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A REPORT ON THE USE OF A TRAVEL COST DEMAND MODEL FOR RECREATION ANALYSIS IN NEW ZEALAND: AN EVALUATION OF LAKE TUTIRA

by

B.S. Harris

A.D. Meister

DISCUSSION PAPER IN NATURAL RESOURCE ECONOMICS NO. 4

Department of Agricultural Economics and Farm Management
Massey University, Palmerston North

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PREFACE

Conflicts between groups often arise where a resource can be used in various ways. This discussion paper reports on a recreation analysis conducted at Lake Tutira. This beautiful freshwater lake, between Napier and Wairoa on the East Coast of New Zealand, is slowly deteriorating due to eutrophication caused mainly by agricultural run-off. Conflict exists between agricultural development and recreation use of Lake Tutira.

There are no simple methods for resolving conflicts in resource use between recreation and development. However the authors describe one methodology to provide additional information that can be used to aid decision making in particular conflict situations. The paper describes a technique for estimating the value of a resource to those using it for recreation purposes. The approach adopted in this paper does not imply that the authors regard the recreational value of a resource to be of overriding importance, or that economic considerations alone should guide decisions about optimal resource use. However, the paper does demonstrate that objective measures of the recreational value of a site can be obtained and it is strongly suggested that these can usefully replace more subjective observations in the overall decision making process.

This paper is based on a Master of Agricultural Science (Natural Resource Economics) thesis written by Mr B.S. Harris under the supervision of Dr A.D. Meister. I wish to thank all those who assisted Mr Harris in conducting his research, and acknowledge the financial support from the Department of Lands and Survey and Mobil Oil (N.Z.) Ltd. that made this study possible.

R.J. Townsley,
Head, Department of Agricultural Economics and Farm Management.

CONTENTS

LIST OF TABLES

LIST IF FIGURES

INTRODUCTION

During the last thirty years in New Zealand the number of people taking advantage of our natural resource amenities for recreational purposes has increased considerably. This is consistent with a world-wide trend of increased recreational participation and is generally attributed to increased urbanisation, greater affluence and travel opportunity, more leisure time, and expanding population levels. This increased desire for outdoor recreation in New Zealand has led to conflicting demand for the natural resources that provide the recreational opportunity, e.g. forests, lakes, rivers and beaches. Conflicts can arise between users of natural resources such as recreation, industry and agriculture and between those who want to develop resources and those who want to preserve them. If recreation is to be considered a legitimate alternative use of New Zealand's natural resources then the desirability of recreation compared to alternative uses needs to be identified.

It must be recognised that society does have multiple goals and that decisions involving alternative uses of resources will often involve a trade-off situation. In some instances several different objectives can be achieved simultaneously, but often this is not possible and one goal must be traded off against another. For this to be achieved satisfactorily, information on the costs and benefits relating to each alternative must be identified and compared.

In accepting the need for quantified costs and benefits relating to alternative uses of the same resources, the analyst is faced with a major difficulty in attempting to obtain them. The problem is that in New Zealand (and other market economies) the provision of natural resources for recreational use is not handled by the usual market mechanisms. Recreational amenities in New Zealand are provided and maintained in most cases by central government. As a result of this no pricing mechanisms exist to value the benefits people gain from a recreational experience, as they pay through their taxes; not for specific use. Therefore, resources are allocated without full quantitative knowledge of the costs and benefits involved, a situation that will inevitably lead to a misallocation of resources.

Uncertainty about the true costs and benefits associated with an action can only lead to controversy as has been shown in New Zealand in the past. The 'Save Manapouri' campaign was a result of disagreement between government and the conservation lobby about the value of electricity generation compared to recreation and conservation. A current example is the 'wild and scenic rivers' controversy, once again a confrontation between recreational use and electricity generation. Emotive arguments are heard on both sides, but no quantitative benefit calculation is available for recreation as

there is for increases in electricity supply. The final decision remains subjective. In the U.S.A. the amount of over-regulation in environmental matters has raised concern that in some cases the cost of regulation and protection could far outweigh benefits obtained. This is also a possibility in New Zealand.

The specific problem that this discussion paper directs itself to is that of Lake Tutira, in the Hawkes Bay area. The lake is a valued recreation site that is threatened by advanced eutrophication. A 'clean-up' scheme is proposed that will reverse the lake's deterioration but the question is, "do the benefits of such a scheme outweigh the costs?" An indication of the benefits of the lake to the users is required for this question to be answered.

It has become obvious in the last decade, due to the types of controversy described above, that some form of *recreation analysis* is required to provide quantitative measurement of the benefits associated with recreational use. Given such information, a study of the relevant costs and benefits relating to the alternative choices of resource allocation can be carried out, and decisions concerning the optimal use of the particular resource can be made objectively according to the particular allocation criteria in use.

The trend in New Zealand of increased recreational activity may or may not continue. Factors such as petrol price, static population level and a less favourable economic climate may slow down the trend. Regardless of this however, there will still exist a major demand for the finite recreation resources in the future and it remains the responsibility of the government to allocate a certain amount of resources for this purpose. To achieve efficient allocation, the decision makers must accept some form of recreation analysis that will provide a measure of the benefits.

This discussion paper summarizes a study (Harris, 1981) of one particular type of recreation analysis, the Travel Cost Method. In the study the method is applied to Lake Tutira and the suitability of the approach to a New Zealand problem is evaluated.

I. RECREATION ANALYSIS

1.1 Theory

The main objective of recreation analysis is to identify the users of a particular recreation site, and to determine how much the site (or the recreation experience) is worth to these people. As stated already in the introduction, recreation sites are often freely available for all to use in New Zealand. Many people make use of these sites. But, because no fee is charged, it is hard to get any idea of how valuable the site is to its users. This is in contrast to a private park where one has to pay an entrance fee before one can enter. To those who pay the entrance fee the value of a visit to the park must at least be equal to or greater than the cost of entrance, otherwise they would not have come.[1]

Many recreation sites in New Zealand are of such nature that it is hard to make them privately owned. Goods of this type are often called 'public goods'. A public good, once provided, is freely available to all and it is difficult to exclude people from using the good or receiving the benefits of it (e.g. a lake, national park, defence etc).

To place a value on such goods, it is necessary to create a situation in which people treat them as private goods and in doing so reveal how valuable the goods are to them. Alternatively, it is possible to observe people's spending behaviour on private goods which are complementary to the recreational good and from these observations derive indirectly a value for the recreational site. This latter approach is represented by the travel cost method of recreation analysis. This discussion paper presents an application of a travel cost method to a recreation site in New Zealand.

Before the method can be discussed however, it is necessary to define first what is understood by value. The concept of individual value is associated with a person's *willingness to pay* for a particular good or activity. As said above, for private goods this willingness to pay is usually revealed by the price people are prepared to pay. Observations on people's buying behaviour provide us with price-quantity information which allows the determination of a demand curve. The area under the demand curve represents the total willingness to pay or value people place on the particular good. For public goods, such as recreation sites, we cannot obtain such

---

1 *For what follows, the concepts of value, demand curves, willingness to pay and consumers; surplus will be briefly discussed. The coverage of the topic will, however, only be very superficial and the reader should look at other texts such as Price (1977) for a more thorough discussion.*

price-quantity information directly. Therefore an alternative way has to be found to determine a demand curve and total willingness to pay for a particular site.

Assume that we have been able to obtain a demand curve for a private good, figure 1.1.

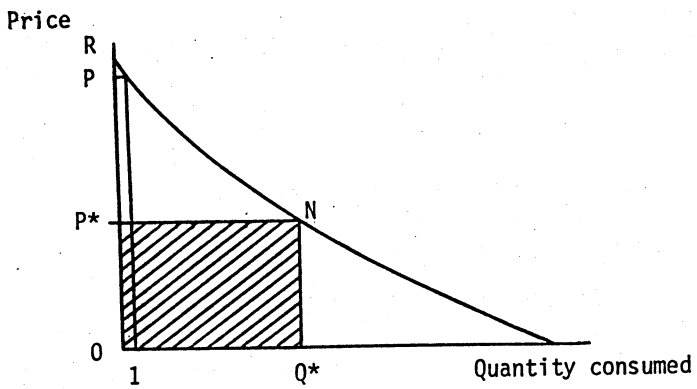

Figure 1.1: Demand curve for a private good

To be able to buy the good in a shop, people have to pay P*. At that price the total amount bought is Q* and the total amount actually paid is P* x Q*. However, the demand curve also shows that if somehow the seller of the good could force people to pay the maximum amount they would be willing to pay for say the first unit, a price as high as P could be obtained (e.g. tickets for an important football game sold on the black market). For a second unit the price will be a bit less and for the last unit purchased the maximum price equals the market price. No further units are bought which indicates that an extra unit beyond Q* would return less in terms of satisfaction to the consumer than the loss in satisfaction from having to give up the money (i.e. he could spend that money better somewhere else).

A demand curve therefore shows that total willingness to pay is equal to ORNQ* and that this amount is greater than the actual amount paid of OP*NQ*. The total value of the goods OQ* to the consumer is OP*NQ* plus RP*N, this latter amount is called the *consumers' surplus*.[2] If now, instead of OQ* being a private good it is a public good, then we know that no actual payments have to be made to be able to consume the good. With actual payments equal to zero, the whole area under the demand curve is now the consumers' surplus and is equal to total willingness to pay.

---

2 *The concept of a consumers' surplus is a complex one. Certain conditions have to hold before we can actually measure it and use it in the valuation process. It is beyond the scope of this discussion paper to discuss all these conditions and for this we refer the reader to Burns (1974) and Currie* et al. *(1971).*

Therefore, to value a recreation site, we need to first determine the demand curve for the site and then to measure the area under the curve to determine the value of the site to its users. The travel cost method to be discussed in the next section, does exactly that.

1.2 The Travel Cost Method

This approach to the indirect valuation of non-market recreational resources was developed mainly by Clawson (1959) and Knetsch (1966). The approach imputes the price-quantity reactions of consumers by examining their actual current spending behaviour with respect to travel cost. The central theme of the method is that the cost of travelling to a particular site influences the number of visits made to it. This relationship can be expressed as,

$$Q = f(TC, X, \ldots Xn) \qquad (1.1)$$

where Q = number of visits
TC = travel cost
$X_1 \ldots X_n$ = other explanatory variables.

Observations on people using a particular site (surveys) allow the derivation of equation 1.1. This equation gives a prediction model explaining visitation behaviour in terms of travel cost and other variables.

For the second part of this approach, an assumption is made that visitors to the site would react to the levying of an admission fee in the same manner as they would to increases in travel cost to the site. Acceptance of this assumption allows the visitation-prediction model to be used to estimate visitation to the site at various admission charges, i.e. by adding admission fees to the travel cost variable. Although in actuality no fees are charged at all, the assumption that changes in admission fees affect the consumers the same as changes in travel costs, allows us to predict visitation behaviour under various fee levels by equation 1.1 and calculate how consumers would react to similar increases in travel costs. The resulting price (fee) - quantity (visitation) observations provide a demand schedule for the site per se, and can be displayed in the form of a demand curve. The area under the demand curve gives a measure of the consumers' surplus enjoyed by the lake users at zero admission fee (i.e. total consumers willingness to pay) which is a measure of the value of the lake to its users.

II. BACKGROUND TO THE PROBLEM AND SUMMARY OF THE SURVEY RESULTS

2.1 Lake Tutira

The study involved carrying out a travel cost method recreational evaluation of Lake Tutira, a lake of 174 hectares situated 50 km north of Napier on state highway two (see figure 2.1). The area surrounding the lake is extremely picturesque with an abundance of native trees, willows and grassy areas. The lake also supports a large variety of wildlife including black swan introduced from Australia. As a result of its attractive environment Lake Tutira has become a unique recreational resource to the many people who use it for a variety of activities.

During recent years the lake waters have been subjected to severe eutrophication which has resulted in a marked decrease in the quality of both the water and the recreation experience. The number of people visiting Lake Tutira has decreased in direct contrast to the national trend of increasing recreational activity. The problem takes on greater importance when it is considered that Lake Tutira is the only fresh-water lake of reasonable size in the region. For many recreationists an alternative recreation site to Lake Tutira involves travelling to Lake Waikarimoana (180 km from Napier) or Lake Taupo (150 km from Napier) both of which require travelling on steep, winding roads.

A scheme designed to revert the eutrophication at Lake Tutira has been proposed and recently accepted by government and local bodies. The scheme necessitated public expenditure which needs to be justified in terms of the benefits received. The potential benefits resulting from a clean-up scheme were initially considered to be mostly of an intangible non-monetary nature, and there was no information available as to whom the benefits would accrue. In order to provide information for an objective consideration of the economic viability of the proposed clean-up scheme a recreation analysis was carried out to measure the monetary value of Lake Tutira to the public as a recreational amenity.

A summary of the costs of the clean-up scheme is given in Table 2.1 (Peptoe, 1980).

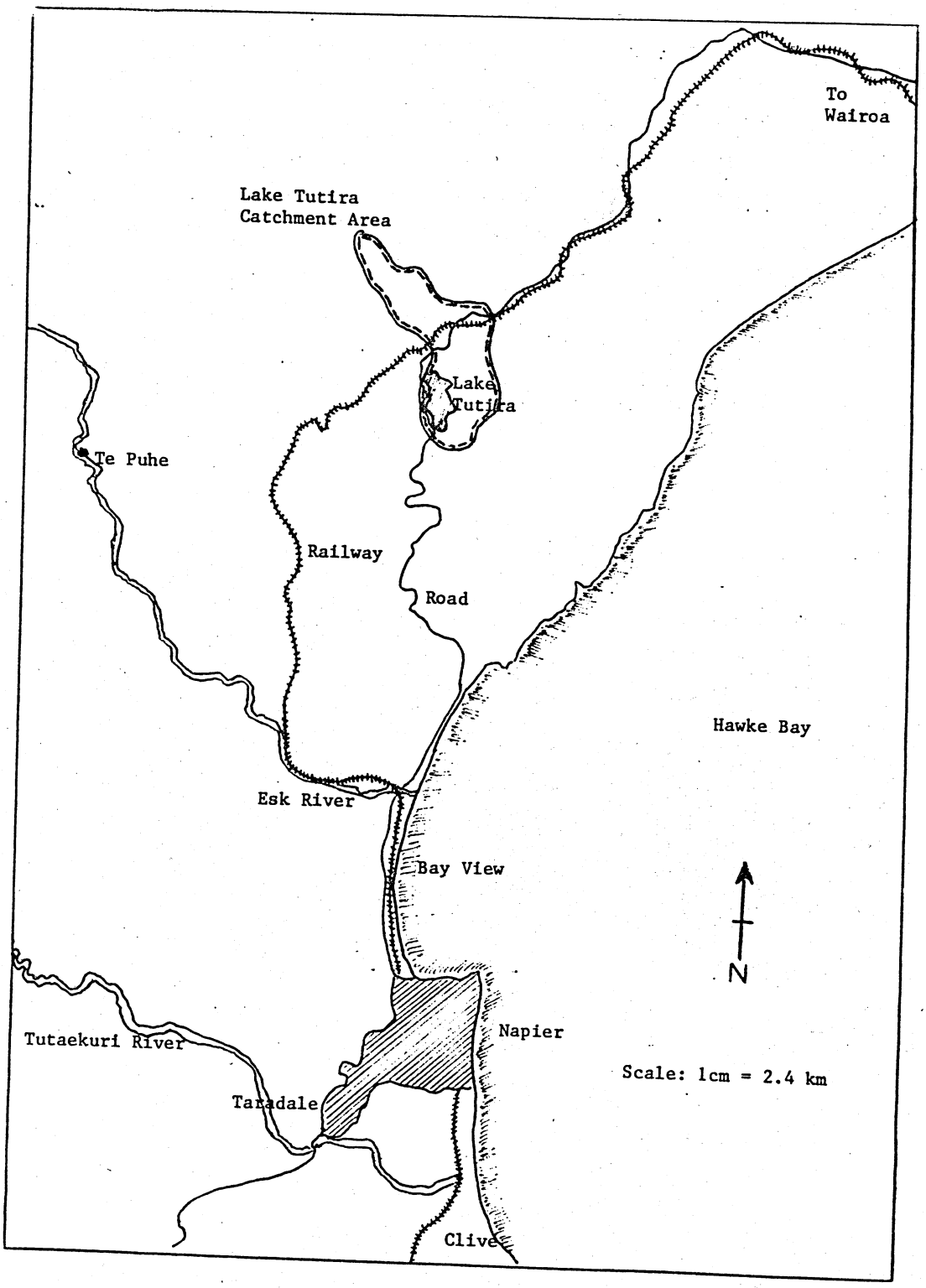

Figure 2.1: Lake Tutira locality map

Table 2.1: Summary of costs of the Tutira scheme

	$
On-farm soil conservation works	105,185
Lake shore protection measures	63,824
Sandy Creek (Parariki) diversion	20,000
Contingencies (10%)	18,900
Conservation fee (20%)	41,581
Total cost	$249,490
Yearly maintenance cost	$10,000

In the final section of this paper the results of the TCM are used in conjunction with the above costs to present a partial economic analysis of the Lake Tutira clean-up scheme.

2.2 The Survey

The method used to obtain information for use in the Travel Cost Method was the *personal interview approach.* A questionnaire was designed to obtain data on travel costs, visitation behaviour, frequency of use, and socio-economic characteristics of those people that use Lake Tutira for recreational purposes. A copy of the questionnaire is presented in Appendix I.

In practice, the questionnaire was found to be easy to administer and the respondents had little trouble in understanding the questions.

The sampling frame that the questionnaire was administered to, consisted of all the groups of recreationists that attended Lake Tutira for a period of longer than three hours. The current visiting population of Lake Tutira (1980/81 season) was estimated to be 10,000 visitor days per year. It was noted by local residents that visitation had decreased considerably during the last five years, presumably due to the decreasing quality of the lake water.

The questionnaire was administered by an interviewer and periods of peak usage (weekends) were sampled as much as possible. On a particular survey day every visiting group with the exception of the 'outlaws' motorcycle club was sampled.

2.3 Survey Results and Management Recommendations

In this section data not related to the Travel Cost Method is analysed and used to make recommendations for future management of the lake as a recreation site.

2.3.1 Breakdown of visitation origins

The number of groups visiting Lake Tutira from the various places of origin and the total number of visitor days per year consumed by these groups are presented in Table 2.2. These figures are also shown as a percentage of total visitation for ease of illustration.

Table 2.2: Breakdown of visitation origins

Origin area	*No. of visitor groups*	*% of total groups*	*Total no. of visitor days*	*% of total visitor days*
Napier	290	40	3,050	31
Hastings	175	25	2,917	29
Wairoa	10	1	70	0.7
Waipukurau	10	1	130	1
Taupo	5	0.7	15	0.2
Pahiatua	5	0.7	30	0.3
Gisborne	30	4	335	3
Palmerston North	35	5	270	3
Rotorua	15	2	70	0.7
Masterton	15	2	45	0.5
Tauranga	5	0.7	20	0.2
Waikanae area	25	3	110	1
Wellington area	80	11	2,150	22
Auckland area	15	2	500	5

NOTE: 1. The Waikanae area includes Paraparaumu and Paekakariki.
2. Total percentage does not equal 100% due to rounding error.

A total of 143 groups were successfully interviewed at Lake Tutira which, when adjusted by the population factor,[3] amounts to a total of 720 groups of recreationists visiting the site that summer. The total yearly visitation had been estimated at 10,000 visitor days per year.

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3 *The sample totals are multiplied by a population factor to bring the levels up to the true population totals.*

As would be expected, a large majority of visitor groups (65 per cent) originated from the Napier/Hastings area. Also Wellington and Auckland areas supply a significant portion of the lake visitation even though the distance is quite large. This could be explained by the large population centres from which the visitors are drawn. It becomes obvious that visitation to Lake Tutira originates from throughout a major part of the North Island, not just from local areas.

2.3.2 The value of travel time

The respondent groups were asked to comment on how they viewed the time spent in travelling to Lake Tutira. This question was considered necessary to provide information on whether or not a value (cost) of travel time should be included in a calculation of travel cost. The respondents had the choice of answering pleasant, unpleasant, or indifferent to the question about time spent in travel. The results are shown in Table 3; 141 respondents answered the question.

Table 2.3: The value of travel time

	No. of groups	*% of groups*
Pleasant	134	95
Unpleasant	3	2
Indifferent	4	3
	141	100

The results show that almost all the respondent groups (95 per cent) considered the travel time spent in getting to and from Tutira a pleasant experience. This would indicate that it is unnecessary to place a cost value on travelling time to New Zealand recreation sites. Although there would seem to be some benefit derived from the journey, this benefit is not a result of the recreation site per se and therefore should not be added to any calculation of consumers' surplus.

2.3.3 Alternative recreation sites

The respondents were asked if they would have chosen an alternative place to visit if Lake Tutira had not been available for their present trip. Of the 141 groups who replied to the question, 114 (81 per cent) stated they would have chosen another site, 15 (10 per cent) of which were uncommitted as to where they would have gone as an alternative. One hundred groups responded with specific alternative sites (as shown in Table 2.4), although the majority noted that they would not exchange recreation areas willingly. Twenty-seven (19 per cent) of the respondent groups expressed no alternative planning, stating that they would have remained home if Lake Tutira was not available.

Table 2.4: List of alternative sites to Lake Tutira

Alternative recreation area	*Percentage of respondent groups*
Camp ground at Napier or Hastings	14
Mahia Peninsula	12
A beach in the Napier area	30
Taupo	4
Waikarimoana	8
Wairoa	4
Lake Hatuma (Waipukurau)	4
White Pine bush sanctuary	6
Hawkes Bay river (Tuki Tuki, Eastdale, Dartmoor)	16
Lake Opuaki	1
Takapau	1
	100

Based on the comments of the respondents and the results in Table 2.4, it would seem that there is no real alternative site of a freshwater lake to Lake Tutira, other than Taupo and Waikaremoana which only 12 per cent of the respondents chose in the absence of the Tutira opportunity. It is also possible to conclude from the comments of individuals at Lake Tutira that any change to an alternative site would involve a definite loss of welfare to the users.

2.3.4 Breakdown of recreation activities

The respondent groups were asked to indicate the activity that was the *main* reason for their visit to Lake Tutira. The possible activities were listed on a showcard to help the respondents place their answers within the survey classifications. The respondents were asked to pick a classification that best explained the activity that was the main reason for their visit. The results are displayed in Table 2.5.

Table 2.5: Choice of activity

Main activity of the group	*Percentage of user groups*
General recreation and relaxation	62
Sailing/boating	18
Fishing	3
Walking/hiking	17
	100

These results indicate that the majority of groups (62 per cent) attend Lake Tutira for the purpose of relaxed non-specific recreation, for example picnicking and bird watching, enjoying the aesthetic surroundings and sunbathing. A significant number of the visitor groups (18 per cent) travelled to Lake Tutira specifically for the sailing and boating opportunities. This large percentage might indicate the usefulness of developing easier access for boats and yachts along the lake's edge. The many walks and trails around the lake and surrounding hills attracted 17 per cent of the visitors to Lake Tutira. The number of walkers and hikers would seem to justify both the upkeep of the trails and any work done developing new tracks.

2.4 Lake Tutira Management Recommendations

At the conclusion of the questionnaire respondents were given the opportunity to express their views and make relevant comments about Lake Tutira. These comments were studied and used along with secondary data and the researcher's observations in forming lake management recommendations. The feasibility of some of the recommendations in terms of cost is not discussed within the framework of this paper - they are merely presented as possible improvements to the overall management of the lake and surrounding area. The comments are as follows:

1. The survey has established that yearly visitation is at least 10,000 visitor days per year, with 65 per cent of the visitors originating from the Napier/Hastings area. The remaining visitation is accounted for from all over the North Island, from Auckland to Wellington. It is obvious from the data that Lake Tutira is the responsibility of both national agencies and regional bodies as it is utilized both on the national and regional levels. The non-productive disassociation of responsibility by both government and regional parties in the past must not continue. Co-operation and sharing in the costs associated with Lake Tutira is in the mutual interests of all those concerned.

2. Lake Tutira must be accepted as a unique recreational resource to Hawkes Bay as there exists no alternative freshwater lake of its size until Taupo (140 km) or Waikarimoana (180 km). The uniqueness of the lake and its surroundings deserves some level of priority within the region regarding its maintenance and development.

3. The general atmosphere of quiet and scenic beauty at Lake Tutira should be maintained as the main attraction of the site. The majority of visitors stated that they travel to Lake Tutira mainly for relaxation, not for vigorous recreation.

4. Due to the patronage given to Lake Tutira by people involved in sailing and boating the regional bodies should take a financial interest in the upkeep of the existing boat ramp. The ramp was built by the local Trailer-Sailor Club at their own expense, but is available for public use at the northern end of the lake. Lake Tutira is considered by many sailors to be an ideal area of water for teaching boating skills and safety.

5. The walkways provided by the Lands and Survey Department and Tutira Station are popular with the recreationists, and maintenance and development of these trails should be encouraged. It is thought that with the planting of exotic and native trees around the lake's edge an even more pleasant walking environment will emerge in time.

6. Many users of Lake Tutira expressed a need for a supply of clean, fresh, running water as campers are presently obliged to bring their own fresh water in containers. Possibly some form of supply could be arranged with the cooperation of Tutira Station. Some visitors are restricted from staying for longer periods at the lake due to the lack of water, and many first time visitors are not aware of the need to bring their own supply.

7. An issue of some importance to the users of Lake Tutira is the provision of toilet facilities. At present, a toilet block is available alongside the main road, just within the boundaries of the reserve. However, this block is subjected to such a degree of vandalism as to be unusable most of the time. The general feeling amongst the recreationists is that the disadvantage to passers-by of siting the block well away from the road would be easily outweighed by the lack of vandalism and availability of toilets to the lake users.

8. A common theme discovered from the recreationist's comments is that the site should remain in an undeveloped, natural state except for the provision of rubbish tins, the occasional barbeque, a water tap and toilets. The people using the lake area are, on the whole, enthusiastic campers and would not like to see a formal campground set up on the reserve, believing that such development would ruin the setting.

9. The wildlife at Lake Tutira should continue to be monitored and protected - the birdlife on the lake is a major attraction. When the water quality begins to improve, steps should be made to re-establish the trout population to the level once enjoyed by fishermen at the lake.

10. Motor boats should continue to be banned from the lake as the general concensus of the users indicates that they feel that power boats would detract from the peaceful atmosphere of the area. Power boats would also introduce the added problem of erosion of the lake shore from wake movement.

Further recommendations resulting from the study have already been accepted for implementation. These include the planting of more trees around the lake's edge, the fencing off of stock from the lake's edge, the diversion of nutrient-rich runoff during periods of heavy rain and the removal of stock yards from near the lake.

III. ESTIMATION OF THE VISITATION PREDICTION RELATIONSHIP

3.1 Introduction

The Travel Cost Approach (TCM)[4] involves dividing the recreationists into geographical areas (zones) and attempting to predict total visitation to the lake from each zone using regression techniques. The TCM relies heavily on the assumption that visitation to a particular recreation site is influenced by the costs involved in getting there, such that as the cost increases, visitation will decrease. For this reason the relationship between visitation and travel cost is expected to be negatively sloped.

Ideally, the relationship would follow the form shown in Figure 3.1.

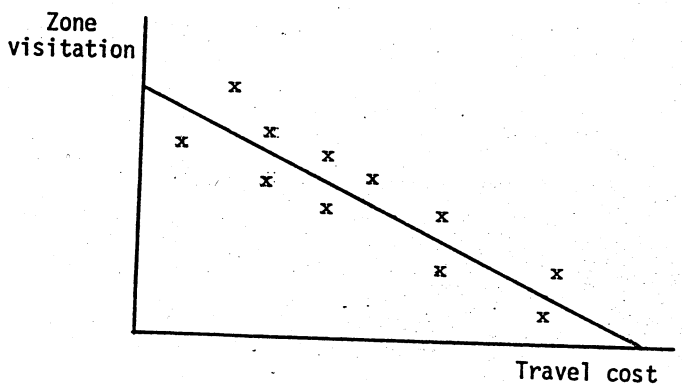

Figure 3.1: Relationship between zone visitation and travel cost

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4 *There are several variants of the Travel Cost Method. These variants can be divided into a) individual observation approaches; and b) aggregate data approaches. Both approaches were tried in this study. The aggregate data approach turned out to be the better of the two in this particular application and the results discussed refer therefore to this approach only. For a discussion of the other approach see Harris (1981).*

Alternatively, this can be expressed as:

$$V = f(TC \text{ plus other independent variables})$$

where V = zone visitation,
TC = travel cost.

Once a linear relationship[5] is established, zone visitation can be predicted at different levels of travel cost. If it is assumed that people will react to increases in admission fees in the same manner as they would to increases in travel cost, different admission fees can then be added to the travel cost variable in the regression equation to predict zone visitation at various admission fees. The resulting price quantity relationship provides a demand schedule.

3.2 Zone Specification

The first step of the aggregate data approach to the TCM is to specify the zone areas. The zones were designated as the major centres in the North Island from which recreationists travelled to Lake Tutira. Due to the unique distribution of population in New Zealand no absolute boundaries were allocated to the zones, i.e. the large majority of the population of the zones reside in the main centre serving what is usually a rural area, often bounded by its own topography. The zone average distance to Lake Tutira was taken from the major population centre. Due to the concentration of population within the regional centres it was thought that the error component caused by visitors from similar distances but different zones (i.e. on the borders of two zones) would be minimised.

As it was considered impossible to divide single towns in separate zones as they would not reflect different travel costs, the town unit was taken as the smallest possible zone unit. It transpired that it would have been useful to have obtained more zonal divisions within 100 km of Tutira but unfortunately the population within this distance is mainly restricted to three population centres, and it was considered infeasible to attempt to break them down into further divisions.

The zonal divisions are outlined below.

Zone 1. NAPIER and surrounding area
2. HASTINGS, HAVELOCK NORTH, WAIROA
3. WAIPUKURAU and surrounding area
4. TAUPO area
5. PAHIATUA and district

---

5 *An understanding of regression methods, correlation and statistical significance can be obtained from books on general statistical techniques.*

Zone 6. GISBORNE area
7. PALMERSTON NORTH and Manawatu area
8. ROTORUA area
9. MASTERTON and surrounding area
10. TAURANGA area
11. WAIKANAE, PARAPARAUMU, PAEKAKARIKI
12. GREATER WELLINGTON AREA, including Hutt Valley
13. GREATER AUCKLAND area

The geographical distribution of these zones is shown in Figure 3.2.

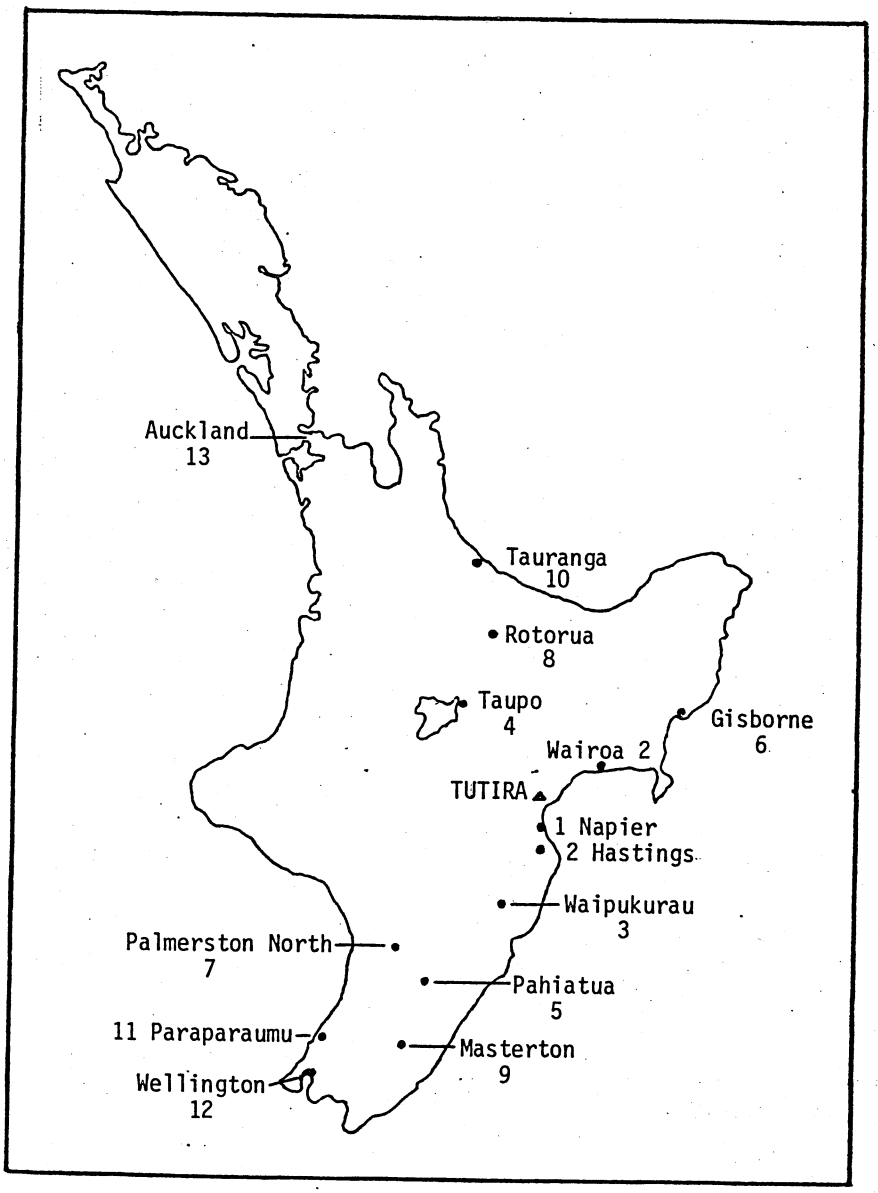

Figure 3.2: Zone centres within the North Island of New Zealand

3.3 The Visitation Prediction Relationship

The information on travel costs and zone visitation obtained from the survey at Lake Tutira is presented on a scatterplot (Figure 3.3). It was immediately obvious that the relationship between the two variables would not be explained sufficiently well by an ordinary linear-relationship. For this reason several different functional forms were applied to the data in an attempt to find a line of best fit. The functional form eventually chosen as best describing the relationship is a reciprocal transformation of the travel cost variable.

The form of a reciprocal transformation is:

$$Y = A + \frac{B}{X} \qquad (3.1)$$

where Y = visitation rate (per thousand population)
X = travel cost

$$\frac{dY}{dX} = -B/X^2 \qquad (3.2)$$

such that the slope is everywhere negative and decreases in absolute value as X increases. The relationship is asymptotic on both axes, i.e. as X tends to zero, Y tends to infinity, and as Y tends to zero, X tends to infinity.

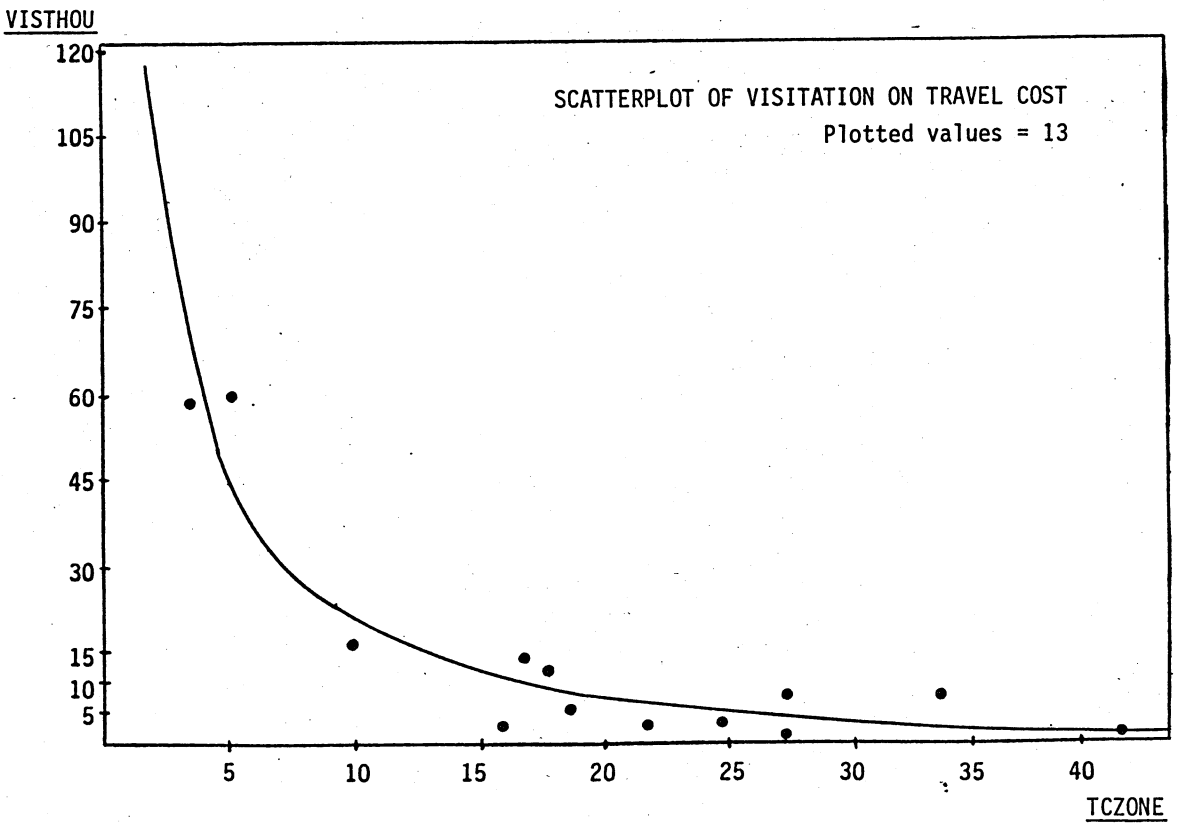

Figure 3.3: The relationship between visitation and travel cost described by a Reciprocal Functional Form

To calculate the relationship, a regression analysis was carried out with visitation rate as the dependent variable and the inverse of travel cost as the independent variable. The regression equation is:

$$Y = -3.99 + \frac{233.5}{X} \qquad (3.3)$$

The regression results are summarised in Table 3.1. The estimated relationship is strong ($r^2 = 0.88$) and statistically significant at the 1 per cent level ($F = 81$ with 11 d.f.)

Table 3.1: Regression summary for the reciprocal function

Dependent variable:	VISTHOU		
Independent variable:	INV		
Multiple R	0.94		
R square	0.88		
Adjusted R square	0.87		
Standard error	7.58		
Analysis of variance	*D.F.*	*Sum of squares*	*Mean square*
Regression	1	4681.63	4681.63
Residual	11	632.34	57.48
F ratio = 81.44			
Variables	*B*	*Standard error B*	
INV	223.53	24.76	
CONSTANT (A)			

A graph of the relationship between visitation rate and travel cost using the reciprocal functional form (Figure 3.3) indicates a good data fit and as the curve is asymptotic to both axes it includes the distant zones with positive predicted visitation. Due to the asymptotic nature of the curve it is necessary to draw boundary limits to the travel cost axis. The Auckland zone provided visitors from the greatest distance (hence greatest travel cost) so it was decided that the travel cost limit would be just beyond the figure for zone 13. It was considered highly unlikely that people would travel from further afield than Auckland with Lake Tutira as the main destination. Therefore the travel cost limit was set at $45.00.

It is possible to establish confidence intervals for the slope of the linear relationship. The calculation of these confidence intervals is presented in Appendix 2.

IV. DERIVATION OF A RECREATIONAL DEMAND CURVE

4.1 Calculation of Visitation at Various Admission Fees

In the previous chapter a relationship was determined for predicting zone visitations from travel cost information. The next step of the TCM is to use the prediction model to derive a demand curve for Lake Tutira. We have already one point of this demand curve, this is point A in Figure 4.1.

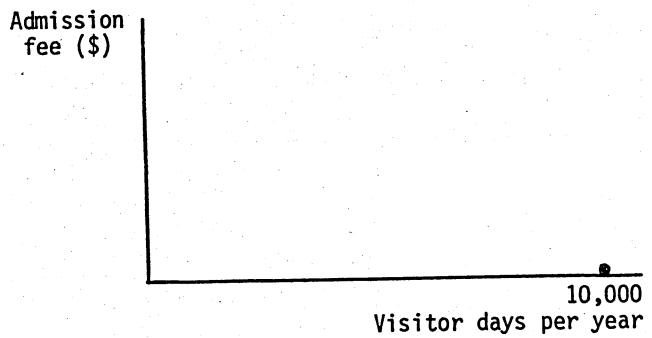

Figure 4.1: The initial stage of a demand curve

To determine other points on this demand curve it is necessary to find out by how much visitor days will reduce if an admission fee is charged for using the lake. To determine this, one crucial assumption has to be made and that is that people react to increases in admission fees in the same manner as they react to increases in travel cost. If this assumption is acceptable then the other points on the demand curve can be calculated using the travel cost - visitation relationship determined in the previous chapter (equation 3.3). Using this relationship the effect of increased admission fees can be calculated by adding the new admission fee to the travel cost figure (x) for each zone and then calculating the new zonal visitation rates. The new zonal visitation rates in turn allow the calculation of total zone visitation at a given admission fee and the sum of the total zone visitation figures will indicate total visitation to Lake Tutira at that particular admission fee.

The new travel cost figures and visitation rates from each zone resulting from increased admission fees are calculated and presented in Table 4.1. An example of the calculation involved is as follows:

Zone 1: Travel cost = \$3 at zero admission fee,
therefore
Visitation rate = 73.8 visitor days/1000 population,
calculated from equation (3.3).

If one introduces an admission fee = \$3, then the travel cost figure becomes \$6. The new travel cost figure is fed into equation 3.3

$$\text{i.e. } Y = -3.99 + \frac{233.5}{6} = 34.9$$

i.e. visitation rate = 34.9 visitor days/1000 population
= the new visitation rate at admission fee equal to \$3.

Similar calculations were made for all the zones at the ten different admission fees shown in Table 4.1.

Table 4.1: Predicted visitation rates at increased admission fees (visitation rates = visitor days/1000 population)

Zone	*Admission fee (\$)*										
	0	*3*	*5*	*10*	*15*	*20*	*25*	*30*	*35*	*40*	*45*
1	73.8	34.9	25.2	14.0	8.9	6.1	4.3	3.1	2.2	1.4	0.9
2	42.7	25.2	19.4	11.6	7.7	5.4	3.8	2.7	1.8	1.2	0.7
3	19.4	14.0	11.6	7.7	5.4	3.8	2.7	1.8	1.2	0.7	0.3
4	10.6	8.3	7.1	5.0	3.5	2.5	1.7	1.1	0.6	0.2	-
5	9.7	7.7	6.6	4.7	3.3	2.3	1.6	1.0	0.5	0.1	-
6	9.0	7.1	6.1	4.3	3.1	2.2	1.4	0.9	0.4	-	-
7	8.3	6.6	5.7	4.1	2.9	2.0	1.3	0.8	0.3	-	-
8	6.6	5.4	4.7	3.3	2.3	1.6	1.0	0.5	0.1	-	-
9	5.4	4.3	3.8	2.7	1.8	1.2	0.7	0.3	-	-	-
10	4.3	3.5	3.1	2.2	1.4	0.9	0.4	-	-	-	-
11	4.3	3.5	3.1	2.2	1.4	0.9	0.4	-	-	-	-
12	2.9	2.3	2.0	1.3	0.8	0.3	-	-	-	-	-
13	1.6	1.2	1.0	0.5	0.1	-	-	-	-	-	-

The new visitation rates for various zones now enable the calculation of total zone visitation figures at different admission fees (i.e. visitation rates times zone population). At each level of admission fee, the total yearly visitation from each zone is summed to provide an estimate of total yearly visitation to Lake Tutira. The results of these calculations are shown in Table 4.2. The total site visitation figures at different admission fees provide a *demand schedule* for Lake Tutira as a recreation site. This derived demand schedule is best displayed by a *demand curve*, as shown in Figure 4.2.

Table 4.2: Total yearly visitation at various admission fee levels

Zone	*Population (000's)*	*Admission Fees*										
		0	*3*	*5*	*10*	*15*	*20*	*25*	*30*	*35*	*40*	*45*
1	50.0	3691	1745	1260	700	445	305	215	155	110	70	45
2	50.0	2135	1260	970	580	385	270	190	135	90	60	35
3	7.9	153	111	92	61	43	30	21	14	9	6	2
4	13.1	139	109	93	-6	46	33	22	14	8	3	0
5	2.2	21	17	15	10	7	5	4	2	1	0	0
6	30.0	270	213	183	129	93	66	42	27	12	0	0
7	53.8	447	355	307	221	156	108	70	43	16	0	0
8	47.4	313	256	223	156	109	76	47	24	5	0	0
9	19.7	106	85	75	53	35	24	14	6	0	0	0
10	34.3	147	120	106	75	48	31	14	0	0	0	0
11	15.3	66	54	47	34	21	14	6	0	0	0	0
12	349.9	1015	805	700	455	280	105	0	0	0	0	0
13	805.9	1289	967	806	403	81	0	0	0	0	0	0
	TOTAL	9792	6097	4879	2945	1759	1067	645	420	251	139	82

4.2 Measurement of Consumers' Surplus

In Chapter II it was explained that total willingness to pay is the correct measure of the value of Lake Tutira to society. It was also shown that when the recreational good is a free good, total willingness to pay equals consumers' surplus. Consumers' surplus can be defined as the benefit consumers receive from the consumption of a good or service over and above that which they actually pay to be able to consume or use the good or service. This benefit measure is equal to the area under the demand curve and above the price line.

The demand curve for Lake Tutira is shown in Figure 4.2. The price line is the horizontal axis as the recreational site is a free good. Hence the consumers' surplus is equal to the whole area under the demand curve. It represents a measure of consumers' willingness to pay for the site rather than go without the recreational opportunity.

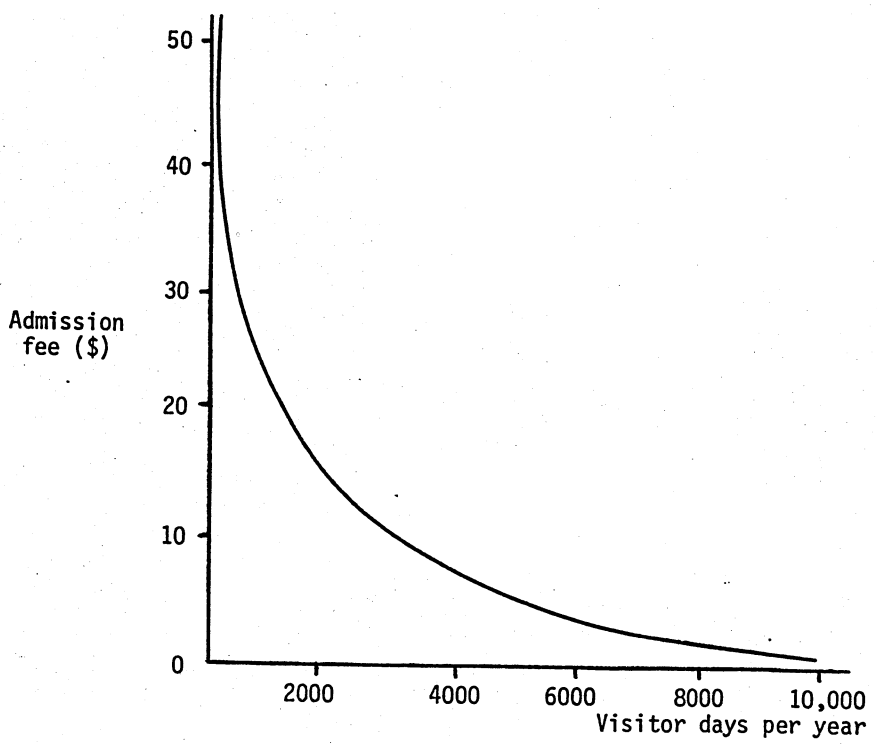

Figure 4.2: Demand curve for Lake Tutira

The total area under the demand curve was calculated in monetary units and found to be equal to $83,349. Therefore, if one accepts consumers' surplus as the correct measure of the worth of Lake Tutira, it can be stated that the lake is worth $83,349 per year to its users.

The demand curve itself shows that demand for Lake Tutira is considerably affected by increases in the admission fee. Demand appears to drop off quickly as the fee is raised but at higher levels of the admission fee the effect is much smaller.[6]

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6 *The robustness of the method and the resulting demand curve was tested by changing the input variables and the functional form. For more details see Harris (1981).*

V. APPLICATION OF THE TCM RESULTS

5.1 Introduction

The result obtained in the previous chapter represents the value of the lake to the people who use it. In this chapter this value is incorporated into a decision making framework to resolve the question of optimal resource allocation with respect to cleaning up the lake.

The need for recreational analysis arose in the field of resource economics because questions of trade-offs had to be resolved. The situation at Lake Tutira is a typical example. The clean up of the lake costs money and resources but failure to clean up also involves costs in terms of welfare lost to its current and potential users. Which of the two costs is the greatest? To answer this question it is necessary to determine if the consumers' surplus value derived in the previous chapter can be used directly in an economic analysis of resource allocation at Lake Tutira.

In an economic analysis of a project (in our case 'the cleaning up of Lake Tutira') the costs and benefits of the project are identified and quantified (mostly in money terms). The costs are usually measured at market prices which do not reflect surplus values that may exist over and above the price paid, i.e. economic surplus. The benefits of the project are the recreational benefits of the lake which are measured as consumers' surplus. Can these benefits and costs be compared?

Economic theory defines willingness to pay as being the correct measure of benefit, rather than price paid, so the argument that consumers' surplus values should not be included in an analysis because the other values used do not include it, is essentially invalid. Just because other values are sometimes incorrectly presented is no reason not to use a correct measure of value for recreational benefits.

In an attempt to present the value of a recreation site in a similar manner to market values some economists (Brown, Singh and Castle, 1964) advocate the use of only part of the consumers' surplus. They suggest using the demand curve to calculate the maximum revenue obtainable by a non-discriminating monopolist, which they consider can then be used in cost-benefit calculations as a value figure of similar basis to market values, (i.e. no inclusion of consumers' surplus).

Clawson and Knetsch (1966) have stated that as long as the additional output associated with the costs of a recreation based project is small relative to the total market output then the use of the resources will have a negligible effect on the price. If this is the case then the value of the marginal output is expressed by the price multiplied by the quantity supplied, and this is equal to total willingness to pay as the change in consumers' surplus is negligible. Given this situation Clawson and Knetsch maintain that taking the whole area under the demand curve for a recreation site that is consumed in large quantities (non marginal consumption) is consistent with measuring value as the market price multiplied by quantity consumed for a relatively small portion of a market output.

This problem remains one of reconciling theoretical correctness with practical application. The consumers' surplus value is theoretically the correct measure of value, and in water project evaluation in the U.S.A. it has been used for analysis in its entirety. However, there may be some justification for using the monopolists' revenue value when recreational benefit is to be included with non-marginal market based values as it may provide a closer approximation of the market system. The choice of which value to use will depend on the use to which it will be put, e.g. merely as an indicator of value or for use in a complete cost-benefit framework. The authors are of the opinion that the consumers' surplus value should be used at all times but with the understanding that it will sometimes overstate the benefits of recreation in comparison to other market evaluated benefits.

5.2 The Value of Lake Tutira as a Recreation Site

Using the aggregated data approach to the Travel Cost Method a consumers' surplus figure of $83,349 was derived and presented as the value of Lake Tutira as a recreation site. The method cannot be viewed as providing exact quantified results. Therefore the value of the lake is presented as approximately $80,000 per year. In terms of individual visitation, the *average* amount people would be prepared to pay per year for the use of Lake Tutira for recreational purposes is $8. Obviously the variation around this average figure will be large but the figure does help to visualise individual willingness to pay. The aggregate willingness to pay figure of $80,000 gives an objective and quantified measure of the value of Lake Tutira, a very necessary piece of information for any considerations involving management proposals for the lake and surrounding area.

The consumers' surplus figure is presented as an alternative to subjective appraisal of the lake's value based on incomplete knowledge. Decisions relating to the lake clean-up can now be made with a clear understanding of the cost and benefits associated with the change, which must lead to a more efficient allocation of public funds.

In the next section a partial economic analysis of the proposed clean-up scheme is presented, showing the relevant cost/benefit flow over time.

5.3 Partial Economic Analysis of the Lake Tutira Proposal

An economic analysis can be carried out to compare the alternatives of either doing nothing to the lake resulting in a loss equal to the consumers' surplus, or carrying out the clean-up proposal resulting in benefits equal to the consumers' surplus value minus the associated cost of the clean-up. Using the Net Present Value criteria at 10 per cent, the proposed expenditure is compared with the benefits resulting from that expenditure. If a positive Net Present Value figure is obtained it signifies that the clean-up proposal is an economically efficient one at a 10 per cent discount rate.

It is necessary to assume that no pollution abatement expenditure at Lake Tutira will result in the lake no longer being available for recreational purposes. Judging by the advanced eutrophication already experienced at Lake Tutira this is not an unreasonable assumption.

It should also be mentioned that the calculation of consumers' surplus will underestimate the true benefits received by the public at Lake Tutira. Consumers' surplus does not include the benefits accruing to casual visitors who stop at the lake for a short period only. Such visitors were not a part of the sampling frame. Further, no account has been made in this study for option demand, i.e. the benefits people receive from the knowledge that the lake recreation experience is available if they wish to utilize it, even if they do not actually travel to the lake. A similar demand that has not been included in the calculation of consumers' surplus concerns those people who would like to take advantage of the recreational benefits at Lake Tutira but are unable to, due to some reason, such as lack of finance. It is impossible to quantify these extra benefits mentioned but it is worthwhile to note that the consumers' surplus value of the recreation site will represent a minimum value of the total true benefits.

The consumers' surplus is presented as the value of the lake to the users during the year April 1980/81. The value will change with time, affected by factors such as inflation, quality of the lake waters, ability to consume due to income levels and greater freedom to travel. In the partial economic analysis it is assumed that the value of the lake will remain constant over the years.

The cost of the clean up scheme is $250,000 spent over the first five years of the project. After this time, $10,000 per year will be required for maintenance.

The expenditure flow is discounted at 10 per cent over 25 years and presented in Table 5.1.

Table 5.1: Cost flow (1,000's)

Year	1	2	3	4	5	6	7	8	9	10	...	25
Capital cost	50	50	50	50	50	-	-	-	-	-		-
Maintenance	-	-	-	-	-	10	10	10	10	10	...	10
Total	50	50	50	50	50	10	10	10	10	10	...	10

The present value of the expenditure is $242,402.

The benefits of the scheme are considered to be mainly recreational benefits. Savings on artificial breeding costs of $1,000/year (Peptoe, 1980) are also expected after the initial 5 year clean up. The benefits associated with continued use of the outdoor recreation centre are estimated (Peptoe, 1980) as approximately $4,000 per year.

The benefit flow is discounted at 10 per cent over 25 years.

Table 5.2: Benefit flow (1,000's) using consumers' surplus

Year	1	2	3	4	5	6	7	8	9	10	...	25
Recreation	80	80	80	80	80	80	80	80	80	80	...	80
Ed.hostel	4	4	4	4	4	4	4	4	4	4	...	4
Fishery	-	-	-	-	1	1	1	1	1	1	...	1
Total	84	84	84	84	85	85	85	85	85	85	...	85

The present value of the benefit flow = $769,730.

The Net Present Value = Benefits - Costs
= 769,730 - 242,402
N.P.V. = $527,328

The NPV of approximately $500,000 is presented to show the economic viability of the clean up proposal. Any final decision involving allocation of public funds would have to consider other factors such as the availability of substitutes to Lake Tutira, and the extent to which the nation's overall welfare might decrease if Lake Tutira visitors are forced to obtain their recreation elsewhere. Certainly, in this partial economic analysis, benefits clearly outweigh costs (in net present value terms).

VI. EVALUATION OF THE METHOD AND CONCLUSION

6.1 Evaluation

The major purpose of this study was to evaluate the effectiveness of the TCM in valuing a recreation site in New Zealand. Our basic reason for this is to come up with a tool that can help in the management of outdoor recreational resources.

This study has shown that the method can be applied using little survey information (thus low survey costs). The primary variables of visitation and travel cost can be obtained from information on yearly visitation, hometown and zone specifications.

Information on the current visiting population has been shown in the study to be very important to the final result so an effort in this direction is necessary to provide an accurate estimate.

In the study it was found to be relatively easy to obtain a predictive visitation/ travel cost relationship, but it was also found that the choice of the correct functional form to fit the data is of great importance to the final result. There are no set rules beyond a priori reasoning and statistical testing for finding a 'best fit' to the data, but testing all the logical alternatives will usually provide one functional form that has a stronger predictive ability and statistical significance than the others. In the study the reciprocal of travel cost was used with visitation to provide the most satisfactory functional form.

Although this approach is possible using only two variables (visitation and travel cost) other variables should be tested for influence on the visitation behaviour. If these other variables exhibit a notable effect on the correlation coefficient then they should be included in the equation, thus increasing its predictive nature. If, as was the case in the Tutira study, other independent variables show little influence on the visitation variable then the study should be restricted to a bivariate analysis for the sake of simplicity.

In summary, the Travel Cost Method is a successful and usable technique for valuing recreational amenities in New Zealand. It is relatively cheap and easy to administer, but the final consumers' surplus figure should be taken as an approximate estimate of the value of a site, not an exact figure. A sensitivity analysis should be carried out at the end of the study to indicate the amount of variation to be expected in the final result.

6.2 The Future of Lake Tutira Domain

The results of the study have indicated that Lake Tutira is a highly valued recreation area to people from all over the North Island. If current trends of increased recreational demand continue, the management of the Tutira Domain in its renovated state is likely to become more and more important. The administration of the domain is regulated under the Reserves Act of 1977, in which Lake Tutira is classified as a Recreation Reserve and must be administered (section 17-1):

> "... for the purpose of providing areas for recreation and sporting activities and the physical welfare and enjoyment of the public, and for the protection of the natural environment and beauty of the countryside, with the emphasis on the retention of open spaces and on outdoor recreational activities, including recreational tracks in the countryside."

The Act also states in Section 17-2(c):

> "Those qualities of the reserve which contribute to the pleasantness, harmony, and cohesion of the natural environment and to the better use and enjoyment of the reserve will be conserved."

The funds forthcoming from central and local government are committed to a scheme that will improve the quality of the recreational experience and enhance the attractiveness of the area to recreationists. How the area caters to the visitors will affect the quality of the experience. The authors have come to the opinion, based on discussions with many of the lake visitors, that the area should remain an undeveloped source of enjoyable, unregulated camping. The peaceful, quiet nature of the lake should be maintained as a major attraction.

Several specific recommendations have resulted from the study and have been presented in Chapter II. With regard to those recommendations it only remains to be stated that the Guthrie-Smith Trust and the Lake Tutira Domain Board should continue to administer the area in the responsible manner they have displayed to date.

6.3 Concluding Remarks

The Travel Cost Method used at Lake Tutira to determine the value of the lake to its users has proved to be a successful means of approximating non-market recreational worth. The amount of resources necessary for its implementation is not excessive and the statistical analysis, when understood, is quite straight forward. The consumers' surplus result is of considerable value for comparison with costs associated with the provision of recreational resources. A partial economic analysis using the results of this study has indicated that the proposed clean-up scheme at Lake Tutira is an economically efficient proposal.

The authors are convinced that the TCM can and should be included in any major evaluation of project viability that involves large expenditure and definite changes in the availability of recreational resources. Failure to evaluate recreational benefits and costs will invariably result in a less than optimal allocation of expenditure, and this is an inefficient use of public funds.

BIBLIOGRAPHY

Abelson, Peter. *Cost Benefit Analysis and Environmental Problems.* Farnborough, Saxon, 1979.

Anderson, R.W. "Some Issues in Recreation Economics" in *Economic Policies and Social Goals - Aspects of Public Choice*, ed. by A.J. Culyer. London, 1974.

Barker, W.H. and Brown, A.J. *Preservation and Recreation.* Christchurch: Joint Centre for Environmental Sciences, Occasional Paper No. 9, 1979.

Bishop, Richard. *Valuation of Extra-Market Goods: Potential Applications of the Travel Cost and Hypothetical Methods in Asia and the Pacific Basin.* Report to East-West Center, Hawaii, 1979.

Bishop, R.C. and Heberlein, T.A. "Measuring Values of Extra Market Goods: Are Indirect Measures Biased?" *American Journal of Agricultural Economics*, 61 (5) (1979), pp.926-930.

Bouma, F. "Some Models for Determining the Value of Recreational Areas". *Environmental Economics*, Vol. 2 (1976), pp.131-149.

Bowes, M.D. and Loomis, J.B. "A Note on the Use of Travel Cost Models with Unequal Zonal Populations". *Land Economics*, 56 (4), (November 1980).

Brown, W.G., Singh, A. and Castle, E.N. "Net Economic Value of the Oregon Salmon-Steelhead Sport Fishery". *Journal of Wildlife Management*, 29 (2), (1965), pp.266-279.

Burns, M.E. "A Note on the Concept and Measures of Consumer Surplus". *The American Economic Review*, 63 (3), (June 1973).

Burt, O.R. and Brewer, D. "Estimation of Net Social Benefits of Outdoor Recreation". *Econometrica*, 39 (5), pp.813-827.

Cesario, Frank. "Value of Time in Recreation Benefit Studies". *Land Economics*, 52 (1), (February 1976), pp.32-41.

Clawson, M. *Methods of Measuring Demand for and Value of Outdoor Recreation.* Resources for the Future Inc. Baltimore: The Johns Hopkins Press, 1959.

Clawson, M. and Knetsch, J.L. *Economics of Outdoor Recreation.* Baltimore: Johns Hopkins Press, 1966.

Common, M.S. "A Note on the Use of the Clawson Method for the Evaluation of Recreation Site Benefits". *Regional Studies*, Vol. 7 (July 1973), pp.401-406.

Currie, J.M., Murphy, J.A. and Schmitz, A. "The Concept of Economic Surplus". *The Economic Journal*, Vol. 81 (December 1971).

Everett, R.D. "The Monetary Value of the Recreational Benefits of Wildlife". *Journal of Environmental Management*, Vol. 8 (February 1978), pp.203-213.

Flegg, A.T. "Methodological Problems in Estimating Recreational Demand Functions and Evaluating Recreational Benefits. *Regional Studies*, Vol. 10 (1976), pp.353-362.

Freeman, A.M. *The Benefits of Environmental Improvement - Theory and Practice.* Resources for the Future Inc., Baltimore: The Johns Hopkins Press, 1979.

Gosse, L.E. and Kolter, R.M. "User Response to Outdoor Recreation. A Comment". *Journal of Leisure Research*, Vol. 2 (1970), pp.131-134.

Guthrie-Smith, H. *Tutira. A Story of a New Zealand Sheep Station.* (3rd ed.) Edinburgh: Blackwood, 1953.

Harris, B.S. Application of a Travel Cost Demand Model to Recreation Analysis in New Zealand: An Evaluation of Lake Tutira. Masterate of Ag.Sc. thesis, Massey University, 1981.

Hyman, E.L. *The Valuation of Extramarket Benefits and Costs in Environmental Impact Assessment.* Hawaii: East-West Center, 1980.

Kavanagh, N.J. "Economics of Water Recreation". *Water and Water Engineering.* October 1968.

Knetsch, J.L. and Davis, R.K. "Comparisons of Methods for Recreation Evaluation". *Water Research*, ed. by A.V. Kneese and S.C. Smith. Baltimore, Johns Hopkins Press, 1960.

Long, B.L. and Barron, J.C. "Conflicts Within Recreation: Comment". *Land Economics*, 45 (1), (February 1969).

Loomis, John B. "Monetizing Benefits Under Alternative River Recreation Use Allocation Systems". *Water Resources Research*, Vol. 16 (February 198), pp.28-32.

McMaster, J.C. and Webb, G.R. ed. *Australian Project Evaluation - Selected Readings.* Sydney: Australia and New Zealand Book Company, 1978.

Mansfield, N.W. "The Estimation of Benefits from Recreation Sites and the Provision of a New Recreation Facility". *Regional Studies*, Vol. 5 (February 1971), pp.55-69.

Merewitz, L. "Recreational Benefits of Water Resource Development". *Water Resource Research*, 2 (2), (1966), pp.167-182.

Nijkamp, P. ed. *Environmental Economics, Volume 2: Methods.* Leiden: Nijhoff, 1976.

Norton, G.A. "An Economic Analysis of Outdoor Recreation as a Rural Land Using Activity in Northern Wales". Unpublished Ph.D. dissertation, University of Wales, 1968.

Pearse, P.H. "A New Approach to the Evaluation of Non-priced Recreational Resources". *Land Economics*, 44 (1), (1968), pp.87-99.

Price, G. *Welfare Economics in Theory and Practice.* London. MacMillan, 1977.

Randall, A. and Stoll, J.R. "Economic Surplus and Benefit-Cost Analysis". Agricultural Economics Research Report No.35, University of Kentucky, October, 1980.

Sinden, J.A. "The Application of Benefit-Cost Principles to Recreation Management - Case Study of Coloshire, N.S.W." *Australian Project Evaluation. Selected Readings.* ed. by J.C. McMaster and G.R. Webb. Sydney: Australia and New Zealand Book Company, 1978.

_____ "A Utility Approach to the Valuation of Recreational and Aesthetic Experiences". *American Journal of Agricultural Economics*, 56 (1), (February 1974), pp.61-72.

Sinden, J.A. and Worrell, A.C. *Unpriced Values-Decisions Without Market Prices.* Brisbane: Wiley, 1979.

Shucksmith, D.M. "The Demand for Angling at the Derwent Reservoir, 1970 to 1976". Paper to the University of Newcastle upon Tyne, Newcastle: University upon Tyne, 1977.

Smith, R.J. "The Evaluation of Recreation Benefits: The Clawson Method in Practice". *Urban Studies*, Vol. 8 (October 1970), pp.89-102.

Smith, V. Kerry. "Travel Cost Demand Models for Wilderness Recreation. A Problem of Non-tested Hypothesis". *Land Economics*, 51 (2), (May 1975).

Smith V. Kerry and Kopp, R.J. "The Spatial Limits of the Travel Cost Recreational Demand Model". *Land Economics*, 56 (1), (1980), pp.64-72.

Stevens, Joe B. "Angler Success as a Quality Determinant of Sport Fishery Recreational Value". *Transactions of the American Fisheries Society*, 95 (4), (October 1966), pp.357-367.

_____ "Recreation Benefits from Water Pollution Control". *Water Resources Research*, 2 (2), (Second quarter, 1966).

Teirney, L. "Tutira: A Lake Worth Restoring". *Soil and Water*, 16 (1), (February 1980), pp.10-13.

Trice, A.H. and Wood, S.E. "Measurement of Recreational Benefits". *Land Economics*, Vol. 34, (1958), pp.195-207.

Tutira Technical Committee. "Lake Tutira and its Catchment: Current Condition and Future Management". Unpublished report to the Hawkes Bay Catchment Board, Napier, 1976.

Ulmon and Volk. "An Operational Mode for Predicting Reservoir Attendance and Benefits. Implications of a Location Approach to Water Recreation". Report to Michigan Academy of Sciences, 1961.

Whitby, M.C. and Willis, K.G. *Rural Resource Development: An Economic Approach*, 2nd ed. London: Methuen and Company, 1978.

APPENDIX I

THE QUESTIONNAIRE

Interviewers Name: _____

Date: _____

QUESTIONNAIRE

Human Use Value of Lake Tutira - Travel Cost Method

Identify the head of the family/group, or the driver of the vehicle.

General introductory statement:

- survey for Department of Agricultural Economics at Massey University.
- study of recreational use of the lake
- information is confidential

1. HAVE WE ASKED YOU TO COMPLETE A QUESTIONNAIRE ALREADY ON THIS VISIT TO THE LAKE?

   Yes - close questionnaire

   No

2. WHERE IS YOUR HOME TOWN? _____

3. FROM WHAT TOWN DID YOU BEGIN YOUR TRIP?

   _____

4. AT WHAT PLACES DID YOU STOP ON THE JOURNEY FROM YOUR HOME TO TUTIRA?

   _____

5. WHAT PLACES DO YOU PLAN TO VISIT WHEN YOU LEAVE TUTIRA? _____

   _____

6. HAVE YOU VISITED TUTIRA BEFORE?

   No

   Yes. How long ago? _____

7. HOW MANY DAYS WOULD YOU ESTIMATE YOUR GROUP WOULD SPEND AT LAKE TUTIRA PER YEAR?

   _____

8. HOW MANY VISITS WOULD YOU ESTIMATE YOUR GROUP WOULD MAKE TO LAKE TUTIRA EACH YEAR?

_____

9. HOW LONG ARE YOU PLANNING TO STAY AT TUTIRA ON THIS TRIP?

_____

10. HOW LONG WILL YOU BE AWAY FROM HOME ON THIS TRIP? _____

11. WHAT WOULD YOU SAY YOUR APPROXIMATE ROUND TRIP TRAVEL COSTS WOULD BE FROM YOUR HOME TO TUTIRA AND BACK AGAIN? THE TRAVEL COSTS ARE THOSE OVER AND ABOVE THAT WHICH YOU WOULD HAVE SPENT IF YOU HAD REMAINED AT HOME.

_____

(allow time for consideration, but do not prompt.)

12. WHAT IS THE APPROXIMATE TOTAL DRIVING TIME FROM TUTIRA TO YOUR HOME?

_____

13. WHAT ACTIVITIES WILL YOUR GROUP PARTICIPATE IN WHILE AT TUTIRA? (show card)

swimming	walking/hiking
fishing	picnicking
sailing	bird watching
boating	other (specify) _____

14. WHICH OF THESE ACTIVITIES IS THE <u>MAIN</u> REASON FOR YOUR GROUP'S VISIT TO TUTIRA?

_____

(record all if more than one.)

15. IF LAKE TUTIRA WERE NOT OPEN TO THE PUBLIC WOULD YOU HAVE CHOSEN AN ALTERNATIVE PLACE TO VISIT?

Yes No

If Yes, WHAT ALTERNATIVE AREA WOULD YOU HAVE CHOSEN?

_____

16. WHAT IS THE ENGINE SIZE OF THE VEHICLE YOU TRAVELLED IN TO LAKE TUTIRA?

_____(if don't know make a note of

the make and model of the vehicle). _____

17. GENERALLY, WOULD YOU SAY THAT THE TIME SPENT IN DRIVING TO TUTIRA WAS A PLEASANT OR AN UNPLEASANT EXPERIENCE?

Pleasant Unpleasant Indifferent

18. DUE TO POLLUTION, LAKE TUTIRA MAY NOT BE AVAILABLE TO THE PUBLIC IN THE FUTURE. WHAT AMOUNT OF MONEY WOULD YOU BE WILLING TO PAY PER YEAR TO RETAIN THE USE OF THE LAKE IN GOOD CONDITION?

IT IS NOT INTENDED THAT YOU WILL EVER BE ASKED TO PAY SUCH AN AMOUNT, BUT I WOULD APPRECIATE YOUR OPINION.

_____

Zero (if not willing to pay for this purpose)

Don't know

19. I would now like some background information about yourself and members of your group for my analysis.

	AGE	SEX	MAIN OCCUPATION (specific as possible)
Group head or Driver			
Members 1			
2			
3			
4			
5			
6			
7			
8			

COMMENTS

20. DO YOU HAVE ANY COMMENTS YOU WOULD CARE TO MAKE ABOUT LAKE TUTIRA?

_____

_____

_____

_____

_____

_____

Respondents NAME _____

and ADDRESS _____

_____

THANK YOU FOR YOUR CO-OPERATION.

APPENDIX II

CALCULATIONS OF CONFIDENCE INTERVALS

If 95 per cent confidence intervals are calculated on the estimate of the slope of equation 3.3, then the analyst can state that if many samples were drawn from the population, 95 per cent of the time the slope estimates would fall within the range described by the confidence interval, presuming either a normal or a students t distribution in the variation about the slope.

So, for the linear relationship:

$$\text{visitation rate} = A + \frac{B}{\text{travel cost}}$$

it is possible to obtain values for:

Slope B = 223.5
Standard error of the estimate (SEE) = 7.5
Number of cases = 13.

With a small sample size (13) the B estimates will follow the *t distribution* with N - 2 (11) degrees of freedom. The confidence intervals will follow the form:

$$\hat{B} \mp (\text{SEE}) < B < \hat{B} \mp (\text{SEE})$$

where t is taken from the students t distribution with probability = 0.05 at degrees of freedom V = 13 - 2 = 11.

i.e. $223.5 - 1.796(7.5) < B < 223.5 + 1.796(7.5)$
$210 < B < 237$

Given the above calculations it is possible to state that one is 95 per cent sure that the true slope of the linear regression line will be within the bounds of 210 to 237. The confidence limits on the slope of the linear regression line resulting from the reciprocal transformation are displayed in Figure A.1.

The confidence region can be taken one step further from the linear relationship by indicating a confidence belt for the reciprocal relationship in terms of the slope of the regression equation, shown in Figure A.2. The region indicated in Figure A.2 (the shaded area) is bounded by the prediction line calculated from the regression equation with the slope B within the range 210 to 237 (i.e. the confidence interval for B in the regression equation).

It can be stated that the researcher is 95 per cent certain that if the whole population were sampled, the resulting line of best fit would fall within the regions specified in Figures A.1 and A.2, i.e. a 95 per cent confidence belt around the regression line.

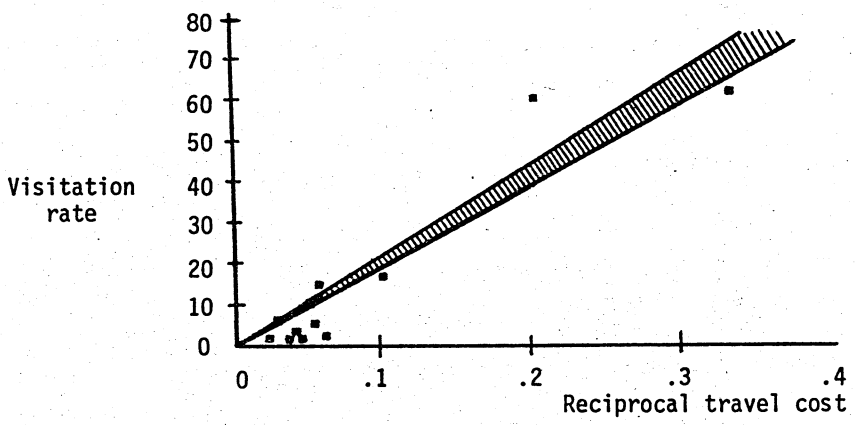

Figure A.1: The confidence region for the linear function

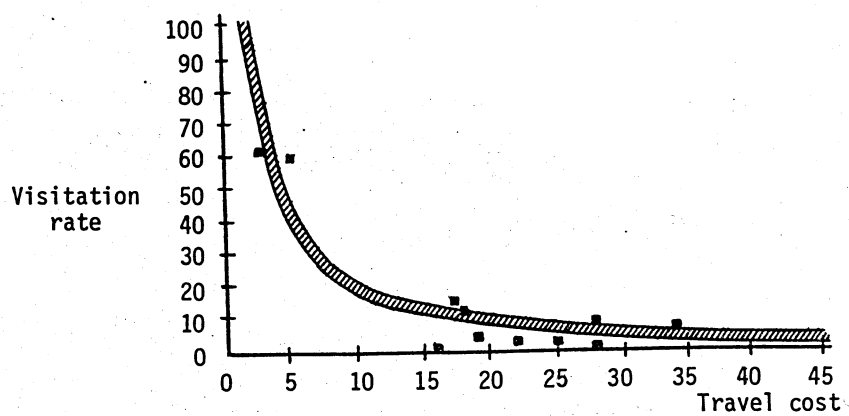

Figure A.2: The confidence region for the reciprocal function

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