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ECONOMIC EVALUATION OF WATER-ORIENTED RECREATION IN THE PRELIMINARY TEXAS WATER PLAN

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PREFACE

Healthy and vigorous economic growth is based on many factors, among which is the availability and distribution of potable water. Texas is a paradoxical state for water planners and developers since it contains elements of both arid and humid areas within its vast boundaries. The generalization has been made that east of a line from Gainesville to San Antonio then to Corpus Christi are found water surplus areas of the State, and west of that line water deficit areas.

The problem is not quite as simple as the generalizers presume. When historic patterns of economic growth based upon surface-water supplies in the east and large but unsustainable withdrawals of ground water supplies in the west are projected and compared with rainfall, streamflow, and ground-water availability, the problem becomes statewide. All of the people of Texas must have sufficient quantities of potable water at the proper time in their development and at an economic price to sustain growth wherever it may occur. Without that supply, the growth of the State and its regions could be retarded.

In August 1964, Governor John Connally directed the Texas Water Commission to begin work on a 50-year comprehensive State Water Plan. The Legislature reorganized water agencies in Texas in September, 1965, and divided functions of the Texas Water Commission between the Texas Water Rights Commission and the Texas Water Development Board. The planning function was designated a responsibility of the Board.

The Consulting Advisory Panel for the Texas Water Plan, Joe Kilgore, Chairman, recognized the importance of water-oriented recreation to the people of Texas at an early date. Their recommendation for a study of recreation demand and benefits on reservoirs of Texas was adopted and implemented by the staff of the Texas Water Development Board.

This publication, a part of that recreation study, presents some of the problems inherent in such studies together with suggestions for their handling in the future. Present limitations of recreation studies are also noted with the hope that the growing body of empirical knowledge in this field will eliminate some of these limitations in the near future.

The authors are especially indebted to Dr. Allen V. Kneese of Resources for the Future, Inc., and Dr. Jack Knetsch of George Washington University for their valuable assistance in this study. The U.S. Army Corps of Engineers provided the Texas Water Development Board with historical visitation data and assisted in the development of a comprehensive survey form. The assistance of numerous State agencies including Texas Parks and Wildlife Department, Texas Highway Department, Texas Employment Commission, Texas Department of Public Safety, The University of Texas at Austin, and Texas Technological College is gratefully acknowledged. Many members of the staff of the Texas Water Rights Commission and the Texas Water Development Board gave of their time and effort to the completion of this study. We are also indebted to Lawrence Wolfe, who wrote many of the computer programs and acted as liaison between our offices and the computer equipment in the different centers where the computer work was performed.

While the above assistance is gratefully acknowledged, the decisions concerning methods used and conclusions reached were the authors', with Agency review and concurrence.

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ECONOMIC EVALUATION OF WATER-ORIENTED RECREATION IN THE PRELIMINARY TEXAS WATER PLAN

SUMMARY

The primary objective of this study was the estimation of potential recreation benefits from reservoirs proposed for inclusion in the preliminary Texas Water Plan. Benefits that will accrue to existing reservoirs or those under construction were excluded from consideration. All benefits in this study are therefore additional benefits which would accrue only to planned projects.

The benefits subjected to study represent only a fraction of water-oriented recreation benefits and a much smaller fraction of total outdoor recreation benefits.

Data collected during a 1965 survey of eight Texas reservoirs are used with population and income data to estimate a recreation visitation prediction equation. Counties are the observation units used in fitting an equation to the survey data. The equation represents a least squares regression which is fitted to a double logarithmic transformation of the original data. Statistically significant explanatory variables contained in the equation are population, per capita income, cost of travel to reservoirs, proximity to competing reservoirs, and reservoir size.

Recreation demand curves for each decade between 1970 and 2020 are generated from the visitation equation for 54 proposed reservoirs. Recreation benefits estimates at each decade are obtained by calculating total areas under the estimated demand curves; thus, the estimates pertain to primary recreation benefits. The present worth in 1970 of estimated recreation benefits has been calculated for each reservoir, using an interest rate of 3.25 percent.

The project life of proposed reservoirs is assumed to be 100 years. In order for recreation benefits to be expressed over the same time period as other benefits, recreation benefits are expressed as present worth in 1970 of a 100-year estimated benefit stream extending to 2070. The calculations are based on the assumption that estimated benefits for 2020 will remain constant to 2070.

Estimates of benefits for individual reservoirs range from $4 million to $25.8 million. The present worth in 1970 of primary recreation benefits accruing to the 54 proposed reservoirs which were studied is estimated to exceed $550 million. While the present worth is a useful analytical device, it may not be entirely familiar to non-analysts. Therefore, an additional tabulation has been completed which expresses dollar benefits over the 100-year period. These benefits total more than $3.8 billion.

Annual benefits estimates vary widely from reservoir to reservoir. Some reservoirs are estimated to produce annual recreation benefits in excess of $1 million by 2020, while others are projected to yield annual benefits on the order of $150,000. Part of this wide range in recreation benefits may be explained by the different time periods in which recreation benefits accrue, and part is due to differences in the explanatory variables.

Upward shifts of the demand curves, and therefore a rising estimated benefits stream, are expected to result from increases in population and per capita income. Since more reservoirs will be available for recreational use as Texas water development planning is implemented, the benefits estimating procedure uses a variable which considers the competitive effect for recreationists among alternative reservoirs. This variable adjusts benefits estimates downward at a particular reservoir as the availability of competing reservoirs increases.

Visitation estimates (number of visitor days) are determined at a zero fee schedule. These estimates indicate the annual number of visitors which can be expected if no fees are charged at the reservoir for admission or the daily use of facilities. The visitor would, however, pay travel costs from his county of origin to the reservoir.

No attempt has been made to calculate estimates of the variances associated with the benefits estimates. Important sources of variation include sampling errors, errors in the projected population and income data, errors due to extrapolation of the prediction equation to proposed reservoirs, and errors due to extrapolation of the prediction equation to future decades.

The form of the equation may be in error, or error could exist because of failure to include important explanatory variables in the model. The present model does not include recreational quality indicators for reservoirs, as those data are not available. The estimates could be refined if information on recreation facilities, fishing success, historic site interest, and other recreational quality variables were available.

INTRODUCTION

In December 1966, Texas had 148 reservoirs existing or under construction with a capacity exceeding 5000 acre-feet. These reservoirs have more than 1 million surface acres available for water-oriented recreational use. Also, recreational opportunities abound at many smaller reservoirs designed principally for municipal or industrial water supplies. Many farm ponds and small farm lakes are available for fishing, swimming, picnicking, and other types of activities. Since public access is generally restricted on private farms and many small municipally owned reservoirs, most fresh-water-oriented recreation occurs on the larger reservoirs. Facilities at larger reservoirs are also more complete and capable of supporting a larger visitation per unit of area.

Texas water projects are directed by a variety of local, State, and federal agencies as well as private organizations. At the State level, river authorities and water districts manage water projects under statutory authority. Projects of the U.S. Army Corps of Engineers and Bureau of Reclamation contain elaborate recreational facilities. The Texas Parks and Wildlife Department operates State parks and manages reservoir associated wildlife resources. Numerous privately managed water-oriented recreational facilities are available ranging from small fishing lakes to elaborate attractions such as the Aquarena at San Marcos.

Visitation at all of Texas' reservoirs is not accurately recorded; however, available data indicate that it is substantial. The Texas Parks and Wildlife Department estimated visitation at water-oriented State parks at 3.2 million in 1965. During the same year, 17.9 million visitors were recorded at 13 U.S. Army Corps of Engineers projects in Texas. In 1965, 927,000 fishing licenses were sold, and Texans owned nearly 750,000 boats.

The economic trends in Texas portend the continued expansion of incomes, population, and leisure time in the State. Those factors all contribute to expectations of increases in the demand for water-oriented recreation.

The water planning program of Texas includes the economic evaluation of alternative reservoirs.[1] This evaluation will assist in the selection of a combination of economically feasible projects. Project benefits include, but are not limited to, those from water supply, flood protection, navigation, fish and wildlife enhancement, and water-oriented recreation.

The supply of water-oriented recreation has increased with the development of water projects for other purposes. Historically, water-oriented recreation has been considered a by-product of water development rather than a major purpose. The increasing recreational use of water projects indicates clearly that recreationists obtain satisfaction from those activities. No doubt, many recreationists include water-oriented recreation as a budgetary item and choose that type of consumption over others.

The use of water projects for recreational purposes has expanded, and recreation must now be counted a project purpose in federal developments. Local sponsors are often as interested in the recreational aspects of a multiple-purpose reservoir as in its water supply.

If recreation is to be examined on equal footing with other project purposes and costs, a method must be devised to estimate recreational benefits. The benefits can then be compared with recreational costs in a determination of economic justification of water projects.

This study arose from the need to determine potential benefits from recreational use of reservoirs in the preliminary Texas Water Plan.[2] The objectives of the study were (1) to estimate a recreation visitation prediction equation applicable to reservoirs, (2) to generate recreation demand curves for proposed reservoirs, and (3) to calculate estimates of recreation benefits for the reservoirs at each decade between 1970 and 2020. Basic relationships are derived from data of the 1960-65 period. Benefits estimates for future decades are obtained by including projected population, income, and supplies of reservoirs in the derived relationship.

Projected population used in the analysis was that developed jointly by the Bureau of Business Research at The University of Texas at Austin and the Texas Water Development Board. Income projections by county were developed specifically for this study and represent a parabolic curve projecting historic trends. The supply of reservoirs available for future recreation opportunity was closely correlated to those contained in the preliminary Texas Water Plan.

The estimates pertain only to water-oriented recreation and do not apply to outdoor recreation in general.

[1] Authorized by the Texas Water Development Board Act of 1965.

[2] A condensed summary of the preliminary Texas Water Plan is given in *Water for Texas—A Plan for the Future,* published by the Texas Water Development Board in May 1966.

A complete analysis of outdoor recreation in Texas would include determining explanatory relationships and benefits pertaining to all public and private outdoor recreational opportunities. The present study does not consider allocations of project products and services.

The data did not permit the development of historical trends in the activity participation rates. Therefore, the rates as determined by this study are not projected to change with time. Since most sources suggest substantial increases in participation rates over time, the estimates of visitation and benefits in this study may be conservative.

These limitations of the study should be considered when its results are applied.

BACKGROUND TO RECREATION BENEFITS ESTIMATION

Recreation Benefits in Federal Projects

While recreation planning has been evident for many years in federal projects, only since 1962 has it emerged as a major partner to other project purposes.

The Eighty-Seventh Congress, Second Session, published Senate Document 97 in 1962. It remains the basis on which federal recreation planning is studied as part of total project purposes. Entitled *Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources,* Senate Document 97 was prepared under the direction of the President's Water Resources Council.

The Water Resources Council is composed of the Secretaries of the Army, Interior, Agriculture, and Health, Education, and Welfare. They are all concerned with recreation planning and water resource development through their subordinate agencies: U.S. Army Corps of Engineers, Bureau of Reclamation, Soil Conservation Service, and Public Health Service. (Note: Federal Water Pollution Control Administration is now in Department of Interior, but formerly was associated with Department of Health, Education, and Welfare through the Public Health Service.)

Senate Document 97 specifically states that recreation should be studied as a project purpose and included in the benefit-cost allocation. While the Department of Interior uses its Bureau of Outdoor Recreation (BOR) in estimating recreation demand and benefits on its projects, the U.S. Army Corps of Engineers has its own evaluation section and derives its own estimates. The Department of Agriculture and Department of Health, Education, and Welfare normally use BOR estimates, if they are available. In recent years the U.S. Army Corps of Engineers has been more disposed to use BOR estimates.

Within the Department of Interior, the Bureau of Sports Fisheries and Wildlife (BSF&W) is responsible for estimating sport fishing and hunting demands and benefits. It also estimates hunting losses, in man-days, due to a proposed project.

This apparently has caused several problems within Interior. The first problem is in differentiating between recreational fishing, which is incidental to other outing activities, and sport fishing, which is a definite primary purpose. The former is estimated by BOR, the latter by BSF&W. Some double counting is inevitable. The second problem is the BSF&W practice of estimating dollar values for increased fishing opportunities at project sites but estimating hunting losses in man-days. Their contention is that hunting and fishing are not perfect substitutes and cannot be compared in terms of money. Project benefits are thus presented as gross fishing benefits not net of hunting losses. This leads to an overstatement of project benefits from sport fishing and hunting opportunities. All other types of outdoor recreation estimates are made by BOR.

Methods used by federal agencies in estimating recreation benefits were not standardized until the release of a series of reports to the Outdoor Recreation Resources Review Commission (ORRRC) by Commission staff. The Commission was chaired by Laurance S. Rockefeller and included four senators and four congressmen among others in its composition. It was created by an Act of June 28, 1958, (Public Law 85-470, 72 Stat. 238) to answer questions about recreational needs, available resources for fulfilling the needs, and policies and programs needed to insure that needs are adequately met for the years 1976 and 2000. Twenty-seven reports were published by 1962 covering every phase of outdoor recreation planning.

Since the release of the reports filled a vacuum that had existed for many years, their conclusions and methodology have become standard procedures for many agencies of the federal government. Agencies use ORRRC reports as a guideline for actual project evaluation and adapt participation rates in calculations of demand and suggested acreages for participation needs per activity, even though at present the ORRRC reports have no official standing as operating procedure.

The basic procedure used by BOR in estimating recreation benefits will be explained, followed by that used by the Corps of Engineers. A discussion of Public Law 89-72 (1965), the Federal Water Project Recreation Act that provides uniform policies with respect to recreation and fish and wildlife benefits and costs of federal multiple-purpose water resource projects, will conclude the discussion pertaining to considerations of recreation by federal agencies.

Concepts Underlying Recreation Benefits Estimation for Proposed Texas Reservoirs

Benefits to water development projects are normally calculated by estimating income generated by a project or the economic losses prevented by its construction. An example of the former is the calculation of irrigation benefits, and of the latter, flood control benefits. Projects usually produce a stream of future annual benefits. This stream of future annual benefits is discounted to present worth and compared with present worth of the cost stream. If the benefits exceed the costs, using these criteria, the project is said to be economically justified.

If recreation is to be included as a function of a multiple-purpose project, a measure of economic value must be applied to anticipated recreational use of the project. However, no market has been established for water-oriented recreational services in which quantities and prices are determined. At present, the use of recreational facilities on reservoirs is permitted at low, if not zero, direct price to users. Visitation data by themselves do not provide the basis for an economic evaluation of recreational services at water development projects. Although those data are important, they must be valued in economic terms before meaningful estimates of recreational benefits can be made.

Travel and the consumption of recreational equipment and services are the major costs incurred by water-oriented recreationists. The recreationist pays little, if anything, for the explicit use of recreational facilities at water projects. Therefore, evaluation techniques that require calculations of total revenue from recreation sales are inapplicable in the evaluation of recreation benefits to multipurpose water projects.

Consumers have shown a willingness to allocate portions of their incomes to water-oriented recreation. This fact indicates that benefits accrue from the recreational project whether or not payments are made for its use. Since recreationists forego the consumption of other types of goods and services and incur costs in pursuit of water-oriented recreation, a measure of recreational benefits can be approximated. This approximation requires an analysis of important factors underlying recreation such as travel costs to reservoirs, population, numbers of recreationists, and their incomes.

Distances traveled by recreationists, when converted into dollars, indicate costs they are willing to incur for the recreational experience. Studies by Clawson (1959) show that as distance to a reservoir increases visitation per unit population declines, or that visitation is negatively correlated with travel cost and travel time.

Travel time to reservoirs is an important factor underlying visitation. It is conceivable that time required for travel could be a more important factor to distant recreators than travel costs. Since travel time and costs are highly correlated in Texas, it is not necessary to include both variables in explanatory visitation models which use data for one year. In time series analysis using data from more than one year, it perhaps would be desirable to include both variables in the models for estimating the effect of travel time upon visitation. This type of analysis would perhaps shed light upon questions about visitation rates under conditions of increasing travel cost and decreasing travel time.

The recreation demand curve, in the conventional sense, is the curve that shows the number of users (visitors) per unit time that could be expected at each possible price, if other things are equal. Clawson (1959) indicates that the slope of the recreational demand curve is normal or negative; i.e., visitation decreases per unit time as price (travel cost) increases. The cost of travel can be used as a part of the data in determining a price-quantity relationship (demand curve) for outdoor water-oriented recreation. Recreation benefits can then be estimated from the recreation demand curve.

Travel cost is here defined as that cost incurred by the recreationist only for his means of transportation to and from the recreational site. If the mode of travel is an automobile owned by the recreationist, two types of costs must be considered. The owner of an automobile incurs certain fixed costs, such as depreciation, insurance, taxes, etc., regardless of the vehicle's use. He also incurs variable costs, such as fuel, oil, chassis lubrication, repairs, etc., which are determined by the distance traveled. Since the Texas recreationist would probably purchase an automobile regardless of his desire for recreation, and since he probably subconsciously deletes fixed costs from those incurred in recreational travel, only variable transportation costs are considered to be travel costs in the analyses of study.

The use of travel cost data in the benefits estimating procedure does not mean that recreational benefits at a reservoir equal travel cost to that reservoir, but rather that charging reservoir entrance fees would logically cause visitation to decline. The decline in visitation resulting from fees can be considered similar to that resulting from the increased travel costs associated with greater distances between recreationists and reservoirs. Travel costs from a zone or area such as a county can be used with varying fee schedules to establish points on a demand curve for recreational services provided by a reservoir. The entire demand curve can be estimated by estimating a sufficiently large number of individual points on the curve. The techniques of point estimation will be presented later.

Each point generated on a demand curve pertains to a specific fee (price) and indicates the visitation (quantity) expected from a population zone if a fee is added to travel cost. The inclusion of other information about population, income, and the availability of other reservoirs to the project being analyzed can be expected to improve the estimate of each respective point on the demand curve.

The demand curve estimates the quantity of recreational use at each possible price. The area under the demand curve is a measure of total recreational benefits when admission fees are zero and when consumer surpluses are included as benefits.

Consumer surplus is a measurable abstraction. While a demand curve shows quantities consumed or used at each of the various prices, it also indicates the willingness of people to pay rather than do without or substitute for goods or services. In the conventional sense, the demand curve tells us that when a single price is established, X number of units are bought. Some consumers would be willing to pay a higher price for the number of units they obtain. All people willing to pay the higher price are going to receive the same satisfaction from the transaction as if they had in fact paid the higher price. The difference between the price actually paid and the price the consumer would have been willing to pay rather than forego the purchase is a monetary measure of the consumer surplus per unit of purchase. In this study, consumer surplus is equivalent to obtaining all revenues which could be expected if it were possible to collect the fees that each user would be willing to pay as admission to the reservoir rather than do without being admitted. The admission fees referred to would range from zero up to the value at which no one would be desirous of admission (see Figure 1).

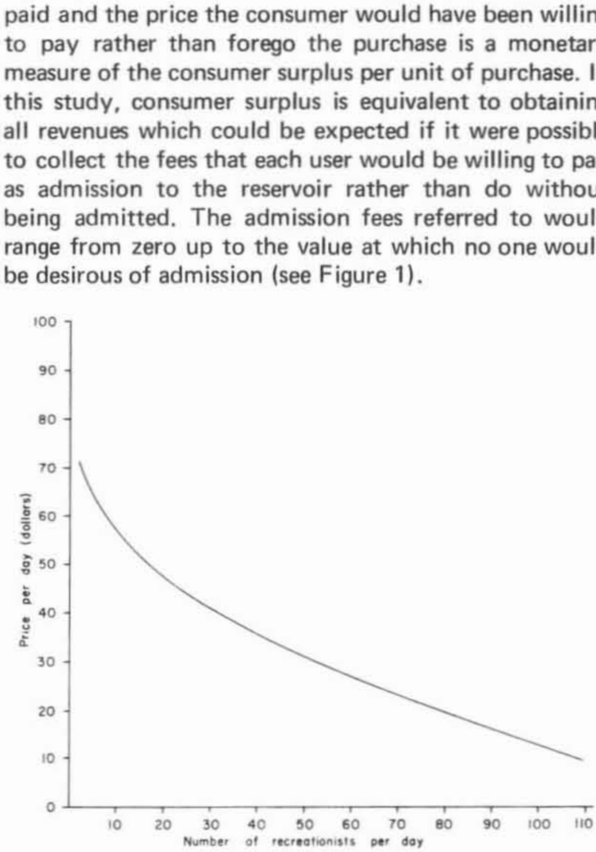

Figure 1.--Hypothetical Demand Curve for Recreation

The calculation of consumer surplus can be illustrated by the following example. If one person is willing to pay \$100 for a recreational experience, and he plus two others will pay \$50 for the experience, a simple demand curve may be generated. The individual willing to pay \$100 will surely pay \$50 since he considers the experience a bargain. Since three recreationists will visit the project at a cost of \$50 each, total revenues at the project are \$150. Two people will pay exactly the value of the experience to them. One individual, however, will pay less than its value to him. If a demand curve exists and shows the difference between the amount paid and recreational value to the recreationist, the difference can be measured quantitatively. In the example, the recreationist who paid \$50 for a \$100 experience has received a consumer surplus of \$50. Therefore, his payment is not representative of the benefit he received from use of the visited project. Total recreation benefits are not 3 x 50 = \$150, but rather (1 x 100) + (2 x 50) = \$200.

Recreational demand curves for a particular time period, in this case one year, must be determined for each reservoir in order to estimate its recreational benefits during that time period. Anticipated population growth, rising income, and associated positive influences pertaining to future recreational demand indicate a probable upward shift in the demand curve for a particular reservoir. Estimates of demand curves in future years provide estimates of the shift over time in recreation demand at a reservoir. The annual benefits increase as the annual demand curves shift to the right. In this study, recreational demand curves were estimated for each proposed reservoir in 1970, 1980, 1990, 2000, 2010, 2015, and 2020. The time stream of future annual recreation benefits was obtained from these decade point estimates for the purpose of calculating total recreation benefits to each proposed reservoir.

While the demand curve is expected to shift upwards over time, negative effects may be felt on some reservoirs because of the degradation of quality. If water quality deteriorates or land use patterns occur which are aesthetically unappealing, fewer recreationists may visit a project than expected. Since the effect of quality on the value of an experience cannot be measured except indirectly through incurred visitation, this study assumes recreational quality will remain at the average level of those reservoirs used in developing the demand model. However, this negative effect will probably be more than offset by the improved quality of facilities at recreational projects. The calculated shifts are therefore probably conservative in the absence of a quality variable in the model.

ESTIMATING A RECREATION VISITATION EQUATION

The Model

A recreation visitation relationship has been obtained by relating sample survey data on recreation visitation in 1965 to recreation visitation associated factors (income, population, travel cost, reservoir size, and population proximity to available reservoirs).

Steps used by the BOR in estimating benefits are normally as follows (but not necessarily in this order):

1. Determine the zone of influence of the project.

2. By using population estimates and projections, determine the present and projected population that likely would be served within the study area.

3. Use established or revised participation rates for each type of outdoor activity to determine the demand in terms of visitor days or activity occasions for each activity within the study area for the life of the project.

4. Using land use formulae, determine the projected acreage necessary to serve the demand for each type of activity.

5. Inventory current and projected facilities, both public and private, to estimate a supply.

6. Develop a composite picture of land needs per activity through a comparison of supply (5) and demand (4).

7. Plan recreational facilities at the project to serve as much of the present and projected unfulfilled demand as possible.

The above only serves to help determine those facilities proposed for inclusion in the project. Benefits are calculated by using the facility analysis as follows:

1. Recreational facilities proposed for inclusion are examined in light of their possible use in activity occasions or visitor days. A visitor day is one visit during a day for any length of time to a recreation facility. The trend in recent years is to the activity occasion analysis, an activity on one day. A person who fishes and boats during a day will represent one activity occasion of fishing and one of boating. A person fishing three different times of day still represents one activity occasion of fishing for the day.

2. Values are attached to participation by activity, and the resulting number represents an unweighted benefit of those activities on proposed facilities.

3. Those values are then weighted up or down depending upon such factors as water quality, scenic beautification, etc., which vary from site to site.

4. The final weighted value represents the benefit which will accrue to the facility and is used in the benefit-cost analysis.

While other factors are considered and some judgments are highly subjective, the preceding covers the major parts of the recreation benefit estimation process as used by BOR.

The Corps of Engineers uses surveys and traffic counts at all facilities which they operate to determine current demand. They will normally use a visitation model developed at projects of similar size with approximately the same population in the zone of influence to estimate visitation at the proposed project. Facilities are designed for the project and potential use of those facilities is determined by the visitation model. Values are assigned to the participation in each activity, and multiplication yields total recreational benefit to the project.

If the benefits calculated by BOR or the Corps of Engineers exceed the separable cost of the recreational facilities at the project, recreation is justified as a purpose in the multiple-purpose project.

Public Law 89-72 of July 9, 1965, is the Federal Water Project Recreation Act. This law sets forth the responsibilities of non-federal public bodies in providing cooperation for recreational planning at a project. Sections 2 and 3 of the Act are of greatest interest to the states.

Section 2 provides for a non-federal letter of intent to agree to administer project land and water areas for recreation or fish and wildlife enhancement pursuant to the plan for project development. The letter would be signed by the interested non-federal public body. The letter would agree to bear at least one-half of the separable costs of the project allocated to recreation or fish and wildlife enhancement and all associated costs of operation, maintenance, and replacement.

In return, benefits of the project to recreation and/or fish and wildlife enhancement will be considered in determining economic benefits of the project. Also, one-half of separable costs and all the joint costs allocated to those purposes will be borne by the federal government and be considered non-reimbursable.

Section 3 states that in the absence of a letter of intent, no facilities will be provided unless (1) they serve other project purposes and are justified without recreational benefits, and (2) they are minimum facilities required for public health and safety and are located at access points of construction. In this case, project costs would be reimbursable.

However, also in Section 3, a provision is made for local acquisition to preserve recreation potential even without the letter of intent. It then provides for a 10-year period during which the non-federal body can comply by accepting its responsibilities under Section 2. After 10 years, the land could be disposed of through sale or transfer or used for any lawful purpose by the head of the agency having jurisdiction over the project.

The general form of the visitation estimating equation is as follows:[3]

$$(Y + 0.8) = A\ X_1^{b_1}\ X_2^{b_2}\ X_3^{b_3}\ X_4^{b_4}\ X_5^{b_5},$$

where Y is the number of visitor days from a particular county of origin per unit time (one visitor per day is considered one visitor day), X_1 is population of the county of origin of visitors, X_2 is round trip cost of travel from the county of origin of visitors, X_3 is per capita income in the county of origin of visitors, X_4 is a "gravity" variable constructed to reflect the competitive effect of other reservoirs available to visitors of the county of origin upon visitation to the study reservoir, and X_5 is size, in surface acres of the conservation pool, of the reservoir visited.

Least squares regression was used to select a mathematical equation with which to estimate visitation. Linear polynomials, semilogarithmic transforms, and double logarithmic transforms were fitted to 1965 data from a sample of Texas reservoirs. The double logarithmic transform was selected for making recreation visitation estimates, since the double logarithmic transformation resulted in a larger number of statistically significant recreation visitation explaining variables than either of the other forms investigated, although the semilogarithmic transform had a higher coefficient of determination.

The gravity variable, X_4 has been constructed for each Texas county, and includes competing lakes within 100 miles of the center of each county. The 1965 survey data used in this analysis indicated that more than 90 percent of visitors originated within 100 miles of each sample reservoir, thus the choice of a 100-mile radius for purposes of this analysis. The assumptions underlying this variable are as follows: (1) the larger the number of reservoirs near a county, the less likely residents of that county will visit a particular reservoir; (2) the reservoir's surface size is an important factor in attracting recreationists. The gravity variable was determined as shown in the next column.

$$X_{4j} = \sum_{i=1}^{n} \frac{\log_{10} S_i}{d_i},$$

where X_{4j} is the gravity value for county j, S_i is surface acre size of the conservation pool in reservoir i, and di is the distance from reservoir i to the center of county j. There are as many terms in the gravity equation as there are reservoirs within 100 miles of the center of county j (n equals the number of reservoirs within 100 miles). In the calculations, the logarithm of reservoir size has been weighted by distance, in miles, to each respective reservoir. Large numeric values associated with the gravity variable are expected for counties having large reservoirs nearby, while counties having few reservoirs nearby are expected to have smaller numeric gravity values. The sign of the regression coefficient of the gravity variable can be expected to be negative. Appropriate numeric gravity values associated with each respective county are important factors in estimating visitation from that particular county to new recreation projects, since the gravity variable is expected to reflect the competition from other available reservoirs.

The Data

This study required the use of data from several sources. Each important source is discussed in detail below, and the underlying assumptions pertaining to data development are stated and explained.

Data Used in Estimating the Recreation Visitation Equation

Basic recreation participation data were obtained from a survey of recreation visitors at a sample of eight Texas reservoirs. The survey was conducted during the summer of 1965 at a sample of reservoirs chosen on the basis of accessibility, facilities, variety of recreation opportunity, and geographic representation. Recreationists who visited sample reservoirs during the survey period were interviewed and the following information was obtained: number in the party, place of origin, time required to travel to the reservoir, age group of party leader, income group of party leader, primary purpose of the outing, secondary purposes of the outing, occupation of the party leader, and educational level of the party leader (see the Appendix). Interviewees were requested to designate an education level, an income group, and an age group on a specially designed card rather than asked to state exact answers to these questions. The survey at each sample reservoir was conducted on two consecutive weekends and on four of the intervening week days. The weekend consisted of Saturday and Sunday. Friday was counted as a week

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3 The quantity 0.8 was added to each observation of the dependent variable to facilitate calculation of the demand curves at the origin or zero visitors. The inclusion of a constant is necessary for calculating purposes since the logarithm of zero is undefined. The addition of a constant to non-transformed data merely shifts the function without affecting the slope of the function, but the same constant in the logarithmic transformation changes both the slope and shifts the function. Since the constant used here was small in relation to the observations, it did not noticeably affect the estimates.

day. Survey stations were set up on each of the sample reservoir's access roads so that all visitors could be interviewed.

The observations used in calculating estimates of the regresssion coefficients of the recreation model applied to those counties from which recreation visitors originated during the 1965 survey plus all other counties within 100 miles of the sample reservoir. (The 1965 survey data showed that more than 90 percent of visitors originated within 100 miles of the reservoir visited.) The county was chosen as the observation unit in order to test hypotheses of the influence of population density and income upon recreational visitation at lakes and reservoirs. The data for these variables were most readily available on a county basis. In some cases, counties near the reservoir did not send visitors to the lake during the survey period. These counties could not be ignored, however, since they represent a portion of the potential recreators. Such counties were entered into the analysis with zero visitors, but with the counties' actual population, per capita income, and gravity values.

The number of visitors from each county was obtained from the survey and used as the numeric observation in the statistical analysis. These data were then matched with other characteristics of the county of origin for the purpose of calculating estimates of the parameters of the hypothesized recreation visitation model. For example, if during the survey, county A sent 20 parties totaling 43 people to reservoir B, the number 43 is the observation on Y, and county A's population, travel cost [(distance from the center of county A to lake B) X (round trip cost per mile)], county A's per capita income, county A's gravity value, and surface acres in the conservation storage pool of reservoir B are the concomitant observations of the respective explanatory variables associated with the number of visitors (43). Other studies of a similar nature have used concentric zones surrounding the study reservoir as observation units, in which case the population and incomes of people residing in counties which did not send visitors were included in the zone totals. The choice of counties rather than concentric zones as the observation unit can be expected to result in lower explanation of variation in visitation than if zones were chosen because of the variation in numbers of visitors originating from each county. Aggregating counties into zones tends to reduce variation from this source but also reduces the number of observations available for statistical analysis.

The choice of counties as the observation unit required that distance to the reservoir—an important visitation explanatory variable—be associated with the individual counties. Distance, therefore, was measured from the approximate geographic center of the county to the sample reservoir. Cost of travel was then calculated by using round trip average variable travel costs published by the American Automobile Association. The cost of travel associated with visitation from a particular county entered the regression analysis as a proxy for price of recreation. Travel costs was entered into the regression analysis as a visitation explaining variable.

The regression model was fitted for each individual sample reservoir, ignoring the reservoir size. These individual reservoir analyses did not appear to be different: R^2's ranged from 0.65 to 0.69, regression coefficients were about the same size for each respective variable, and signs of respective regression coefficients were identical for each of the separate reservoirs. Observations for the individual sample reservoirs were then pooled and reservoir size, in terms of surface acres in the conservation pool, was entered into the regression model as an explanatory variable. This procedure was followed in order to permit a test of the hypothesis that visitation to reservoirs varied with reservoir size. Pooling data from the sample reservoirs resulted in 495 total observations and eight different reservoir sizes. This analysis showed that reservoir size was a significant variable. Thus, pooling the sample reservoirs permitted the estimation of a single recreation visitation equation for use in estimating visitation to proposed reservoirs.

Data Used in Projecting Visitation Estimates, 1970-2020

The estimation of recreation benefits for use in development of the preliminary Texas Water Plan required visitation projections by decades to 2020. In order to make the visitation projections, it was necessary to use projections of the data pertaining to each variable included in the visitation estimating model.

Population projections were made, on a county basis, by the Texas Water Development Board in cooperation with the Bureau of Business Research of The University of Texas at Austin, for use in calculating projected water requirements. These population projections were used in calculating projected recreation visitation.

Income projections were made for use in estimating visitation at each decade from 1970 to 2020. Income projections were based on the assumption that annual per capita income would increase at a constant rate of 3 percent of the 1964 level after 1970. For example, county per capita income in 1970 would be 1.3 times the 1964 level, and the 2020 per capita county income would be 2.8 times the 1964 level.

Since the gravity variable is included to reflect the competitive effect of alternative reservoirs upon visitation at a particular reservoir, it is important that the individual county gravity values include new reservoirs as they are added. The following procedure was used to keep the gravity variable updated for calculating visitation at each of the decades between 1970 and 2020. All lakes having 5,000 or more acre-feet of storage and located within 100 miles of the center of each county were included in calculations of the numeric gravity value for each respective county. The 1970 numeric gravity value for the typical county included the reservoirs present in 1963 plus those reservoirs under construction that were expected to be completed by 1970. The gravity data calculated for 1970 were used in calculating visitation estimates for 1970, 1980, and 1990. A new set of numeric gravity values, which included those reservoirs planned for completion by the year 2000, was calculated. This latter gravity value for the typical county was obtained by adding to the numeric quantity value of 1970, new terms in the gravity equation to represent all the anticipated new reservoirs within 100 miles of the center of the county. The revised gravity data were used in calculating visitation estimates for the years 2000, 2010, and 2020.

Visitation estimates for proposed reservoirs were calculated for that set of Texas counties located within the zone of influence of a proposed reservoir location. Counties outside Texas are not included in the calculations. The zone-of-influence boundary and the omission of nearby counties in neighboring states are expected to result in an underestimate of visitation to Texas reservoirs. The error due to the 100-mile boundary was expected to be small, as the 1965 survey data indicate that few visitors traveled more than 100 miles to visit sample reservoirs. The error in estimating visitation to reservoirs located near the State's boundaries, due to omitting counties in neighboring states, could be significant, depending upon population density, distance to the lake, and availability of water-based recreation opportunity in neighboring states. There are, however, barriers to the interstate use of reservoirs such as out-of-state licenses to fish and hunt. These barriers can be expected to reduce the use of reservoirs by recreationists from neighboring states and thereby reduce the visitation estimation errors associated with the exclusion of out-of-state recreationists in this analysis.

Recreation visitation records of the Texas Parks and Wildlife Department indicate that the water-based recreation season is approximately 8 months in north Texas and 10 months in south Texas. Since the estimation equation obtained from the 1965 recreation survey pertains to approximately 1.5 weeks, a blow-up factor of 21.9 is applied in order to convert the sample estimate to an annual estimate in north Texas and 26.6 in converting the sample estimate to an annual estimate in south Texas.

A discount rate of 3.25 percent per annum is used in calculating present worth of the recreation benefits stream. This was the rate chosen for evaluating other benefits and associated costs of the preliminary Water Plan. The above interest rate was used to make recreation benefits estimates equivalent to other benefits estimates of the Plan, and to permit a comparison with associated cost streams. (Note: Subsequent analyses of specific projects and systems have used a 3.5 percent discount rate, but all reservoir recreational benefits were discounted at 3.25 percent for the preliminary Plan. The total listing of reservoirs in this study uses 3.25 percent for comparative purposes based upon the original or preliminary studies.)

The Statistical Equation

The double logarithmic transformation using natural logarithms and 495 observations was fitted to sample data obtained at the eight sample reservoirs of the 1965 recreation survey described above. The following equation was obtained:

$$\log_e(Y + 0.8) = \underset{(2.08063)}{-8.60308} + \underset{(0.04404)}{0.57373}\log_e X_1 - \underset{(0.07502)}{1.18626}\log_e X_2 + \underset{(0.26744)}{0.75292}\log_e X_3 - \underset{(0.04806)}{0.32666}\log_e X_4 + \underset{(0.06377)}{0.20955}\log_e X_5$$

$$R^2 = 0.41$$

The variables were defined earlier. The standard errors of the estimates of the regression coefficients are shown in parentheses beneath each coefficient. The coefficients are significant at the 5 percent level and each has the expected sign. A simple correlation between variables of the recreation visitation equation is shown as Table 1.

The equation is linear in the parameters (coefficients and exponents) but is curvilinear in the variables. Therefore, there is a continual change in the effect of increases or decreases in the variables, depending upon the level at which a particular variable happens to be entered into the equation. The regression coefficients of the population and income variables indicate that each successive population or income increase results in smaller and smaller increases in visitation, given constant values of the other variables in the equation. This effect is due to the present county to county variation in visitation per unit of population and income; i.e., the parameters are estimated using concomitant observations of present visitation, population, income, and other variables in each county. As shown above, the coefficient of X_1 (population) is less than one. Thus, a larger population of an originating county is associated with a lower proportion of that population visiting the sample reservoirs (given data pertaining to the other explanatory variables).[4] Analogously, the coefficient of X_3 (per capita income) indicates that visitation from the originating county increases at the sample reservoirs as per capita income increases, but at a decreasing rate. Visitation due to the other variables of the equation can be explained similarly.

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[4] The simple correlation between visitation and county population was estimated at 0.33 and that between visitation and per capita income was 0.11.

Table 1.--Simple Correlation Coefficients Between Variables of the Recreation Visitation Equation

VARIABLES	NUMBER OF VISITORS (Y)	COUNTY POPULATION[a] (X_1)	TRAVEL COST[b] (X_2)	COUNTY PER CAPITA INCOME[c] (X_3)	GRAVITY (X_4)	LAKE SIZE[d] (X_5)
Number of visitors (Y)	1.00000	0.33044	-0.35780	0.11475	-0.01774	-0.00470
County population (X_1)	--	1.00000	0.29748	0.33779	0.15316	0.08838
Travel cost (X_2)	--	--	1.00000	0.25060	-0.27276	0.27935
County per capita income (X_3)	--	--	--	1.00000	-0.05360	-0.16553
Gravity (X_4)	--	--	--	--	1.00000	-0.09570
Lake size (X_5)	--	--	--	--	--	1.00000

[a] 1960.
[b] Calculated at $0.074 per mile.
[c] 1960.
[d] Surface acres in conservation pool.

The size of the coefficient of determination ($R^2 = 0.41$) is explained in part by the size of the observations, in part by the use of the county as the observation unit, and in part by the specification of the model. The untransformed data exhibit large variation in the number of visitors originating from the different counties. In general, counties near the sample reservoirs sent large numbers of visitors, but a fairly large number of distant counties also sent visitors even though the numbers originating from distant counties were low. A plot of the raw data in the distance-traveled-number-of-visitors plane revealed that correlation between these two variables would be low. The analysis shows, however, that the correlation between distance traveled and the number of visitors is statistically significant.

The use of counties as the observation unit requires that all counties in the surrounding area served by the lake be included in the analysis. During the sample period, some of the nearby counties did not send visitors to the reservoir, while counties located farther from the reservoir did send visitors. This is not unexpected, especially as the survey period at each sample lake was relatively short (1.5 weeks). All counties within 100 miles of a reservoir were considered as a part of the zone served by the reservoir and any counties within this radius which did not send visitors were entered among the observations at zero visitation, but with the counties' appropriate concomitant population, travel cost, income, lake size, and gravity values.

The relatively low coefficient of determination means that individual county estimates of visitation can be expected to vary considerably from the quantity of visitors actually observed. When the visitation estimating equation was applied to the 1965 survey data, the estimates of numbers of visitors originating from counties near the sample lakes were lower than the number of visitors actually observed during the survey, while there was a tendency to overestimate the number of visitors from more distant counties.

The estimation equation applies to the unit of time involved in the survey—approximately 1.5 weeks. Blow-up factors (discussed earlier in the various Texas sub-areas (north and south Texas) were used to expand survey estimates to annual estimates. Visitation reports of the Texas Parks and Wildlife Department for parks and lakes provided a basis for devleoping these annual coefficients which converted the sample period visitation estimates to an annual basis.

ESTIMATING RECREATION DEMAND CURVES

The recreation prediction equation presented earlier is used in the calculation of recreation demand curves for each proposed reservoir of the preliminary Texas Water Plan. The recreation demand equation for a particular lake is estimated as follows. The prediction equation is partially solved for each of the counties included in a circular zone around the lake by inserting the county values for population (X_1), income (X_3), gravity (X_4), and reservoir size (X_5). The zone served was limited to 100 miles in east Texas and approximately 150 miles in west and south Texas, based on visitation indicated in the 1965 recreation survey. Visitation declined sharply as distance traveled increased. Less than 5 percent of visitors traveled more than 100 miles to visit reservoirs surveyed in 1965. The setting of a zone of service of 100 mile radius resulted in an underestimate of visitation and, therefore, reduced estimated recreation benefits, but the error thus introduced was expected to be small for most reservoirs proposed for the preliminary Texas Water Plan. The partial solution of the prediction equation for a reservoir results in a number of equations (the number equals the number of counties within the zone served by the reservoir) of the following form:

$$\log_e (Y + 0.8) = B - 1.18625 \log_e X_2,$$

where B is the accumulation of terms A, X_1, X_3, X_4, and X_5 when respective county data were inserted and the algebraic sums of the multiplications were obtained. Since X_2 is round-trip travel cost from the respective counties, X_2 is replaced by \$0.074D, where D is one-way distance in miles from the center of the county to the reservoir and \$0.074 is round-trip variable cost of travel per mile. Cost of travel data published by the American Automobile Association are used in fitting the regression model to 1965 survey data. The recreation prediction equation is fitted for the individual survey reservoirs using both \$0.074 and \$0.12 per mile as travel costs. The higher travel cost (\$0.12 per mile) gives a slightly higher intercept term of "A" value, but the other regression coefficients are not noticeably changed. Average variable cost of travel (\$0.074 per mile) is chosen for use in this analysis since the recreationist is most apt to view additional visits to reservoirs in terms of variable costs rather than full costs, especially once his automobile, boat, motor, tent, etc., are already purchased. The choice of the lower travel cost per mile results in slightly lower estimates of visitation and consequently lower estimates of recreational benefits at reservoirs than the higher travel cost yields since its effect upon the prediction equation is to shift it downward in a parallel fashion.

The solution of each equation for each county, and a summation of the results, yields an estimate of visitation when the user fee at the lake is zero. The estimates of visitation to reservoirs at zero added cost (zero user fee) are obtained from a modified recreation prediction equation. The recreation prediction equation obtained by fitting the double log transform to the 1965 survey data has been shifted upward from -8.60308 to -5.60308 so that the estimates of visitation from counties near the survey reservoirs which sent large numbers of visitors closely approximated the actual number of visitors observed from those nearby counties during the survey.

The effects of adding a user fee of a certain amount (P) per person is estimated by recalculating the above set of equations, for each reservoir, with the variable X_2 replaced by (\$0.074 D + P) and then summing the values obtained for each county. Solutions for as many different P's or user fees as are desired can be obtained. Each such solution estimates a point on the reservoir demand curve. The equation is solved for a sufficient number of points to permit sketching the demand curves applicable for each proposed reservoir at each specified point in time. Demand curves of the type just described are estimated for each decade between 1970 and 2020 using projected county population, income, and gravity data. The general appearance of the demand curves is illustrated in Figure 2.

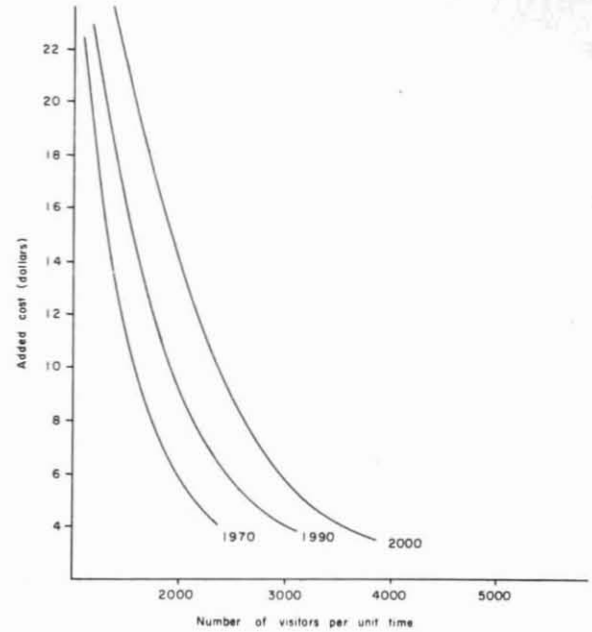

Figure 2.--Shifting Recreation Demand Curves

Due to the shape of the function (logarithmic) and to the tendency of the equation to overestimate visitation from distant counties, the underestimation bias of the estimating equation becomes increasingly less important as visitation estimates are calculated at higher and higher user fees. The effect of an increased travel cost term in the equation (user fee + actual travel cost) is analogous to shifting nearby counties radially away from the reservoir. The estimates at higher user fees are, therefore, not expected to be underestimates of visitation. The net effects of the relatively poor fit to the data are an underestimate of visitation at zero user fee. Since the demand curves derived from the equation are logarithmic in shape, and benefits estimates are areas (integrals) under the curves, the benefits estimates are not appreciably affected by a poor estimate of visitation at zero user fee.

ESTIMATING RECREATION BENEFITS

Points on recreation demand curves are obtained for each proposed reservoir at each decade between 1970 and 2020 by solving the recreation visitation equation for each decade. The equation is solved using the decade's projected population, income, and gravity data, and using the range of admission fees mentioned earlier. Each solution gives a point on the demand curve (Figure 3). The decade demand curves are obtained by plotting these estimated points.

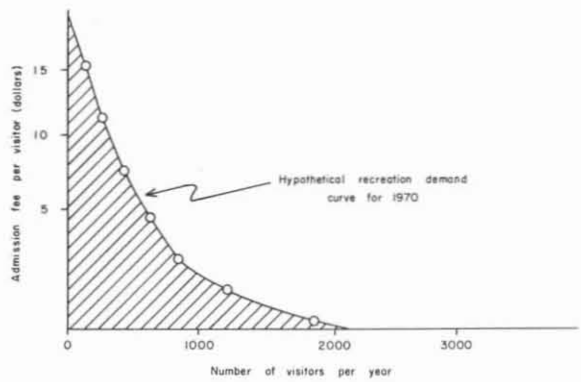

Figure 3.--Recreation Benefits—Area Under the Demand Curve

Annual recreation benefits at each decade are obtained by estimating the area under the demand curve (shaded region of Figure 3). Benefits estimated in this way contain what is known in economics as "consumer surplus"—a concept explained earlier. If admission fees are in fact zero, i.e., if there is no admission price for recreation at the reservoir, the benefit is the entire area under the estimated demand curve.

Since population and income are projected to increase with time, each successive decade demand curve lies above the preceding one, resulting in increased annual benefits with time (Figure 4).

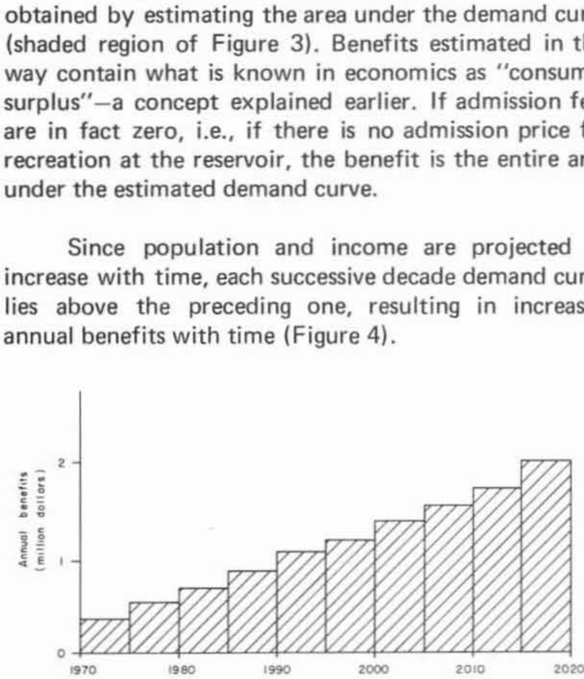

Figure 4.--Nature of Expected Increases in Recreation Benefits at Proposed Reservoirs

Table 2 shows estimates of visitation at numerous proposed reservoirs. The estimates are based on the modified visitation equation and pertain to visitation when admission fees are zero, i.e., travel cost to the reservoir has been included, but not increased to reflect the effect of an admission fee upon visitation. In terms of present visitation reports at existing reservoirs, visitation estimates seem consistent except perhaps in the lower Guadalupe, San Antonio, and Nueces River basins. Since there are several large reservoirs in these three basins, and present population in the area consists primarily of the cities of San Antonio and Corpus Christi, the model may overestimate visitation to the proposed reservoirs. Although the gravity variable in the visitation prediction model was operating to adjust for the presence of nearby competing reservoirs, the number of large reservoirs in the area had an offsetting effect. The resulting total basin estimates are probably high for the early decades. If population in the area increases as the population projections used in the analysis indicate, visitation estimates for later decades would not be considered high.

Table 3 shows the estimated recreation benefits for the proposed reservoirs. The benefits shown for mid-decade points were obtained by linear interpolation between the decade estimates. For purposes of calculating present worth of the estimated recreation benefits stream, each estimate in Table 3 is assumed constant for 5 years.

Present worth of the benefits stream was calculated by using standard discounting procedures:

$$PW = \sum_{i=1}^{n} \frac{B_i}{(1+r)^i} ,$$

where PW is present worth of recreation benefits, B_i is benefit in year i, and r is the annual discount rate.

Construction time is not yet determined for some lakes, and it is impossible to further analyze recreation benefits estimates of these reservoirs. Present worth of the estimated benefits stream and equivalent annual benefits are calculated for those lakes for which approximate completion dates are available. Implicit in the present worth calculation is the assumption that annual benefits remain constant at the estimated 2020 level between 2020 and 2070.

Present worth of recreation benefits is expressed as if 1970 equals time zero, regardless of the year in which project construction is expected. For example, estimated annual recreation benefits of Big Pine Reservoir in the year 2005 are $400,000, but in the year 2020 annual benefits are estimated at $682,000 (Table 2). The 1970 present worth of this annual benefits stream is estimated at $5.14 million. Under the assumptions of this study, the equivalent annual or level annual 100-year benefit stream, amounting to a present worth of $5.14 million, is $0.174 million. Benefits will not be realized, however, until construction is completed; thus, zeros are shown in cells of Table 2 for the years prior to expected completion of lakes for which tentative staging has been done.

Potential annual benefits estimates are shown, beginning in 1970, for those reservoirs which have not been staged into one or more of the various multiple-reservoir systems.

In order to compare recreation benefits among reservoirs and to compare the benefits with associated costs, it is necessary to express present worth and

Table 2.--Estimated Number of Recreational Visits to Proposed Reservoirs, 1970-2020[a]

(In Thousands of Visitor Days Per Year)

RIVER BASIN AND RESERVOIR	1970	1980	1990	2000	2010	2020
Red River basin						
Sweetwater Creek	240	306	349	380	434	467
Bois d'Arc	0	288	368	448	528	656
Big Pine	0	0	0	0	861	966
Pecan Bayou	0	0	0	0	874	998
Timber Creek	43	55	67	79	98	110
Sulphur River basin						
Sulphur Bluff 1	0	0	554	651	779	893
Naples 1 and 2	0	0	0	0	646	741
Cooper	441	571	710	834	1,006	1,155
Cypress Creek basin						
Franklin County	0	462	567	672	798	924
Titus County	0	588	735	861	1,029	1,197
Marshall	0	0	0	0	1,155	1,323
Black Cypress	0	0	0	0	1,128	1,361
Sabine River basin						
Mineola	0	0	987	1,176	1,428	1,575
Lake Fork	0	0	903	1,050	1,281	1,407
Kilgore 2	336	462	567	693	861	966
Neches River basin						
Blackburn Crossing Enlargement	525	693	861	1,008	1,239	1,344
Rockland	0	0	0	0	2,982	3,280
Ponta	0	0	0	0	1,073	1,285
Trinity River basin						
Lakeview	0	1,407	1,764	2,121	2,583	3,087
Aubrey	0	315	399	483	567	672
Richland Creek	0	0	1,308	1,567	1,898	2,249
Tehuacana Creek	0	0	651	760	918	1,092
Tennessee Colony	735	966	1,218	1,428	1,743	2,016
Bedias	0	0	0	0	1,100	1,417
Wallisville	609	840	1,092	1,302	1,638	2,016
San Jacinto River basin						
Cleveland	735	1,008	1,323	1,533	1,911	2,373
Humble	2,142	2,940	3,780	4,242	5,292	6,510
Lower East Fork	861	1,197	1,533	1,806	2,268	2,814
Lake Creek	525	735	945	1,092	1,365	1,701
Brazos River basin						
Millers Creek	0	0	363	431	496	565
De Cordova Bend	487	626	777	922	1,111	1,323
Aquilla Creek	0	630	787	932	1,128	1,315
North San Gabriel	374	479	594	672	809	964
Breckenridge	0	395	462	557	651	756
Stephenville	0	294	378	441	525	630
Laneport	470	603	750	846	1,021	1,218
Cameron	0	0	0	0	2,413	2,881
Navasota 2	0	0	0	0	1,336	1,569
Millican	0	1,323	1,680	1,869	2,310	2,835
Colorado River basin						
Robert Lee	533	666	769	916	1,071	1,241
Stacy	0	0	588	680	804	941
Columbus Bend	0	1,029	1,302	1,407	1,722	2,121
Matagorda	714	945	1,197	1,218	1,512	1,827
Upper Pecan Bayou	286	359	416	494	578	670
Lavaca River basin						
Palmetto Bend	0	1,167	1,466	1,453	1,778	2,153
Lavaca-Guadalupe Coastal basin						
Garcitas	0	737	928	890	1,090	1,323

Table 2.--Estimated Number of Recreational Visits to Proposed Reservoirs, 1970-2020[a]--Continued

(In Thousands of Visitor Days Per Year)

RIVER BASIN AND RESERVOIR	1970	1980	1990	2000	2010	2020
Guadalupe River basin						
Ingram	0	0	588	672	798	945
Cloptin Crossing	0	473	594	659	804	970
Lockhart	0	403	498	525	630	748
Cuero 1 and 2	0	1,347	1,669	1,695	2,044	2,441
Confluence	0	1,011	1,248	1,175	1,425	1,716
San Antonio River basin						
Cibolo	0	609	756	777	945	113
Goliad	0	1,206	1,498	1,464	1,765	2,109
Nueces River basin						
Choke Canyon	0	0	1,149	1,201	1,453	1,742
Total	10,056	27,135	41,148	46,082	66,720	78,431

[a] Calculated with the equation:

$$\log_e (Y + 0.8) = -5.60308 + 0.57373 \log_e X_1 - 1.18626 \log_e X_2 + 0.75292 \log_e X_3$$

$$-0.32666 \log_e X_4 + 0.20955 \log_e X_5.$$

Y = visitor days per unit time (1.5 weeks).

X_1 = population of county or origin of vistors.

X_2 = travel cost from county of origin of vistors.

X_3 = per capita income of county of origin of visitors.

X_4 = gravity for county of origin of visitors.

X_5 = surface size, in acres, of the conservation pool of the reservoir.

Table 3.--Estimated Recreational Benefits of Proposed Reservoirs, 1970-2020

(In Thousands of Dollars)

RIVER BASIN AND RESERVOIR	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020	TOTAL UNDISCOUNTED BENEFITS, 1970-2070	PRESENT WORTH IN 1970 OF FUTURE BENEFITS a/	EQUIVALENT ANNUAL BENEFITS b/
Red River basin														
Sweetwater Creek	130	146	161	175	189	205	221	242	262	317	371	28,295	c/	c/
Bois d'Arc	0	108	121	134	146	161	175	192	209	273	336	24,350	4,690	158
Big Pine	0	0	0	0	0	0	0	400	440	561	682	41,105	5,140	174
Pecan Bayou	0	0	0	0	0	0	0	376	421	568	714	42,525	5,250	177
Timber Creek	13	16	18	20	22	24	26	29	31	41	50	3,700	c/	c/
Sulphur River basin														
Sulphur Bluff 1	0	0	0	209	233	261	288	315	341	464	586	39,855	6,490	219
Naples 1 and 2	0	0	0	0	0	0	0	270	286	424	562	33,005	4,010	135
Cooper	165	191	216	244	272	305	337	368	398	543	685	49,445	9,780	331
Cypress River basin														
Franklin County	0	491	552	636	719	719	720	870	1,020	1,257	1,494	109,620	21,310	723
Titus County	0	223	240	288	335	373	412	457	503	621	740	54,260	9,780	331
Marshall	0	0	0	0	0	0	0	383	401	579	756	44,615	5,450	184
Black Cypress	0	0	0	0	0	0	0	397	448	623	797	47,190	5,780	195
Sabine River basin														
Mineola	0	0	0	461	512	564	616	680	745	973	1,201	82,805	13,710	464
Lake Fork	0	0	0	458	510	559	608	707	806	972	1,137	79,950	13,470	456
Kilgore 2	143	163	184	210	236	259	282	314	345	445	544	40,105	c/	c/
Neches River basin														
Blackburn Crossing Enlargement	280	319	359	410	461	499	536	596	655	866	1,076	78,705	15,900	538
Rockland	0	0	0	0	0	0	0	771	857	1,299	1,740	101,635	12,260	415
Ponta	0	0	0	0	0	0	0	475	520	739	958	56,570	6,910	234
Trinity River basin														
Lakeview	0	428	480	590	699	709	719	798	878	1,096	1,315	97,835	19,310	654
Aubrey	0	144	161	178	194	214	234	256	279	364	449	32,570	6,250	212
Richland Creek	0	0	0	590	650	720	789	853	917	1,337	1,757	117,130	18,650	632
Tehuacana Creek	0	0	0	415	460	503	545	626	706	1,244	1,782	111,595	16,250	551
Tennessee Colony	382	446	510	567	626	695	767	798	830	1,188	1,546	111,345	22,180	751
Bedias	0	0	0	0	0	0	0	537	537	745	954	56,795	6,980	236
Wallisville	248	295	342	393	444	481	517	579	641	845	1,049	76,375	15,240	516
San Jacinto River basin														
Cleveland	343	407	471	552	633	681	729	797	865	1,145	1,425	104,365	c/	c/
Humble	566	667	768	876	985	1,052	1,119	1,257	1,394	1,691	1,988	151,275	c/	c/
Lower East Fork	410	474	538	661	783	792	801	927	1,053	1,341	1,630	120,400	c/	c/
Lake Creek	280	320	360	384	408	434	460	490	521	761	1,001	72,140	c/	c/

Table 3.--Estimated Recreational Benefits of Proposed Reservoirs, 1970-2020--Continued

(In Thousands of Dollars)

RIVER BASIN AND RESERVOIR	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020	TOTAL UNDISCOUNTED BENEFITS, 1970-2070	PRESENT WORTH IN 1970 OF FUTURE BENEFITS a/	EQUIVALENT ANNUAL BENEFITS b/
Brazos River basin														
Millers Creek	0	0	0	210	226	229	232	270	309	385	461	32,355	5,490	186
De Cordova Bend	266	287	309	343	378	419	461	512	563	655	746	58,265	12,750	432
Aquilla Creek	0	293	350	365	380	411	443	492	541	711	880	63,930	8,460	286
North San Gabriel	201	234	266	293	321	333	346	374	401	568	734	53,385	10,890	369
Breckenridge	0	133	149	176	202	222	242	265	287	391	495	35,085	6,500	220
Stephenville	0	140	156	184	212	233	254	277	301	397	492	35,370	6,660	226
Laneport	232	263	295	335	376	395	414	465	516	708	899	64,945	12,980	439
Cameron	0	0	0	0	0	0	0	1,179	1,297	1,660	2,023	121,830	15,220	515
Navasota 2	0	0	0	0	0	0	0	0	689	956	1,223	69,375	7,970	270
Millican	0	567	625	742	859	919	980	1,033	1,086	1,485	1,884	135,680	25,850	875
Colorado River basin														
Robert Lee	235	260	285	311	336	372	407	440	473	646	819	59,775	12,180	413
Stacy	0	0	0	266	283	310	337	365	394	545	695	47,250	7,720	261
Columbus Bend	0	457	518	588	658	686	714	805	895	1,099	1,302	97,200	19,330	654
Matagorda	354	409	464	531	597	607	616	692	768	971	1,175	88,795	c/	c/
Upper Pecan Bayou	111	126	142	153	164	181	197	216	234	322	411	29,780	c/	c/
Lavaca River basin														
Palmetto Bend	0	584	662	748	834	846	858	959	1,059	1,380	1,700	125,150	24,460	828
Lavaca-Guadalupe Coastal basin														
Garcitas	0	254	285	326	367	367	367	448	448	557	665	50,345	10,180	344
Guadalupe River basin														
Ingram	0	0	0	351	377	401	426	451	476	672	867	59,120	9,750	330
Cloptin Crossing	0	189	220	246	272	316	359	359	359	492	624	45,260	8,690	294
Lockhart	0	271	300	318	335	369	402	436	470	645	819	58,680	11,190	379
Cuero 1 and 2	0	407	458	509	559	565	570	636	702	1,128	1,554	105,370	18,770	636
Confluence	0	479	536	640	743	789	835	916	996	1,264	1,531	112,540	21,850	740
San Antonio River basin														
Cibolo	0	338	380	420	460	477	493	541	589	774	958	70,260	13,820	468
Goliad	0	470	562	608	653	663	673	736	799	1,188	1,576	110,560	20,680	701
Nueces River basin														
Choke Canyon	0	0	0	539	599	614	629	690	752	1,062	1,372	93,025	15,230	516
										Total		3,832,890	551,410	18,637

a/ Present worth in 1970 of the estimated benefits stream. Benefits begin in the year of anticipated project completion and continue at estimated levels to the year 2070. Present worth of benefits is calculated at 3.25 percent annual discount rate.

b/ Equivalent annual benefits are the undiscounted, level annual benefits for the period 1970 to 2070, which when discounted at 3.25 percent would produce the corresponding 1970 present worth estimates.

c/ Construction staging has not been suggested, therefore present worth has not been calculated.

equivalent annual benefits and costs at the same point in time. Equivalent annual benefits are calculated to obtain a readily comprehensible indication of benefits. The equivalent annual benefits estimates presented here pertain to the 1970 present worth of the benefits stream. As expressed here, the equivalent annual benefit is a level annual benefit which when discounted yields a 1970 present worth equal to the 1970 present worth of the rising benefits stream shown in Table 2. Different equivalent annual benefits estimates would be obtained if some year other than 1970 were chosen as the beginning point for present worth calculations.

Benefits estimates vary between reservoirs because of differences in the size of nearby populations, distance from population centers to the various reservoirs, incomes of potential reservoir visitors, and the availability of alternative reservoirs. The sample data, from which the estimating equation is derived, show that visitation increases in 1965 as population increases from county to county, but that successive additional increases in population can be expected to result in smaller and smaller increases in numbers of visitors at reservoirs. Results of the analysis show that the visitation forecasting equation indicates visitation in 1965 increasing as per capita income increases from county to county, but that each successive increase in per capita income can be expected to yield smaller and smaller increases in visitation at reservoirs.

Since sample survey data are heavily used in obtaining benefits estimates for this study, the estimates are subject to the usual sampling errors. In addition, they are subject to errors associated with extrapolation of the sample reservoir characteristics to a set of reservoirs not yet constructed, and to errors associated with extrapolation of the derived relationships into the future. Data with which to estimate the errors are not available. The benfits estimates, therefore, are tentative and before final decisions pertaining to recreation are made for each proposed project, a more detailed feasibility study should be conducted. The present benefits estimation techniques do not consider unique quality, historical, or environmental characteristics of potential reservoir sites. The recreation benefits estimates for individual reservoirs can be improved when data pertaining to quality factors are included in the benefits calculation procedures.

This study is directed toward obtaining benefits estimates accruing to recreationists, the primary beneficiaries. Benefits accruing to reservoirs listed in Table 2 are estimated to exceed a 1970 present worth of $550 million, and $3.8 billion in monetary or undiscounted value.

Significant additional benefits are expected to accrue because of water-oriented recreation activity. These additional benefits accrue to those other than recreationists and are often referred to as secondary or tertiary benefits. They are realized by local areas which provide goods and services consumed by water-oriented recreationists, including tourists. Expenditures on food, lodging, gasoline, sundries, and other items needed by the recreational visitor contribute to the local economic base. Also, retailers on routes leading from the populated centers to recreational areas and sellers of recreation hardware in the recreationist's home city benefit from increased recreation expenditures.

Secondary recreation benefits result from the increased employment of labor and capital in the recreational equipment manufacturing industry, wholesaling and retailing establishments which merchandise recreational products to recreationists, and to restaurants, motels, and hotels that provide food and lodging for recreationists. The latter benefits usually accrue to that portion of the economy outside the recreationist's home community, since he needs those services while away from home. The purchase of major items of water-oriented recreational equipment such as boats, motors, skis, camping equipment, fishing tackle, and other supplies usually occurs in the recreationist's home community.

Also, local area economic opportunity benefits may accrue from the construction of that portion of the project attributed to recreation. The source of these benefits would arise from the use of labor and capital employed in project construction if they would be unemployed without the project.

Water-oriented recreation benefits beyond primary benefits are not estimated in this study. Estimates such as those require data which are presently unavailable.

Calculating accurate estimates of secondary benefits will require: (1) the estimation of secondary benefits accruing to other kinds of recreation which may be substituted for water-oriented recreation, and (2) the estimation of secondary benefits from other kinds of consumption for which water-oriented recreation substitutes. The net increases in local, state, and national incomes at the secondary level generated by water-oriented recreation are the appropriate estimates of additional benefits to water development projects. Further study of relationships among overall recreation activities is needed before total primary and secondary benefits can be accurately estimated. It is important in the estimation of benefits that transfers from one sector of the economy to another be eliminated from the estimate, or that the secondary effects of such transfers be quantifiable so that real net benefits to the project may be calculated.

RELATION OF RECREATIONAL TO OTHER BENEFITS ESTIMATES AND LIMITATIONS OF THE STUDY

The benefits concepts used in calculating recreation benefits incorporates the features of consumer surplus rather than the features of market values heretofore used in many recreation benefits analyses. The use of consumer surpluses in calculating recreation benefits puts recreation benefits estimates on a comparable basis with benefits of other project purposes. Calculations of other benefits from multipurpose water development projects, such as flood control, water quality, and water supply, also incorporate features of consumer surplus. The benefits for each single-purpose project are usually considered either equal to the value of the most likely or least costly single alternative when alternative projects could be undertaken, as in municipal water supply, or are based on the potential economic losses to the economy without the project, as in flood control benefits. Neither of these methods of benefits estimation uses the concepts of willingness to pay as would a market price. In practically all cases, the benefits for single-purpose projects are of such nature that consumers either have little choice of whether or not to engage in projects, as in water supply, or must bear high risk, as in flood hazard. The benefits, therefore, are more nearly indicative of the total value of projects to water-oriented recreation consumers as stated here than if the benefits estimates were based entirely on total revenue to be derived from the sale of water or the "book value" of flood damaged property.

In the past, water project evaluation practices have not considered separate single-purpose alternative recreational projects.

This was due in part to a lack of information about the demand for such facilities. Recreational use of multipurpose projects does not compete directly with some other water uses and, therefore, is in some instances incidental to water development. Recently, project evaluation practice has expanded to include recreation as a full partner in project cost sharing, but recreation benefits have not been "pegged" at the cost of a single-purpose recreation project. The usual practice is to include recreation at its estimated benefits.

The estimation of benefits from recreation (consumer surplus) is difficult in the absence of a recreation market. The techniques of this study (using travel cost as a proxy for recreation price) are approximative for estimating water-oriented recreational benefits. Although it can be argued that consumers pay at least the transportation cost in order to be able to consume water-oriented recreation, it cannot be said that this is all consumers would pay to use the facilities. The recreation demand curves from which consumer surpluses are estimated are obtained by adding fees to the transportation cost variable; i.e., total price to consumers for water-oriented recreation equals travel cost plus a fee. The effect of this treatment can be viewed as a constriction of the zone of influence to smaller and smaller concentric circles as fees are increased. Increased fees are assumed to reduce the estimated number of visitors in a manner similar to the effect of increased travel costs.

Local recreationists, who do not pay high transportation costs, may however show a higher negative response to a fee than recreationists located a greater distance from the reservoir.

The analysis used in the study is based on the assumption that the purpose of each trip to reservoirs was recreation at the reservoir site. The trip may have multipurpose objectives, which include sightseeing and other activities en route. In this respect, the benefits estimates of this study are perhaps too high. Perhaps part of the estimated benefits should be attributed to outdoor recreational facilities other than reservoirs.

The study is based on a sample of reservoirs from which data were collected during a period of approximately 1.5 weeks. The benefits estimates, therefore, are subject to sampling errors. Published data used in the analysis are also subject to sampling and measurement errors which contribute to errors in the benefits estimates. Although available data are not adequate to estimate the size of each variance component, the following discussion examines the sources of variation.

Probably the most important source of variance in visitation is the year to year variation at the sample reservoirs. This variance cannot be estimated for existing reservoirs unless data are collected in each of several years. Another important source of variance is that associated with the recreational season for any given year. If the recreational season were divided into weeks and a random sample of weeks were chosen for survey, then the week to week variation could be estimated and thereby estimates of seasonal variation could be obtained.

Another important source of variance of the benefits estimates is variation among reservoirs. In order to obtain an accurate estimate of this variance one would need a larger sample of Texas reservoirs than the present sample of eight. The sample of reservoirs should be randomly selected after having been stratified according to reservoir size, proximity to large population centers, the amount and quality of recreation development, and other quality considerations such as scenic beauty, amount of fish stocked, geographic location, and climate. The present sample is limited especially with respect to the number of reservoirs included and because reservoirs nearer the large population centers of Dallas-Fort Worth and Houston were not included.

One of the strongest points of the data underlying this study is the manner in which recreationists were selected. Survey stations were established on all access routes to the reservoir so that all who entered the premises could be interviewed. Permanent residents at the reservoir site who passed the interview stations, operators of service vehicles, employees of recreational concessions, and other non-recreationists were counted but were not interviewed as recreationists. Recreationists were interviewed only once per daily visit to the lake. Those who passed more than one interview station during the day were not interviewed a second time, although they were interviewed on each daily visit.

Traffic counters, which recorded the number of passing axles, were placed across each access route and a traffic count was made for the period of time during which the personal interviews were being obtained. Calculation of the number of visitors based on the traffic count data, using factors of one boat per five vehicles and three persons per vehicle, gave an estimate which was more than 4.5 times greater than the total number of visitors counted by the interviewers.

The interviews revealed that recreationists at the sample reservoirs intended to participate in a wide variety of activities. The analysis of this study does not take the different kinds of activity into account; therefore, the visitor-day of this study is an aggregation of all activities designated by the interviewees. It is felt that intent of purpose for recreation was more important in a study of recreation demand than actual participation. Therefore, the recreationist was interviewed about recreational activity upon entering the area, rather than upon leaving it. The fact that a recreationist traveled to the area to fish and did something else because the fishing was poor on that day in no way detracted from his demand for fishing. It also does not indicate a perfect substitutability of something else for fishing to that recreationist.

The present study is limited in its ability to forecast recreation in future years as a time shift variable is not included in the model. Inclusion of a time shift variable will require time series data which are not presently available.

The projections of the study assume that the visitation model derived from current data will reflect visitation conditions at future years. The projections do not include provision for an increasing participation rate in water-oriented recreational opportunities. If, in the future, larger and larger proportions of the population visit reservoirs, the present projections will be an underestimate of benefits.

The procedure of analysis and the data used in obtaining benefits estimates of this study can be extended to estimate the value of fees which could be collected at a reservoir. This can include the estimation of a fee which would maximize revenues. The analysis can be further extended to estimate the effects of a discriminatory fee system. One which is readily apparent is a different fee for weekends and weekdays in an attempt to "level" recreational use, thereby reducing crowding.

The techniques of this study could also be used to estimate the visitation at different reservoirs if fee discrimination between reservoirs were practiced. This might permit an improved allocation of recreationists among the reservoirs. Fees could be increased at crowded reservoirs or decreased at little used ones to shift recreational use from one to the other. This could be practiced only on certain combinations of reservoirs which were substitutable in some degree for each other.

The results of this study indicate that a change in fees would be expected to affect both number of visitors and total fees collected if a system were adopted. Further study using the techniques and data of this study would permit a systematic approach to the management of a group of reservoirs for recreational purposes.

RECOMMENDATIONS FOR FURTHER STUDY

Further studies are needed for developing statistical models which explain the interdependencies and competition between water-oriented and other kinds of outdoor recreation. Additional research is needed to determine the trends in demand for recreation. Perhaps a set of simultaneous equations could be formulated for explaining visitation to parks, reservoirs, Gulf Coast beaches, scenic attractions, outdoor sporting events, and other recreational attractions.

For such studies it will be necessary to improve the quality of the data now available, collect data periodically, and significantly increase the quantity of data pertaining to outdoor recreation. The recent upward trend in the amount of leisure time available to practically all consumers, the continuing increase in income, and other factors have resulted in a rapid expansion of use of present outdoor recreation facilities. It is now clear that not enough is known about present demands to permit efficient planning for the development of recreational facilities. Recent trends in the use of present facilities indicate that they are not adequate either in scope, location, or quantity to satisfy future recreation needs.

The research effort would be aided significantly by the development of standardized units for quantifying the use of outdoor recreational facilities. For example, a standard visitor day activity occasion, or an acceptable alternative measure of use, should be adopted and used in data collection and analysis. A framework should be developed for distinguishing between the recreational benefits of higher cost activities such boating and lower cost activities such as sightseeing. There is need also for the introduction of units of measure which accurately reflect the quality of available facilities and the quality of recreation produced at individual sites. Such quality variables as geographic location, vegetation (especially forested as opposed to open areas), water quality, sandy beaches, on-shore facilities, and perhaps other important items which appeal to recreationists should be included among the data and entered into the explanatory demand model. This type of anlaysis would provide information useful in guiding water-oriented recreational development both as to its location and the kinds and quality of accompanying on-shore recreational facilities.

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APPENDIX

THE RECREATION SURVEY

THE RECREATION SURVEY

In April 1965, the Texas Parks and Wildlife Department began the development of a statewide recreation plan. Since the development of water projects would affect the supply of suitable outdoor water-oriented recreation, a line of coordination was established between the planning units of the Texas Water Development Board and the Texas Parks and Wildlife Department. Information obtained from a study of water-oriented recreation proposed by the Texas Water Development Board would be useful to both agencies. The Texas Parks and Wildlife Department offered its full cooperation in the undertaking. Various other State agencies offered assistance in men and material that enabled the survey to be completed quickly and efficiently within the constraints of time and money. Among these were the State Highway Department, Texas Department of Public Safety, and Texas Employment Commission.

In order for the survey to be a representative sample, eight reservoirs in Texas were chosen to provide the data. These were chosen from a representative list of 23 reservoirs.

The criteria for choosing the reservoirs were:

1. They should be representative of each recreational area in Texas and should not be concentrated in any one part of the State.

2. They should have representative recreational facilities for multipurpose activity.

3. Private development of homesites and year-round living areas should be scarce.

4. The access routes to and from the lakeshore should be few and easily covered by a small number of survey stations.

5. The reservoirs should not be those operated by the U.S. Army Corps of Engineers, as the Corps was already using surveys and traffic counts at their projects which could supplement data obtained by the survey.

On this basis, the following seven reservoirs were chosen: Brownwood Reservoir, Lake J. B. Thomas, Lake Stamford, Murvaul Lake, Lake Kickapoo, Lake Corpus Christi, and International Falcon Reservoir. In addition, surveys were made in the State parks on Dam B and Whitney Reservoirs when the rest of the lakes was surveyed by the U.S. Army Corps of Engineers. The Corps of Engineers has been concerned with recreational visitation benefits estimates at existing and proposed Corps reservoirs for approximately 9 years. Attempts were made during this time to develop an accurate model for estimating recreation demand and benefits, but the required data were not available.

Recently, a major emphasis on recreation as a water development project purpose and its limitation as a non-reimbursable in repayment analysis has required a reappraisal of analytical approaches in recreational benefits analysis. This reappraisal has begun with the development of adequate recreational data collection.

The district office of the Corps of Engineers at Sacramento, California, began a program in 1965 designed to systematize the collection and analysis of recreational data at all Corps' projects. These data will be stored at the Sacramento office until needed for research. It is expected that analyses using these Corps' data will be undertaken for the purpose of developing explanatory and predictive recreational visitation models.

While full implementation will take a number of years, the Corps has considered eventual data requirements and a general first concept of model development. These concepts were discussed informally by representatives of the Texas Water Development Board and Corps of Engineers at a meeting in Dallas, Texas, in the spring of 1965.

The Texas Water Development Board desired to conduct its recreational survey so that data obtained would be compatible with future Corps data. This would provide a basic time series of historical data essential to the revision of any model derived from the Texas survey. The Corps of Engineers had developed a survey form embodying its concepts of future data requirements for recreational model building. The form was modified slightly to meet Texas requirements, but the revised form used in the survey is compatible with the original Corps form.

Since the Corps form will not be in general use for several years, and present Corps interview procedures are somewhat different from those expected in the future, presently available Corps data for Texas projects are not entirely compatible with the data used in this study.

The survey questionnaire form contained the usual questions about purpose of visit and point of origin. The form also included population characteristics of a personal nature. Among these were income, education, age, and occupation. To overcome some reluctance to answer these questions, ranges of possible responses were coded on a separate card, shown below, which was handed to each interviewee. At the appropriate point in the interview, he (she) would designate answers to these personal questions by a code which was not known to others in the same party.

Personal Data Code Card	
f -	Code for entire family: A - $5,000 or below B - $5,000 to $8,000 C - $8,000 to $12,000 D - $12,000 or over
g -	Code: A - 17-25 B - 25-35 C - 35-45 D - 45-65 E - 65 and over
h -	Code: A - Office worker B - Factory worker C - Outside worker D - Retired worker

In every case, the head of the party was interviewed whether driving the vehicle or not. A separate code was devised to cover students since it was felt that their answers would bias such information as education and income.

Each lake was completely manned for four weekend days (two consecutive weekends) and four weekdays (Monday, Tuesday, Thursday, and Friday). In addition to the manned stations, traffic counters were set up at each access point one week before the survey at the lake and left for one week after the survey. They were read at 5:00 p.m. on Friday and at 8:00 a.m. on Monday.

People whose work took them routinely to the reservoir or who lived at the reservoir were not surveyed but were counted manually. Therefore, only bona fide recreationists were surveyed.

The survey personnel were hired from a group screened and made available by the Texas Employment Commission. In every case they were local men, usually college students on vacation, who were willing to work for 8 days at a rate of $1.25 per hour. Local men were used because of their familiarity with the area and the people whom they would be interviewing. Approximately 4 hours of orientation were required to explain interview procedures. In addition, certain suggestions were made as to dress, courtesy, and safety. The supervisors were personnel of the Texas Water Development Board and the Texas Parks and Wildlife Department.

Before the survey began, personal contact was made with the local sheriff, county judge, representatives of water districts, county commissioners, district highway engineers, game warden, state highway patrolmen, and all other public or private figures who should be aware of happenings in their county or district. The press was also contacted. Because of this advanced explanation, local opposition was not encountered. The recreationists cooperated fully with the survey personnel.

The survey began at Brownwood Reservoir in July, after the abnormal crowds of the Fourth of July, and ended September 1 at International Falcon Reservoir and Lake Stamford. During this time, 15,000 interviews were taken representing about 40,000 recreationists.

The data were then summarized, coded, and punched on data cards by personnel of the Electronic Data Processing Division of the Texas Water Development Board. Facilities for computer analysis were provided by Texas Technological College, The University of Texas at Austin, and the State Highway Department. A systems analyst assisted in the preparation of the necessary programs for analysis.

After the data had been culled to eliminate those interviews which were unusable, 13,000 interviews remained as a data bank for the study.

On the following pages are shown a sample of the questionnaire form used by interviewers in the recreation survey, and a list of codes used in filling out the form. Also shown are the instructions given to surveyors concerning interview procedures.

Codes for the Recreation Survey Form

a Weather as C-clear, O-overcast, R-raining

b Camp trailer as C-camper pickup, S-self-contained travel trailer, T-Tent, tent trailer or other non-self-contained unit.

c Code:
P - Primary activity of group
S - Other activities to be carried on by the group

d For day users only. Omit campers.

e Code actual number of years. If college, 16 - B.A., 18 - M.A., 19 - Medical or legal, 20 - Ph.D.

f Code for entire family:
A - $5,000 or below
B - $5,000 to $8,000
C - $8,000 to $12,000
D - $12,000 or over

g Code:
A - 17-25
B - 25-35
C - 35 -45
D - 45-65
E - 65 and over

h Code:
A - Office worker
B - Factory worker
C - Outside worker
D - Retired worker

Instructions Given to Surveyors on Interview Procedures

Purpose

The role of outdoor recreation in family entertainment has been increasing over the last 10 years because of higher incomes, better means of transportation, and increased leisure time. The demand for water-oriented recreation has increased faster than other types of outdoor recreation in the United States as well as in Texas.

The Texas Water Commission is currently involved with the development of a comprehensive State Water Plan to the year 2020. This plan will provide for water to meet all the needs of Texas' citizens including recreation. Since water projects to achieve specific goals are expensive, a sound method of evaluating the public benefits of these public expenditures is necessary to prevent waste.

Economists have spent many years seeking the methods most useful in evaluating recreational expenditures. Modern computer analysis when used with good sampling techniques now enable economists to determine the demand for and benefits from recreation now and in the future, at existing and proposed reservoir areas.

A computer is only as reliable as the data fed into it. The raw data is being collected at representative reservoir areas over the State by survey crews. All this data will be fed into a computer and the results will be very accurate if the survey crew does its job well.

Data collected in these surveys are important to the planning divisions of the Texas Water Commission, Texas Parks and Wildlife Department, and the State Highway Commission. These three agencies are cooperating to the fullest extent possible towards creating optimum conditions for interviewing. The most important jobs, however, are those performed by survey crews on the site.

General Guide

The following procedures will serve as a guide in making effective use of the short period of time available for an interview.

1. Remember that you are a representative of the State of Texas. Always be courteous and friendly to interviewees. We cannot force anyone to give us information. All information obtained is a voluntary service by the interviewee to help us. The interviewee will be anxious to continue his journey so make interviews short but not abrupt.

2. Interview as many cars as possible, but never hold up more than two cars behind the one being interviewed. Although you will be pulling cars over to the right if possible, a stopped line of cars is always in danger of rear end collision. Also, we must not hold up people longer than a reasonable length of time.

3. Constant and continual attention must be paid to safety both of vehicle occupants and yourselves. Wear highly visible though not loud shirts. Never step back from a car after completing an interview before looking in both directions. Never stand in front of a car to force it to stop. The State Highway Patrol will be in the area to insure that traffic laws are obeyed and has been given instructions to cooperate fully with our crews as well as offer suggestions that will increase safety at each station.

4. Two supervisory personnel will be in the area at all times to assist you with any problems. If a bottleneck exists anywhere, the supervisors will help in interviewing or performing any of the duties necessary to help the station function as it should.

5. If an interviewee is impolite or obviously is giving you false information, cut the interview short and go on to the next car. Note this on the interview sheet. We expect no trouble along this line as you will discover most people to be friendly and helpful as possible.

6. Since most people are friendly, some will become excessively gabby. As soon as you have the information written down, immediately ask the next question.

7. In the event a party is vulgar or is intoxicated to the point of being a menace to the safety of other people, let him pass but jot down the license number and give it to your supervisor. He will in turn give that number to the patrol car in the area to check out.

The Survey Form

The survey form is an 8½ x 11 sheet divided into sections for easy use.

The upper left hand corner provides a space for your name. Your first initial and last name should be written in that space.

Under a majority of the other blanks are numbers 1-80. These numbers will not affect you. They are numbers representing fields on the computer card. In discussing the form, however, these numbers may help you to understand these directions so we will use them.

The weather (No. 1) is to be coded as C for clear, 0 for overcast, and R for raining. The weather should be noted as you go on duty and the appropriate code placed in the space provided.

The temperature (2, 3, 4) will not be read at each station. The maximum daily temperature will be obtained from the weather station of the nearest large city by your supervisor and written down by him.

The date (5, 6, 7, 8) will show the month, day, and year. The year will be 5 instead of 65. July 18, 1965, would by 7/18/5.

The project number (9, 10, 11, 12, 13) and the area (14, 15) will be filled in by your supervisor.

Weekday or weekend day (16, 17) should be circled depending on which day is covered by the survey.

The sheet number (18, 19) will start with 01 for the first sheet on your shift, then 02, 03, etc.

The total vehicles during survey time (20, 21, 22, 23, 24) will be filled in by your supervisor as well as the number of vehicles surveyed (25, 26, 27, 28).

The weekly distribution of vehicles is not numbered and will be calculated by the supervisor.

The above instructions cover the heading for each sheet. The rest of the spaces on the sheet will be filled in during interviews. Some spaces may be filled in from simple observation; others will be filled in from questioning.

The number of persons (31, 32) in a vehicle can be observed and written down before starting the interview.

If the vehicle is pulling a trailer, it will either be a boat trailer or a camping trailer (including trailer-tents). If the trailer is a boat trailer, print a capital B in the space under boat (33). If the trailer is a camping trailer (34) it will be coded C if it is a camper pickup (which we consider as a trailer), S if it is a self-contained trailer including electricity, water, and gas, or T if a tent trailer or other non-self-contained unit.

The type of visitor day use activity (camping is not a day use activity) covers six activities (35, 36, 37, 38, 39, 40). The interviewer will ask the primary purpose for the outing (Why did you come down here today?). Upon receiving one answer giving the main reason for the trip, the interviewer will then ascertain secondary purposes for the visit (What else is your party going to do?). Print a capital P in the space provided for primary activity and a capital S in the spaces for all other activities performed by the group.

If the party is going to camp overnight write the number of days they will be there in the space provided for camping on project (41, 42).

If the party is strictly a day party, write the approximate number of hours they will be at the project (43, 44).

The distance to the point of origin (days) will be filled in by the supervisor (45, 46, 47).

Distance to the point of origin (hours) will be obtained by asking the driver how long it took him to drive from his point of origin to the project.

The number of visits made this month will be written down in the space provided (50, 51).

Upon getting an answer to the question of time spent driving to the project, hand the head of the party the card covering the income, age, and occupation code.

The education of the head of the group will be written down in actual years of school attendance. The questions asked should be. "What was the last year completed in school?" If a man quit school in the 10th grade, the 9th year was the last year actually completed and the number 9 should be placed in the space provided (52). A high school graduate gets a 12, a college graduate 16, a professional man such as a lawyer or doctor 19, and a college professor with a PhD 20.

The income group is coded on the card as A, B, C, or D. Do not ask what a family's income actually is. Ask within which group the family income falls. Print a capitol A, B, C, or D in the space for income (53).

The next two spaces (54, 55) calling for the number of males above 17 and the number of children below 17 will be filled in with the actual number of people in these categories.

The age group of the head (56) will be taken from the coding on the card and written down as A, B, C, D, or E.

Occupation will be done in the same way from the coding card. The proper question to ask is, "Where do you spend most of your working time?" The answer will be either A, B, C, or D. This letter will be written in space 57.

The last space on the form is for the place of origin. The place from which the group left will be written in that space. If the head is from out of state, write down the state on the car license plates. If the head is from out of state but the car has Texas plates, insert the city where the car is garaged. If the head is from a farm, write down the nearest small town as the place of origin.

In all of the explanation necessary for the survey form, the word "head" has been used in lieu of "driver." We are speaking of the head of the household as this is the person who is the nominal leader of the group. On occasion the head's son, daughter, or wife may be driving the vehicle so we wish to draw attention to the fact that the head should be interviewed in every case whether or not he is driving the vehicle being interviewed.