 1. _____ 2. _____

- k) If college is indicated, what degrees do you hold? 1. _____
2. _____ 3. _____
- 1) What was your income in 1964? (The income you reported for tax purposes will do fine here and should include wages, salaries, business profits, net farm income, pensions, rents, etc.)
- | | |
|----------------------------|------------------------------|
| 1. under \$3,000 _____ | 5. \$7,000 - \$9,999 _____ |
| 2. \$3,000 - \$3,999 _____ | 6. \$10,000 - \$14,999 _____ |
| 3. \$4,000 - \$4,999 _____ | 7. \$15,000 - \$19,999 _____ |
| 4. \$5,000 - \$6,999 _____ | 8. over \$20,000 _____ |

C O N F I D E N T I A L

CABIN OWNER'S QUESTIONNAIRE
 RECREATION SURVEY
 OKLAHOMA AGRICULTURAL EXPERIMENT STATION
 DEPARTMENT OF AGRICULTURAL ECONOMICS
 STILLWATER, OKLAHOMA
 in cooperation with
 CITY OF DUNCAN, OKLA

1. General Information:

- a) Where is your home? _____ town _____ state
- b) How much driving time and how many miles is it from your home to your lake cabin? _____ hours _____ minutes _____ miles
- c) How many persons usually accompany you when visiting the Duncan City Lakes? Adults: Male _____ Female _____
 Children: Male _____ Female _____
- d) What is the usual time you spend while visiting at the lake?
 days _____ hours _____
- e) How many times during the past year did you stay at the lake?

- f) Do you let other people (friends, relatives, etc.) use your cabin? yes _____ no _____. If yes, how many times in a year? _____ and average number of people each time? _____
- g) What other recreation areas did you visit during the past 12 months?

<u>Area Visited</u>	<u>No. of Times</u>	<u>Avg. time spend (days, hrs.)</u>
Most _____	_____	_____
2nd most _____	_____	_____
3rd most _____	_____	_____
4th most _____	_____	_____

- h) What days of the week do you most often come to the lake?

- i) Of all the times you visited the lake(s) during the year, how would you say your visits were distributed as to how many in each part of the year? Jan.-Mar. _____, April-June _____, July-Sept. _____, Oct.-Dec. _____
2. Types of Recreation: (This section is identical to that in the previous questionnaire)
3. Investment in Cabin and Other Expenses:
- a) Description of cabin: Material _____
 Number of Rooms _____ list and describe _____

 Age _____ other _____

- b) Cost of the cabin \$ _____.
- c) Description of well and pump: Depth _____, size pipe _____, type of pump _____, No. of cabins using well _____, cost of well and pump _____
- d) Original owner _____ second owner _____ other _____
- e) Miscellaneous cabin costs (i.e., patio, shrubs, driveway, landscaping, dock, etc.). List and describe _____

- f) Yearly costs; electricity _____, gas _____, maintenance and repairs _____, improvements _____, lease fee _____, other _____, _____.
- g) Approximately what is your original investment in the following?
- | | <u>Cost</u> |
|--|-------------|
| 1. Fishing tackle and equipment | _____ |
| 2. Boat and motor | _____ |
| 3. Bait (yearly expense) | _____ |
| 4. Water skiing equipment | _____ |
| 5. 12 months gas, oil and maintenance for boat & motor | _____ |
| 6. Camping equipment | _____ |
| 7. Hunting equipment | _____ |
| 8. Other (please list) _____ | _____ |
| 9. _____ | _____ |
- h) What type of license did you purchase during the past year?
 Fishing _____ Hunting _____, combination _____
 Out of State _____
- i) How much more per day per person do you spend for food and refreshments while staying at the lake than you would spend at home? _____
4. Personal Data Section: (This section is identical to that in the previous questionnaire)

APPENDIX B, TABLE I

NUMBER OF PERMITS SOLD BY MONTHS AND TOTAL NUMBER AND VALUE FOR THE YEAR, DUNCAN LAKES COMPLEX, 1955

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total		
													Number	Value	
<u>Clear Creek Fishing</u>															
Family	338	---	---	---	---	---	---	---	---	---	---	---	---	338	\$ 2,535.00
Single	407	---	---	---	---	---	---	---	---	---	---	---	---	407	2,035.00
Daily	77	256	742	1,255	1,945	1,769	1,941	1,371	882	690	503	219	11,650	5,825.00	
<u>Lake Duncan Fishing</u>															
Family	73	---	---	---	---	---	---	---	---	---	---	---	---	73	255.50
Single	73	---	---	---	---	---	---	---	---	---	---	---	---	73	182.50
Daily	72	78	445	755	1,091	727	1,009	683	387	227	91	63	5,628	1,407.00	
<u>Fishing Boat Permits - Season</u>															
Clear Creek	178	---	---	---	---	---	---	---	---	---	---	---	---	178	712.00
Lake Duncan	24	---	---	---	---	---	---	---	---	---	---	---	---	24	72.00
<u>Fishing Boat Permits-Daily</u>															
Clear Creek	---	---	4	8	5	10	15	5	---	1	2	---	50	50.00	
<u>Skiing-Season</u>															
Lake Duncan	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
<u>Skiing-Daily</u>															
Lake Duncan	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
<u>Duck Hunting</u>															
Daily	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
<u>Quail Hunting</u>															
Daily	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
<u>Hunting Season</u>															
Duck	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Quail	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total															\$13,047.00

APPENDIX B, TABLE II

NUMBER OF PERMITS SOLD BY MONTHS AND TOTAL NUMBER AND VALUE FOR THE YEAR, DUNCAN LAKES COMPLEX, 1956

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total		
													Number	Value	
<u>Clear Creek Fishing</u>															
Family	374	---	---	---	---	---	---	---	---	---	---	---	---	374	\$ 2,805.00
Single	388	---	---	---	---	---	---	---	---	---	---	---	---	388	1,940.00
Daily	93	431	986	1,636	2,160	2,301	2,008	1,332	1,117	696	306	101	13,167	6,583.50	
<u>Lake Duncan Fishing</u>															
Family	72	---	---	---	---	---	---	---	---	---	---	---	---	72	252.00
Single	71	---	---	---	---	---	---	---	---	---	---	---	---	71	177.50
Daily	49	78	522	963	1,155	1,048	755	446	297	200	121	---	5,636	1,409.00	
<u>Fishing Boat Permits- Season</u>															
Clear Creek	189	---	---	---	---	---	---	---	---	---	---	---	---	189	756.00
Lake Duncan	22	---	---	---	---	---	---	---	---	---	---	---	---	22	66.00
<u>Fishing Boat Permits-Daily</u>															
Clear Creek	112	---	---	---	---	---	---	---	---	---	---	---	---	112	112.00
<u>Skiing Season</u>															
Lake Duncan	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
<u>Skiing Daily</u>															
Lake Duncan	---	---	---	---	---	---	---	---	120	16	---	---	---	136	272.00
<u>Duck Hunting</u>															
Daily	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
<u>Quail Hunting</u>															
Daily	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
<u>Hunting Season</u>															
Duck	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Quail	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total															\$14,373.00

APPENDIX B, TABLE III

NUMBER OF PERMITS SOLD BY MONTHS AND TOTAL NUMBER AND VALUE FOR THE YEAR, DUNCAN LAKES COMPLEX, 1957

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total		
													Number	Value	
<u>Clear Creek Fishing</u>															
Family	308	---	---	---	---	---	---	---	---	---	---	---	---	308	\$ 2,310.00
Single	346	---	---	---	---	---	---	---	---	---	---	---	---	346	1,730.00
Daily	61	232	552	1,003	2,010	2,157	2,085	2,130	1,239	632	301	161	12,623	6,311.50	
<u>Lake Duncan Fishing</u>															
Family	25	22	---	---	---	---	---	---	---	---	---	---	---	47	164.50
Single	24	---	---	---	---	---	---	---	---	---	---	---	---	24	60.00
Daily	20	134	221	345	420	437	1,154	1,017	849	479	150	138	5,364	1,341.00	
<u>Fishing Boat Permits-Season</u>															
Clear Creek	170	---	---	---	---	---	---	---	---	---	---	---	---	170	680.00
Lake Duncan	14	---	---	---	---	---	---	---	---	---	---	---	---	14	42.00
<u>Fishing Boat Permits-Daily</u>															
Clear Creek	---	3	6	8	24	46	53	18	16	2	4	1	181	181.00	
<u>Skiing-Season</u>															
Lake Duncan	25	22	---	---	---	---	---	---	---	---	---	---	---	47	1,081.00
<u>Skiing-Daily</u>															
Lake Duncan	---	---	---	---	96	169	246	250	97	---	2	---	860	1,720.00	
<u>Duck Hunting</u>															
Daily	---	---	---	---	---	---	---	---	---	47	76	28	151	75.50	
<u>Quail Hunting</u>															
Daily	---	---	---	---	---	---	---	---	---	---	118	32	150	150.00	
<u>Hunting Season</u>															
Duck	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Quail	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total															\$15,846.50

APPENDIX B, TABLE IV

NUMBER OF PERMITS SOLD BY MONTHS AND TOTAL NUMBER AND VALUE FOR THE YEAR, DUNCAN LAKES COMPLEX, 1958

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total		
													Number	Value	
<u>Clear Creek Fishing</u>															
Family	302	---	---	---	---	---	---	---	---	---	---	---	---	302	\$ 2,265.00
Single	383	---	---	---	---	---	---	---	---	---	---	---	---	283	1,415.00
Daily	102	179	388	1,338	1,943	1,975	1,556	1,324	753	478	219	65	10,320	5,160.00	
<u>Lake Duncan Fishing</u>															
Family	88	25	---	---	---	---	---	---	---	---	---	---	---	113	395.50
Single	77	21	---	---	---	---	---	---	---	---	---	---	---	98	245.00
Daily	72	63	141	984	1,263	760	561	419	61	190	122	12	4,648	1,162.00	
<u>Fishing Boat Permits- Season</u>															
Clear Creek	172	---	---	---	---	---	---	---	---	---	---	---	---	172	688.00
Duncan	25	---	---	---	---	---	---	---	---	---	---	---	---	25	75.00
<u>Fishing Boat Permits- Daily</u>															
Clear Creek	1	1	5	25	33	21	21	13	17	1	3	---	---	141	141.00
<u>Skiing-Season</u>															
Lake Duncan	5	6	8	22	43	11	5	---	---	---	---	---	---	100	2,000.00
<u>Skiing-Daily</u>															
Lake Duncan	9	7	4	38	115	194	254	237	93	11	4	---	---	966	1,449.00
<u>Duck Hunting</u>															
Daily	---	---	---	---	---	---	---	---	---	108	208	81	---	397	198.50
<u>Quail Hunting</u>															
Daily	---	---	---	---	---	---	---	---	---	---	124	133	---	257	257.00
<u>Hunting - Season</u>															
Duck	---	---	---	---	---	---	---	---	---	50	15	3	---	68	340.00
Quail	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
<u>Total</u>															\$15,791.00

APPENDIX B, TABLE V

NUMBER OF PERMITS SOLD BY MONTHS AND TOTAL NUMBER AND VALUE FOR THE YEAR, DUNCAN LAKES COMPLEX, 1959

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total		
													Number	Value	
<u>Clear Creek Fishing</u>															
Family	188	---	---	---	---	---	---	---	---	---	---	---	---	188	\$ 1,410.00
Single	180	---	---	---	---	---	---	---	---	---	---	---	---	180	900.00
Daily	88	235	462	873	1,972	1,257	1,144	867	606	362	165	124	8,155	4,077.50	
<u>Lake Humphrey Fishing</u>															
Family	856	---	---	---	---	---	---	---	---	---	---	---	---	856	8,560.00
Single	336	---	---	---	---	---	---	---	---	---	---	---	---	336	2,520.00
Daily	---	---	---	---	---	5,370	656	782	448	176	47	35	7,514	7,514.00	
<u>Lake Duncan Fishing</u>															
Daily	16	70	192	508	678	333	452	359	510	84	23	25	3,250	812.50	
<u>Fishing Boat Permits-Season</u>															
Lake Humphrey	363	---	---	---	---	---	---	---	---	---	---	---	---	363	2,178.00
<u>Fishing Boat Permits-Daily</u>															
Clear Creek	---	2	6	38	36	32	37	20	9	22	15	5	222	222.00	
Lake Humphrey	---	---	---	---	---	484	44	40	22	5	---	---	595	595.00	
<u>Skiing Permits-Season</u>															
Clear Creek	83	---	---	---	---	---	---	---	---	---	---	---	83	1,660.00	
Lake Humphrey	28	---	---	---	---	---	---	---	---	---	---	---	28	420.00	
<u>Skiing Permits-Daily</u>															
Clear Creek	---	---	---	---	---	---	356	367	134	3	---	1	861	1,722.00	
Lake Duncan	---	6	2	16	145	222	81	78	15	---	---	---	565	847.50	
<u>Hunting</u>															
Quail-All Lakes-Daily	---	---	---	---	---	---	---	---	---	---	15	82	147	147.00	
Ducks-Humphrey-Daily	---	---	---	---	---	---	---	---	---	81	19	---	100	49.00	
Season (Duck and Quail)	32	---	---	---	---	---	---	---	---	---	---	---	32	160.00	
<u>Barge and Large Boats</u>															
Season	28	---	---	---	---	---	---	---	---	---	---	---	---	28	280.00
Total														\$34,074.50	

APPENDIX B, TABLE VI

NUMBER OF PERMITS SOLD BY MONTHS AND TOTAL NUMBER AND VALUE FOR THE YEAR, DUNCAN LAKES COMPLEX, 1960

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total		
													Number	Value	
<u>All Lakes Fishing</u>															
Family	178	56	85	145	87	35	10	3	---	---	---	---	599	\$ 5,990.00	
Single	88	32	55	70	25	11	5	1	---	4	---	---	291	2,182.50	
Daily	138	124	348	1,513	2,111	1,750	1,853	1,462	1,076	694	277	114	11,460	5,730.00	
<u>Clear Creek Lake</u>															
Family	7	---	7	11	7	4	2	2	2	1	---	---	43	215.00	
Single	4	1	5	12	5	3	7	3	---	1	---	---	41	143.50	
Daily	44	36	105	490	694	638	624	532	414	256	97	34	3,964	1,982.00	
<u>Lake Humphrey</u>															
Family	16	7	15	70	33	15	7	1	---	---	---	---	164	984.00	
Single	5	7	8	32	15	4	6	---	2	3	---	---	82	328.00	
Daily	6	11	21	125	141	191	155	126	107	46	10	3	942	471.00	
<u>Lake Duncan</u>															
Family	---	---	1	1	3	1	1	---	---	---	---	---	7	24.50	
Single	1	---	1	1	2	1	---	---	---	---	---	---	6	15.00	
Daily	22	25	58	145	288	336	254	130	103	135	23	5	1,524	381.00	
<u>Fishing Boats</u>															
Season	2	---	---	---	---	---	1	---	---	---	---	---	3	10.50	
Daily	1	---	4	4	5	4	5	2	11	---	---	---	36	18.00	
<u>Skiing-Clear Creek and Duncan</u>															
Season	8	3	11	40	93	39	17	3	---	---	---	---	214	3,210.00	
Daily	2	1	8	37	192	270	334	278	124	20	4	---	1,270	1,905.00	
<u>Boat Permit</u>															
All Lakes - Season	36	18	22	39	28	12	5	10	---	---	---	---	170	1,020.00	
Lake-Season															
Humphrey	14	7	7	42	18	13	4	3	1	---	---	---	109	436.00	
Duncan	---	1	---	---	---	1	---	---	---	---	---	---	2	8.00	
Clear Creek	---	---	---	---	---	1	3	1	---	---	---	---	5	20.00	
All Lakes-Daily	2	8	10	48	87	47	41	63	44	28	5	---	383	383.00	
L. Humphrey Barge-Season	7	1	7	6	13	8	6	3	---	---	---	---	51	408.00	
<u>Hunting</u>															
Quail	---	---	---	---	---	---	---	---	---	1	74	59	134	134.00	
Total														\$25,999.00	

APPENDIX B, TABLE VII

NUMBER OF PERMITS SOLD BY MONTHS AND TOTAL NUMBER AND VALUE FOR THE YEAR, DUNCAN LAKES COMPLEX, 1961

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
													Number	Value
<u>All Lakes Fishing</u>														
Family	148	98	119	102	51	17	7	4	---	---	---	---	546	\$ 5,460.00
Single	75	37	67	40	23	12	3	3	2	---	---	---	262	1,965.00
Daily	173	241	834	1,264	1,672	1,508	1,482	1,055	761	413	240	102	9,745	4,872.50
<u>Clear Creek Lake</u>														
Family	8	2	4	1	8	4	5	3	---	1	---	---	36	180.00
Single	7	3	9	3	12	4	1	2	---	---	1	---	42	147.00
Daily	58	56	280	411	570	492	583	349	265	135	71	19	3,289	1,644.50
<u>Lake Humphrey</u>														
Family	13	29	39	31	31	12	10	3	1	---	---	---	169	1,014.00
Single	5	18	22	34	19	6	10	---	1	---	---	---	115	460.00
Daily	8	13	54	105	162	113	155	84	53	30	13	3	793	396.50
<u>Lake Duncan</u>														
Family	1	---	1	2	2	---	1	1	---	---	---	---	8	28.00
Single	---	---	---	1	1	---	2	---	---	---	---	---	4	10.00
Daily	19	31	147	84	193	98	141	125	103	77	20	11	1,049	262.25
Season Fishing Boat	---	---	---	1	---	---	---	---	---	---	---	---	1	3.50
Daily Fishing Boat	---	---	6	3	6	1	4	2	2	2	---	---	26	13.00
<u>Skiing-Clear Creek and Duncan</u>														
Season	2	10	13	45	76	37	12	5	1	---	---	---	201	3,015.00
Daily	---	4	6	23	99	175	347	242	63	2	2	---	963	1,444.50
<u>Boat Permit</u>														
All Lakes-Season	30	20	27	38	16	10	10	1	---	---	---	---	152	912.00
Lake-Season														
Humphrey	10	13	18	20	11	4	10	4	---	1	---	---	91	364.00
Duncan	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Clear Creek	3	1	1	3	2	2	2	2	---	---	---	---	16	64.00
All Lakes-Daily	2	6	19	40	59	47	57	31	18	7	2	---	288	288.00
L. Humphrey Barge-Season	6	5	9	15	4	7	3	1	1	2	---	---	53	424.00
<u>Hunting</u>														
Quail	13	---	---	---	---	---	---	---	---	---	66	39	118	118.00
Total														\$23,085.25

APPENDIX B, TABLE VIII

NUMBER OF PERMITS SOLD BY MONTHS AND TOTAL NUMBER AND VALUE FOR THE YEAR, DUNCAN LAKES COMPLEX, 1962

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
													Number	Value
All Lakes Fishing														
Family	116	91	58	97	42	35	13	4	1	---	---	---	457	\$ 4,570.00
Single	46	32	46	29	18	23	7	1	1	1	---	---	204	1,530.00
Daily	134	233	379	1,029	1,399	1,465	1,192	947	922	406	337	200	8,643	4,321.50
Clear Creek Lake														
Family	5	5	4	3	7	2	1	---	---	---	---	---	27	135.00
Single	7	4	4	8	5	9	3	---	---	---	---	---	40	140.00
Daily	38	88	115	369	573	586	551	419	382	236	137	89	3,583	1,791.50
Lake Humphrey														
Family	7	30	14	27	36	19	10	2	2	---	---	---	147	882.00
Single	5	14	14	33	16	10	3	4	4	---	---	---	103	412.00
Daily	8	21	27	73	145	136	156	88	83	51	23	11	822	411.00
Lake Duncan														
Family	---	---	---	1	---	7	---	---	---	---	---	---	8	28.00
Single	---	1	1	2	2	4	---	1	---	---	---	---	11	27.50
Daily	7	28	17	157	157	587	255	191	117	100	36	28	1,680	420.00
Season Fishing Boat	---	---	---	---	1	---	1	---	---	---	---	---	2	7.00
Daily Fishing Boat	---	2	1	3	4	3	9	5	1	3	3	5	39	19.50
Skiing-Clear Creek and Duncan														
Season	2	8	5	28	78	48	20	4	2	---	1	---	199	2,940.00
Daily	---	1	7	17	177	189	348	267	103	4	1	---	1,114	1,671.00
Boat Permit														
All Lakes-Season	22	22	14	23	18	21	7	6	---	---	---	---	133	798.00
Lake-Season														
Humphrey	10	19	16	14	13	10	8	2	1	---	---	---	93	372.00
Duncan	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Clear Creek	---	---	2	6	2	3	---	---	---	1	---	---	14	56.00
All Lakes-Daily	1	8	7	44	40	38	43	54	42	18	11	1	307	307.00
L. Humphrey Barge-Season	6	13	2	13	11	1	3	---	---	---	---	---	49	392.00
Hunting														
Quail	19	---	---	---	---	---	---	---	---	---	56	45	120	120.00
Total														\$21,351.00

APPENDIX B, TABLE IX

NUMBER OF PERMITS SOLD BY MONTHS AND TOTAL NUMBER AND VALUE FOR THE YEAR, DUNCAN LAKES COMPLEX, 1963

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
													Number	Value
<u>All Lakes Fishing</u>														
Family	93	40	117	71	44	20	6	2	---	1	---	1	395	\$3,950.00
Single	41	19	56	34	27	10	3	4	2	1	---	---	197	1,477.50
Daily	140	176	677	1,204	1,470	1,376	1,193	1,051	872	503	346	62	9,070	4,535.00
<u>Clear Creek Lake</u>														
Family	6	6	8	11	9	1	2	3	2	---	---	---	48	240.00
Single	11	5	7	15	12	6	---	3	6	1	6	---	72	252.00
Daily	42	81	313	560	716	824	676	544	520	323	164	42	4,835	2,417.50
<u>Lake Humphrey</u>														
Family	8	16	35	27	34	13	15	4	2	1	---	---	155	930.00
Single	1	10	22	27	19	14	5	5	4	1	1	---	109	436.00
Daily	15	7	64	143	200	194	182	143	156	77	36	12	1,229	614.50
<u>Lake Duncan</u>														
Family	1	---	2	---	1	3	---	---	---	---	---	---	7	24.50
Single	---	2	2	2	1	---	1	---	---	---	---	---	8	20.00
Daily	16	25	150	199	360	295	219	172	202	104	55	4	1,801	450.25
Season-Fishing Boat	---	---	---	---	---	1	---	---	---	---	---	---	1	3.50
Daily Fishing Boat	---	2	15	11	17	7	3	2	3	2	---	---	62	31.00
<u>Skiing-Clear Creek-Duncan</u>														
Season	1	3	15	50	76	33	20	4	---	1	---	---	203	3,045.00
Daily	---	---	14	36	132	348	356	334	100	23	4	1	1,348	2,022.00
<u>Boat Permit</u>														
All Lakes Season	19	7	32	29	24	20	3	5	3	---	---	---	142	852.00
Lake-Season														
Humphrey	5	10	22	22	19	2	6	2	2	---	---	---	90	360.00
Duncan	---	1	---	---	---	1	---	---	---	---	---	---	2	8.00
Clear Creek	---	---	8	4	5	---	---	---	5	1	---	---	24	96.00
All Lakes Daily	2	2	26	41	69	45	61	44	58	26	8	1	383	383.00
L.H. Barge-Season	6	4	7	8	9	5	10	4	---	---	---	---	53	424.00
<u>Hunting</u>														
Quail	11	---	---	---	---	---	---	---	---	---	85	93	189	189.00
Total														\$22,760.75

APPENDIX B, TABLE X

NUMBER OF PERMITS SOLD BY MONTHS AND TOTAL NUMBER AND VALUE FOR THE YEAR, DUNCAN LAKES COMPLEX, 1964

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total		
													Number	Value	
<u>All Lakes Fishing</u>															
Family	82	28	77	78	53	19	5	1	---	1	---	---	344	\$ 3,440.00	
Single	53	17	52	43	20	10	4	1	2	1	---	---	203	1,522.50	
Daily	105	110	394	901	1,457	1,261	907	869	483	283	138	103	7,021	3,510.50	
<u>Clear Creek Lake</u>															
Family	7	7	7	9	17	11	7	2	---	---	---	---	57	285.00	
Single	3	3	4	12	12	5	1	1	---	---	---	---	41	143.50	
Daily	56	67	208	571	890	724	549	442	263	149	84	57	4,060	2,030.00	
<u>Lake Humphrey</u>															
Family	15	9	17	35	28	20	8	14	4	---	---	---	150	900.00	
Single	4	11	20	35	25	16	8	2	1	---	---	---	122	488.00	
Daily	14	20	63	162	195	172	147	154	72	50	14	10	1,073	536.50	
<u>Lake Duncan</u>															
Family	---	---	3	---	1	---	---	---	---	---	---	---	4	14.00	
Single	---	---	1	---	---	1	---	---	1	---	---	---	3	7.50	
Daily	17	13	50	117	174	215	94	89	94	28	10	---	901	225.25	
<u>Skiing-Clear Creek & Duncan</u>															
Season	3	---	8	17	75	52	15	1	---	---	---	---	171	2,565.00	
Daily	---	3	11	15	119	268	329	278	99	5	---	1	1,128	1,692.00	
<u>Boat Permit</u>															
3-Lakes Season	41	25	63	63	37	25	10	8	5	3	3	---	283	1,415.00	
3-Lakes Daily	2	1	16	60	93	66	61	57	41	14	9	10	430	430.00	
Lake Humphrey Barges	6	6	6	6	4	2	4	1	---	1	---	---	36	288.00	
Daily Quail Permit	24	---	---	---	---	---	---	---	---	---	89	65	178	178.00	
Senior Citizens (No Chg.)	103	49	62	60	33	15	10	11	9	1	1	3	357	00.00	
Total															\$19,670.75

APPENDIX B, TABLE XI

NUMBER OF PERMITS SOLD BY MONTHS AND TOTAL NUMBER AND VALUE FOR THE YEAR, DUNCAN LAKES COMPLEX, 1965

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total		
													Number	Value	
All Lakes Fishing															
Family-Season	60	33	22	62	39	18	1	2	2	---	---	---	239	\$ 2,390.00	
Single-Season	38	23	16	44	16	13	4	---	1	---	---	---	155	1,162.50	
Daily	---	---	---	11	3	---	6	2	11	8	3	---	44	22.00	
Clear Creek Lake															
Family-Season	4	3	2	8	11	4	---	1	1	---	---	---	34	170.00	
Single-Season	7	2	3	12	7	4	---	6	---	2	---	---	43	150.50	
Daily	76	125	161	606	778	707	678	414	277	235	173	59	4,289	2,144.50	
Lake Humphrey															
Family-Season	6	17	13	47	28	17	8	4	2	---	---	---	142	852.00	
Single-Season	3	5	---	63	26	16	9	3	---	---	---	---	125	500.00	
Daily	66	113	155	1,032	1,160	1,138	1,308	766	557	303	194	76	6,868	3,434.00	
Lake Duncan															
Family-Season	---	---	1	---	1	1*	---	---	---	---	---	---	3	10.50	
Single-Season	---	---	1	2	2	---	---	1	---	---	---	---	6	15.00	
Daily	3	7	13	75	203	238	164	142	110	66	23	11	1,055	263.75	
Skiing-Clear Creek & Duncan															
Season	1	3	3	31	59	46	24	1	---	---	---	---	168	2,520.00	
Daily	1	---	3	24	124	210	385	283	124	10	---	---	1,164	1,746.00	
Fishing Boat Permit															
3 lakes-Season	30	22	27	81	37	30	13	9	2	---	---	---	251	1,250.00	
3 lakes-Daily	3	5	9	53	57	61	65	23	35	29	19	4	363	363.00	
Lake Humphrey Barge	8	5	4	7	8	5	1	1	---	---	---	---	39	312.00	
Daily Quail Permit	20	---	---	---	---	---	---	---	---	---	125	93	238	238.00	
Senior Citizen (No Chg.)	26	25	10	44	24	12	21	1	11	6	5	2	187	00.00	
Total														\$17,548.75	

APPENDIX C

ALTERNATIVE ESTIMATES OF DEMAND EQUATIONS FOR FISHING AND WATER SKIING

The equations for the average individual demand curves which used cost per user day (P) as the independent variable and the number of user days participated in during the year (Q) as the dependent variable were obtained in the same way as were equations (1.2) and (1.3) reported in Chapter V. Linear regression techniques were used to fit an exponential equation of the general form $Y = AX^b$ to the price-quantity data. This equation was converted to natural logarithms for the regression analysis and then converted back to its exponential form for plotting the demand curves. This procedure allowed for linear regression techniques to be used on nonlinear data and resulted in demand curves whose shapes were curved. The average individual demand equation for fishing was:

$$(1) \quad Q = 66.1377 P^{-1.0614}$$

The coefficient of determination for equation (1) was $R^2 = .3984$ and $s_{\hat{b}} = .07431$. The means were: $\bar{P} = \$5.04$; and $\bar{Q} = 11.91$. The average individual demand equation for water skiing was:

$$(2) \quad Q = 248.924 P^{-1.10158}$$

The coefficient of determination for equation (2) was: $R^2 = .4486$ and $s_{\hat{b}} = .13485$. The means were: $\bar{P} = \$4.80$; and $\bar{Q} = 44.2$. The elasticity of demand with respect to price for the individual demand curve for fishing is -1.0614 and for water skiing is -1.1016 .

The market demand curves for these two activities were obtained by aggregating the respective average individual demand curves by the number of individuals estimated in Table XVI. The market demand curve for fishing was:

$$(3) \quad Q = 164,881 P^{-1.0614}$$

The market demand curve for water skiing was:

$$(4) \quad Q = 106,838 P^{-1.10158}$$

Vita

John Gordon McNeely, Jr.

Candidate for the Degree of
Doctor of Philosophy

Thesis: STATISTICAL ESTIMATION OF DEMAND FOR SELECTED RECREATIONAL
ACTIVITIES

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Fayetteville, Arkansas, May 2, 1938, the
son of John G. and Lillian McNeely.

Education: Graduated from A. & M. Consolidated High School, College
Station, Texas, in 1956; received the Bachelor of Science
degree from The Agricultural and Mechanical College of Texas,
with a major in Agricultural Economics, in January, 1962;
received the Master of Science degree from New Mexico State
University, with a major in Agricultural Economics, in August,
1963; engaged in graduate study toward the degree of Doctor of
Philosophy at Oklahoma State University, Stillwater, Oklahoma,
from September, 1963, to the present.

Professional Experience: Student Enumerator, Industrial Economics
Division, Texas A. & M. College, summer of 1961; Research
Assistant, New Mexico State University, February, 1962, to
August, 1963; Research Assistant, Oklahoma State University,
September, 1963, to July, 1967.