A PRELIMINARY ECONOMIC ANALYSIS OF OUTDOOR RECREATION IN THE SOURIS RIVER BASIN

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Herbert D. Schellenberg

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Abstract

A resource base for outdoor recreation can be provided by a multiple-purpose reservoir. Benefits attributable to the reservoir from recreational use, in addition to benefits from other uses, should be compared with construction costs in order to determine the economic feasibility of a proposed development. The non-marketed nature of outdoor recreation makes benefit measurement difficult, if not impossible, for comparison purposes. The basic objective of this study was to estimate the magnitude of benefits, in the absence of market prices, at a multiple-purpose reservoir in the Souris River Basin.

The existing artificial lake at Minnedosa, Manitoba, was chosen as a subject of study. A visitation prediction model was developed which related population size and distance to the site as significant factors in explaining attendance from a given origin zone. Benefits were measured at Minnedosa Beach by simulating a demand curve for recreation. Using distance as a proxy for price, the consumers' surplus as measured by the area under the demand curve was obtained, and equated to the benefits attributable to the reservoir. Attendance and benefits at a proposed hypothetical reservoir in the Souris River Basin were then estimated. It was assumed that the new facility would be identical in all respects to Minnedosa Beach other than population distribution and travel distance.

Approved:

In Charge of Major Work

Head of Major Department

Dean of the Faculty of Graduate Studies

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Chapter 1

INTRODUCTION

Description of the Souris River Basin

The main body of the Souris River originates in south-western Saskatchewan, loops through North Dakota, returns to Canada south of Melita, in Manitoba, and empties into the Assiniboine River thirty miles south and east of Brandon. The Souris valley in Manitoba is 112 miles long and cuts deeply into the surrounding prairie. The topography of the watershed varies from hilly and rolling country to almost level land. Despite a general area water deficiency, the Souris River has a very heavy spring runoff and is a contributor of flood waters to the Assiniboine River.

Problematic Situation

Concern over the need for flow augmentation in the Souris River Basin has resulted in a number of studies and investigations. Various damsites that are technically feasible have been proposed along the course of the river and its tributaries. The provision of irrigation water, transportation services, hydroelectric energy, municipal water supplies, and the reduction of flood hazards are "products" that can be supplied with reservoirs created by dam construction. The provision of a resource base for outdoor recreation can be an additional purpose in the creation of a reservoir. In this case, the product is the furnishing of water-based recreational opportunities for the population of the country.

The construction of any water resource installation absorbs valuable inputs of labor and capital. Such "costs" should be compared with the "benefits" created by the new facility in order to determine its worth. A firm in the private sector is usually concerned with only those gains and losses, of a new productive facility, that accrue to the particular firm. In contrast, a project that is the responsibility of a federal or provincial government should be considered in a more comprehensive way. All costs and gains to the entire nation that are associated with the undertaking should be accounted for in the investment decision made by the public sector. A proposed facility in the Souris River Basin is the main responsibility of the federal or provincial government. Consequently, an estimation of benefits to the nation as a whole that results from the project should be obtained.

This study is addressed to the problem of determining those primary benefits resulting from the use of reservoirs for recreational purposes. Quantification of the benefits, if any, accrueing to the project and the nation allows the comparison with the costs associated with reservoir construction in the Souris River Basin project. Such comparisons are necessary so that a maximum return can be obtained with a limited amount of public funds.

Objectives of Study

It is not possible in this study to consider all aspects of outdoor recreation in the Souris River Basin. Consequently, four objectives were developed which this study attempted to achieve: 1. to derive a visitation prediction function based on an existing resource in the Souris River Basin, which would relate various factors to present recreational attendance; 2. to obtain an estimate of the recreational benefits accrueing to the existing facility selected above; 3. to estimate recreational attendance at a hypothetical reservoir in the Souris River Basin; and 4. to estimate benefits generated at the proposed non-existent facility.

Method of Analysis

The non-marketed nature of water-based outdoor recreation makes benefit estimation difficult, if not impossible. Chapter 2 provides a review of alternative theories advanced to quantify recreation benefits. Since most of the techniques consider recreation to be a private consumption good, the nature of recreation as a public or private good is discussed. A discussion of alternative visitation models that are used to predict attendance at a recreational facility completes the chapter. Models for predicting usage appear to be a vital part of benefit determination theory since an estimate of total usage is required. On the basis of the theoretical analysis and literature review, the Clawson-Hotelling model was selected for the analysis undertaken in this study.[1] The derivation of a visitation prediction equation is an inherent part of the benefit model chosen.

Chapter 3 describes the data collection process that was involved in the study. As a source of data, the existing lake chosen was the small P. F. R. A. (Prairie Farm Rehabilitation Act) reservoir located near Minnedosa in Western Manitoba. The lake was chosen for

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[1]Clawson, M., Methods of Measuring the Demand for and Value of Outdoor Recreation, Reprint No. 10, Washington, R. F. F., Feb., 1959.

study purposes since it appeared to be a representative recreational facility in the Souris River Basin area. Analysis of visitation data, collected by a survey technique, was made to obtain a prediction model. Population size and distance were isolated as being the chief variables for predicting usage of the facility.

A fuller discussion of the Clawson-Hotelling model is presented in Chapter 4, where it is applied to a real situation. The problems involved in interpreting the "demand curve" which is obtained by this model are reviewed. It is used to quantify the value of primary recreation benefits attributable to the resource.

Chapter 5 estimates attendance and benefits at a hypothetical reservoir used for recreation in the Souris River Basin. It is assumed that the prediction equation derived for Minnedosa Beach can be transferred directly to a proposed facility, which has identical characteristics other than the volume and distribution of the population.

A summary of study results and problems encountered is presented in Chapter 6. Some suggestions for further study are provided to complete the chapter.

Scope and Limitations

It is beyond the scope of this study to consider all aspects of outdoor recreation in the Souris basin in relation to the feasibility of proposed developments. This study evaluates an existing facility and caution must be used in transferring the results obtained at Minnedosa Lake to a reservoir that does not yet exist. Although Minnedosa Lake is in western Manitoba, it lies north of the Souris watershed. The proximity of Minnedosa Beach to Riding Mountain National Park reduces its representative nature. Thus, a limitation of the study is that it concentrates on only one small lake, and uses data collected in just one season. The results should be compared with an analysis conducted over a longer period of time, and at other reservoirs, in order to assess the stability of the relationships and coefficients.

To some extent, data limitations have reduced the usefulness of this study. The survey was conducted in 1968, which had a summer of unseasonal weather conditions. It was short, wet and cold with inclement weather spoiling many weekends for recreationists. Original plans called for about one hundred completed questionnaires, but this was reduced to fifty-five for the season since overall attendance was lowered considerably.

Finally, the model used for benefit measurement has many controversial aspects. Some, such as the use of consumers' surplus, are at its very basis. In addition to conceptual difficulties, practical problems in applying the model beset this study. These are discussed in the forthcoming chapters.

Chapter 2

THEORETICAL ANALYSIS AND LITERATURE REVIEW

Introduction

An objective of this study is to consider recreation in the proposed Souris River Basin project from the view-point of the Province, where it is concerned with water resource evaluation. A customary method of project evaluation in Canada in this decade employs the technique of benefit cost analysis. Recreational benefits often constitute a considerable portion of the total benefits attributable to a particular project. Yet, the absence of conventional market prices forces the government agency concerned to use some other means of determining recreational benefits. Considerable controversy exists as to the merits of the various theories and methodologies advanced in response to this need.

Outdoor recreation is frequently considered to be a public good, because of its non-marketed nature. Samuelson defines a pure public good as one in which "each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good . . .;"[1] hence,

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[1]Samuelson, P. A., "The Pure Theory of Public Expenditure", The Review of Economics and Statistics, Nov. 1954, p. 387.

> it differs from a private consumption good in that each man's consumption of it, X_2^1 and X_2^2 respectively, is related to the total X_2 by a condition of equality rather than summation. Thus, by definition, $X_2^1 = X_2$ and $X_2^2 = X_2$.[2]

A property of public goods is that "exclusion" is not possible.[3] The good is provided for each person to enjoy or not, according to his tastes. National defense provides a good example of public good. Defense is always available, whether or not the citizen actually wishes to avail himself of its benefits. Since it is available to everyone, it cannot be marketed.

Public goods represent industries in which resources are not allocated in a competitive market system so as to maximize social welfare. Outdoor recreation, however, cannot be considered a public good since it violates at least two common properties. The property of non-exclusion is not exhibited since people can readily be excluded from access to outdoor recreation sites by the charging of user fees. A second violation is that outdoor recreation supplied to one person does diminish the amount supplied to other persons. For example, the use of a picnic table prevents other people from using the same table.

Hence, recreation can be shown to possess characteristics of

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[2]Samuelson, P. A. "Diagrammatic Exposition of a Theory of Public Expenditure", The Review of Economics and Statistics, Feb. 1955, pp. 350-356.

[3]Bator, F. M., "The Anatomy of Market Failure", Quarterly Journal of Economics, Oct. 1958, p. 374.

a private consumption good as previously defined by Samuelson.[4] There is no good economic reason to prefer production in the public over the private sector.[5] This implies that additional criteria to economic efficiency are used in making public decisions on outdoor recreation. Considerable productive resources are consumed in the provision and maintenance of such items as parks, beaches and roads. The desire to use free access to recreational resources as a means of redistributing income is an example of such possible criteria.[6] Externalities associated with consumption are often advanced as further reasons for government intervention. Two such effects are the favourable impact on productivity and output per worker, and reduced crime and illness resulting from the relaxation and reduced tension acquired by participation in recreation.

An indication of the real cost to society of providing free recreational services can only be made after recreational benefits

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[4]Recreation, however, exhibits certain properties of public goods. The notion of "option demand" is an example. This demand is characterized as a willingness to pay for retaining an option to use an area that would be difficult or impossible to replace and for which no close substitute is available. Since options are not traded on the market, all of the problems of organizing a market for public goods arise. See Krutilla, J. V., "Conservation Reconsidered", The American Economic Review, Sept. 1967, pp. 777-786.

[5]Musgrave, R. A., The Theory of Public Finance, McGraw-Hill Book Co., New York, 1959, pp. 9f.

[6]Robinson, W. C., "The Simple Economics of Public Outdoor Recreation", Land Economics, Feb. 1967, p. 73-74. See also Seckler, D. W., "On the Uses and Abuses of Economic Science in Evaluating Public Outdoor Recreation", Land Economics, Nov. 1966, pp. 485-494.

have been estimated. Efforts to measure such benefits abound in the literature, with most being based on the premise that recreation can be marketed as a private consumption good. By simulating the market mechanism, the social cost (if any) in interfering with resource allocation for outdoor recreation can be estimated. With regard to the Souris River Basin, an evaluation method using such techniques is considered of some great importance in attempting to assess the value of recreation as one of the benefits of a multi-purpose reservoir.

The Evaluation of Recreational Benefits

Recreational benefits, in the context of this study are those values that accrue to the recreationist as a result of the actual experience.[7] These benefits, in turn, can only be attributed to the site or facility where the experience is undertaken. Such benefits will be termed primary or direct recreation benefits. Those economic values created by the monetary expenditures of recreationists, and the multiplier effects that result are termed as secondary or indirect

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[7]According to Clawson, the total recreational experience can be separated into five distinct phases. The first is the anticipation and planning that is required at the beginning of a recreation experience. The second major phase involves travel, whether it is pleasant or otherwise, to the recreational site. The third involves the actual on-site experiences and activities that are usually thought of as being the total outdoor recreation experience. The fourth and fifth phases are the return trip experiences and recollection. The fifth phase, especially after a journey of longer distance and duration often involves the processing of photographs. The recreation experience is discussed more fully in: Clawson, M., and Knetsch, J., Economics of Outdoor Recreation, R.F.F., John Hopkins Press Inc., 1966, p. 33.

recreation benefits. These benefits are normally applied to the area or region in which the expenditures are made in order to assess the contribution of recreation to area development.[8] Secondary benefits are not directly discussed in this study since the main purpose is to determine the value of the recreational usage of a multi-purpose river basin project.

Means of determining primary recreation benefits can be separated into eight main categories. None of those existing methods of benefit evaluation are entirely satisfactory in attaching an economic value to the recreation experience. The following discussion will attempt to relate each alternative method to water-based outdoor recreation in the Souris River Basin.

1. <u>Benefits Estimated by Educated Guess</u>

There is no precise procedure established in this means of evaluation. It is unlikely that two persons, working independently, would arrive at the same results. It is cheap but involves a high degree of "personal judgment".[9] The value is selected

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[8]Normally, in economic analysis, primary or direct economic benefits refer to the volume of monetary expenditures on goods and services. Secondary or indirect benefits, in turn, are used to define those benefits resulting from the multiplier effects caused by the initial expenditures. Recreation, however, is unusual in that the absence of market prices causes direct benefits under this definition to be equal to zero.

[9]Spargo, R. A., "Methods and Techniques of Evaluation of Sport Fishing", <u>Canadian Fisheries Report</u> Number 4, (Ottawa, Canada: Department of Fisheries of Canada, Queen's Printer, 1965), pp. 53-69.

according to the "quality of the experience available at the site and should vary between $0.50 and $2.50 per visitor-day."[10,11] Total recreation benefits would equal the product of the unit value and the number of visitors.

A similar technique is to rate recreational resources according to the number of merit-weighted user-days they produce. The subjective merit-weights are based on such factors as the uniqueness of a resource in addition to quality, accessibility, availability of alternatives, population density, and income groups served.[12] No basis for a priority ranking of competing development is provided. The weakness of this method lies in the arbitrary nature and difficulty in selecting the unit value. This renders it almost useless in determining an objective value based on theory for water based outdoor recreation.

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[10]U. S. Senate, Document No. 97, Supplement No. 1, Washington, 1962.

[11]The precise measurement of a unit of recreation is difficult, if not impossible. For use in economic analysis, an activity-day is registered whenever a visitor to a recreational site participates in a certain activity in the time period of one day or less. For example, an activity-day is registered if a recreationist on a visit to a site participates in swimming. If he also enjoys some boating on this same visit, another activity-day is obtained. In such a case the recreation mix is swimming and boating. The entire visit, if a period of time is involved of less than or equal to twenty-four hours, can be considered a visitor-day. The term user-day is synonymous.

[12]Laub, M., The Economic Evaluation of Non-Marketed Recreational Resources, Paper presented to the Colloquim Committee of the University of Manitoba Interdisciplinary Water Resources Study Group, January, 1969, p. 8, and Hines, G. H., "The Measurement of the Benefits of Public Investment in National Parks", paper presented to the Canadian National Parks Conference, University of Calgary, October 12, 1968.

2. Benefits Equal Market Value of Catch or Hunt

This technique is based upon the theory that a minimum value for sport fishing and hunting can be obtained by using the market value of similar species of fish and game sold commercially.[13] This method is open to severe criticism. If true, it can only measure part of the benefits received since the actual cost of catching the game may well be above commercial costs and product values. In addition, some fish and game are not marketed commercially. For example, if the value of a deer hunt is under consideration, this technique cannot be applied. Deer meat is not available for market purchase. The cost incurred by a hunter, however, is often very high in money terms. It is frequently the case that the hunt is not successful in terms of deer being taken but, nevertheless, much pleasure may still be derived by the hunter.

This theory, in addition to severe criticism, can only be applied to hunting and fishing. It is not useful for evaluating other forms of recreation.

3. Benefits Equal Opportunity Cost of Time

There are two main versions of this technique of benefit measurment. One is that the benefit is equal to the wages foregone

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[13]Crutchfield, J. A., "Valuation of Fishery Resources", Land Economics, May, 1962, pp. 145-154, and, Spargo, op. cit., p. 58.

by time spent in recreation.[14] It is valid where a day's wages are sacrificed but not when leisure time is used. In addition, the choice of substituting recreation for work is usually not available. Another means of determining recreational benefits using the opportunity cost of time is to consider that recreation and leisure are complementary to work and contribute to real production. The problem of selecting the appropriate value remains since according to Robinson, "a great many other services may have externalities of consumption in the form of a favorable impact on productivity and output per worker. These include educational T. V., symphony concerts and pretzels and beer."[15]

Such means are not very helpful in determining the value of recreational resources; in addition to the criticisms outlined above, they assign equal values to all forms of recreation.[16]

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[14]Spargo, Ibid., p. 58, and Johnson, M. B., "Travel Time and the Price of Leisure", Western Economic Journal, Spring 1966, pp. 135-145.

[15]Robinson, op. cit., p. 72.

[16]A frequent application in recreational literature of the first version of this technique is to place a value on the time spent in travelling to and from a recreational site. This value is credited as part of the total value or benefits of the recreation experience if the time spent in travel is considered to be arduous. It is a measure of the "willingness to pay" to reach a destination faster. This technique is also commonly used in the evaluation of highway projects. See Johnson, op. cit., for a fuller discussion of the cost of travel time.

4. Benefits Equal Project Costs

This method simply equates the cost, or some multiple, of the recreational project as equal to the recreational benefits received.[17] This renders all projects equally desirable and feasible so that no means is available for comparison purposes. If benefits are equated to the cost of the recreational project, a benefit-cost ratio of one is automatically achieved. The project is thereby economically justified.

The development plan of a multiple use project can be seriously affected by the use of this technique. The entire project can be justified as economically feasible by looking solely at the recreation sector. Additional benefits resulting from other uses can be added to the total with the end result of a distorted benefit-cost ratio. It will most likely be biased upwards. This is particularly true if recreational usage of the project is not the main use and purpose of construction.

5. Benefits Equal the Cost of Alternatives

The estimated benefits attributable to the project being analyzed can be considered as being equal to the cost of the least expensive alternative project that would provide the same visitor-day capacity with similar quality features.[18]

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[17] Trice, A. H. and Wood, S. E., "Measurement of Recreation Benefits," Land Economics, August 1958, pp. 196-207.

[18] Tussey, R. C., Jr., Analysis of Reservoir Recreation Benefits, Lexington, Kentucky: University of Kentucky, Water Resources Institute, Research Report No. 2, 1967, p. 13.

This general method is useful in comparing projects and resources, but it cannot place a good absolute value upon benefits accrued through any given project or resource. An absolute measure of some form is necessary in addition to ordinal measurement so that it can be determined whether or not any investment in recreation resources can be justified. In addition, it fails to distinquish any differences there may be in the quality of the recreation available at alternative sites. This is a serious shortcoming because in reality, quality differences are very important.

This method is not useful for the Souris Basin since an absolute measure of recreational benefits is required. Indeed, only through such knowledge can the spending of public funds on any recreational services be justified.[19]

6. Benefits Equal Expenditures

Visitor expenditures for such goods and services related to the recreation experience are often equated to the benefits attributable to a particular resource.[20] Benefits tend to be

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[19]A closely related theory is to equate benefits to the saving in cost incurred by the recreationist by not having to travel to the next highest alternative if the facility that offered maximum enjoyment in relation to costs did not exist. For an example of such a method of calculating benefits, see Ullman, E. L. and Volk, D. J., "An Operational Model for Predicting Reservoir Attendance and Benefits: Implications of a Location Approach to Water Recreation", Papers of the Michigan Academy of Science, Arts and Letters, (1961 meeting) Vol. XLVII, 1962, pp. 473-484. This theory is discussed more fully in the upcoming section which considers indirect travel cost means of determining benefits.

[20]Crutchfield, op. cit., and Trice and Wood, op. cit.

overestimated by using the cost of all recreation related items to justify the particular proposed facility. If an individual recreational facility was eliminated, its users would likely still spend the same total amount of money on other recreational facilities and goods and services but would suffer a welfare loss as a result of being forced to second choices. It is this welfare loss that measures the value of recreational benefits. It cannot be quantified with expenditure techniques.[21]

Primary benefits cannot be properly measured by expenditures since this would ignore the benefits which accrue to persons having little or no expenditures.[22] In addition, money spent on goods and services related to recreation, other than that amount spent for one particular visit only, cannot be considered to be primary benefits. Instead, these expenditures represent secondary benefits if they are made in the area under consideration and represent increased net income.

7. Benefits Estimated by Imputed Prices and Values

This category includes an array of techniques for benefit estimation. One method, applied mainly to sports fishing, is to impute benefits on the basis of prices charged for sport fishing privileges by a private operator.[23] Rental fees for fishing and

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[21]Laub, op. cit., p. 17.

[22]Spargo, op. cit., p. 64.

[23]Ibid., pp. 61-62.

hunting rights can also be used. However, relevancy is lost in evaluating a project which is open to the general public since an entirely different service is often involved.

Recreation benefits are often estimated by "interview techniques". One procedure involves asking the visitors, through questionnaires, what they would be willing to pay to use the facilities under study.[24] The total project benefits would then equal the sum of the sacrifices that the visitors would be willing to make. Extreme care must be exercised in framing the questions since they are hypothetical. Similarly, careful attention must be given to the assumptions underlying them.

A variant of the "interview technique" is to ask the respondent the sum of money he would demand for compensation to reimburse him for exclusion from an activity which he presently enjoys.[25] This is normally higher than the maximum amount he is willing to pay for access since the compensation payment will maintain the individual at his current level of well-being, while the user-fee will lower his standard of living. The measurement of compensation is more expensive since biases are more difficult to detect and measure. It is only recommended for recreational resources where close substitutes do not exist.

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[24]Davis, R. K., The Value of Outdoor Recreation: An Economic Study of the Maine Woods, unpublished Ph. D. thesis, Harvard University, 1963, and, Phillips, W., Regional Development of the Owens Valley, California; An Economic Base Study, unpublished Ph. D. thesis, University of California, Berkely, 1967, pp. 123-137.

[25]Laub, op. cit., pp. 20-25.

Interview methods place the problem of measuring the magnitude of primary benefits in the hands of those persons who enjoy them. They are severely limited by the cost of questioning and difficulty in getting adequate replies. A hypothetical question is answered by a hypothetical reply and, in practice, the user may not react as he states. The questions may not be carefully considered by the respondents. In addition, those who would interview recreationists to find out their willingness to pay for the experience face the respondents' fear that user charges will be imposed in the future. For this reason, replies may be deliberately low. Users may also give misleading answers in that they may consider themselves limited by the amount of money that they have available for recreation.

In practice, interview techniques have been used extensively for outdoor recreation valuation. Results, in general, have been less than satisfactory due to the numerous conceptual and practical problems outlined above.

8. Benefits Determined by Indirect Travel-cost Techniques

The original method using distances was proposed in 1947 by Hotelling in a letter to the United States National Parks Service on possible methods of evaluating recreation benefits.[26] He suggested that there exists, for those living near a park, compared with those living far away, a consumers' surplus consisting of the differences in transportation costs.

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[26]Quoted in: Brown, Singh and Castle, An Economic Evaluation of the Oregon Salmon and Steelhead Sport Fishery, 1964.

Hotelling's approach was applied by Trice and Wood who used data obtained from visitors to the Sierras to calculate an average cost of travel per visitor-day.[27] An analysis of the data was made to obtain the value of the highest cost incurred in travel expenses per visitor-day. In order to exclude extreme high values in the data, this level was chosen to be at the 90th percentile level. The visitor who exhibited this level of costs was assumed to have no consumers' surplus. The level of travel costs or recreational value per visitor-day for the median level of the population was then subtracted from the 90th percentile level to obtain "free value received". This, supposedly, approximated a consumer surplus value in dollar terms attributable to the resource.

This study promoted immediate debate. Hines suggested that this method requires the additional unrealistic assumption that individual preference scales are identical.[28] Lessinger questioned the basic notion whether it is generally true that those who are able to enjoy the parks without incurring the full travel expense of the most distant visitors obtain a consumers' surplus.[29] A crucial limitation of the Trice and Wood study was related to the cost per visitor-day and the number of visitor-days represented at that cost level. This did not give a good approximation to the demand for visitor-days or actual price-quantity relationships. A second

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[27] Trice and Wood, op. cit.

[28] Hines, L. G., "Measurement of Recreation Benefits: A Reply", Land Economics, Nov. 1958, pp. 365-67.

[29] Lessinger, J. L., "Measurement of Recreational Benefits: A Reply," Land Economics, Nov. 1958, pp. 369-370.

limitation concerned the arbitrary selection of the 90th percentile level.[30]

However, interest in travel-cost approaches to benefit estimation was stimulated. Clawson first computed an approximation to the demand curve for the recreation experience as a whole.[31] Two stages were involved. The first consisted of deriving an attendance prediction model in which visitation from a particular origin area was a function of the cost of travel by automobile. This took the form of: $U = kP/D^n$, where U is visitation, P is the population of the origin area, D is the distance from the site to the origin area, and k and n represent constants. The second stage involved the derivation of a "demand schedule" for outdoor recreation at the site under consideration. One point on the schedule is obtained by determining the number of visitors at zero entrance fee. This is the actual number of visitors recorded at the site. Next, an incremental distance is added to the actual distance recorded for each area. This results in new visitation levels that are obtained by substituting the increased distance into the first stage prediction equation. Lower total visitation is now recorded since the visitors incur additional economic costs. The difference between the first and second number of visitors is that number who do not value the experience highly enough to make

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[30]Brown, Singh and Castle, op. cit., pp. 6-8.

[31]Clawson, M., Methods of Measuring the Demand for and Value of Outdoor Recreation, Reprint No. 10, Washington: Resources for the Future, February, 1959.

the sacrifice. A second point on the demand curve is obtained. Repeating this cycle yields an array of new visitation rates at increasing levels of entrance fees represented by higher costs of travel. This provides all the points necessary to complete the curve.

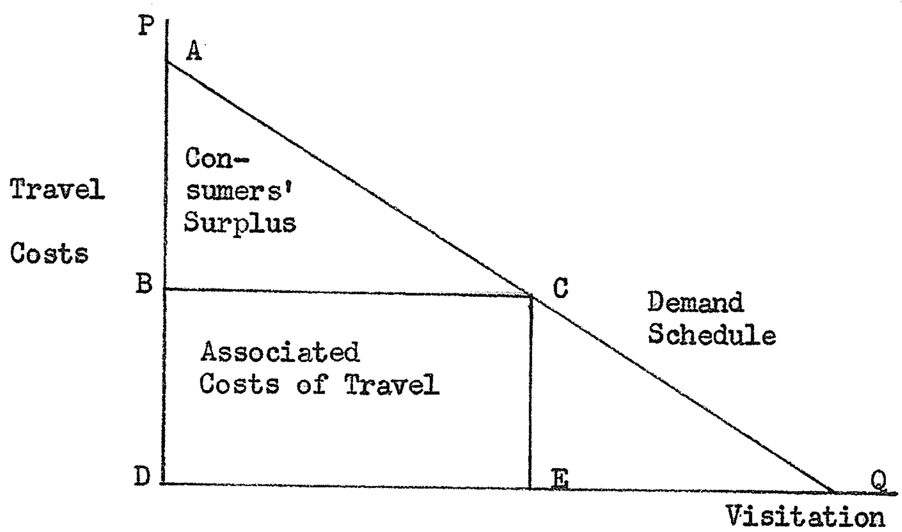

Figure 1. The Clawson "Demand Schedule".

Figure 1 represents the Clawson "Demand Schedule". Visitation at the existing zero entrance price is equal to DE. The mean travel cost of the visitors is BD, so that the rectangle BCED represents associated costs of travel. The zero entrance fee is represented by point B on the vertical price axis. The area ABC indicates the value of consumers' surplus attributable to the site. Clawson, however, rejected consumers' surplus in favor of the concept of maximum revenue collectible by a monopolist. This would be equal to the largest rectangle that could be inserted in the area ABC. Thus, the market value of a visitor-day of recreation was equated to that fee that would be charged by a revenue-maximizing monopolist. The problem of deriving and interpreting this curve will be considered in more detail later in Chapter 4.

The basic technique was simple and direct but numerous limitations to the theory existed. A crucial limitation concerned the curve itself. It may not represent a true demand curve since hypothetical prices are used and visitors may not react to increased cost as the theory assumes. In addition, other non-price items such as time[32] and travel variables are part of the vertical axis. The curve regards the entire population as homogeneous in relation to recreational demand except for distance. This assumption is reflected in that the experience of users in one area are used to simulate what people in other origin areas would consume if costs were the same. The curve ignores the quality of the recreation

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[32]For example, omitting the cost of the trip in time will shift the curve to the left if travel time is onerous. This is due to the nature of curve derivation. If Zone A faces additional user fees or travel costs so that total costs are equivalent to the travel costs encountered by Zone B, the visitation rate of A will decline to that of B. However, if time spent in travel is unpleasant, the cost of time is faced only by those users in Zone B. Zone A, accordingly, will react with a higher rate of visitation than B simply because the users of Zone A do not face the additional cost in travel time as do the users in B. This causes the demand schedule to be biased consistently to the left. For a fuller discussion, see Scott, A., "The Valuation of Game Resources: Some Theoretical Aspects", Canadian Fisheries Report Number 4 (Ottawa, Canada: Department of Fisheries of Canada, Queen's Printer, 1965), pp. 27-47. Similarly, distance will shift the curve to the left. The greater a zone is from a particular recreation site, the greater are the number and appeal of available substitutes, since other sites become relatively cheaper in time and money.

experience and assumes that it is equal over a wide range of visitor concentration levels. Similarly, it does not consider the mix of alternative activities participated in by the recreationists. It assumes that the sole purpose of a trip is to visit the site, and consequently, cannot consider multiple purpose trips. The schedule is a complex curve relating many things, instead of price only, to visitation as the dependant variable.

In addition to the above theoretical limitations of the model, several important technical limitations exist. Users must be dispersed over a sufficiently wide geographic area so that a meaningful curve can be derived.[33] Results are sensitive to the number and boundaries of the origin regions chosen. Clawson used concentric circles in order to delineate origin zones. This often results in the problem of limited degrees of freedom when the curve is estimated by regression analysis. This problem, however, can be overcome with the use of political divisions as origin areas. The difficulty remains of selecting appropriate distance values from each area to the site. A third limitation is that a value must be determined for the mean variable cost of automobile travel in order to convert distance into dollars. The same is true in placing a value on the cost of time spent in travel from the origin to the site. The final estimation of benefits depends very heavily

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[33]If a site caters entirely to one origin area such as a nearby metropolitan center, no basic curve relating visitation to distance travelled can be obtained. In such a case, there is only one point representing the entire curve. This leaves no means available for deriving the demand schedule.

upon the figures chosen to represent automobile and time costs.

A study in Oregon in 1964 applied the Hotelling-Clawson model to sports fishing.[34] A demand curve for angling was derived. The maximum revenue that a monopolist could obtain by charging user-fees was calculated from this curve. The notion of determining consumers' surplus was rejected on the basis of being too difficult to interpret.

Lerner, however, considered the concept of benefit as being the total area under the curve, or consumers' surplus. This is the amount a hypothetical discriminating monopolist could collect and, in general, is a larger quantity than Clawson's measure.[35] Ullman and Volk measured consumers' surplus by using an attendance prediction model relating attendance densities at various sites to travel distances. They evaluated a hypothetical reservoir fifty miles from St. Louis, Missouri, by aggregating total willingness to travel more than fifty miles, the consumers' surplus.[36] Merewitz employed the concept of total consumers' surplus as measured by calculating the entire area underneath the demand curve.[37] He

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[34]Brown, Singh, and Castle, op. cit.

[35]Lerner, L., "Quantitative Indices of Recreational Values", Water Resources and Economic Development of the West, Report No. 11, Economics in Outdoor Recreation Policy, 1962.

[36]Ullman and Volk, op. cit.

[37]Merewitz, L., "Recreational Benefits of Water Resources Development", Water Resources Research, Vol. 2 (Fourth Quarter, 1966), pp. 625-640.

relaxed Clawson's assumption that demand is a function of population and travel cost only. By allowing other factors to explain variation in attendance, the assumption that all populations were identical in respect to recreational demand was not made. Such factors as population density and mean income were useful in explaining visitation from a particular origin zone to the lake. To determine benefits, the population density of each origin zone was incorporated in addition to population size and travel costs. An additional refinement of the Hotelling-Clawson model was made by using political boundaries for origin zones instead of concentric circles. This resulted in the easier adaptation of socio-economic characteristics of alternative origin areas. In addition, statistical estimation was improved for prediction purposes since the number of origin zones was greatly improved. The use of concentric circles normally provides only six or eight alternative origins. The use of counties greatly improved the number of degrees of freedom.

A very recent study by Tussey[38] further refined the model as developed by Merewitz. In addition to population size and density, Tussey incorporated median family incomes, certain age groups, percentage of high income families, and route and competition characteristics in the basic prediction model. This reduced further the Clawson assumption of population homogenity from one origin area to another. Instead of calculating consumers' surplus by taking the area

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[38] Tussey, op. cit.

under the demand curve from zero price or distance to infinity (on the vertical axis), Tussey employed a cut-off point equivalent to the cost of 150 miles of travel. The reason for this was that after each visitor travelled 150 miles or more, demand for recreation at the lake was considered to be effectively equal to zero. Thus, benefits could be overstated by using the total distance or cost from zero to infinity. In addition to this concept, Tussey employed "effective out of the way" distance. This is that additional travel distance specifically undertaken by the visitor to reach the recreational site. It is often considerably less than the distance from the origin area of the visitor to the lake. In this manner, Tussey relaxed the basic Hotelling-Clawson assumption that the sole purpose of a trip is to visit the recreation site under question. Multiple-purpose trips were now considered by using only that distance which the visitor travels out of his way to reach the site.

Pearse, despite the refinements incorporated by Merewitz and Tussey, objected to the necessity of assumptions about the characteristics and homogenity of the base populations from which recreationists are drawn.[39] He returned to the Hotelling notion of grouping visitors into areas of similar characteristics. Instead of geographical distances, Pearse grouped recreationists into

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[39]Pearse, P. H., "A New Approach to the Evaluation of Non-Priced Recreational Resources", Land Economics, February 1968, pp. 87-99.

similar income levels. In each particular income class, the visitor with the highest travel cost was chosen. If this visitor was assumed to be a marginal user in that he would not attend if costs were higher, the gross benefit derived by any member of the group was considered to be equal to this maximum value. By subtracting the travel costs for the other visitors from this value, a measure of consumer surplus or net recreational benefit was obtained. This variant of the consumer surplus model eliminated the necessity for homogenity of population characteristics. However, by merely changing the basic groupings from population and distance to income, Pearse makes the equally severe assumption that visitors of the same income levels have similar indifference curves for outdoor recreation. In addition, he must assume that participating recreationists are evenly distributed among areas offering substitutes of differing quality so that the recreationist with highest fixed costs faces alternatives of average quality.

Norton rejected the Hotelling-Clawson model on two basic issues.[40] The first is that the model does not represent a pure demand curve since it is a complex schedule, relating to many goods and services besides outdoor recreation. Secondly, if it does represent a demand curve, the value obtained for consumers' surplus must be compared with the consumer surplus of other market

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[40] Norton, G. A., An Economic Analysis of Outdoor Recreation as a Rural Land-Using Activity in North Wales, unpublished Ph. D. thesis, University of Wales, 1968.

products in order to be useful. Such comparison is difficult, if not impossible. Norton proposed an alternative theory of benefit estimation, rejecting consumers' surplus, but still based upon travel costs. He contendedthat the recreational benefits or value attributable to any particular site can be obtained simply by summing the total travel costs incurred by the visitors to reach the site. This sum, in turn, is directly comparable to the total revenue for conventionally priced market goods since consumers incur a real transportation cost because of their spatial separation from the recreation area. Since this cost is a significant portion of the total consumption budget spent by the visitor, he must choose between allocating his budget between the wide range of goods and services available, including recreation. This choice reveals the magnitude of recreation benefits. By varying the location of recreation sites, Norton stated that the associated redistribution to various sectors should be recognized so that compensation can be quantified if necessary. Location is important since recreationists may sacrifice income in order to purchase proximity to a site. In addition, the relocation of a site to a low income area effectively raises the real income of those residents. One limitation of this theory involves rationing of visitors through permits or lack of accessibility. This will not allow the real demand for recreation at that site to be fulfilled since it is restrained by institutional factors. A second limitation concerns the situation where leisure time rather than money may be the significant factor affecting participation.

The main criticism of this theory is that the summation of travel costs may yield benefits that are attributable to the transportation sector instead of to the recreational site under consideration. Merewitz makes this same point by stating that although the sum of associated travel costs plus consumers' surplus equal willingness to pay for the entire recreational experience, only the consumers' surplus is attributable to the recreational facility. This amount is the only one a discriminating monopolist could collect.[41]

This completes a review of alternative theories that may be employed for recreation benefit analysis. Each model reviewed exhibits certain problems of conceptual and practical nature in varying degrees of severity. The first six methods reviewed can be rejected outrightly on the basis of the limitations indicated in the analysis. Certain of the techniques such as determining benefits by using the market value of catch are not applicable to water-based recreation. A choice is left between different versions of the interview techniques and the indirect travel cost approaches. In practice, determination of "willingness-to-pay" through interviews have been beset with difficulties in obtaining reliable answers to the questions posed by the interviewer. The interviewer himself must be very skilled in eliciting responses that are free of bias. The respondents, as discussed previously, may not consider the questions and underlying assumptions severely. In addition to these problems, interview techniques are expensive and time-consuming. For

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[41]Merewitz, op. cit., p. 630.

these reasons, they were rejected in this study in favor of an indirect travel cost model.

Although the basic notion of consumer surplus is controversial, the Clawson-Hotelling model attempts to contrive an analysis based on economic theory. It illustrates the systematic application of theory to the evaluation of outdoor recreation analyses. Despite various conceptual difficulties, the application of this model deals with the practical problem of measurement. The estimation of recreation benefits with the use of such a model would be better than, or at least equal in validity to the arbitrary method of selecting one dollar per visitor-day as used by the International Pembina River Engineering Board for use in the Pembina Valley.[42]

Visitation Prediction Models

The first stage of determining benefits with the use of the Clawson-Hotelling model involves deriving an attendance prediction model for the recreational resource. Indeed, each technique considered in the previous section relies upon a measure of expected visitation so that the total amount of benefits can be calculated.

Ullman and Volk, in an early attempt, predicted attendance for a hypothetical reservoir fifty miles from St. Louis, Missouri.[43] They determined, through various surveys, the percentage distribution of visitor origins at the nearest large impoundments of water to St. Louis.

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[42]Pembina Engineering Board, "Joint Investigation for Development of the Water Resources of the Pembina River Basin, Manitoba and North Dakota", 1964, Appendix H, Recreation.

[43]Ullman and Volk, *op. cit.*

The distance from the reservoir to St. Louis and the per capita attendance were plotted on a logarithmic scale. On the average, they found that attendance to a reservoir declined by about the cube of the distance. With this graph, attendance at a new reservoir could be estimated. The per capita visitation was determined for concentric zones around the new reservoir. This was done by obtaining the visitation rate that corresponded to the distance from the zone to the reservoir. Multiplying the per capita visitation by the population in each zone yielded the potential visitation from each zone. Finally, the visitors from each zone were summed to obtain potential total visitation at the new reservoir.

The Battelle Memorial Institute estimated recreational usage in the Susquehanna River Basin with the help of multiple regression analysis. Battelle concluded that visitation to a particular park in Ohio was a function of an attractiveness variable (acres of park j), and accessibility (measured by taking the total population residing within sixty miles of the park and the proportion of total visitors originating within this same distance). Similarly, visitation to parks in Ohio were a function of the capacity of the park, attractiveness (measured by a weighted activities index and water acreage), and accessibility (miles from park j to the nearest interstate highway). Visitation levels estimated with these models were used to calculate the level of employment necessary to service the recreation industry.[44]

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[44]Battelle Memorial Institute, <u>A Dynamic Model of the Susquehanna River Basin</u>, 1964, Appendix Q, Recreation.

Tussey, Merewitz, and others have used various forms of regression analysis to isolate variables affecting recreation visitation. In each case, population and distance are the main factors explaining visitation as the dependant variable. Other variables such as age, incomes, urbanization and quality of roads are frequently but not consistently significant.

The population of St. Louis, Missouri, was again a subject of study by Gillespie and Brewer.[45] They concluded that education, race, occupation and family income multiplied by age were the most significant variables for use in estimating the demand of a metropolitan area for water-oriented outdoor recreation.

A new approach to predicting the level of recreational usage at parks and lakes has been proposed by Ellis and Van Doren.[46] They compared the simple gravity model[47] with a system theory model. The system theory model, based on electrical engineering theory, simulated

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[45] Gillespie, G. A. and Brewer, D., An Econometric Model for Predicting Water-Oriented Outdoor Recreation Demand, U. S. Department of Agriculture, ERS-402, March 1969.

[46] Ellis, J. and Van Doren, C., "A Comparative Evaluation of Gravity and System Theory Models for Statewide Recreational Traffic Flows", Journal of Regional Science, Vol. 6, No. 2, (1966) pp. 57-70.

[47] The standard gravity model is in the form of: $Y = kP/D^n$; where Y is the level of visitation for the zone under consideration, P is the population of the zone, D is the distance from the zone to the site, and k and n represent constants. This is the basic equation used in the simple Clawson model.

recreation traffic flows. Instead of identifying the path that offers the minimum resistance to an electric current passing from a given source to a given destination, the model determined the minimum resistance traffic flow pattern to Michigan parks. The attractiveness or drawing power for each park was measured by the capacity and the quality of the experience available. The relative strength of origin areas was obtained from the size and density of populations. Similarly, the resistance to traffic flows by roads was measured by the quality and directness of routes from population centers to the parks. The actual traffic flow pattern was obtained by using a computer to minimize traffic "resistance". This was done according to the relative resistance of all parks and links in conjunction with the relative strength and size of population origin sources.

In an actual comparison with the simple gravity model, the systems analog led to a better fit of the data. The new model performed better where unusual origin boundary shapes existed. Also, it could cope better with uneven distribution of demand and supply. The usefulness of the model lies in its ability to predict attendance at a new park. To achieve this purpose, the characteristics of the new park and access roads are entered into the original model. The computer recalculates traffic flows. From this, potential visitation can be estimated.

This completes a brief review of alternative visitation prediction models. Multiple regression analysis was chosen for use in this study due to its ease of application and consistency of results as indicated by other studies.

Chapter 3

DERIVATION OF A VISITATION PREDICTION MODEL

Introduction

The basic objective of this study is to estimate potential visitation and benefits at a hypothetical reservoir in the Souris River Basin. To achieve this objective, a visitation prediction model relating recreational attendance to distance travelled was obtained for Minnedosa Beach. Recreation benefits were then determined at this existing site. It was assumed that the hypothetical facility in the Souris River Basin would be identical in nature to Minnedosa Beach. With this assumption, visitation was estimated at the proposed development by using the prediction model formulated for Minnedosa Beach. Finally, an estimate of recreational benefits at the new facility was made.

This chapter is primarily concerned with the collection of basic data that was required to fulfill these goals. An analysis of the data was made to achieve a simple prediction model that is used in subsequent chapters. To guide data collection, a basic model was hypothesized. It took the form of:

$Y = F(Pj, Dj)$, where:

Yj = visitation to Minnedosa Beach from zone j,

Pj = size of population in zone j,

Dj = distance from zone j to the lake.

At a later point in this chapter, additional variables are hypothesized and tested in order to determine their ability to explain visitation.

Description of the Reservoir

Minnedosa Reservoir, in its present form and size of 300 acres of water surface, was created in 1950 by the construction of a P. F. R. A. dam (Prairie Farm Rehabilitation Act). The dam is located three-quarters of a mile east of the townsite of Minnedosa and was built to replace a previous one constructed in the 1920's. The main purpose of the original dam was to store water for hydroelectric generation for the town. It failed just previous to construction of the existing dam, but by this time, large-scale rural electrification eliminated the need for the power plant. The reservoir is located on the Minnedosa River which originates in Riding Mountain National Park and empties into the Assiniboine River ten miles west of Brandon, Manitoba. The valley of the Minnedosa River is generally quite deep, with a depth near Minnedosa of 150 to 175 feet below the surrounding prairie.

The existing reservoir was turned over to the management of the town of Minnedosa in 1952. Since that time, the reservoir has become quite popular as a recreation center with the surrounding population. The present development of Minnedosa Beach became the focus of activity on the reservoir, and a large number of private cottages were constructed in an allotted portion of the hillside. The public beach area is a site for annual festivals, and the reservoir has been used for Manitoba championship water-skiing competitions. Present facilities for recreation include a campsite, picnic area, beach, dock, launching ramp, sanitary facilities, electricity, kitchen shelters, playground equipment for children, and drinking water. A snack bar, ball diamond, miniature golf, dancing and roller skating are available on the grounds.

Data Collection

The main data required to obtain a prediction function are the magnitude and distribution of visitation. Such information was not available at Minnedosa Beach since the town did not collect any visitation statistics. The required information could only be obtained by on-site survey techniques. One such survey technique is to pass out questionnaires to each vehicle as it enters the beach, and request the visitors to fill them out in their leisure and return them by mail. Another means considered was simply asking the information of each visitor as he drove through the main entrance. A third would be mailing questionnaires to a cross-section of the neighboring population. A fourth method, and the one finally chosen, was to approach visitors on the beach, the boat docks, and the picnic area. These are the main areas of recreation activity and are closely situated to each other. At the same time, it would be relatively easy to obtain additional information such as incomes and professions of the visitors, and opinions of the facilities found at Minnedosa Beach. Consequently, a questionnaire[1] was developed to obtain information on age and sex of person interviewed, place of residence, driving distance, length of

[1]The questionnaire in this study was based on a questionnaire used in Recreational Aspects of Three Nebraska Lakes, Community Study Number Three, The University of Nebraska, 1960, and modified to suit the purposes of this project.

stay, frequency of attendance, type and size of group, recreational activities participated in, opinions on facilities, occupations and incomes.

Since the writer would be doing most or all of the interviewing due to limited research funds, it was impossible to be present at the beach throughout the entire summer. Participation in outdoor recreation is mainly on weekends and holidays. Six weekends were chosen during the summer of 1968 on which interviews would be conducted. It was hoped that an average of at least ten interviews would be made each day, assuming good weather existed. One of these weekends included the Monday of the August long weekend. This would give a total of about 130 interviews, under perfect conditions, but this was reduced to 100 in order to make allowance for weather and other unknown factors. In addition, it was planned to spend one full week at the reservoir in order to assess recreation use during the week.

However, only fifty-five interviews were collected instead of the proposed one hundred. Inclement weather throughout the summer season was the main reason. Out of the thirteen typical summer days selected for the survey there were only seven that saw any appreciable visitation. Rain, wind and below normal temperatures kept most visitors away. Table 3.1 shows a summary of the dates on which interviews were conducted.

Table 3.2 summarizes weather conditions on those remaining six weekend days at Minnedosa Beach when very little or no visitation was recorded. It is important to note that other weather factors not considered such as wind velocity and rainfall may influence visitation considerably.

Table 3.1. Survey Dates, Weather Conditions and Interview Results

Date (1968)	Total Population (by count)	Number of Actual Interviews	Number of People Audited	Percent of Total Daily Population Audited	Number of Groups Who Were Cabin Residents	Daily Maximum Temperature(a) in Degrees Farenheit	Daily Hours of Sinshine
Sat., July 13	275	7	20	7.3	3	80	13.1
Sun., July 14	475	11	41	8.6	1	84	10.8
Sat., July 27	125	4	28	22.2	1	70	14.6
Sun., July 28	500	18	107	21.2	0	69	14.5
Sat., Aug. 3	350	6	28	8.0	1	77	14.0
Mon., Aug. 5	300	5	25	8.3	1	77	12.0
Sun., Aug. 11	425	4	27	6.3	2	81	13.0

(a) Weather data is for Rivers Airport, Rivers, Manitoba.

Table 3.2. Weather Conditions on Survey Days With Negligible Visitation

Date (1968)	Daily Maximum Temperature	Daily Hours of Sunshine
Sun., Aug. 4	77	2.8
Sat., Aug. 10	65	13.7
Sat., Aug. 17	65	10.8
Sun., Aug. 18	69	2.8
Sat., Aug. 24	64	2.7
Sun., Aug. 25	68	13.1

Finally, interviews were not collected for those days on which special events were held at the lake. Such dates do not represent typical recreation days at the beach since it is customary to charge entrance fees. For this reason, it was assumed in this study that such events do not exist. The consideration of special events would probably affect the analysis and results of this study. Nevertheless, festivals and water-skiing championships are important since they are usually characterized by high attendance figures and a high intensity of resource use.

Survey Method

Ideally, visitors on the beach should be approached on a random basis. This could be done by dividing the selected area into a grid, and then choosing, for example, one group of visitors in each square. In practise, interviews were taken by beginning at the southern edge of the beach area and then working towards the north, attempting to keep in a relatively straight line. The presence of an interviewer on a beach is conspicuous. This resulted in the pattern being interrupted after about four or five interviews were taken. Instead, several interviews were collected in the picnic and boat dock areas. They were then resumed on the beach to maintain the pattern.

This working pattern could only be adhered to with any degree of resemblance on the Sundays of July 14 and 28, when a good crowd was present. A summer student assisted on the weekend of July 27 and 28 with the survey, resulting in a large number of interviews collected on that very rewarding Sunday. People were interviewed only once. Occasionally, a person who had been interviewed previously would be encountered again, but faces were usually recognizable to prevent this annoyance. By the end of the summer, a considerable percentage of the total number of people were interviewed. As a result, only four interviews were collected on the last survey day.

A head count of all people on the beach was made each survey day. This was necessary since the town did not collect total visitation data. The head count was, at best, only an estimate since people come and go continually.

A study of Table 3.1 indicates that there is considerable "length of stay" bias. This bias favors encountering visitors who are on a longer length of stay than others in that visitors who come for a short period of time are not likely to be met by the interviewer in his rounds. For example, the Sundays of July 14 and 28 saw two of the biggest crowds present last summer; yet, only one group interviewed stayed in a cottage. Cottage residents are usually present every weekend throughout the summer, and often stay for extended periods. However, the Saturdays of July 13 and 27 saw few visitors on the beach. Nearly forty per cent of these were cottage residents. Thus, on those days on which weather is poor, only cottage residents seem to be on the beach. On pleasant days, they are very out-numbered by day users. This indicates that a bias exists in the data in favor of visitors who are cottage residents. On the other hand, an opposite bias is possibly created by the excessive number of interviews collected on the 28th of July. Finally, an additional bias results from those groups of children from the town who were not interviewed. This group of visitors, which could possibly have been quite large at times, indicates that Minnedosa visitation is under-estimated.

Origins of Visitors

The first step in converting the data into usable form involves grouping visitors into areas of origin. This was the most difficult problem encountered in the study. The small absolute size of the sample was one reason for the problems encountered. A second reason was the high proportion (forty-two per cent) of the groups interviewed that were from one origin area, the city of Brandon.

Initially, concentric circles were used in recreation literature to delineate origin areas.[2] However, this notion has been

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[2]Clawson, op. cit.

replaced in studies by Merewitz and Tussey who instead used political subdivisions.[3] Such divisions are preferable since population size and socio-economic characteristics are readily available for towns, counties, municipalities and cities. For purposes of regression analysis, concentric circles yield very few origin zones. For example, if ten-mile rings were used in this study, six out of thirteen would encompass all visitors. The remaining seven rings would exhibit zero visitation. Adjustment could be made by using six rings, obtained by varying the distance between them. In this way, each ring would exhibit visitation. Each would count as an observation for regression analysis. However, only four degrees of freedom would be available if one independant variable were used. The concentric ring notion was untenable for this very simple reason of too few degrees of freedom.[4]

The use of political boundaries in this study is equally unsatisfactory. Only four towns and cities are represented by more than or equal to four groups of visitors in the sample. The remaining visitors are highly dispersed among various villages, towns, and rural municipalities. Most of these are represented in the sample by only one group. This leaves the possibility of random error extremely high. One method of reducing such random error is to group

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[3]Merewitz, op. cit., and Tussey, op. cit.

[4]In addition to limited degrees of freedom, concentric rings tend to "wash out" any differing characteristics of population areas. If the visitation from one ring is concentrated entirely in one city, all resemblance to the real situation is lost. This tends to defeat the very purpose of obtaining a prediction function. No means is available to explain why visitation is not equally dispersed around the lake or reservoir.

political units together. Each composite area would then be represented by more than one group in the sample. An attempt to apply this idea resulted in the total sample being distributed among eight alternative origin areas. However, the six degrees of freedom for use with one independant variable represented an improvement over the concentric ring notion.[5] The model is still unsatisfactory since no means is provided with which to consider those large populations in Manitoba which, according to the sample, had zero visitation to Minnedosa Beach. It is possible to add such populations to the nearest area that possesses visitation. For this study, such an idea was not possible due to the large number involved. Nevertheless, in reality these origin areas may exhibit considerable visitation. An equation derived to explain visitation at Minnedosa Beach would be unsatisfactory for use as a general prediction model at other reservoirs, if these zero attendance population areas were omitted.

The only recourse possible was to combine concentric circles with political subdivisions. This resulted in eight origin areas. Degrees of freedom were still very limited. Five concentric rings were obtained. Visitors from the city of Winnipeg were placed into the outermost ring. The town of Minnedosa, the town of Neepawa, and the city of Brandon constituted the three remaining origin areas.

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[5]Preliminary regression analysis was applied to the distribution of visitors across these origin areas. Air distance from the origin areas to the lake was found to be a highly significant variable (.01 per cent) for explaining visitation.

Table 3.3 summarizes the origin areas obtained in this fashion.

A combination of rings and political units is novel in recreation literature. Most of the disadvantages of the concentric ring notion are retained. For example, accurate population levels in the rings are difficult to obtain. In addition, socio-economic characteristics such as incomes, education, and ages of the populations cannot be tested as independant variables that may affect recreational demand. However, the incorporation of three political units in addition to the rings allows uneven spatial disperson of the visitors to be accommodated. The notion of concentric rings assumes that populations are evenly distributed throughout the entire zone. This restriction is overcome since population and visitation concentrations within a zone are now considered as separate entities. For predictive purposes, however, the model developed on the basis of this grouping is somewhat limited in approach. A certain amount of "judgment" must be used to determine which of the cities or towns can be incorporated as a separate potential origin area, instead of including it in a concentric circle.

Finally, regression analysis does not appear to be affected by the combination of rings and political sub-divisions as used in this study. For example, if political units were used to group visitors into origin zones, areas of various sizes and shapes would be obtained. Typically, however, there are usually some zones with no attendance on the basis of the population sample obtained for study purposes. Such zones could be incorporated by simply adding the population figures to the nearest political unit or zone exhibiting attendance and possessing similar distance characteristics to the recreational site. If there were a sufficient number of zero attendance zones in the sample, and they were all added to one zone with positive attendance and similar distance, it is possible to visualize a new, larger zone that would be effectively equivalent to a concentric circle. There would now be the combination of a concentric circle, and various political subdivisions that would accommodate all visitors to the site. However, the resulting regression analysis based on this hypothetical distribution would probably not be affected to any extent. If visitation per capita is the dependant variable and distance to the site is the independant variable, the equation relating these two variables does exactly what it is asked to do. If it is statistically significant, it simply illustrates the existing relationship between distance and visitation per capita. No additional assumptions appear to be necessary.

Total Visitation per Normal Season

The population size at Minnedosa Beach on the survey dates was estimated, according to Table 3.1, to be equal to 2,450 visitor-days. This sample was converted to a yearly basis in order to gauge the total number of visitor-days that would be characteristic of a typical summer at Minnedosa Beach. To achieve such a conversion, a normal summer season was assumed to extend from June 15 to September 15. Every day in the summer, however, is not suitable "weatherwise" for recreational purposes. Consequently the sample can only be converted to a yearly basis after an adjustment is made for weather conditions. To accomplish this adjustment, the Saturday and Sunday on the survey dates were chosen that had the poorest attendance. It was assumed that the weather on these days was marginally suitable to allow outdoor recreation on the beach to proceed. Maximum daily temperatures and hours of sunshine per day were used to indicate general weather conditions. On this basis a check of weather data over the last five years (including and up to 1968) indicated that approximately one-half of the days are not suitable for recreation. As shown in Appendix C, expansion of the sample after allowing for weather conditions yielded an estimate of weekend usage in a hypothetical normal year.

This value excluded any visitation during the week. James states that weekday usage is fifteen per cent of peak Sunday visitation.[6] This figure was assumed to be applicable to Minnedosa Beach. It was used after allowing for weather conditions (as illustrated in Appendix C) to determine recreational usage during the week. The sum of weekend and weekday use yielded a total estimate of 7,400 visitor-days for a hypothetical, normal summer at Minnedosa Beach.

Visitation Distribution in Origin Areas

Users were questioned in regard to the time duration of their visit to the lake. In addition, they were asked to express the frequency of visits made to this resource in a normal year. From this information, and the size of each group, the number of visitor-days

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[6]James, L. D., "The Economic Analysis of Recreational Reservoirs", Kentucky Law Journal, Vol. 55, summer 1967, Number 4.

accounted for by each party per year was estimated. The visitor-days were then summed to obtain an estimate of the total yearly number of visitor-days represented in the sample.

The next step involved determining the percentage of visitor-days that accrued to each origin area. The total number of visitor-days was multiplied by this percentage to yield the number of visitor-days per summer for each origin area. This entire procedure is also illustrated in Appendix C.

Finally, for use in regression analysis, visitation rates were reduced to a per capita basis. This was done by obtaining the visitation rate per 1,000 population in each zone. Population size in each zone was estimated in the 1966 Census.

Table 3.3 summarizes the results of this analysis. The two righthand columns are explained in the next section.

Data Collection for Independant Variables

A basic prediction model was formulated in an earlier section of this chapter. However, logic supports the hypothesis that characteristics other than distance and population may affect visitation to a recreation reservoir. Population characteristics such as income and income distribution, age and age distribution, the degree of urbanization, the type of highway between the population center and the site, and the competitive position of the site with respect to alternative sites available to the population center should all affect visitation.

In an effort to isolate other factors than distance which may affect visitation, the following general model was hypothesized:

Table 3.3. Summary of Origin Zones, and Zonal Characteristics

	Zone	Total 1966 Population	Total Visitor-days	Visitor-days Per 1,000 Population	Distance to Minnedosa Beach (Mi.)	Percentage Urbanization
1	Town of Minnedosa	2,300	888	384.9	1	0
2	1-15 mi. zone	5,350	482	89.6	14	0
3	Town of Neepawa	3,250	467	144.3	18	100
4	16-30 mi. zone	19,700	140	7.2	27	0
5	City of Brandon	34,000	3,416	100.5	33	100
6	31-40 mi. zone	23,950	645	27.0	49	0
7	41-70 mi. zone	77,320	370	4.7	83	31
8	71-130 mi. zone	767,000	992	1.3	127	70

$Yj = F(Pj, Dj, Uj, Cj, Hj)$, where:

Yj = visitation to Minnedosa Beach from zone j;

Pj = size of population in zone j;

Dj = distance from zone j to Minnedosa Beach;

Uj = the degree of urbanization of zone j;

Cj = a measure of competing opportunities for zone j;

Hj = a measure of accessibility from zone j to Minnedosa Beach.

The variables Y and P have already been considered in the previous section where they were combined to obtain the visitation rate per thousand population in the zone under consideration.

Distance

A measure for the distance from each zone to the lake was readily obtained. The mean travel distance as indicated by the visitors in Appendix A was used for this measure. These values are indicated in Table 3.3.

Urbanization

An urban center was defined as any town or city that had a population greater than 2,500 people. Thus, the percentage of the population in each zone that lived in an urban center could be determined. This percentage was used as a measure of urbanization, as indicated in the right-hand column of Table 3.3.[7]

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[7]Incomes of the population could not be tested as an independant variable. The use of concentric circles makes an income measurement meaningless since any real differences are obscured.

Competing Opportunities

A measure of competing opportunities is more difficult to obtain. Distance from the zone to the site is one measure that can be used since increased distance makes additional alternatives available to the recreationist. Another measure for alternative facilities was employed in this study. It is most easily illustrated by an example. Visitors from the town of Neepawa exhibit a willingness to travel eighteen miles to enjoy the recreational facilities on the shore of Minnedosa Lake. The only other alternative within this same distance is Lake Irwin, another P. F. R. A. reservoir located two miles south and east of Neepawa. Thus, within an eighteen-mile radius, Neepawa residents have a choice between two alternatives. This number is used as the measure of competing opportunities for the origin zone of Neepawa.

A competing opportunity was defined as any developed public recreation area that offered a beach for swimmers, a dock and boat ramp for boaters, and a camping area. These four facilities are available at Minnedosa Beach.[8]

This measure was readily obtained for the zones of Minnedosa, Neepawa and Brandon. The origin areas based on concentric circles were more difficult to evaluate. The number of alternatives does not remain constant around the entire circle. To overcome this obstacle, the number of alternatives were counted at the four compass points on

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[8]The main source for the identification of competing opportunities was The Manitoba Vacation Handbook, published by the Department of Tourism and Recreation, Tourism Branch, Manitoba, 1969 ed.

each ring. The mean was then used as a measure for the zone. Table 3.4 indicates the number of alternative recreation areas for each zone.

Table 3.4. Availability of Alternatives for Each Zone

Zone	North	East	South	West	Mean
1					1
2	2	2	1	1	1.5
3					2
4	4	3	3	5	3.75
5					3
6	6	5	6	6	5.75
7	13	10	14	9	11.5
8	16	31	21	21	22.25

Accessibility

Origin zones were categorized into two possibilities on a 0 - 1 dummy variable basis. The value "0" was given to those which do not have direct paved access roads to the lake. This was determined on the basis of the routes followed by the visitors. The value "1" was given to those zones which possessed straight-line paved highways from places of residence to the lake. These divisions were not entirely satisfactory. However, on this basis, zones 1, 3, 5 and 8 were classified as being very accessible, while the remaining were considered to be less accessible.

Derivation of a Visitation Prediction Model

As indicated previously in this chapter, eight origin zones leave only six degrees of freedom for use with one independant variable. Nevertheless, the variables hypothesized were tested as to their ability to explain visitation at Minnedosa Beach. Each variable was tested individually in linear and logarithmic form. In addition, all possible combinations of two and three variables were tested in multiple regression equations. In summary, distance was isolated as one significant variable in logarithmic form (at the 0.025 per cent level based on student-t distribution). The competing opportunities variable was also significant for use in predicting visitation. However, the correlation coefficient between distance and competing opportunities, as obtained from the correlation matrix, was in the order of .986. This indicates very strong multicollinearity between the two variables. However, distance was preferred over competing opportunities on the basis of slightly higher R^2 and student-t values. None of the remaining variables and combinations were useful for explaining attendance. They were rejected on the basis of low R^2 values and insignificant (.1 per cent level) student-t values.

On the basis of the regression analysis, a simple prediction model using distance as the only independant variable was obtained. This took the form of:

$$Y = 905.3/D \underset{(.317)}{1.074}$$

where Y = visitation per 1,000 population in the zone under consideration,

D = road distance from the zone to the site.

The correlation coefficient is equal to .657. The student-t value is equivalent to 3.39, which is significant at the .025 per cent level. The standard error is indicated in brackets beneath the exponent.

Attendance prediction at Minnedosa Beach, however, was somewhat erratic on the basis of this simple model.[9]

Table 3.5. Estimated Attendance at Minnedosa Beach According to the Prediction Model

Zone	Actual Visitor-days per 1,000	Estimated Visitor-days per 1,000	Actual Total Visitor-days	Estimated Total Visitor-days
1	384.9	430.0	888	989
2	89.6	53.1	482	284
3	144.3	40.6	467	132
4	7.2	26.3	140	517
5	100.5	21.1	3,416	719
6	27.0	13.8	645	331
7	4.7	7.9	370	608
8	1.3	5.0	992	3,817
			7,400	7,397

[9]An adjustment was made in respect to estimated Minnedosa visitation. The equation estimates 1,906 visitor-days per 1,000 population. This causes total visitation for this zone to be considerably overestimated. However, estimated attendance in the table was based on a distance of two miles instead of the original one mile. The reason for such an adjustment is that Minnedosa visitors take proportionally longer to travel the one mile to the lake than other visitors. Much of the total travel is at very slow in-town speeds.

Four of the zones exhibit greater than 100 per cent variation from actual to estimated visitation. However, the total estimated visitor-days are identical to the actual. This indicates that errors tend to even out when considering the overall total attendance at the lake.

Chapter 4

THE ESTIMATION OF BENEFITS AT MINNEDOSA BEACH

Introduction

The Clawson-Hotelling model was used to estimate recreation benefits at Minnedosa Beach. By using the relationship between distance and visitation, new visitation levels can be estimated by adding incremental travel distances to the actual distances travelled. In this way, reduced visitation is related to the additional travel cost that the visitor must undertake to reach the reservoir. This cost can be determined by multiplying the distance by a unit cost per mile of travel. A demand curve is obtained in this manner which relates quantities of recreation demanded to varying levels of cost.

Interpretation of the Demand Curve

Considerable controversy exists over the interpretation of the demand curve derived in the above fashion. One general method of interpretation consists of using the curve in order to find the maximum revenue obtainable by a non-discriminating monopolist. A second means of interpretation is to determine total consumers' surplus. This is obtained by measuring the entire area underneath the curve.

The advantage claimed for the first method is that it places the evaluation of recreational facilities on a basis comparable to private market evaluation. Total revenue is maximized by identifying the largest rectangle that can be inserted underneath the demand curve. Such a rectangle is represented by the shaded area in Figure 2. The proponents of this concept state that the maximum revenue obtained in such a manner is equivalent to the recreational benefits attributable to the resource.[1]

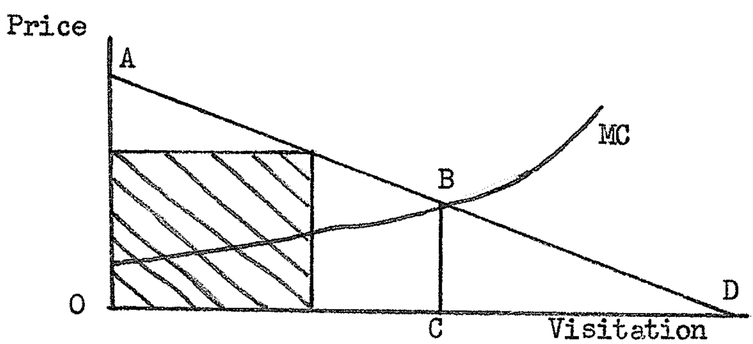

Figure 2. Recreation Demand and Marginal Cost Curves.

This interpretation can only be applied, however, if recoverable benefits are thought to be the proper criteria for all investment, public and private.[2] Market failure in outdoor recreation indicates that such a criterion is not usually the case. Revenues are not collected by the government from recreational facilities. Instead, benefits are considered by the proponents of this method of interpretation to be equal to the total consumers' surplus as measured by the entire area underneath the curve. This assumes that the curve is identical with the marginal utility curve

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[1]Brown, Singh & Castle, op. cit., p. 30.

[2]Merewitz, op. cit., p. 632.

of the users. In other words, a perfectly discriminating monopolist who could charge each user exactly the amount he would be willing to pay could collect this sum of money for that facility.[3] Entrance fees are assumed to be equal to zero for this means of interpretation. If user-fees are charged, the value of the resource is equal to the total consumers' surplus plus the actual collected revenue.

An alternative interpretation of consumer surplus arises in the presence of positive marginal costs. Optimum price and usage is defined at the point where marginal cost intersects with the demand or marginal utility curve. Under this theory, the value of the resource would equal revenue collected plus consumers' surplus. This would equal the area OABC, instead of AOD which is the total consumers' surplus. The maximum benefit-cost ratio of that facility, according to Seckler, is the ratio of the total area below the demand curve to the left of C (OABC) to the area below the MC curve that is also to the left of C.

An interpretation of the demand curve in this latter manner is applicable only if the level of use is restricted to OC by user-fees or other means. In practice, outdoor recreation is not restricted to such a measure of economic efficiency. Similarly, the maximum revenue interpretation does not apply since recoverable benefits are not thought to be a purpose of public investment. A more proper interpretation of the demand curve is considered to be total consumers' surplus since it measures the total utility generated by the resource.

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[3]Seckler, op. cit., p. 486.

The consideration of total consumers' surplus by the public sector appears to be an unfair comparison between public and private investment. Investment decisions seem to be biased in favour of the public sector in that private decisions are based, in a perfectly functioning market system, on the maximum revenue and profit generated by a resource. Merewitz counters this charge by observing that "it is a behavioral observation that monopolists set prices to maximize total revenue (neglecting variable costs) not a normative prescription."[4] He contends that revenue maximization, by setting a particular price, is more arbitrary than using total consumers' surplus which requires no set price. Thus, total consumers' surplus must be calculated whenever a marginal benefit will not give proper results. Such cases arise when the "investment is indivisible and either increasing returns (decreasing costs) prevail or all-or-none decisions are necessary, and when prices diverge from incremental cost because of intentional underpricing."[5]

Nevertheless, a number of restrictive assumptions must be made before a measure of consumers' surplus can be equated to the benefits attributable to the lake under consideration. It must be assumed that the marginal utility of income remains constant. This is necessary so that all increments and levels of willingness to pay, as indicated by travel distance and costs, will remain proportional and measurable by the same standard. At the same time, it is assumed

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[4]Merewitz, op. cit., pp. 631-635

[5]Ibid., p. 635.

that the utilities of many different individuals can be aggregated. According to Meretwitz, an analysis based upon consumers' surplus is a partial equilibrium analysis. However,

> to allow this simplification, we must make a set of 'competitive assumptions': that people benefit only from their own consumption; that prices equal marginal costs throughout the economy; and that the scale of project development is not so large that it will affect prices in general.[6]

Similarly, Hicks states that a measure of consumers' surplus can only be used when there is a change in price of only a few commodities. One cannot let the prices of all commodities in the economy vary since there must always be a sufficient background of fixed-price commodities.[7]

In a large, nearly perfect market, additions to output can be evaluated by the market price of the commodity. Price is constant over the entire range and equal to marginal benefit. In such a case, the consumers' surplus is negligible. However, by assuming that a lake's entire output is devoted to recreation, it can be shown that the willingness to pay or price varies considerably among users. This appeared to be indicated in this study. Visitation was found to decline with increased distance, which acted as a proxy for price. Thus, it seems to indicate that consumers' surplus is substantial.

However, to use consumers' surplus as a measure of benefits, it must be assumed that there are no competing uses to recreation at the lake under consideration. Such an assumption appears to be quite

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[6] Ibid., p. 627.

[7] Hicks, J. R., A Review of Demand Theory, Oxford University Press, 1956, p. 126.

realistic for the reservoir at Minnedosa since recreation is a main output of this lake. The lake is also used to store water for the town of Minnedosa, but this use can be assumed to be non-competing. However, for a multiple-purpose reservoir in the Souris River Basin, the assumption of no competing uses becomes more restrictive. In effect, it must be assumed that there are no uses of the lake other than recreation in a multiple-purpose project. In summary, however, Lerner states that:

> the notion of consumers' surplus can help us to consider and compare the social costs and the social benefits of changes in taxes, trade restrictions, on degrees of monopoly, of social services, indivisible investments, and policies and plans of many kinds.[8]

Benefit Estimation

The total area underneath the demand curve or consumers' surplus, is thus deemed to be the desirable measure of recreation benefits at Minnedosa Beach. The demand curve for the beach can be formulated with the use of the prediction model developed in the previous chapter. Assuming that all other characteristics remain constant, estimated visitation declines with increased distance. Table 4.1 illustrates the decline in visitation as each origin area faces an additional cost, over and above the actual cost incurred to reach the site. The total amount demanded at each cost level is obtained by summing horizontally the visitation from the eight separate origin areas. Row 1, which indicates the estimated total visitation

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[8] Lerner, A., Consumer's Surplus and Micro-Macro, Journal of Political Economy, Feb. 1963, p. 80.

at the existing level of zero access fees, is equivalent to the right-hand column of Table 3.4 in the previous chapter.

Table 4.1. Derivation of Points to Derive a Demand Curve

Additional Cost in Miles	Origin Zones								Total Visitation Demanded (Visitor-days)
	1	2	3	4	5	6	7	8	
0	989	284	132	517	719	331	608	3,817	7,397
10	158	160	72	286	434	229	483	3,272	5,094
20	79	110	59	231	355	199	440	3,054	4,527
40	38	67	37	168	267	155	366	2,690	3,791
70	21	42	24	118	192	117	293	2,254	3,061
100	15	30	18	91	150	94	246	1,963	2,606
500	2	6	4	20	36	34	73	691	866

An inspection of this table, and resulting demand curve plotted in Figure 3, reveals a problem of serious nature. It is expected that estimated attendance will be close to zero after each zone faces a very high travel distance to the lake. However, if each zone faces, for example, an additional access cost of 500 miles, estimated visitation is still of considerable magnitude due to the "inelasticity" of the curve. At such a distance, alternatives become relatively very inexpensive and visitation at Minnedosa Beach should be effectively equal to zero.

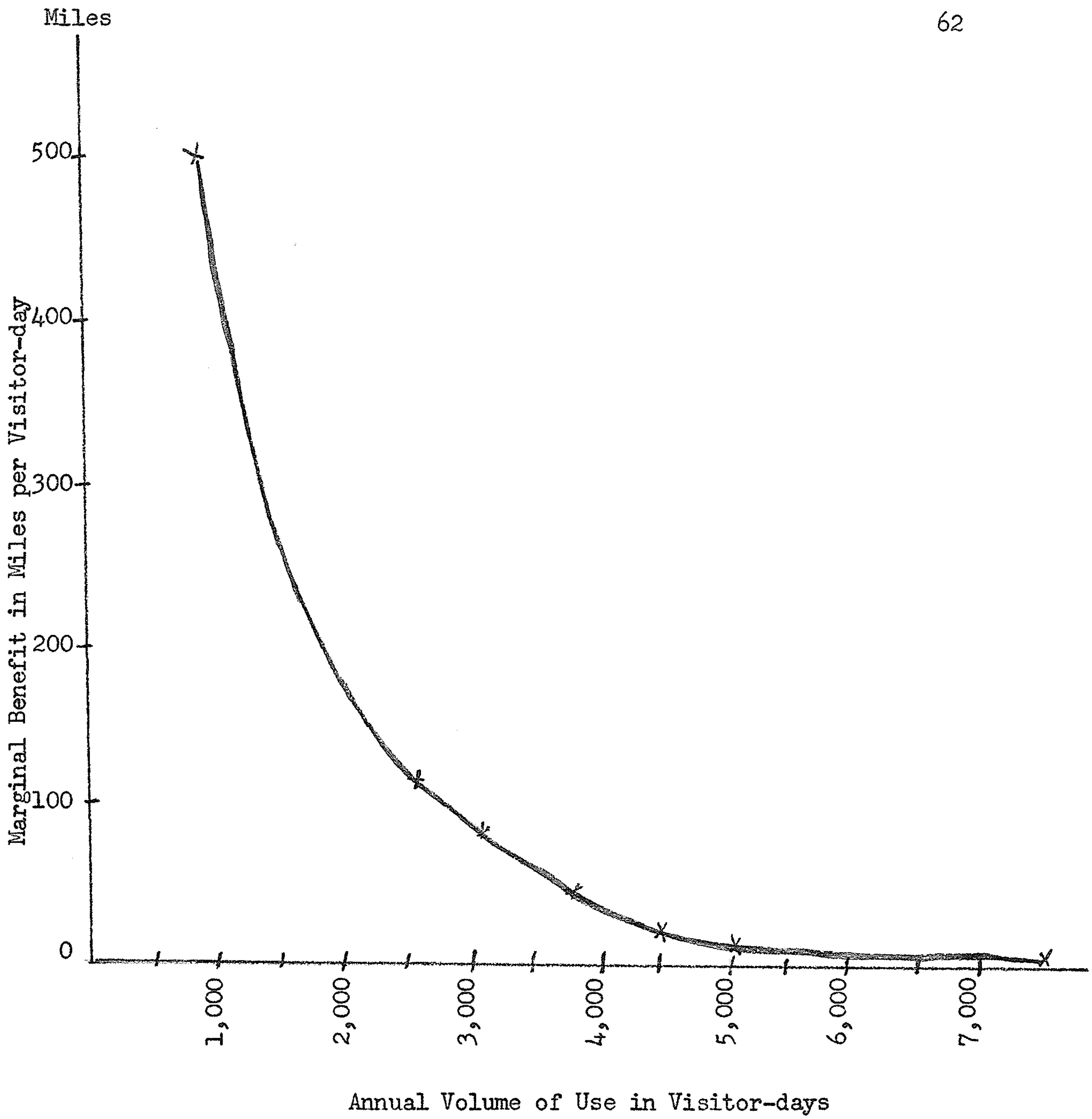

Figure 3. Demand Curve For Minnedosa Beach

The "inelasticity" of the curve poses difficulty in measuring total consumers' surplus. Ideally, the entire area under the curve between zero distance to infinity on the vertical axis should be included. However, if this were done, a measure of unusually high benefits would be obtained. The alternative possible at this stage is to select an arbitrary cut-off point for distance. One such cut-off point could be the distance of 500 miles, which was illustrated above. At this distance, it would be assumed that visitation at the site would be "effectively" equal to zero. In other words, 500 miles would be substituted for infinity in evaluation of the integral. A second cut-off could be selected on the basis of the furthest actual distance travelled by any of the visitors encountered at the lake. If this were used, the mean travel distance of those visitors from the outermost origin zone would be chosen. In this case, it would be equivalent to 125 miles.

Such cut-off points are very arbitrary in nature. However, the simplicity of the visitation prediction model results in a demand curve which does not tend to zero at any price. As a result, the benefits estimated in this study are very sensitive to the cut-off point selected.

Actual measurement of benefits indicated that this was indeed the case. There were two stages necessary to evaluate the magnitude of benefits. The first involves measurement of the area underneath the curve. Since consumers' surplus is formed by multiplying small increments of miles per visitor-day by the consequent number of visitor-days forthcoming, its unit is miles. Appendix D provides an example of determining consumers' surplus in miles for one of the zones under consideration. Table 4.2 summarizes benefits, in miles, obtained for each of the eight origin zones. The two alternative cut-off points, introduced above, were used.

If the results obtained by using a cut-off point of 500 miles are considered first, it is seen that zone 8 visitation severely dominates the total value of benefits. The main reason for such domination is the overestimation of visitation for this zone by the prediction equation. In addition, the value of consumer surplus for this zone is still of considerable magnitude. It is assumed with this cut-off point that there will still be considerable visitation forthcoming at higher travel costs than faced by zone 8 visitors. To overcome this defect of the model, the cut-off point of 125 miles was used as an alternative. It is now assumed that visitors from zone 8 are "marginal" in that they would not attend Minnedosa Beach if costs were higher. Consequently, they can be considered to have zero consumers' surplus. The value of benefits for any other zone is the saving in miles determined by the difference between the distance that they actually travelled and the distance travelled by the most distant visitors (125 miles). Comparison, however, is more readily possible if the benefits are expressed in dollar terms as shown by the next paragraph.

Table 4.2. Consumers' Surplus in Miles for Alternative Cut-off Points

Zone	Population in Thousands	125 Miles Consumers' Surplus Per Thousand	125 Miles Total Consumers' Surplus	500 Miles Consumers' Surplus Per Thousand	500 Miles Total Consumers' Surplus
1	2.3	3,064	7,047	3,897	8,963
2	5.35	1,507	8,062	2,340	12,519
3	32.5	1,321	42,933	2,154	70,005
4	19.7	1,030	20,291	1,863	36,701
5	34.0	887	30,158	1,720	58,480
6	23.95	615	14,729	1,448	34,680
7	77.3	264	20,407	1,097	84,798
8	767.0	0	0	893	684,931
			143,627 Mi.		991,077 Mi.

The second stage involved the conversion of miles into dollars. Travel costs are usually composed of two main items. One is the variable cost of operating an automobile while the other is the cost of the time of the people travelling in the car. Derivation of these costs is illustrated in Appendix E, where .03 dollars per mile was obtained for conversion purposes. Table 4.3 provides the total benefits in dollars attributable to the resource. This was estimated by multiplying the total mileage saved by the value per mile. The value of benefits per visitor-day was obtained by dividing the value of the resource by the number of visitors estimated for the season.

Table 4.3. Value of Benefits

	Cut-off Point at 125 Miles	Cut-off Point at 500 Miles
Total Consumer Surplus in Miles	143,627	991,077
Total Value of Resource	\$4,300	\$29,730
Benefits Per Visitor-day	\$0.58	\$4.02

A full sensitivity analysis was not performed to determine the level of recreation benefits at various cost levels between 125 and 500 miles. There is little to be gained in such an exercise. Inspection of the demand curve in Figure 3 illustrates the changing level of benefits as alternative cut-off points are selected. In reference to Table 4.3, the value based upon the cut-off level of 500 miles is unrealistic due to the domination of zone 8 values. The lower level of approximately 60 cents per visitor-day is likely to be a much better estimate of recreation benefits at Minnedosa Beach, as determined by the Clawson-Hotelling model.

Chapter 5

PREDICTED VISITATION AND BENEFITS AT A HYPOTHETICAL RESERVOIR

Assumptions

It is now possible to make tentative predictions of recreational usage and benefits at a hypothetical reservoir in the Souris River Basin. Many assumptions are required in order to make such a prediction. It must be assumed initially that the visitation prediction model obtained for Minnedosa Beach can be transferred directly to the new facility. For this to be possible, it must be assumed that the new beach development is identical in all respects, other than population and distance variables, to the original facility. For example, quality, accessibility, capacity, and many other features of a recreational resort are assumed to be unchanged. After construction, the two facilities must be considered to be non-competing in the sense that they have no effect on each other. Finally, no account is made for the effect of time and change. Any new facility would only come into existence after a lengthy period of time had elapsed.

For evaluation purposes, the hypothetical beach development was assumed to be located on the shore of the proposed Langvale reservoir which would lie south-west of Brandon. More precisely, the place chosen was assumed to be situated at the present intersection of Provincial Trunk Highway #10 with the Souris River. This hypothetical site is located twenty-two miles south of the city of Brandon.

Visitation Prediction

Concentric circles were drawn around the proposed site on a map. For lack of a better guide, the same number of circles was chosen as were obtained for Minnedosa Beach. In addition to the rings, Brandon was assumed to be a separate origin area. Consequently, six alternative origin areas were defined as indicated in Table 5.1.

Census population for 1966 was obtained for each of these zones. The distance from the zone to the proposed reservoir was determined by multiplying the distance from the center of the zone by a factor to convert air distance to road distance.[1] The distance for each zone was substituted into the prediction equation obtained in Chapter 3, to obtain a visitation rate per 1,000 population. This, in turn, was multiplied by the population in each zone to obtain the number of potential visitor-days forthcoming.

Potential visitation, as was the case for Minnedosa Beach, is very high for the most distant zone in comparison with the others. On the other hand, visitation from Brandon is estimated again to be very low. However, the total number of visitor-days is very similar to the total estimated for Minnedosa Beach. This is as expected since all factors are assumed to remain constant.

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[1]The conversion ratio was obtained by comparing road distance to Minnedosa Beach, as stated by the respondents on the questionnaire, to the actual air distance from the place of residence to the site. This value was approximately equal to 1.15.

Table 5.1. Predicted Visitor-days at the New Facility

Zone	Road Distance	Population in Thousands	Visitation Rate Per Thousand (Visitor-days)	Total Visitor-days
0-15 miles	10	5.5	76.4	420
City of Brandon	22	34.0	35.9	1,221
16-30 miles	25	19.5	28.5	556
31-50 miles	45	25.1	15.2	381
51-80 miles	75	64.3	8.8	564
81-130 miles	130	778,8	4.8	3,765
				6,907

Benefit Estimation

A demand schedule for the new facility was not obtained. Calculation of the decline in attendance with increased cost is very tedious and time-consuming. Instead, benefits were estimated in a similar process as illustrated in Table 4.2 of the previous chapter. A cut-off point of 125 miles was chosen. The consumers' surplus in miles is indicated in Table 5.2.

The total miles saved were converted to dollars by using $ .03 per mile. This yielded a total of $3,135. as the yearly value for recreational benefits attributable to the proposed facility. If this value is divided by the estimated visitors per year from Table 5.1, (6,900) benefits equivalent to approximately $0.45 per visitor-day are obtained.

Table 5.2. Estimated Benefits at the New Facility

Zone	Population in Thousands	Consumer Surplus per 1,000 Population (miles)	Total Consumer Surplus (miles)
1	5.5	1,760	9,680
2	34.0	1,176	39,984
3	19.5	1,084	21,138
4	25.1	492	12,349
5	64.3	232	21,348
6	778.8	0	0
			104,500

This value must be treated with extreme caution. The assumption that recreation is the only output of the reservoir is very restrictive. The basic assumptions underlying the application of the visitation prediction model to the new development should also be realized. It was considered that the new facility would be identical in all respects to the development at Minnedosa. It is impossible for this assumption to be entirely realistic. Different types and capacities of facilities would most likely exist. The new reservoir, if the project were undertaken, would probably be much larger in terms of water acreage. It would thus offer a higher "quality" of outdoor recreation to the visitor. This factor, alone, would probably result in a higher level of benefits per visitor-day at the new proposed facility than estimated by this study.

The main purpose of this chapter was to illustrate a process by which recreation benefits can be estimated at a yet non-existent development. In a very rudimentary manner, a tentative measure of future recreational usage and benefits in the Souris River Basin project has been obtained.

Chapter 6

SUMMARY AND CONCLUSIONS

Evaluation of Results

One objective of this study was to obtain a visitation prediction model which could be used to estimate the amount of visitation at an existing recreational development. To achieve this objective, data were collected by means of a survey and analyzed in order to determine the spatial distribution and visitation rates of users. With the help of regression analysis, a simple prediction model was obtained which related attendance from a given zone to the population size of the zone and the travel distance from it to the reservoir.

There are many serious shortcomings underlying this model which limit its usefulness. It is based upon a hypothetical normal summer which did not exist in reality. The visitation total for this summer was obtained by the gross expansion of a small amount of data, which covered only a small portion of an abnormal summer season. The basic data were obtained through a survey technique that suffered from a series of biases in collecting interviews. In addition, much valuable interview time was taken up by the collection of information that was not directly applicable to visitation estimation. This resulted from the use of a questionnaire which could have been much better designed. The determination of the number of visitor-days in a period of time from the information obtained on the questionnaire was somewhat arbitrary. A serious problem in translating the data involved the selection of origin areas. The total number of interviews collected was too small to provide a good cross-sectional distribution of visitors across various origin areas. Visitors could be "reasonably" divided into only eight origin areas. As a result, the regression analysis was based upon very limited degrees of freedom. This meant that multiple regression analysis could not be used satisfactorily. The use of concentric circles as a base for origin zone selection meant that socio-economic characteristics of the zonal populations could not be adequately obtained and compared. Comparison of the visitation estimated by the model with actual visitation indicated its low level of sophistication. Some origin zones were very badly underestimated while others were equally overestimated.

This summary of the foundation underlying the prediction model indicates that any application of the model should be conducted with a proper awareness of its limitations. The overall inadequacy of the model was borne out by its use in benefit evaluation. Notwithstanding the theoretical difficulties of the Clawson-Hotelling model for benefit estimation, a "demand schedule" could not be obtained that appeared reasonable. Even at extremely high travel distances, the prediction model still estimated considerable recreational usage of the reservoir. Consequently, a good measure of consumers' surplus was difficult to obtain.

Application of Results

As stated previously, an objective of this study was to obtain a general prediction model that could be used to project recreational usage and benefits at a multiple-purpose reservoir in the Souris River Basin project. An attempt was made in Chapter 5 to apply the results of the study to such a hypothetical reservoir. This application should be treated with extreme caution. Full consideration of the underlying assumptions must be realized. Before any adequate measure of recreational usage and benefits can be made in the Souris River Basin, a much more accurate and complete prediction model is required.

Although the Clawson-Hotelling technique for benefit estimation has many controversial and limiting aspects, it possesses usefulness. It provides, for lack of a better available alternative, a value for recreation benefits that can be compared with project costs. Although not entirely satisfactory, an estimate of benefits was obtained for recreation on the Minnedosa reservoir. It provides some indication of the level of benefits that accrue to the facility, from the viewpoint of the provincial government. On the basis of these benefits, recreational output of small reservoirs appears to be of substantial size when comparing project benefits with costs.

Suggestions for Further Research

This study has been introductory in nature. The prediction model obtained in this study needs to be tested over a wider variety of conditions, situations, and time in order to assess the stability of the parameters. Refinement is very possible with the inclusion of more variables and the use of political subdivisions for origin zones.

In this study, the prediction model is inadequate since it can consider only a facility that is identical in all respects to Minnedosa Beach.

The city of Brandon appears to be the most important source of market demand in the Souris Basin. Of the respondents interviewed, forty-two per cent were of Brandon origin. A study of the socio-economic characteristics of Brandon residents needs to be made. Identification of the type and quantity of outdoor recreation that they seek is required.

There is a need to develop better techniques for the quantification of direct or primary benefits and consequences of investment projects that include recreation as a potential use. Continued research is needed to gain a consensus on the measurement of outdoor recreation benefits. As indicated in the literature review, such a concensus does not exist at this time.

The chief problem in recreation analysis is the lack of market prices. Thus, additional research is needed to determine why outdoor recreation is intentionally underpriced by the government. Although the redistribution of income and externalities of consumption are cited as reasons for providing very low or zero user fees, these reasons need to be re-investigated.

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APPENDIX A

RESULTS OF RECREATION SURVEY CONDUCTED AT MINNEDOSA LAKE

Date (1968)	Age: 19&under	Age: 20-35	Age: 36-50	Age: 51-65	Age: 66& over	Sex of Respondent: Male	Sex of Respondent: Female	Place of Residence	Approx. Driving Distance(mi.)	Air Distance	Le[n]th of Stay: 1-2 hr.	3-6 hr.	7-24 hr.	25-48 hr.	2 Days +	Fr… At…: 1-2	…
Sat. July 13		x				x		Minnedosa	1	1		x					
Sun. July 14			x			x		Minnedosa	1	1	x						
Sat. Aug. 3			x			x		Minnedosa	1	1		x					
Sun. July 28			x			x		Minnedosa	1	1		x					
Sat. July 27			x			x		Minnedosa	1	1		x					
Sun. July 14			x				x	Neepawa	12	12		x				x	
Sun. July 14	x						x	Neepawa(12-14-16)	13	12				x			
Sun. July 28		x				x		Basswood(35-15-19)	14	8	x						
Mon. Aug. 5			x				x	Neepawa	17	16					x		
Sat. Aug. 3			x			x		Neepawa	18	16		x				x	
Sun. July 14	x					x		Neepawa	18	16				x		x	
Sun. July 28				x		x		Neepawa	18	16			x				
Mon. Aug. 5			x			x		Neepawa	20	16							
Sat. July 13			x			x		Douglas	35	26					x	x	
Sun. July 28			x			x		Justice	22	18							
Sun. July 28				x			x	Brookdale(32-12-16)	25	17						x	
Sun. July 14			x			x		Rapid City	17	13						x	
Sun. July 14		x				x		Brandon	32	29				x		x	
Sun. Aug. 11		x				x		Brandon	32	29							
Sun. Aug. 11			x			x		Brandon	33	29					x		
Sun. July 14			x			x		Brandon	32	29					x	x	
Sun. July 28		x					x	Brandon	33	29							
Sun. July 28		x				x		Brandon	33	29				x			
Sun. July 28				x		x		Brandon	32	29						x	
Sat. July 13			x			x		Brandon	33	29				x			
Mon. Aug. 5		x				x		Brandon	32	29							
Sun. July 14		x				x		Brandon	33	29					x		
Mon. Aug. 5		x				x		Brandon	32	29							x
Sun. July 14		x				x		Brandon	32	29						x	
Sun. July 14		x				x		Brandon	32	29						x	
Sun. Aug. 11		x				x		Brandon	32	29						x	
Sat. Aug. 3		x				x		Brandon	32	29	x					x	
Sun. July 28			x				x	Brandon	32	29							
Mon. Aug. 5			x			x		Brandon	34	29	2 wes)				x		x
Sun. July 14		x				x		Brandon	32	29							
Sat. Aug. 3		x				x		Brandon	32	29					x		
Sun. July 28			x			x		Brandon	33	29	1 we)				x	x	
Sun. Aug. 11			x			x		Brandon	33	29							
Sat. Aug. 3		x				x		Brandon	32	29							x
Sat. July 27	x					x		Brandon	32	29				x			
Sun. July 28				x		x		Brandon(22-9-18)	44	34							x
Sun. July 28			x			x		Gladstone	40	39					x		

Date (1968)	Age: 19&under	Age: 20-35	Age: 36-50	Age: 51-65	Age: 66& over	Sex of Respondent: Male	Sex of Respondent: Female	Place of Residence	Approx. Driving Distance(mi.)	Air Distance	Leth of Stay: 1-2 hr.	Leth of Stay: 3-6 hr.	Leth of Stay: 7-24 hr.	Leth of Stay: 25-48 hr.	Leth of Stay: 2 Days +	Frequ.of Attend/Yr: 1-2	Frequ.of Attend/Yr: 3-5	Frequ.of Attend/Yr: 6-9	Frequ.of Attend/Yr: 10 +	Type of Grp.: Alone	Type of Grp.: Family	Type of Grp.: Friends	Size of Party: Total	Size of Party: Men	Size of Party: Women	Children	Recreational Activities: Picnic.	Swimming	Boating	W.Skiing	P.Driving S.Seeing	Fishing	Camping	Other	Occupation	Income ($1,000): 0-3	3-5	5-7	7-10	10+	Not Reported	
Sat. July 13		x				x		Minnedosa	1	1		x							x		x		4	1	1	2		x	x	x					R.C.M.P.						x	
Sun. July 14			x			x		Minnedosa	1	1	x								x		x		4	1	1	2	x	x							Town. of Minn.			x				
Sat. Aug. 3			x			x		Minnedosa	1	1		x							x all summer		x		5	1	1	3		x		x		x			Station.Eng.		x					
Sun. July 28			x			x		Minnedosa	1	1		x							x		x	x	10	2	2	6		x	x	x					Gen.Contract.				x			
Sat. July 27			x			x		Minnedosa	1	1		x							x		x		6	3	1	2		x							Broker			x				
Sun. July 14			x				x	Neepawa	12	12		x					x				x		5	1	1	3	x	x							Farming			x				
Sun. July 14	x						x	Neepawa(12-14-16)	13	12				x					x		x		6	1	1	4		x	x	x			x		Student(farm)						x	(have trailor)
Sun. July 28		x				x		Basswood(35-15-19)	14	8	x								x			x	2	1	1			x						x	Farmer			x				
Mon. Aug. 5			x				x	Neepawa	17	16					x			x			x		5	1	3	1	x	x	x	x	x				Farmer/Cartage			x				(have cabin)
Sat. Aug. 3			x			x		Neepawa	18	16		x					x				x	x	8	1	1	6	x	x							Pilot			x				
Sun. July 14	x					x		Neepawa	18	16				x			x					x	3	1	2	–		x	x				x		Student						x	
Sun. July 28				x		x		Neepawa	18	16			x						x		x		3	1	–	2	x	x			x	x			Civil Serv.(Pub.Works)		x					
Mon. Aug. 5			x			x		Neepawa	20	16		x						x			x		7	1	1	5	x	x							Salesman			x				
Sat. July 13			x			x		Douglas	35	26					x		x				x		3	1	1	1	x	x					x		Military			x				
Sun. July 28			x			x		Justice	22	18		x						x			x		4	1	1	2	x	x							Elevator Agent			x				
Sun. July 28				x			x	Brookdale(32-12-16)	25	17						x					x		2	1	1		x				x				Farming		x					
Sun. July 14			x			x		Rapid City	17	13						x					x		4	1	1	2	x	x							Farming			x				
Sun. July 14		x				x		Brandon	32	29				x		x					x		4	1	1	2		x					x		Dept. of Hwy.		x					
Sun. Aug. 11		x				x		Brandon	32	29									x		x		7	4	3	–	x	x							Milkman			x				
Sun. Aug. 11			x			x		Brandon	33	29					x			x			x		8	1	1	6	x	x				x			Fire fighter			x				(have cabin)
Sun. July 14			x			x		Brandon	32	29					x		x				x		4	1	1	2		x				x	x		Garage Mech.			x				
Sun. July 28		x					x	Brandon	33	29								x			x		5	1	1	3	x	x							Firefighter			x				
Sun. July 28		x				x		Brandon	33	29				x					x		x		4	2	2	–	x	x	x		x	x			Firefighter			x				
Sun. July 28				x		x		Brandon	32	29							x				x		6	2	2	2	x	x			x				Watchman		x					
Sat. July 13			x			x		Brandon	33	29				x					x		x		4	1	1	2	x	x	x		x		x		Military			x				
Mon. Aug. 5		x				x		Brandon	32	29									x		x	x	6	1	3	2	x	x				x			Military			x				
Sun. July 14		x				x		Brandon	33	29					x				x		x		4	1	1	2		x					x		Bus driver		x					(have cabin)
Mon. Aug. 5		x				x		Brandon	32	29								x			x		2	1	1	–		x							Printer						x	
Sun. July 14		x				x		Brandon	32	29							x					x	2	2	–	–		x			x				Student						x	
Sun. July 14		x				x		Brandon	32	29						x					x		3	1	1	1		x							Office Worker.			x				
Sun. Aug. 11		x				x		Brandon	32	29						x					x	x	5	2	2	1	x	x							Electrician				x			
Sat. Aug. 3		x				x		Brandon	32	29	x						x				x		5	1	1	3	x	x			x				Teacher				x			
Sun. July 28			x				x	Brandon	32	29									x			x	5	–	3	2		x							Nurse				x			
Mon. Aug. 5			x			x		Brandon	34	29	2 wes)				x			x			x		5	1	1	3		x					x		Teacher				x			
Sun. July 14		x				x		Brandon	32	29									x		x		2	1	1	–	x	x							Draftsman				x			
Sat. Aug. 3		x				x		Brandon	32	29					x				x		x		2	1	1	–		x	x	x					St. Engineer				x			(have cabin)
Sun. July 28			x			x		Brandon	33	29	1 we)				x		x				x		7	1	1	5		x	x	x	x	x	x	x	Construction							(have trailor)
Sun. Aug. 11			x			x		Brandon	33	29									x		x		7	1	1	5	x	x	x			x			Business man				x			(have cabin)
Sat. Aug. 3		x				x		Brandon	32	29								x			x	x	4	1	1	2	x	x			x		x	x	Social Worker					x		
Sat. July 27	x					x		Brandon	32	29				x					x		x		6	4	2	–		x	x	x		x			Storekeeper (father)					x		(have cabin)

APPENDIX A

RESULTS OF RECREATION SURVEY CONDUCTED AT MINNEDOSA LAKE

Date (1968)	Age: 19& under	Age: 20-35	Age: 36-50	Age: 51-65	Age: 66 & over	Sex of Respondent: Male	Sex of Respondent: Female	Place of Residence	Approx. Driving Distance(mi.)	Air Distance	Length of Stay: 1-2 hr.	Length of Stay: 3-6 hr.	Length of Stay: 7-24hr.	Length of Stay: 25-48hr.	Length of Stay: 2 Days+	Frequ. of Attend/Yr.: 1-2	Frequ. of Attend/Yr.: 3-5	Frequ. of Attend/Yr.: 6-9	Frequ. of Attend/Yr.: 10 +	Type of Grp.: Alone	Type of Grp.: Family	Type of Grp.: Friend	Size of Party: Total	Size of Party: Men	Size of Party: Women	Size of Party: Children	Recreational Activities: Picnic.	Swimming	Boating	W.Skiing	P.Driving S.Seeing	Fishing	Camping	Other	Occupation	Income ($1,000): 0-3	3-5	5-7	7-10	10 +	Not Reported
Sat. Aug. 3			x			x		Alexander	50	36	(long wkd.)			x			x				x		4	1	1	2		x					x		Manager				x		
Sun. July 28			x			x		Shilo	58	34			x						x		x		5	1	1	3	x	x			x	x	x		Military			x			
Sun. July 28			x			x		Shilo	52	34			x				x					x	15	3	3	9	x	x			x	x	x		Military			x			
Sun. July 28		x				x		Shilo	50	34			x						x		x	x	5	2	2	1	x	x				x	x		Military			x			
Sat. July 13		x					x	Dauphin	70	62					x				x		x	x	2	1	1	-	x	x			x		x		Lab & X-ray		x				
Sat. July 13			x			x		Treherne	95	65					x				x		x		2	1	1	-			x				x		Bank manager				x		
Sat. July 27		x				x		Winnipeg	150	122		x				x					x	x	8	3	5	-		x			x				Store manager					x	
Sun. July 28				x		x		Winnipeg	130	122					x	x					x		5	1	1	3	x	x						x	Agrologist				x		
Sat. July 13		x				x		Winnipeg	140	122					x				x		x		4	1	1	2		x	x	x		x			Sugar cooker			x			
Sat. July 27			x			x		Winnipeg	135	122	(2 months)				x				x		x		6	1	1	4	x	x			x	x	x		Engine-man(CPR)			x			
Sun. July 28	x					x		Kansas, U.S.A.							x	x			x		x		9	2	2	5		x	x	x	x	x	x		Student				x		(father)
Sat. July 13		x				x		Toronto, Ont.				x				x				x			1	1	-	-		x						.	Engineer					x	
Sun. July 28			x			x		Regina	260						x	x						x	5	1	2	2	x	x					x		Agrologist					x	
TOTAL	4,22,25,4,0					48	7				36,4,6,16					11,11,9,24				1,48,6			274,76,77,121				31	54	13	10	16	16	19	4		9;23,13,5					5

APPENDIX B

SURVEY QUESTIONNAIRE

OUTDOOR RECREATION DEMAND SURVEY

Date: ____________________

Interview location: ____________

Please circle the most appropriate answer.

1. Age (in years):
   (a) 19 or under
   (b) 20 to 35
   (c) 36 to 50
   (d) 51 to 65
   (e) 66 and over

2. Sex:
   (a) male
   (b) female

3. Place of residence:
   (a) city or town ________________________
   (b) if farm, give section ______ twp._______ rge.______

4. Approximate driving distance from this lake. __________ miles

5. How long do you plan to stay at the lake on this visit:
   (a) 1 - 2 hrs.
   (b) 3 - 6 hrs.
   (c) 7 - 24 hrs.
   (d) 25 - 48 hrs.
   (e) 2 days or more.

6. How many times a year do you tend to visit this lake?
   (a) 1 or 2
   (b) 3 to 5
   (c) 6 to 9
   (d) 10 or more

7. Did you come (a) alone?
(b) with family?
(c) with friends?
(d) other

8. Size of party: men ________ women ________

children (under 14) ________

9. Which recreational activities are you or your family participating in while at this lake?

(a) picnicing
(b) swimming
(c) boating
(d) water skiing
(e) pleasure driving and sightseeing
(f) fishing
(g) camping
(h) other (specify) ________________

10. Check your opinion of various facilities at this lake.

Facility	Satisfactory	Neutral or No Opinion	Unsatisfactory or Inadequate
Picnic grounds			
Rest Rooms			
Landscaping (trees, walks, lawns, etc.)			
Swimming Places			
Boating Launching Facilities			
Docks			
Refreshments for Sale			
Supervision			
Gate Fee			
Camping Area			
Other: Specify ________________			
________________			
________________			

11. If any of these which you marked unsatisfactory were improved, would this encourage you to use this lake more often?

Yes ______ No ______

12. What is your occupation? ________________________________
(type of work done or position)

13. Industry ________________________________
(type of work done by firm)

14. What was the approximate total yearly income of you or your family in 1967?

(a) under $3,000
(b) $3,000 to $5,000
(c) $5,000 to $7,000
(d) $7,000 to $10,000
(e) $10,000 and over

15. Additional Comments: ________________________________

____

____

APPENDIX C

EXPANSION AND PRELIMINARY ANALYSIS OF SURVEY DATA

Derivation of Weather Adjustment Ratio

Chapter 3 contained a section which summarized the method used in this study to estimate the total number of visitor-days per year at Minnedosa Beach. Since the survey was conducted in a year which was cooler and wetter than usual, visitation was reduced from other years. This difficulty was overcome in the expansion of the sample by making an allowance for weather conditions. In order to estimate seasonal attendance on the basis of the total number of visitor-days in the sample, it was first required to determine the number of suitable recreation days per normal season. Weather records over a five-year period were obtained. It was assumed that a suitable day for recreation had a maximum temperature greater than or equal to 69 degrees Farenheit, and at least 10.8 hours of sunshine. These minimum values were obtained from Table 3.1. It was further assumed that a typical recreation season extended from June 15 to September 15 and comprised 93 days. This period of time includes fourteen weekends. Two of these are assumed to be long weekends which include Monday as a holiday. A total of thirty weekend days was thus obtained for a hypothetical normal year. However, a check of the weather records indicated that only 45 out of 93 days have weather conditions suitable for recreational purposes. The multiplication of thirty weekend days by the ratio of 45/93 yielded approximately fifteen weekend days with weather suitable for recreation.

There were approximately 2,450 visitor-days tallied on the beach during the seven weekend days on which the survey was conducted. Simple expansion by 15/7 yielded a value of 5,250 visitor-days per normal year. However, only weekend attendance was estimated by this procedure.

As noted in Chapter 3, it was assumed that weekday use was fifteen per cent of a peak Sunday visitation. The mean of Sunday attendance on the survey dates was 465 visitor-days. Multiplying this value by fifteen per cent yielded an estimate of seventy visitor-days per weekday. It was assumed previously that there were ninety-three days in a normal recreation season with thirty of these days falling on weekends. Consequently, there are sixty-three weekend days in the season but only 30.5 of these days are suitable for outdoor recreation on the basis established previously. Thus, a total of 2,135 visitor-days was estimated for weekday usage. The sum of weekend and weekday use yielded an approximate value of 7,400 visitor-days per normal season at Minnedosa Beach.

Conversion of Survey Results to Visitor-days per Year

The number of visitor-days per season for each group was calculated by determining the number of visits per year for each party, multiplying it by the number of party members, and then increasing the value by a length of stay factor that was registered for each party.

Table C.1 summarizes the values used to convert frequency of attendance responses to visitor-days per season:

Table C.1. Number of Visitor-days per Season at Minnedosa Beach

Frequency of Attendance	1 or 2 Times	3 to 5 Times	6 to 9 Times	10 and Over
Number of Visitor-days	1.5	4	7.5	15

Each party was asked to indicated "length of stay" at the beach. Table C.2 indicates the values used to interpret these responses. If the length of stay was less than twenty-four hours, the value from Table C.1 was left unchanged by multiplying by one. If the answer was 24 to 48 hours, the value was multiplied by two. Difficulty was encountered if the reply was two days or longer, and, to overcome this defect of the questionnaire, it was assumed that the length of stay is equal to three. The respondents had difficulty in replying to this question, which asks about the present situation in

Table C.2. Values Used to Adjust Frequency of Visits According to Length of Stay

Length of Stay	24 Hours or Less	25 to 48 Hours	2 Days Plus
Adjustment Factor	1	2	3

regards to the visit they were making just then, and reconciling it with frequency of visits. Theoretically, if a person has a cabin by the side of the lake and stays all season, he would state that he only visits once or twice, in regards to the number of trips undertaken by automobile. Out of the sixteen actual respondents who were on a longer than two-day stay, three replied "1 or 2 visits", four replied "3 to 5", three replied "6 to 9" and six replied "10 and over". The value of three is realistic in that those people who have cabins and stay up to a week or a month, and answered the "10 and over" response, are counted as forty-five visitor days per person during a season. However, this process was not very satisfactory since it is somewhat arbitrary. The difficulty of determining an estimate of the number of visitor-days per season is illustrated. It is particularly difficult in considering those visitors who are cabin residents.

By the above manner, the number of visitor-days per season was estimated for each group interviewed on the beach. After classifying the groups into their respective origin areas, a total number of visitor-days was obtained for each zone by the summation of the groups from each zone. Table C.3 illustrates the method used to obtain the number of visitor-days per zone per summer.

Table C.3. Derivation of Visitor-days per Season for Each Zone

Zone	Number of Interviews	Visitor-days in Sample per Summer	$\frac{\text{Visitation per zone}}{3,625} \times 100$	Total Seasonal Visitor-days per Zone
1	5	435	12.0	888
2	4	236	6.5	482
3	5	228.5	6.3	467
4	3	69	1.9	140
5	23	1,678	46.2	3,416
6	6	316.5	8.7	645
7	2	180	5.0	370
8	4	484.5	13.4	992
	52	3,627.5	100.0	7,400

The right-hand column is the product of the percentage sample visitation obtained in the fourth column and the total number of visitor-days (7,400) estimated for the summer as a whole.

Of the 55 interviews collected, the three groups from distant origin areas were not included in the analysis. It was felt that the visit to the lake was not the main purpose of the trip. The prediction model formulated in Chapter 3 assumes that each trip was made for the specific purpose of visiting the lake.

APPENDIX D

SAMPLE CALCULATION OF RECREATION BENEFITS

The best way to explain the procedure for calculation of benefits is to use an example showing benefits that accrue to those visitors to Minnedosa Beach from an origin zone. The city of Brandon was selected for illustrative purposes.

1. From Table 3.3, the population of Brandon is 34,000 while the distance is thirty-three miles. The prediction model, Table 3.5, estimates 719 visitor-days.
2. From the column in Table 4.1 which represents Brandon, incremental distances are presented in the additional cost (miles) column. The row representing zero additional mileage shows estimated actual attendance. By substituting, for example, fifty-three miles in the prediction equation, which represents an additional twenty miles of travel distance and cost, estimated visitation declines to 355 visitor-days. The addition of forty miles to the original thirty-three reduces visitation to 220. This process is repeated tracing out the proxy demand curve exhibited by Brandon visitors to Minnedosa Beach.
3. To obtain a value for consumer surplus, the integral of the prediction equation is required between the distance of twenty-nine miles and infinity. However, infinity is replaced by a cut-off point selected to be 125 miles. The equation becomes:

$$\text{Area} = \int_{33}^{125} 905.3D^{-1.074}\, dD$$

4. The value of this integral between 33 and 125 miles is 887 miles. Multiplying by the population of Brandon in thousands yields a consumer's surplus of 30,158 visitor-miles.
5. This is converted to dollars by multiplying by .03 dollars per visitor-mile. The derivation of this value is illustrated in Appendix E. A total of $905. is obtained. Dividing by the estimated 719 visitor-days yields a net benefit per visitor-day for Brandon residents of approximately $1.40.

APPENDIX E

CONVERSION OF CONSUMERS' SURPLUS IN MILES TO DOLLARS

The second stage in Chapter 4 involved the conversion of consumers' surplus in miles to dollars. This appendix illustrates the procedure involved to obtain the value of .03 dollars per mile that was used for the estimation of benefits.

This value was determined by using the formula:

$$C = 2(m + t/v)/bp$$

where C is the cost per mile in dollars per visitor-day, the number 2 accounts for round trips, b is the average number of days a visitor remains at the site, p is the average number of visitors per vehicle, m is the variable operating cost in dollars per mile, t is the value of a vehicle-hour of travelling time in dollars, and v is the mean travel velocity in miles per hour. This equation expresses the added cost a visitor would incur to visit the site if he had to travel one mile further.

All of the terms can be readily obtained. The value for p was determined by dividing the actual number of visitors by the number of vehicles used. It was assumed that every group came by automobile. From Appendix A, it was estimated that p was approximately equal to 4.5 visitors per vehicle.

From Appendix C, it was estimated that b was equal to 1.62 days per visitor. This value was obtained by dividing the total number of visitor-days at the lake by the number of days before adjustment was made for length of stay in Table C.2.

Since m is the value for marginal travel cost, only those costs associated with an extra mile of travel can be considered. This was assumed to be the cost of gasoline and oil. Consequently, if an average car obtains eighteen miles per gallon, at an average cost of $0.48/gallon in Western Manitoba in 1968, this is equivalent to $0.0267/mile. If oil is used at the rate of four quarts every 2,000 miles at $1.00 per quart and a new oil filter is installed every 4,000 miles at $3.50 per filter, a cost of $0.0029/mile is incurred. The summation of oil and gasoline expenses yielded the total value for marginal travel cost of automobile operation of $ .0296 per mile.

The value for the cost of time is difficult to quantify. There are those who maintain that time is no restraint since travel to a recreational site is part of the recreational experience. They assign no value for the cost of time spent in travel. However, time is often a major factor other than cost in determining whether or not a visit is made to a particular site. Indeed, in this study, respondents were indirectly questioned on the value of time by asking whether or not one of their recreational activities was pleasure driving and sightseeing. Of those interviewed, twenty-nine per cent (Table F.5) stated that this was one of the activities they participated in that day. Since time is a big factor in pleasure driving and sightseeing, these people appeared to equate the cost of time spent as part of the recreational experience that they were seeking. However, seventy-one per cent of the visitors did not reply to this activity. This can imply that they value the cost of time in driving and do not deem it pleasurable. They may have covered the same road a multitude of times so that actual travel is unpleasant, yielding an opportunity cost for the amount of time spent in travel. The value placed on travel time can be considered as an estimate of the willingness-to-pay to reach a destination faster.

A crude, simplistic measure of the value of time spent in travel is to assume that an hour spent in travel is worth an hour's wages.[1] This theory has limitations, especially when attempting to apply it to travel time during leisure hours such as weekends and vacations. Nevertheless, some value for time is desirable, especially if the drive is tedious. To obtain a value for t (time) in the cost equation used in this study, the mean income for all the visitors was determined from income data. This yielded an annual value of $6,450. This was converted to an hourly basis by dividing by 1,920 hours per year. These hours were obtained by assuming that the average worker works eight hours a day for 240 days per year. A value is yielded of $3.36 per hour. If one worker is assumed in each automobile, this value can be equated to the value of a vehicle-hour in travelling time and used for t. It was assumed that only one person in each automobile can be given this value on time. After dividing this hourly value by the mean number of 4.5 passengers per vehicle, a value across

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[1]Pearse, op. cit., page 24.

all zones of $0.75 per passenger/hour is obtained.[2]

The value for t must be divided by the mean velocity of the vehicle to convert it to a cost per mile basis. For this purpose, v was assumed to be fifty miles per hour.

This completes the evaluation of terms used in the cost equation. Using this equation the cost per mile was estimated to be $0.0288 per mile (rounded to $0.03 in subsequent calculations).

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[2]This corresponds very closely to the value of $0.86 per person-hour as used by Merewitz, op. cit., and Tussey, op. cit. They base their values on calculations by the American Association of State Highway Officials, Road User Benefit Analyses for Highway Improvements, Washington, D. C., 1960.

Johnson, M. B., op. cit., is of the opinion that the use of this theory to quantify the value of time spent in travel seriously overestimates cost conversion. He states that the value for time should not be the mean hourly wage, but rather, the marginal value of the 40th hour of the work week to the worker. In addition, it must be assumed that work is utility neutral to the individual. Since the value of travel time saved is a very significant portion of total benefits in highway improvement, many highways have been built that are not economically feasible.

APPENDIX F

CHARACTERISTICS OF USERS AT MINNEDOSA BEACH

A quantity of information was obtained in the survey. This appendix condenses the information supplied in Appendix A, and provides some additional description.

Table F.1. Ages of Respondents

	Ages of Respondents				
	19 & Under	20-35 Years	36-50 Years	51-64 Years	65 & Over
Number of Respondents Interviewed	4	22	25	4	0
Percentage	7.3%	40.0%	45.4%	7.3%	0%

Table F.2. Type of Group

	Type of Group			
	Families	Friends	Families & Friends	Alone
Number of Groups	39	6	9	1

Table F.3. Length of Stay

	Length of Stay				
	1 - 2 Hours	3 - 6 Hours	7 - 24 Hours	25 - 48 Hours	2 Days Plus
Number of Groups	3	26	4	6	16
Percentage	5.4	47.3	7.3	10.9	29.1

Table F.4. Visits per Year

	Number of Visits per Year			
	1 or 2 Times	3 - 5 Times	6 - 9 Times	10 and Over
Number of Groups	11	11	9	24
Percentage	20%	20%	16.4%	43.6%

The mean size of the groups was exactly five persons, with children representing about 45% of the population. Of the groups interviewed, seven of the nine whose homes were further than sixty miles from Minnedosa stayed longer than two days per visit.

One of the outstanding features of Minnedosa Beach is its excellent swimming and sunbathing area. The swimming portion has a firm bottom that slopes very gradually away from the shore so as to offer good water conditions for young and old alike regardless of swimming ability. This is reflected in the recreation mix or combinations of activities participated in by the users. Every group except one stated that swimming was an activity in which one or more of the groups' members participated. Although this is hardly surprising, it indicates that swimming and associated activities like sunbathing and girl watching are very popular with Minnedosa Beach visitors. A summary of the number of groups participating in various activities is provided in Table F.5. It is important to note that one member of a group can cause that group to be considered in an activity.

Table F.5. Recreational Activities of Visitors

Recreation Activities	Number of Groups	Percentage
Picnicing	31	56.4
Swimming	54	98.2
Boating	13	23.6
Water Skiing	10	18.2
Pleasure Driving and Sightseeing	16	29.1
Fishing	16	29.1
Camping	19	34.5
Other	4	7.3

Swimming is the most popular activity with ninety-eight per cent of the groups participating in this activity while picnicing, as a form of recreation, follows with fifty-six per cent participation. Camping, fishing, pleasure driving and sightseeing, water skiing and boating are less popular. On the basis of these data, each group participates in about three activities on a typical visit to the reservoir.

The group leaders were questioned as to their occupations and family incomes. The information is summarized in Table F.6.

Table F.6. Occupations and Incomes

Occupation of Group Head	Number	%	Incomes ($ '000) 3–5	5–7	7–10	10 & Over	Not Reported
Professional, Technical	11	20.0	1	1	6	3	–
Farming	6	10.9	2	3	–	–	1
Managers, Officials, Proprieters	7	12.8	–	2	3	2	–
Clerical Workers	2	3.6	1	1	–	–	–
Sales Workers	1	1.8	–	1	–	–	–
Craftsmen, Foremen	2	3.6	–	–	2	–	–
Operatives	5	9.1	1	2	1	–	1
Service Workers	11	20.0	3	7	–	–	1
Laborers	1	1.8	1	–	–	–	–
Students	3	5.5	–	–	–	–	3
Military	6	10.9	–	6	–	–	–
Per cent		100.0	16.4	41.8	21.8	9.1	10.9

APPENDIX G

OPINIONS OF FACILITIES AT MINNEDOSA BEACH

Visitors were requested to express their opinions on the facilities found at Minnedosa Beach by attempting to classify the facility as being satisfactory, or unsatisfactory, in comparison to what they felt was adequate. Comments expressed on each facility were noted. This appendix views the comments given by the visitors and provides a more detailed description of each facility. Opinions were also collected on gate tolls and supervision of the grounds.

Table G.1 summarizes opinions on various facilities. Column 1 gives the number of satisfied groups out of fifty-five, while Column 2 gives the number of groups who are unsatisfied with the present arrangements. Column 3 lists the number who have no opinion or are neutral. Column 4 gives the percentage satisfaction of each facility by determining the percentage of satisfied groups versus the total number expressing an opinion on the facility under consideration.

Table G.1. Opinions of Facilities at Minnedosa Beach

Facilities	Satis-factory	Unsatis-factory	Neutral or No Opinion	Percentage Satisfaction
Picnic Grounds	45	2	8	96%
Rest Rooms	37	13	5	74
Landscaping	51	4	0	93
Swimming Areas	53	2	0	96
Boat Launching	26	1	28	96
Docks	23	4	28	85
Refreshments	44	1	10	98
Supervision	50	3	2	94
Gate Fee	53	1	2	98
Camping Area	23	10	22	70

A high level of satisfaction (Column 4) is expressed by the public with most of the facilities offered at Minnedosa Beach. The picnic grounds, the beach and swimming area, refreshments, the boat launching ramp, and the low gate fee are all highly satisfactory to the users. Landscaping and supervision are also quite satisfactory. However, a lesser degree of satisfaction is expressed in regards to docking facilities for pleasure boats. Damage to boats was a common complaint. Restrooms, although quite new, were not satisfactory due to lack of service and inadequate design. Most dissatisfaction was expressed in the camping area by campers who had a variety of complaints. However, in summary, most visitors appeared to be quite pleased with the public beach area on Minnedosa Lake.

A high degree of satisfaction was expressed with the picnic area which is located beside the beach and boat docks. Numerous picnic tables are available, and a covered cook shack is provided for protection from rain. A few large trees provide shade and cover. People were generally quite pleased with the picnic grounds except for overcrowding on Sundays when facilities were too limited, and the entire area was too small.

Opinions on the rest rooms constitute a different story. The changing or dressing rooms are presently located in the new pavilion constructed as a Centennial project by the town during 1967, which houses the refreshment stand (canteen), and a roller skating and dance floor on the roof. This attractive new building is located about one hundred yards north of the main swimming area, close to the shore line. Rest rooms, which are new and similar to those found at provincial roadside stops and campsites, are located between the pavilion and the main beach. They are commonly used for changing rooms by swimmers since it appears to be too far to walk from the parking lot to the pavilion where the proper changing rooms are located, and back to the swimming area. Visitors were quite dissatisfied with the rest rooms. They thought that they could be cleaner and serviced more often. Running water was needed. They were inadequate, in general, and needed considerable improvement.

Landscaping of the developed area was next on the list and received general favorable opinion. However, better beach maintenance in regards to the swimming area was required in order to smooth out holes in the sand dug by children and caused by rain erosion. One visitor thought that more sand should be provided. Better roads, or more repair to the existing roads, in the parking and dock areas was required since they contained numerous deep holes. More trees were required to provide shade and improve a somewhat barren appearance. This need is partially being filled as a number of young trees have been planted.

A high level of satisfaction was expressed with the swimming area. Many visitors thought it was excellent, especially for children. Most swimmers are congregated in an area about 150 feet along the shoreline. A dock and diving boards are provided for swimmers. The swimming portion of the lake is enclosed with floating logs which serve to define the "safe" swimming area, keep out boats, and reduce waves caused by wind and boats. Lifeguards keep a constant watch on the swimmers during peak use. The only criticisms tendered on the swimming area were that it could be larger and somewhat cleaner.

Boaters expressed general satisfaction with the boat launching ramp but reserved praise somewhat for the boat docks. Half the visitors expressed no opinions on the docks since they did not own or ride in boats. The most common criticism was that the docks were hard on boats. More rubber tires were needed to prevent direct contact between the dock and the water craft. One boater complained that docks were too high from the surface of the water with the result that his boat windshield was cracked underneath the dock. General improvement was necessary. A factor to be noted with the docks is that they may purposely be left in a state of disrepair to discourage boaters, since the reservoir is very crowded with boats and waterskiers on peak days.

Some people made no purchases and were not in a position to express an opinion on the availability and quality of the refreshments available. General quality of refreshments that could be obtained at the pavilion was expressed as being very good. However, the canteen is located just a little too far from the general swimming area, where most of the people congregate to swim, sunbathe, visit and watch. Comments were, on the whole, very favorable.

General supervision was expressed as quite adequate. More life-guards and better water supervision were required, according to one visitor. Another person stated that better grounds supervision was needed, especially to control children. However, most people thought that supervision was very good.

The low gate fee, not exactly a facility, brought out very favorable visitor response. On Sundays, vehicles are charged 25 cents for admittance, or a season's ticket can be purchased for one dollar. This was thought very satisfactory and very fair. One person believed that the gate fee was too low.

Most dissatisfaction of all was expressed by that percentage of visitors who stayed in cottages and tents in the main campground. It is located on the side of the valley and about 300 yards southeast of the swimming beach. Approximately eighty cottages (the exact number was not obtained) are located in a very compact and small area. The lots are small with the cabins being located very close to each other. Water and electricity are available. The tenting area is located to the south of the cottage area. Campers stated that the tenting area needed to be better organized and was too small and crowded. Lots were not marked, resulting in a helter-skelter of tents and camper-trailers. Roads were not satisfactory and only limited parking was available. More picnic tables and garbage cans were required. Refreshments and supplies were not readily available, but this complaint may be irrelevent. A lack of supervision in the campground was noted, especially in regard to dogs. Showers were needed, and better servicing of the restrooms. Finally, one person summed up his reaction to the campground in general with the classical enlightening statement that it was "good for what you expect".

This completes a resumé of opinions expressed by visitors to Minnedosa Beach. At times, this writer, while conducting interviews, felt like a "champion of the cause" in that respondents felt that this survey would be instrumental in rectifying complaints at existing and new recreation areas. They seemed to need an outlet to release inward dissatisfaction with the existing outdoor recreation situation, especially those visitors from Brandon.

A crude attempt to gauge visitors' reactions to the improvement of those facilities that were unsatisfactory was made by asking if they would attend more frequently if the situation was rectified. Forty out of the fifty-five respondents did not answer this question, and the issue was not pressed by the interviewer. However, two groups stated that they would not attend more frequently than they do now. Six said that they would come more often if their complaints were heeded and the facilities were made more satisfactory. The confusing part of this question, which reveals its technical weakness in addition to the inexperience of the interviewer, is that seven groups stated that they would come more often despite the fact that they had no complaints and/or they already made ten or more visits per season.