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RELATIONSHIPS OF WEATHER TO SUMMER ATTENDANCE AT SOME OUTDOOR RECREATION FACILITIES IN CANADA

by

© Alexander Humphrey Paul

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

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UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled Relationships of Weather to Summer Attendance at Some Outdoor Recreation Facilities in Canada submitted by Alexander Humphrey Paul in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

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Supervisor

Richmond W. Longley

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....

External Examiner

....

Date 7th January 1971

ABSTRACT

Weather and climate exact responses from man in the pursuit of all his activities, including those engaged in during leisure time. This study investigates the influence of weather on participation in eight summer outdoor recreation activities during 1969. The investigation employs records of daily attendance at recreation facilities in three major climatic regions across Canada. Related observations of daily weather by the Canadian Meteorological Branch at stations within the selected regions were also utilized. From the meteorological data, individual weather variables were tested for their influence on daily use of recreation facilities.

The three regions selected are the outdoor recreation hinterlands of Edmonton, Alberta; of the Ottawa-Hull metropolitan area; of the three largest cities of southern New Brunswick: Saint John, Moncton and Fredericton. A comparative regional treatment was designed firstly to discover whether any geographical variations exist in the response of recreationists to weather situations. Secondly, it was designed to seek out patterns of facility use in each study region, and to assess the role played by weather in these patterns.

The effects of a number of weather variables on attendance at each facility were examined in detail, and the results reported for each activity in turn. Daily weather elements investigated are maximum temperature, total precipitation,

mean relative humidity, mean windspeed and sunshine hours. Two other parameters (Thom's Discomfort Index and Effective Temperature) are derived from combinations of some of these elements.

The results indicate that, in general, maximum temperature is the most significant of the variables analyzed, though for some activities precipitation, relative humidity or sunshine may be the individual variable most strongly affecting participation. The influence of weather on daily participation varies from activity to activity. Swimming and beach use demand very specific weather conditions. Other pursuits such as picnicking and pleasure driving are engaged in over a broader range of weather situations.

Conclusions include the finding that outdoor recreationists are demonstrably selective, on the basis of weather, of the activity in which they will engage. It was also found that the facilities offering the activities most favoured under an existing weather situation are preferred destinations of recreational outings. Maps of the spatial patterns of outdoor recreation use on sample days of contrasting weather conditions provide confirmation of evidence for this behaviour.

The nature of the weather-attendance relationship is also analyzed. Interpretation of relationships for eight different recreational activities provides information which may be usefully applied in prediction of daily attendances at recreation facilities, to the improvement of forecasting of weather for outdoor recreation, and to the derivation of a technique for outdoor recreation capability based on climatic classification to support outdoor recreation.

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County of Leduc, Leduc, Alberta
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INTRODUCTION

Since World War II, North America has experienced what is virtually an "explosion" in outdoor recreation. Canada and the United States, like the rest of the world, are undergoing sociological and economic change. Rapid population growth and urbanization are aspects of this change. Life styles, social reforms, and increasing automation of work and chores are other indications of the changes. Alongside these, and perhaps dependent upon them, is an increasing demand for varied recreation opportunity. In the light of these changes, society is finding it ever more necessary to plan for the use of man's increased leisure time. Leisure time may be defined as time spent away from work not occupied with activities necessary for existence such as washing, eating and sleeping.[1] Various definitions of leisure time have been proposed, but the one used here is straightforward and carries no motivational implications. We may consider all leisure time as being spent in "recreation" (Burton and Noad, 1968, p. 1). "Recreation", then, is a comprehensive term covering all activity undertaken in a person's uncommitted time. It is thus capable of a very broad interpretation, including a range of diverse pursuits from mountaineering to philately, and from volunteer church work to playing baseball or hockey. "Outdoor recreation" is simply recreation that takes place out of

[1] Clawson and Knetsch (1966, p. 11) comment that such categories are not completely watertight in that "time passed in eating may be for pleasure as well as existence".

doors. The "outdoors" signifies particularly the natural environment as far as possible unaffected by man.

There is lack of clarity and agreement on the scope of outdoor recreation. Many researchers have excluded from their studies that aspect of outdoor recreation which occurs within city boundaries, such as swimming, picnicking and outdoor sports. Instead they have concentrated on activities outside urban areas; these activities are largely natural resource oriented. This attitude tends to ignore opportunities for outdoor recreation already existing and in need of development within the cities themselves (de Grazia, 1966). This thesis, besides reviewing outdoor recreation as it has been previously studied, will investigate user enjoyment of a number of man-made modifications to the natural setting both inside and outside urban areas.

The factors responsible for the growth in outdoor recreation have been well documented by sociologists, economists and others. Briefly, they include the rapid growth of total population, increases in disposable income, and the increasing availability of leisure time, some of which is spent outdoors. Leisure time has expanded by virtue of declining weekly working hours, of longer annual vacations, often with pay, and of the spread of domestic labour-saving devices. Davis (1968) comments that man's choice to spend more of his leisure time out of doors results both from changing attitudes to work, play, and domesticity, and from the automation of many jobs. Formerly, spiritual fulfilment for the individual was to be found in work; increasingly it is shared with recreation, especially in the outdoors. Such recreation forms a desirable relief from the confines of the modern urban environment, particularly for the ubiquitous apartment-dweller. It seems likely that an unabated expansion of demand for outdoor recreation will continue for some time to come. This, in fact, is the assessment of most investigators in this field.

The general public has become aware of the burgeoning demands for outdoor recreation. The awareness results from the inevitable development of land use pressures. Governments which have become the protectors of land resources on behalf of their nationals are having to heed the views of this increasingly aware public. The Province of Nova Scotia has recently promised to review the purchase of shorefront property by non-residents. In Ontario there have been demonstrations against the denial of public access to privately-owned lake beaches. Provision of adequate facilities allowing satisfactory participation in outdoor recreation is an urgent legislative problem in planning. Recognition of this urgency in Canada has led to the very recent expansion of research into the field of recreation in general and of outdoor recreation in particular. In future, recreational amenity planning seems more likely to receive the forethought it deserves, from governments, from researchers in universities, from industry, and from the population at large. Hopefully the times are past when Wolfe (1964, p. 203) could bemoan the dearth of geographical research in outdoor recreation because such study was thought to be "frivolous...or trivial".

The status of outdoor recreation research in Canada as of 1967 may be gauged by a perusal of an excellent bibliography compiled by Munro and Anderson (1967). Prior to 1950, research was very limited. During the 1950s it became plentiful, though lacking in unity. Towards the end of that decade, however, there arose realization of the need for long-term planning in the field of outdoor recreation. This tendency towards planning took its greatest step forward at the 1961 Resources For Tomorrow Conference held in Montreal.[2] Included in the conference was a major seminar on the topic of recreation. Its speakers emphasized and reemphasized the need for planning, for studies on demand, for methodical inventory of resources, and above all for basic information and research. Here was a significant gathering of politicians, administrators, researchers and academics to draw attention to future demands on the resource base by the Canadian people. Here too was a strong warning from a group of influential

[2] Conference papers were published in several volumes, Proceedings, Background Papers etc. In terms of outdoor recreation, Vol. 2 of the Background Papers is most significant since it contains papers for the recreation seminar (Res. For Tomorrow, 1961a). The Proceedings, Vol. 3 (Resources For Tomorrow, 1961b) contains reports (pp. 169-137) of the two recreation workshop sessions held at the conference.

people that more careful control and management of a new resource would be required if demands were to be met without deterioration of the physical environment, which forms the main source of supply for outdoor recreation opportunity.

In the decade 1961-1970, the Canadian government, through its Recreational Sector of the Agricultural and Rural Development Act (ARDA) Canada Land Inventory, had started to provide strong leadership. The Sector programme includes a nationwide inventory of existing outdoor recreation facilities, and mapping of the capability of Canadian lands to support outdoor recreation. Provincial Parks Branches and the National Parks Division have co-operated in a major venture known as the Canadian Outdoor Recreation Demand Survey or CORDS (Knetsch, 1967). Scheduled for completion in 1970 or 1971, this programme must ascertain whether or not quality requirements of recreationists are being met, and should provide a basis for predicting future changes in requirements. In the 1960s, governments and research institutions, besides co-operating in these major objectives, have expanded their efforts to cover a wider selection of recreation-related subjects.

One specific topic which has received no detailed analysis in Canada or elsewhere is the influence of the weather factor on human participation in outdoor recreation. The writer's interest in undertaking this study was aroused as a result of the almost total lack of information on the exact nature of weather's influence on participation in outdoor recreation. Three concerns had special significance in the decision: firstly, the writer, to whom it seemed that weather was a major factor in the fluctuations of attendance at parks and recreation areas, had long been interested in the neglected topic of predictability of daily attendances. Literature on predicting outdoor recreation area attendance is mainly concerned with annual or seasonal totals. While recognizing the value of these in the general planning of parks and budgets, and in programme scheduling, the writer feels shorter-term predictions are also helpful in terms of day-to-day operations management. The second concern was how to effectively incorporate weather and climate data into an outdoor recreation capability system of land classification such as the Canada Land Inventory. A study of this type should therefore seek to discover whether relationships between weather and participation in outdoor activities are consistent enough to be utilized in capability classification systems regardless of region. Finally, is weather a factor in the process whereby a recreationist selects on a given day both an activity to pursue, and a location at which to pursue it? This process of selection has received attention from researchers, but the specific role of weather in it has not yet been investigated.

Increased knowledge of weather effects will make possible the evaluation of the benefits or otherwise of future refinements in weather forecasting and even weather modification to recreationists and facility operators. The recreationist may be able to derive greater enjoyment from his recreational experience, while the manager will be able to plan more efficiently for predicted periods of heavy use. Clawson (1966), for example, has suggested that if weather modification can produce reliable and predictable weather for outdoor recreation, peak use problems now evident on summer weekends may become even more accentuated.

The potential benefits accruing from an advance in our knowledge of weather effects on outdoor recreation participation are thus many and varied. There seems no doubt that the study introduced here can usefully fill a void in our knowledge of the behaviour of outdoor recreationists. For a better understanding of some of the terminology used in the discussion, an addendum to this introduction provides a glossary of terms.

GLOSSARY

Activity

This term is used to refer to one specific form or type of outdoor recreation such as swimming or boating. The word "pursuit" is used synonymously with "activity" in this specific sense.

Attendance

This is strictly defined as the number of visitors. Since the practical problems of recording visitors are great, because one visitor may make more than one visit in one day, the term is used synonymously with "visitation". In this thesis, it usually refers to visits made to a facility in one day, or "daily attendance".

Day-Grouping

The facility attendance data for May 15-September 15, 1969 are divided into six categories or "day-groupings". This is designed to allow the differential use resulting from day of the week and stage of the summer to be included in the analysis. It thus permits easier identification of weather influences on attendance.

Day-Use

The use made of a facility by a recreationist whose length-of-stay is of the order of a few hours and who does not remain on the site overnight. There is a distinction to be made between day-use as defined here and "day-oriented use", a term used by the Canadian National Parks Service (for example, Taylor, 1965; and Nixon, 1967).

Destination

The specific recreation facility selected for a visit on either a day or weekend trip.

Dispersed

This term, commonly used in the literature, refers to the area-extensive forms of outdoor recreation such as hunting, hiking, and wilderness activities. Participants are dispersed over large areas in contrast to the concentration of use which is characteristic of swimming, outdoor sports or organized camping, which are "intensive" or "area-intensive" activities.

Facility

A site or area which furnishes opportunity for outdoor recreation activities. A picnic ground is a facility; so too is a national park, or a single campground within that national park. The destination of an outdoor recreation trip is usually a facility.

Hinterland

The area which includes the destinations of most journeys made from a city for outdoor recreation purposes. Because most of the demand for outdoor recreation within this hinterland originates in this city, it is often referred to as the "source city" or "major demand origin" of the hinterland.

Intensive

As used in the literature, the opposite of a "dispersed" activity.

Limiting Weather Criteria

The value of a weather variable beyond which the use of any facility falls below 10 per cent of the weather-related peak use experienced on a single day at that facility.

Manager, Management, Operator

These three terms are used in a broad sense to include those responsible for the management and day-to-day operation of a recreation area or areas. Often an administrative agency will be responsible for general management policy, and the operator or manager will co-ordinate everyday operations on the site.

Multi-Activity Park

A park which supports a number of varied outdoor recreation activities. It carries the connotation of being a little-developed facility lying at such a distance from the source-city that it is not heavily used.

Operation

"Operation" is used in exactly the same sense as "facility" to refer to one outdoor recreation site or area.

Origin

The starting-point of a recreational trip. This is usually a person's permanent or temporary residence.

Park

An area of land which is managed with outdoor recreation or conservation objectives. It may range from a city park to an area of minimal development or wilderness.

Participation

In the outdoor recreation literature, the term "participation" has generally been used in defining the propensity of a given population to engage in a certain activity. Thus the number of persons per thousand who engage in the activity is said to be the "participation rate" of the population for that activity. The term is also used in this thesis with respect to the number of persons engaged in the activity on a particular day.

Peak-Season

The school vacation period which is almost synonymous with July and August. In 1969, the year analyzed, the term refers to June 28-September 1 inclusive. The peak-season is often referred to as the "school vacation period" or the "peak period". This is one of the subdivisions of summer suggested for the analysis, the other being referred to as the "off-peak period" or the "off-season". This second subdivision in 1969 included May 15-June 27 and September 2-15.

Source City

The largest population centre within a region; the source of many of the users of facilities within a 100-mile radius of the city. Used synonymously with "major demand origin".

Use

The "use" made of a recreation facility is a multiple of the number of visits and the length-of-stay of each visit; it is thus commonly recorded in "visitor-hours" or "visitor-days".

True use measurement is often difficult because length-of-stay information is rarely available. Use is thus frequently measured in terms of visitation, with the implicit assumption that the length-of-stay distribution is normal and therefore visitation is truly representative of use. This definition of use is followed here.

<u>Visitation</u>

A count of the number of visits made to a specific facility gives its "visitation". The distinction between visitation and attendance is that the latter counts numbers of visitors. In practice this distinction is almost impossible to make, and the terms "visitation" and "attendance" are used almost interchangeably.

<u>Weather-Related Peak Use</u>

The peak daily use occurring within each of the six day-groupings used in the analysis. This highest level of use will generally be due to weather.

CHAPTER I

THE BASIS

This chapter presents a basic hypothesis for the relationship between weather and outdoor recreation participation. The two fundamental aims of the thesis are then stated and the available literature relevant to the topic is reviewed. There follows an assessment of present knowledge and an examination of the approaches taken by other workers on the subject. The rationale for the actual research procedure adopted is then discussed.

A first postulate is that the decision to participate in all outdoor recreation activities is subject in some degree to the vagaries of the weather. It is further assumed that for most people, enjoyment of a particular activity is permissible only over a certain tolerable range of weather conditions (Figure 1.1). For instance, there are days when most people decide it is too cold to play golf. There are other days when they decide it is too hot. Somewhere within the tolerable range of weather for a given activity lies an ideal weather condition; the two ends of the tolerable range should be marked by limiting weather criteria (Figure 1.1). Outside the limits, participation may be possible, but is negligible. Within the tolerable range, participation rises as "ideal" weather is approached. At the ideal weather condition, which may lie within a narrow or a relatively broad range of weather situations, participation should show a weather-related peak.

The limiting criteria which define the ends of the tolerable range are assumed to be those values of the weather

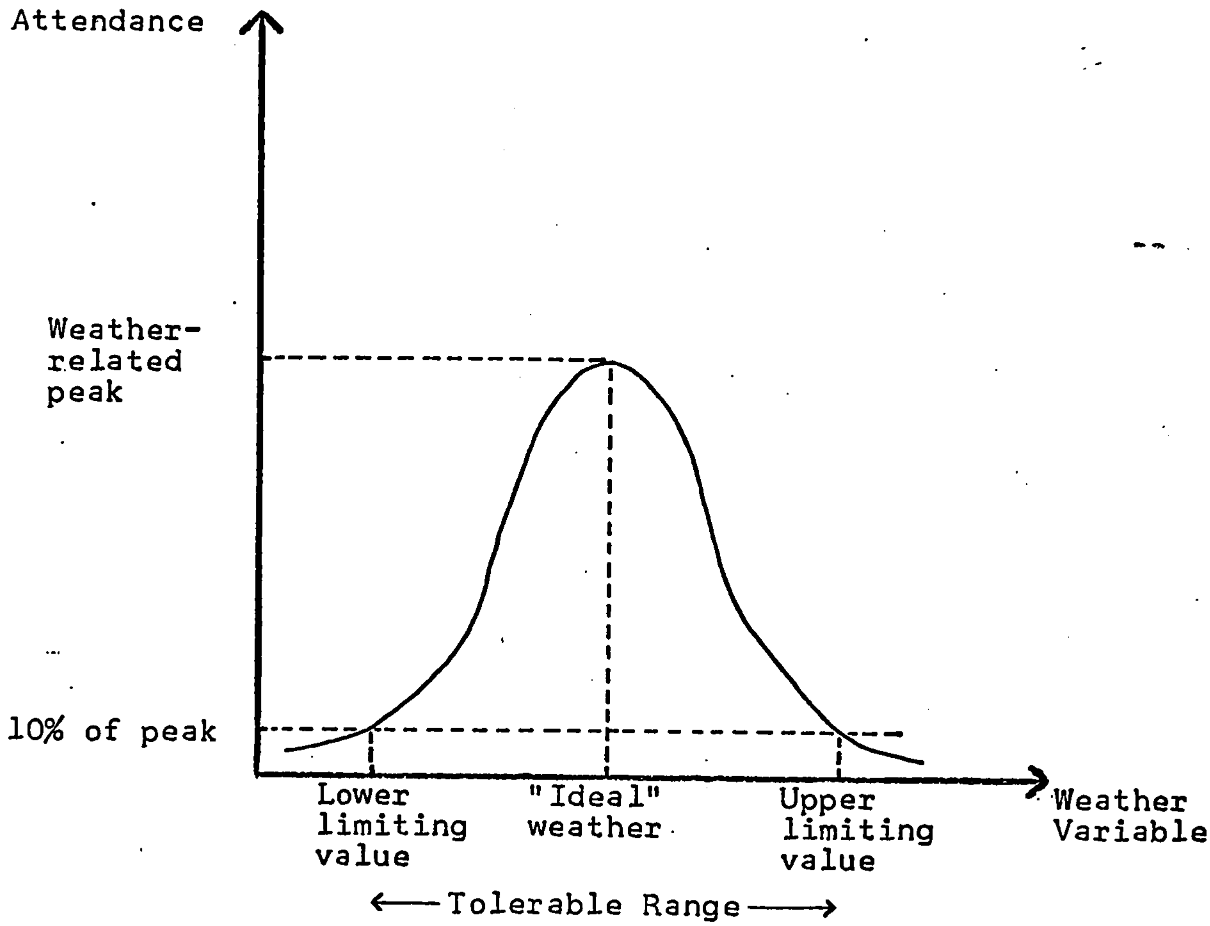

Figure 1.1

HYPOTHESIZED GENERAL WEATHER-PARTICIPATION RELATIONSHIP variable beyond which only 10 per cent of the population are prepared to participate in the particular activity under review. The term "most people" used twice in the previous paragraph thus refers to 90 per cent of all persons who participate in the activity. Limiting weather criteria may be established by studying facility attendance as in Figure 1.1, and identifying the value of the weather variable which coincides with an attendance of only 10 per cent of the peak level.

This relatively simple theoretical exposition forms the framework for the research reported in this thesis. The fundamental aims are twofold:

i) to explore the nature of the relationships between weather and participation in a number of outdoor recreation activities; and

ii) to define quantitatively limiting weather criteria for the enjoyable pursuit of each activity engaged in.

The first aim essentially arises from a necessity to expand our knowledge of weather effects on outdoor recreation. Many useful applications of such information have been referred to in the Introduction. The second aim has a more specific purpose. It was suggested to the writer early in the course of the study that findings confirmed under aim (i) could be used to assess area capability for various forms of outdoor recreation across Canada. Thus at any locality, it should be possible to state the number of days during the year on which weather conditions should fall within the tolerable range for a given activity. Such information could then form an extra input to Stage 2 of the ARDA recreational land classification.[1] The ARDA classification emphasizes land and water resources rather than the total environment.

Eight years ago lack of knowledge in this area of weather-recreation interaction was stated explicity in Study Report 9: Alaska Outdoor Recreation Potential of the Outdoor Recreation Resources Review Commission (ORRRC, 1962:9, p. 47):

> It is recommended that the U.S. Weather Bureau, in co-operation with the Division of State Planning, be requested to prepare a report on climatic criteria to be used in defining limits to various recreational activities in the several regions of Alaska.

As far as the writer is aware, no such report has been published.

Lacking precise information on weather limitations to outdoor activity participation, a number of agencies have arbitrarily ascribed limits for their own purposes. For example, Augulis (1968) reported that the Las Vegas weather office, which provides forecasts for Lake Mead, uses a wind-speed of 20 knots as the upper critical value for recreational

[1] The recreational capability section of the ARDA Canada Land Inventory follows the four stages set out by Taylor and Thomson (1966). Stage 1, the general survey, is largely completed at time of writing. Stage 2 comprises a second look at areas of high potential. A classification scheme incorporating the weather factors neglected in Stage 1 will provide more complete basic data for the assessment of each area's true potential for future development. Appendix A (pp. 231-232) enlarges on this point. Stage 3 encompasses a detailed site analysis of the high potential areas selected in Stage 2. Stage 4 incorporates the organization of the complete body of data into a classification system.

boating. In another study, the authors of Study Report 4 for the ORRRC (1962:4, pp. 31-144) identified the following limiting factors to what they termed "shoreline recreation activities": precipitation, wind over 30 m.p.h., snow [sic], fog, and waves over 4 feet in height. The implication was that any precipitation, which of course includes snow, and visibility of less than 5/8 miles limit shoreline activities. These criteria are entirely hypothetical. At the same time, Maunder (1962), in an attempt to produce a truly "human" classification of climate for New Zealand, was forced to arbitrarily select meteorological parameters which he thought affected recreation choices, and ascribe critical values to them. Thus while little quantitative work appears to have been done on the weather-recreation relationship, there are numerous attempts at subjective correlations. References abound in the literature on the need for quantitative research.

A third, if less fundamental, aim of this thesis is to assess the part played by weather in the recreationist's choice of activity and destination on a particular day. The general literature is quite abundant on the overall processes involved in choosing an activity and destination. Two examples of the many such studies conducted in Canada are by Taylor and Edwards (1960), who surveyed visitors to Wells Gray Provincial Park in British Columbia, and Parlby (1968) in the lake country of central Alberta. In virtually all these studies, however, weather has been neglected as a possible factor in the decision to visit a certain place on a given day. Roberts (1968) included weather as a component of his study of the locational preferences of outdoor recreationists resident in the Alberta Municipal District of Foothills south of Calgary. He established only, however, that "better weather" in British Columbia and the United States was a factor in some decisions to travel from Foothills M.D. to these areas for outdoor recreation purposes. In fact, response to current local weather conditions has not been investigated by researchers in the "locational preference" field. Neither has the possibility that weather affects both activity choice and destination selection on a particular day been examined.

Some analysts have noted that clarification of the precise weather-participation relationship can have a number of implications for the managers and planners of outdoor recreation facilities. A limited amount of research has been or is being conducted into this relationship. Dowell (1970) has completed a thesis relating weather to daily pleasure boat launchings on an Arkansas reservoir. His findings concluded that management could predict 64 per cent of the variation in day-to-day launching totals from fluctuations in the weather parameters of diurnal maximum temperature and total precipitation. The results, however, are only applicable to a very narrow range of outdoor recreational activity. Maunder and Halkett (1969) conducted a preliminary examination of occupance data for Lake Louise campsite, Banff National Park, relative to weather records; the results were inconclusive, however, as the role played by other non-meteorological factors in campsite occupancy was unknown (Maunder, 1970, p. 167).

Two further studies in the United States of America are scheduled for completion in 1970. One is a project at the University of Wisconsin, relating weather to participation in various forms of outdoor recreation at a number of widely scattered localities throughout the United States.[2] However it appears that this project is primarily concerned with assessing, through interviews with outdoor recreation operators, the problems posed directly to management by weather. Investigation of the direct weather-participation relationship seems to be a secondary aim only. The other study, at Michigan State University, envisages examination of weather effects on numbers of persons engaged in given activities at some Michigan State Parks.[3] The Michigan project, because of its design, is of very limited scope in a regional sense, but it may greatly expand our knowledge of recreationists' weather responses. It attempts to relate participation to forecast weather as well as to actual conditions experienced at the recreation area, and to the weather prevailing at the users' origin.

The four studies mentioned above are the only examples of research directly concerned with the relationship of

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[2] *Pers. comm.*, Maurice Warner, Center for Recreation Resources Development, University of Wisconsin, Madison, February 25, 1970.

[3] *Pers. comm.*, D.M. Crapo, Department of Park and Recreation Resources, Michigan State University, East Lansing, April 28, 1970.

weather to participation in outdoor recreation found during a protracted search of the literature. This survey extended to European, Australasian, and North American research results. The writer is thus led to believe that the present study is the broadest of its kind to be prepared. It is one of the first attempts to investigate regional variation of the response shown to weather by outdoor recreationists.

The weather-participation relationship cannot be examined directly only by contacting the outdoor recreationist himself. As Crapo (1970) suggests, while a questionnaire study of recreationists inquiring about their detailed response to weather would yield interesting psychological insights, it is unlikely to produce exact information. The recreationists themselves are not likely to know the precise effect a specific weather situation would have on their activity choices. One must therefore seek some other means of studying their behaviour under differing atmospheric conditions. The technique employed here is to correlate daily attendances at outdoor recreation areas (the direct record of what recreationists actually do) with the prevailing weather patterns of each day. For this, two sources of data are utilized: the daily records of attendance at a number of outdoor recreation facilities, and the relevant climatological observations recorded by the Canadian Meteorological Branch. Correlations of these two sets of data furnish the information on weather-oriented variations in facility use. These correlations and their implications are discussed in later chapters.

Consideration of the whole of Canada is beyond the scope of this project. Thus three climatically different regions of Canada were selected to study a number of recreational activities. These regions are the Edmonton area of Alberta, the Ottawa-Hull area of Ontario and Quebec, and southern New Brunswick (Figure 1.2). Reasons for selecting these study regions are elaborated in Chapter II, which also briefly describes them and discusses in detail the process of delimiting their boundaries. The outdoor activities chosen include swimming, beach use, visiting multi-activity parks, boating, driving for pleasure, outdoor sports, and visitation to sites of special interest such as zoos and historical exhibits. To analyze these few summer activities within the three study regions selected is an immense task in itself. Extension to the whole gamut of outdoor recreation in all four seasons is desirable, indeed necessary if significant contributions to land capability classification are to be made, but is far beyond the resources of a single researcher. Limiting this exploratory study to a sample of summer activities does not rule out future application of the techniques developed to the complete spectrum of outdoor recreation.

Attendance records for the 1969 summer, defined as May 15 to September 15 inclusive, were collected for as many outdoor recreation facilities as possible in each of the three study regions. These were coded and punched on to IBM cards for computer analysis with the climatological records which

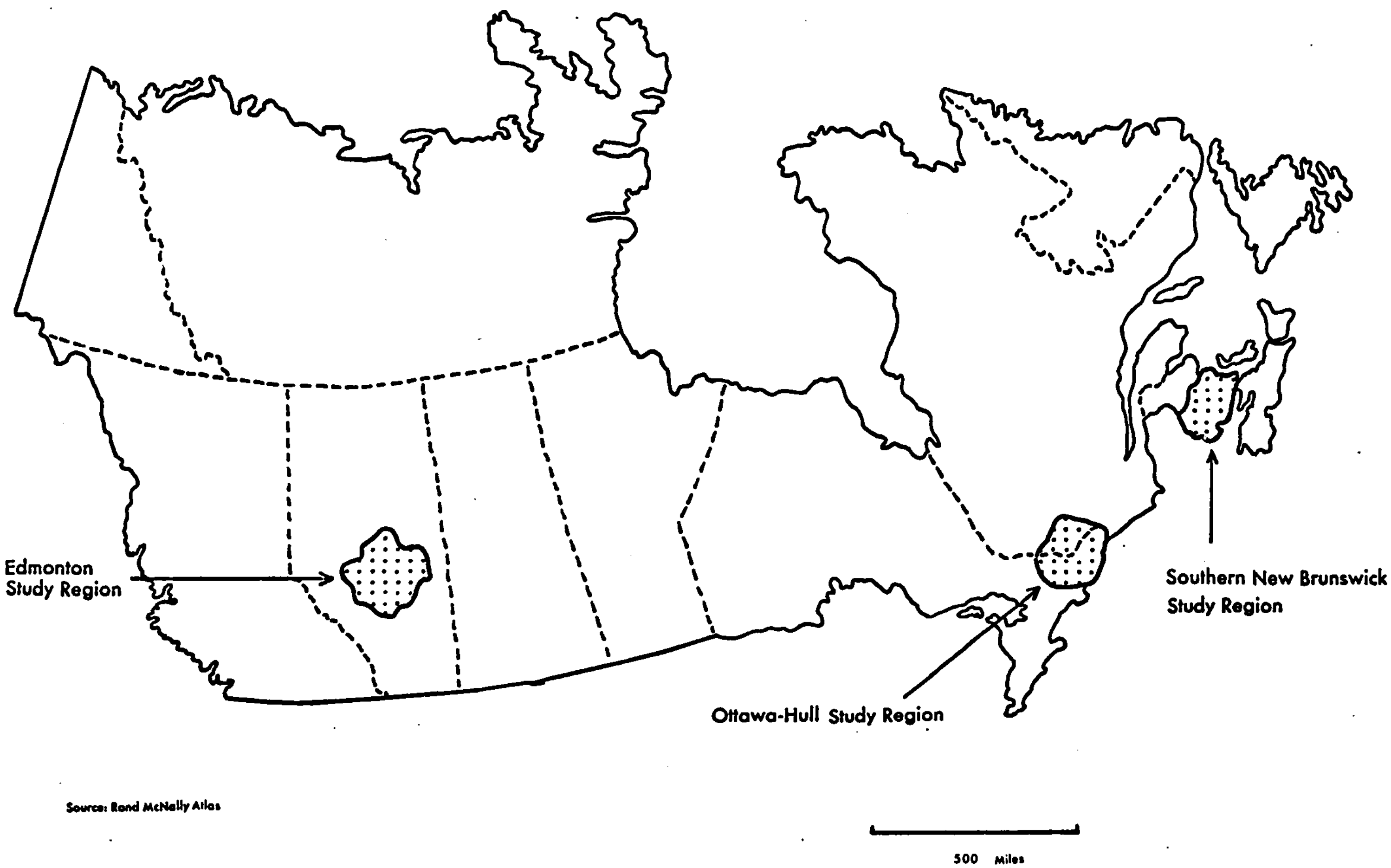


Figure 1.2 Location of the Three Study Regions

are routinely stored on punched cards. Further explanation of the research procedures is to be found in Chapter III.

The body of the thesis is divided into three sections:

1. Introductory: Chapters I - III

2. Analysis and Results: Chapters IV - X

3. Summary, Conclusion and Recommendations: Chapters XI - XII.

Chapter I deals with the formulation of the project. The second chapter is devoted to the description and delimitation of three regions of Canada chosen for investigation. The choice of the forms of outdoor recreation to be analyzed is also justified. The third chapter treats in detail the research methodology and data sources.

All chapters of Section 2 display a common format. Individual outdoor activities are treated in turn. For each activity, the apparent limiting weather criteria are analyzed and identified. The weather-participation relationships for each activity are discussed separately; synthesis in terms of the comprehensive weather-outdoor recreation picture is left for Section 3.

Section 3 analyzes overall outdoor recreational behaviour in each of the three geographical regions. The part played by weather in selection of activities and destinations is clarified. Chapter XI demonstrates how the findings of the thesis can be used by both meteorologists and planners of recreation facilities and activities. Some suggestions are made regarding parameters which should be included in a specialized weather forecast for outdoor recreationists and facility managers. Applications of the results to the ARDA land capability classification, and to the improvement of daily attendance prediction are pointed out. Contributions to knowledge of recreationists' behaviour are also emphasized. The final chapter isolates major findings of the thesis and makes recommendations both for further research and for collection of more pertinent attendance and climatological data in the future.

CHAPTER II

ACTIVITY AND REGION SELECTION

Many writers have suggested lists of the more important types of outdoor recreation. Perhaps the most useful from a Canadian point of view is that given by the Recreation Sector of the ARDA Canada Land Inventory (Canada Dept. For. and Rural Devt., 1967, p.6). This list, reached by the Inventory personnel after much deliberation, is a consensus on activities favoured by Canadians, and comprises the following "popular" activities:

family bathing	primitive camping
snow skiing	gathering and collecting
swimming	ice-skating, sledding
viewing	tobogganing
summer cottaging	recording[1]
boating, sailing, water skiing 2	hiking
fishing	horseback riding
organized public or group camping	driving for pleasure
hunting	picnicking
canoeing	nature walks and studies
	walking

Like any other classification, it has its shortcomings; for instance a place should be found for "visiting special

[1] Defined as "photography, sketching, painting, bird song recording or similar activities" (ARDA Field Manual, p. 120).

[2] Grouped together in this thesis as "recreational boating". This excludes fishing from boats, and canoeing.

sites".[3] The list also has its merits. It separates canoeing from other forms of recreational boating, and primitive from organized camping. Moreover, it illustrates the diversity of pastimes covered by the term "outdoor recreation".

Only five of the twenty-one activities listed will be analyzed. Eight activities in all are discussed, three of which do not appear in the list. All eight activities are chosen on the basis of the existence of meaningful area-use records. Snow-skiing, ice-skating, sledding and tobogganing are excluded because they are winter pursuits. Other activities such as fishing, hunting, and hiking are excluded by virtue of a lack of meaningful daily area-use records. The five activities recognized in the Canada Land Inventory and emphasized in the thesis are family bathing (beach use), swimming, boating, driving for pleasure, and picnicking.

Three forms of outdoor recreation not included in the Canada Land Inventory list are studied. The first is visiting special sites, such as zoos and historic exhibits. The second is outdoor sports, including golf, tennis, and sports programmes for which data are available. Unlike most of the other activities treated, these are leisure pursuits which are not natural resource oriented in terms of the C.L.I definition. The final activity reviewed is multi-activity

[3] The ARDA recreation capability classification distinguishes between "recreation features" and "recreation activities" in a way that is not completely consistent. For instance, the historic site and the interesting landform are among the twenty-five "features" identified as providing opportunity for recreation; but visiting them is not identified as an "activity".

park visitation. Strictly speaking, this is not an activity in itself, but attendance statistics for these parks form a significant portion of our information on outdoor recreation use and cannot be excluded from study.

These attendance statistics demonstrate a problem common to many recreation data; visitation to facilities is measured rather than participation in particular activities. For several of the activities selected for study, this problem requires assumptions to be made before daily participation figures for them can be justified (Table 2.1).

TABLE 2.1

ASSUMPTIONS REGARDING USE MEASUREMENT FOR CERTAIN ACTIVITIES

Activity	Assumption	Use Measurement
Family bathing	Define as "beach activity for groups of people or individuals including non-swimmers & children".* Includes swimming, wading, sunbathing, loafing, etc.	Park attendance where the beach is the attraction to the vast majority of visitors
Driving for pleasure	Usually associated with other activities and is very difficult to measure except in some special cases	Traffic record on purely or predominantly recreational road, e.g. the Gatineau Parkway, Long Sault Parkway
Picnicking	Usually associated with other activities, but use can be measured where picnicking is dominant use of a site	Site attendance record where dominant use is for picnicking
Recreational boating	Number of boats locked each day at stations on the Rideau Canal indicates intensity of recreational boating	Lockage records for individual lock-stations on the Rideau Waterway

* Adapted from ARDA Field Manual (Canada Dept. For. and Rural Devt., 1967), p. 115.

The list of activities reviewed therefore comprises, in the order of treatment in the text, (i) swimming, (ii) family bathing, (iii) multi-activity park visitation, (iv) picnicking, (v) recreational boating, (vi) driving for pleasure, (vii) visiting special sites, and (viii) outdoor sports. While only a small number of forms of outdoor recreation is studied, it does incorporate considerable diversity. Surveys such as those by the ORRRC (1962:20, p.5) of the American population, and by Heaps (1967, p. 49) in Ontario, have generally shown driving for pleasure, picnicking, and swimming (or going to a beach) to be the most popular categories of outdoor recreation. Hence the three activities with the highest participation rates for recreationists in general are included in our study. Furthermore, three of the activities regarded by the ARDA inventory as being most demanding of the resource base are included. Time constraints unfortunately prevented the inclusion of organized camping among the activities studied. We are therefore dealing with several types of outdoor recreation which will need the most careful planning if demands for them are to be met while land resources are conserved. Although some quite popular activities, notably fishing, are not treated here, the techniques developed should be adaptable to them if the requisite daily participation data can be obtained.

<u>Choice of the Recreational Destination</u>

One aim of this thesis has already been specified as an attempt to shed more light on the poorly-understood process whereby an individual or group chooses, from a multitude of possible alternatives, both a recreational destination and an activity in which to participate. Considerable research has been undertaken in the past in attempting to understand the choice of the destination. Most studies however tended to concentrate on only one destination area, as does the study by Taylor and Edwards (1960) of visitors to Wells Gray Provincial Park in British Columbia. Such an approach can tell us why the visitors went where they did, but very little as to why they did not go elsewhere. A comprehensive study of the process of selecting destinations and activities must be oriented to the recreationist himself rather than to the recreation area.

Roberts (1968) recognized this need. He studied the locations used for outdoor recreation by residents of the Alberta Municipal District of Foothills. This was done by mailing a questionnaire to a sample of residents. Somewhat similar procedures were followed by Rigby (1966) and Campbell (1967) in sample studies of Edmonton and Vancouver respectively. It is the writer's belief that these procedures are not applicable to the present study, which is concerned with the effect of daily weather on the choice of recreational destination and activity participation. The writer endorses the comments of Crapo (1970, p.4):

> There is some question as to whether or not individuals are conscious of the effects of weather on their behaviour. Therefore the use of direct questioning (e.g. interview) about the influence of weather would yield data of questionable validity.

This project must therefore look to daily attendance data derived from outdoor recreation facilities as the variable indicative of people's behaviour under or in anticipation of given weather conditions.

Two constraints must be reconciled at this point. On the one hand, to elicit information on the choice process, it is desirable to analyze the movements of the recreationist himself. At the same time, to investigate actual behaviour under given weather situations, it is necessary to consider the existing attendance data recorded at recreation areas. The project, therefore, must be oriented toward the recreationist and must not merely be an investigation of how daily use varies with weather at a number of unrelated outdoor recreation facilities. The only way to satisfy these two conditions is by studying attendance records from a large number of recreational destinations within the "outdoor recreation hinterlands" (Mercer, 1970) of major urban centres. Visitors to these facilities are drawn substantially from the same population. The analysis is thereby directed towards the residents of the urban centres whose outdoor recreation hinterlands are the basis of the regions selected for study here.

Selection of Study Regions

The sampling problem necessitates the selection of diverse regions in Canada for intensive research. It was felt that three major areas were as many as one investigator could hope to handle. This has proved to be a valid impression. Criteria for choosing the three primary regions include differences in available outdoor recreation resources and variations in climate and weather factors. Thus a prairie provinces location, a coastal area, and an inland region of eastern Canada were selected. The climate criterion was invoked to test the view that acceptable weather for participation in given activities might differ between one geographic region and another. The second criterion was that a significant amount of daily attendance data suitable for analysis should be available. Thirdly, the outdoor recreation hinterland of each region's urban centre had to be easy to delineate.

The resultant study regions are:

i) the Edmonton area of Alberta,

ii) the Ottawa-Hull area of Ontario and Quebéc, and

iii) the Moncton-Saint John-Fredericton area in southern New Brunswick.

The urban centres listed are the major demand origins of the study regions. Their urban populations are of manageable size (200,000 to 500,000). Outdoor recreation operations within the cities are not too numerous to make attendance data collection onerous, as might be the case with Toronto, Montreal and perhaps Vancouver. The choice of the Edmonton area as the prairie provinces locality is largely one of convenience to the writer. The region of Ottawa-Hull was chosen as the inland Eastern Canada locale for several reasons. It incorporates the Ontario-Quebec border, it includes portions of both the Canadian Shield and Ontario Lowland physiographic provinces, and the metropolitan area is a suitable size. Also, the Ottawa-Hull hinterland is much easier to delimit than would be the case with a southwestern Ontario city. Southern New Brunswick was chosen by virtue of its Atlantic coastal location, and because of the close co-operation promised by its various outdoor recreation administrative agencies.

Delimitation of the Study Regions

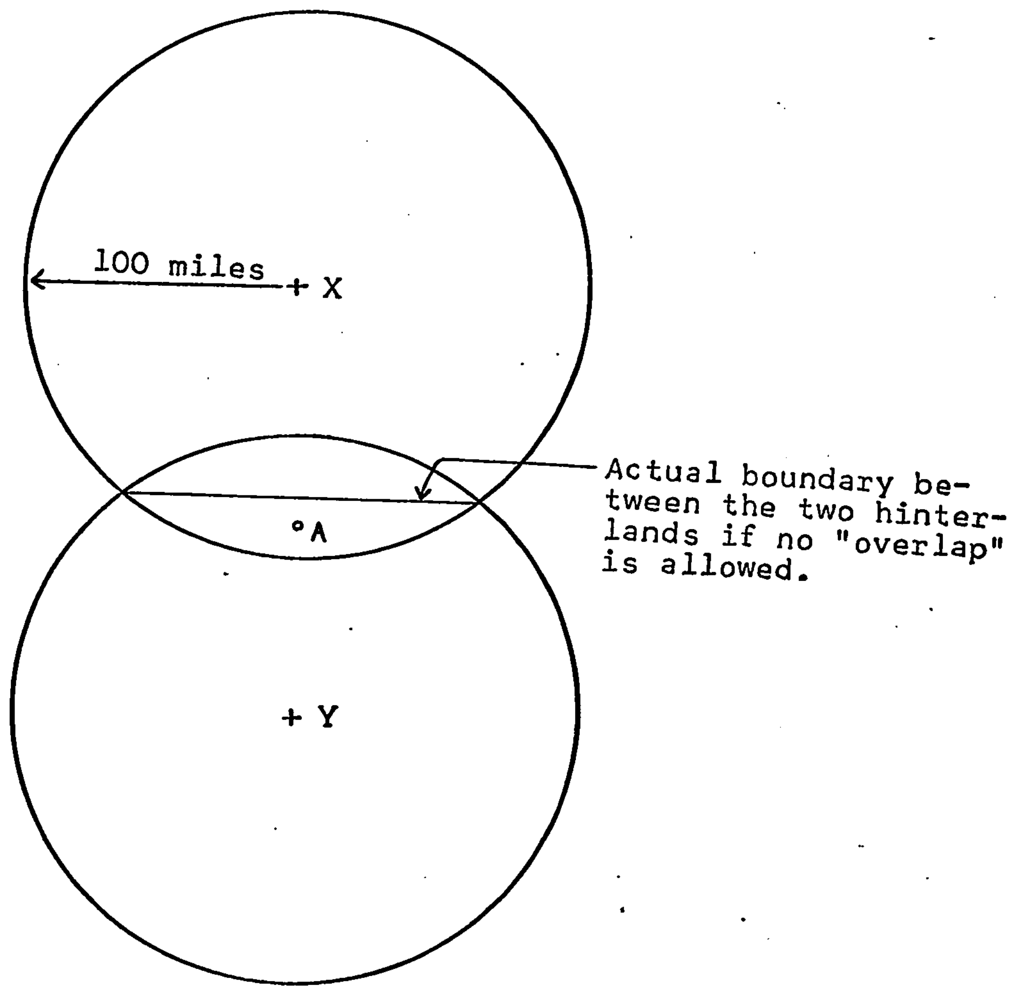
Problems of defining the outdoor recreation hinterland of a city have been reviewed by Mercer (1970). Basically the hinterland area varies with the length of time occupied by the recreational trip, and perhaps also with the activity to be engaged in (Ross, 1969). For the purpose of delimiting the regions used in this study, two points are assumed: firstly, that day and weekend trips originating in the source city are mainly responsible for high attendance at outdoor recreation areas, and that these trips are related to weather; second, that the automobile is the dominant form of transportation used for recreational outings, and that most recreationists will tolerate up to a two-hour one-way drive to the chosen destination. The first assumption implies that study regions should be defined to include the destinations of the majority of recreationists' day and weekend outings from the source cities. They should incorporate the so-called "day trip zone" and "weekend trip zone" as defined in the California Outdoor Recreation Plan (California, 1960). The second assumption allows a "day and weekend hinterland" boundary to be based on highway driving time from the recreationist's point of origin. Anderson (1962, p. 78) used this argument in considering "the fifty-mile travel distance...as the base for defining the limits of the day-trip recreational zone of the London [Ontario] population". This represents approximately a one-hour drive. Most researchers in North America have found virtually all day trips and the majority of weekend trips to have destinations within two hours' travel distance of their origins. The present study utilizes the 100-mile drive (two hours) on highway routes from the source cities as the basis for defining each study region.

An outdoor recreation hinterland bounded solely in terms of road travel time will often "overlap" that of another major city. Figure 2.1, as an illustration, queries whether facility A should be included in the day and weekend hinterland of both cities X and Y, whose hinterlands would then overlap one another, or whether it should be placed within the hinterland of the city which supplies the greater proportion of A's users. This procedure would result in a "compression" of the hinterland of city X, as shown in Figure 2.1, since users from city Y are liable to dominate at facility A. In this case the hinterlands of X and Y will not overlap.

Each of these two diverging views on outdoor recreational hinterland delimitation has its proponents. Mosley (1964), in his study of Tasmania, found that certain recreation areas drew numbers of visitors from both Hobart and Launceston, thus indicating an overlap of the hinterlands of the two cities. On the other hand, Anderson (1962, p. 78) considered that the London, Ontario, day-trip zone was modified by the

Figure 2.1

OUTDOOR RECREATION HINTERLANDS OF CITIES X AND Y



> competitive effect of other recreation-seeking urban populations....[which is] a most dominant factor, and results in the London day-trip recreation zone being compressed from the east [by Galt, Guelph and Kitchener-Waterloo] and from the west [by Detroit-Windsor], although extending more than fifty driving miles north of London, along the Lake Huron shore, where Londoners can and do seek recreational space without encountering increasing numbers of recreation seekers from another major urban area....

In other words, facility A in Figure 2.1 would not receive the visitors that might be expected from City X, because of a tendency of residents of X to avoid the pressure of crowding from Y. To Anderson, then, recreational hinterlands do not overlap; everywhere within the hinterland, the influence of the source city is dominant.

The view held by the writer is that both interpretations may be correct, in different situations. On this premise, the selected study regions are defined by the criterion of a 100-mile road journey; they also may possess some "compressions" of the type made by Anderson, and extensions where an outstanding outdoor recreation resource lies just beyond the 100-mile limit.

Delimitation of the Edmonton Study Region

Figure 2.2 shows the extent of the Edmonton study region. Where the boundary extends beyond the 100-mile highway distance, the latter is portrayed by a dashed line. There are three such areas. One occurs in the vicinity of the Mann Lakes in the northeast; a second includes Baptiste Lake and Island Lake west of Athabasca, and the other, in the southeast, takes in the Buffalo Lake - Big Knife Provincial Park

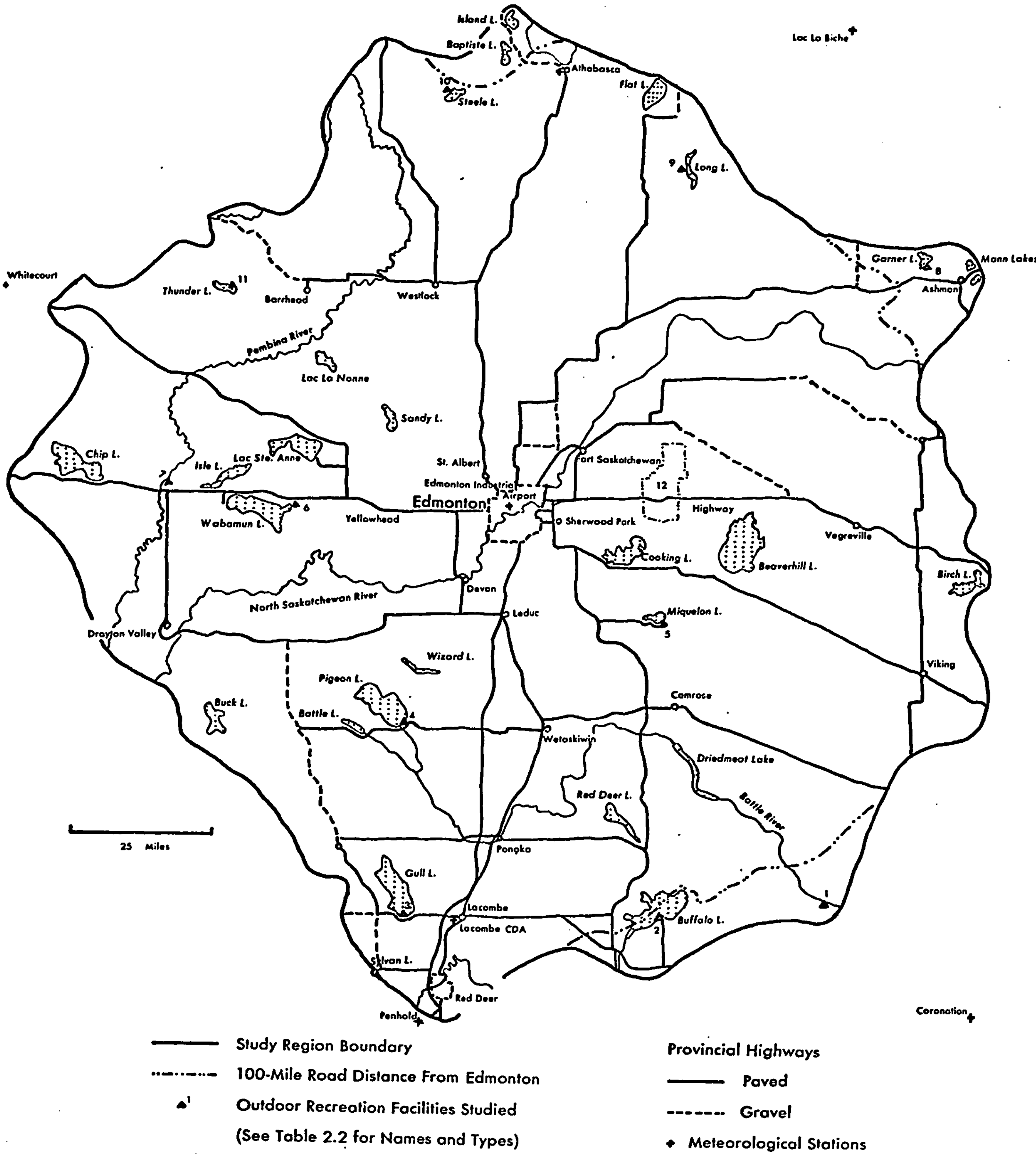


Figure 2.2 The Edmonton Study Region

Source: Alberta Highways Map

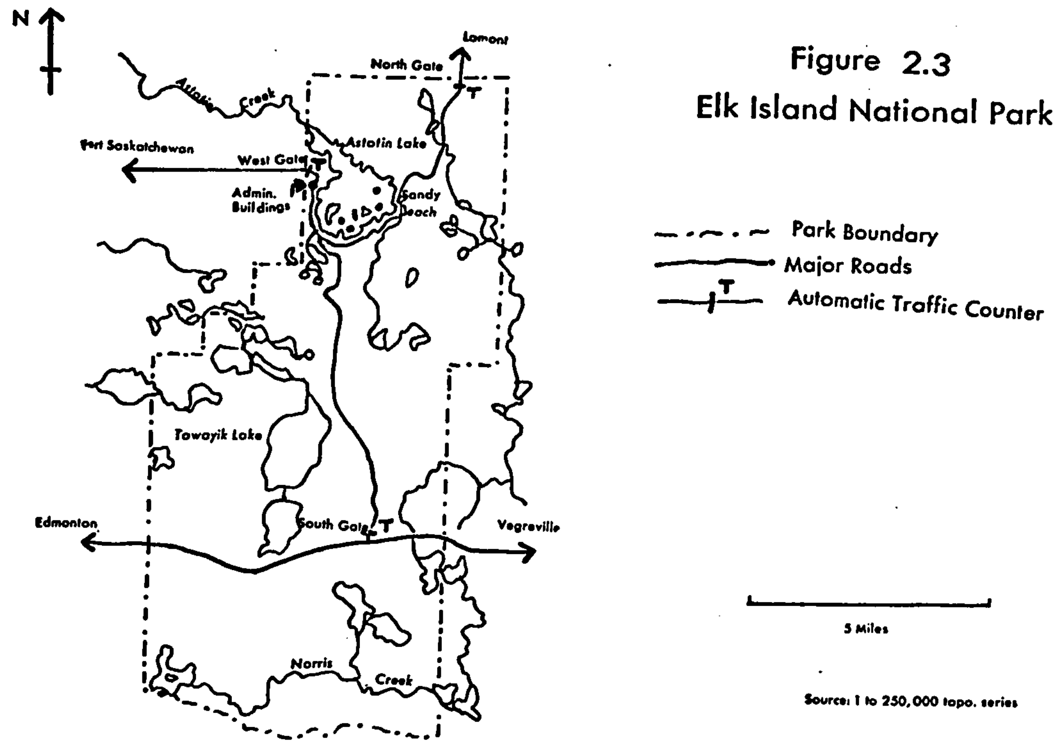


Figure 2.3
Elk Island National Park

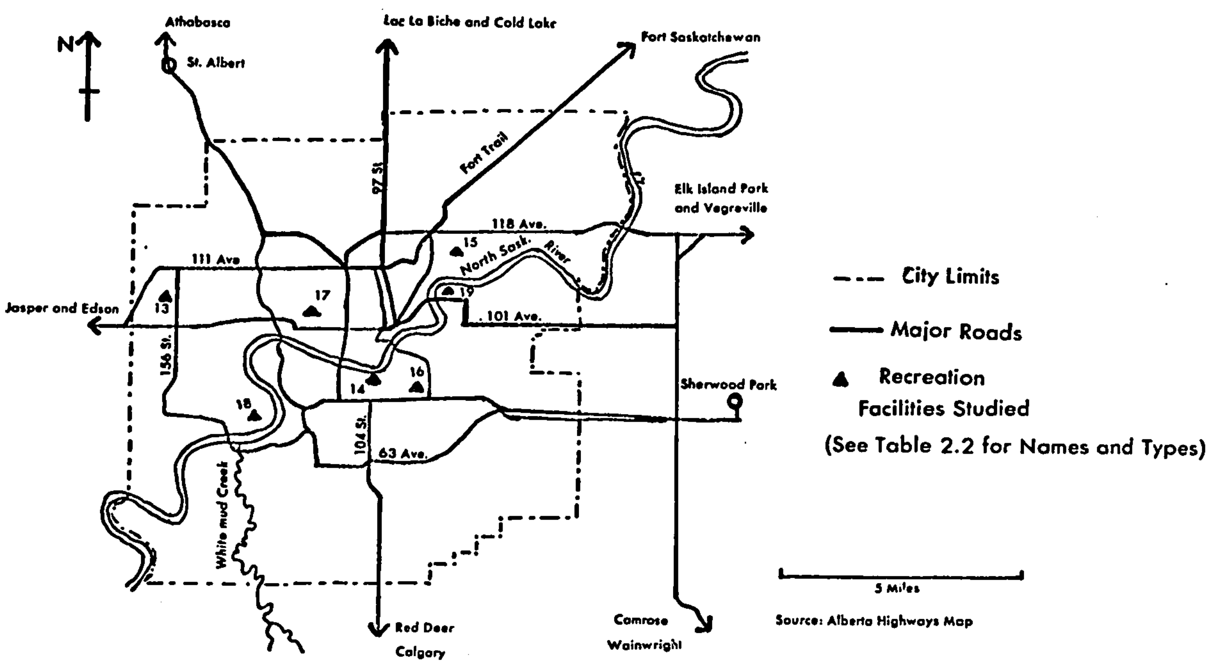


Figure 2.4 City of Edmonton Facilities

country.

In the south the region certainly overlaps the day and weekend trip zone of Calgary. Parlby (1968) reported the following urban centre visitor origins for Sylvan Lake, Aspen Beach Provincial Park on Gull Lake, and Rochon Sands Provincial Park on the south shore of Buffalo Lake:

Sylvan Lake: Red Deer 39%, Calgary 21%, Edmonton 20%

Aspen Beach: Calgary 31%, Edmonton 22%, Red Deer 9%

Rochon Sands: Stettler 30%, Calgary 22%, Edmonton 19%

Calgary is the single other most important origin of visitors at these three localities, but Edmonton provides one-fifth of all the users. Pressure by the recreation-seeking population of Calgary is evidently not high enough to deter large numbers of Edmontonians from visiting these lakes. They can therefore be included in the outdoor recreation hinterlands of both Calgary and Edmonton.

The validity of the boundaries suggested can be tested against the work of Rigby (1966) and Dooling (1967). Ninety-two per cent of Rigby's sample of 224 day trips by Edmontonians had destinations within the region shown in Figure 2.2, as did 40 per cent of weekend trips. Forty per cent is not a high figure, but Rigby defined the "weekend" as two to six days in length, thus bringing the Rocky Mountains within easy reach of such a trip. It is worth noting also that Rigby found 18 per cent of all day outings undertaken for outdoor recreation purposes by Edmontonians terminated <u>within</u> the corporate limits of the city of Edmonton. Eighty-one per cent of the day trips analyzed by Dooling in a similar study of Edmonton outdoor recreationists terminated within the Edmonton study region. This figure is lower than Rigby's value of 92 per cent, but Dooling asked his respondents where they went when they left the city for outdoor recreation. If he had included their day trips within the city, a higher percentage of the total would have terminated within the area we have defined as the Edmonton study region. The area encompasses the destinations of 47 per cent of Dooling's sample of weekend trips originating in Edmonton. This figure is low, compared with the 60 per cent within the 100 miles characteristic of Melbourne, Australia, and regarded as a typical figure by Mercer (1970). Proximity to Jasper and Banff may cause many Edmontonians to travel unusually long distances on some weekend excursions. A further 33 per cent of Dooling's weekend trips were to Banff and Jasper National Parks, especially Jasper (approximately 22 per cent).

The boundaries of the study region have thus been shown to be valid as far as day and weekend excursions by Edmontonians are concerned. It is also desirable to assess what proportion of use of facilities analyzed in the study region is made by residents of the source city, by other local residents and by tourists. Only fragmentary information on users of a small number of facilities in the Edmonton study region is available at the time of writing. Results from the extensive CORDS survey of 1969 are not yet published.

The survey reported by Parlby (1968) has already been noted. It included a sampling of users of four central Alberta lakes, all located within our Edmonton study region. It confirmed a finding common to many such surveys, that rural users of outdoor recreation facilities are negligible. At Ma-Me-O Beach, 50 miles from Edmonton, the survey found that 65 per cent of all users were from Edmonton, and that at least 87 per cent resided in the Edmonton study region; only 1 per cent of the users were from outside Alberta. User-origin figures for the other three lakes further from Edmonton have already been summarized (p. 21). Another significant conclusion was that even the renowned beaches on Gull Lake (Aspen Beach Provincial Park) and Sylvan Lake, both within 10 miles of the Edmonton-Calgary highway and therefore easily accessible to tourists, receive only 3.4 and 4.4 per cent of their use respectively from persons living outside Alberta. This supports the conclusions of the survey by Kates, Peat, Marwick and Co. (1967) that the majority of tourists to Alberta are attracted to Calgary, Edmonton and the Rocky Mountain national parks, visiting few other places in the province. Users of the facilities analyzed in the Edmonton study region are thus largely residents of the region or of areas adjacent to it. Furthermore, within 50-60 miles of Edmonton, recreational use of the facilities studied is dominated by Edmontonians. This is to be expected, as two-thirds of the inhabitants of the study region live within the Edmonton metropolitan area.

The Edmonton Study Region - Description

Figure 2.2 shows the Edmonton study region of central Alberta, and the outdoor recreation areas and sites for which data are analyzed. The paved highway system is also shown. Location of facilities studied within Elk Island National Park and the city of Edmonton is indicated in detail on Figures 2.3 and 2.4 respectively. Numbering is as in Table 2.2 which gives names and the types of recreation use data collected.

The region covers 21,000 square miles. It is the largest of the three study regions, mainly because recreational excursions are unrestricted by either the sea or the United States border as is the case in the other two regions. The Edmonton metropolitan area, including St. Albert and Sherwood Park, is the largest urban centre with a population of some 450,000 in 1969. The only other city with over 10,000 inhabitants is Red Deer with 27,000, and it is peripheral to the study region.

The topography of this region varies from subdued foothills country in the west through rolling parkland zones to the flat prairie in the southeast. The area is poorly served by permanent streams adequate in volume to support water-based recreation activities throughout the summer. Glaciation has endowed the area with lakes of moderate capability for outdoor recreation (Nowicki, 1969). Many of those within easy reach of Edmonton have received considerable development.

The entire region is suited to hunting and fishing. The "bush" country located west of the agricultural areas is

TABLE 2.2

OUTDOOR RECREATION FACILITIES STUDIED IN THE EDMONTON REGION

Name and Numbering System of Facilities as in Figures 2.2, 2.3, and 2.4	Type of Facility	Attendance Records
Provincial Parks:		
1 Big Knife	Recreational parks (1–11)	Nos. 1-3, 5-11 have automatic traffic counters
2 Rochon Sands		
3 Aspen Beach		
4 Ma-Me-O Beach		No. 4 has a visual car count
5 Miquelon Lake		
6 Wabamun Lake		
7 Pembina River		
8 Garner Lake		
9 Long Lake		
10 Cross Lake		
11 Thunder Lake		
National Park:		
12 Elk Island		No. 12: auto. traffic counters, three gates; lifeguard swimmer count
City of Edmonton:		
13 Fred Broadstock	Outdoor swimming pools (13–17)	Nos. 13-17 have ticket counts of swimmers
14 Queen Elizabeth		
15 Borden Park		
16 Mill Creek		
17 West End		
18 Storyland Valley Zoo		No. 18 has record of paid admission
19 Riverside Golf Course		No. 19 has daily records of rounds played

generally unsuitable for more intensive recreation use, but its hunting and fishing are excellent. Even within the farmed sections of the region, geese and duck hunting are good on numerous sloughs and ponds.

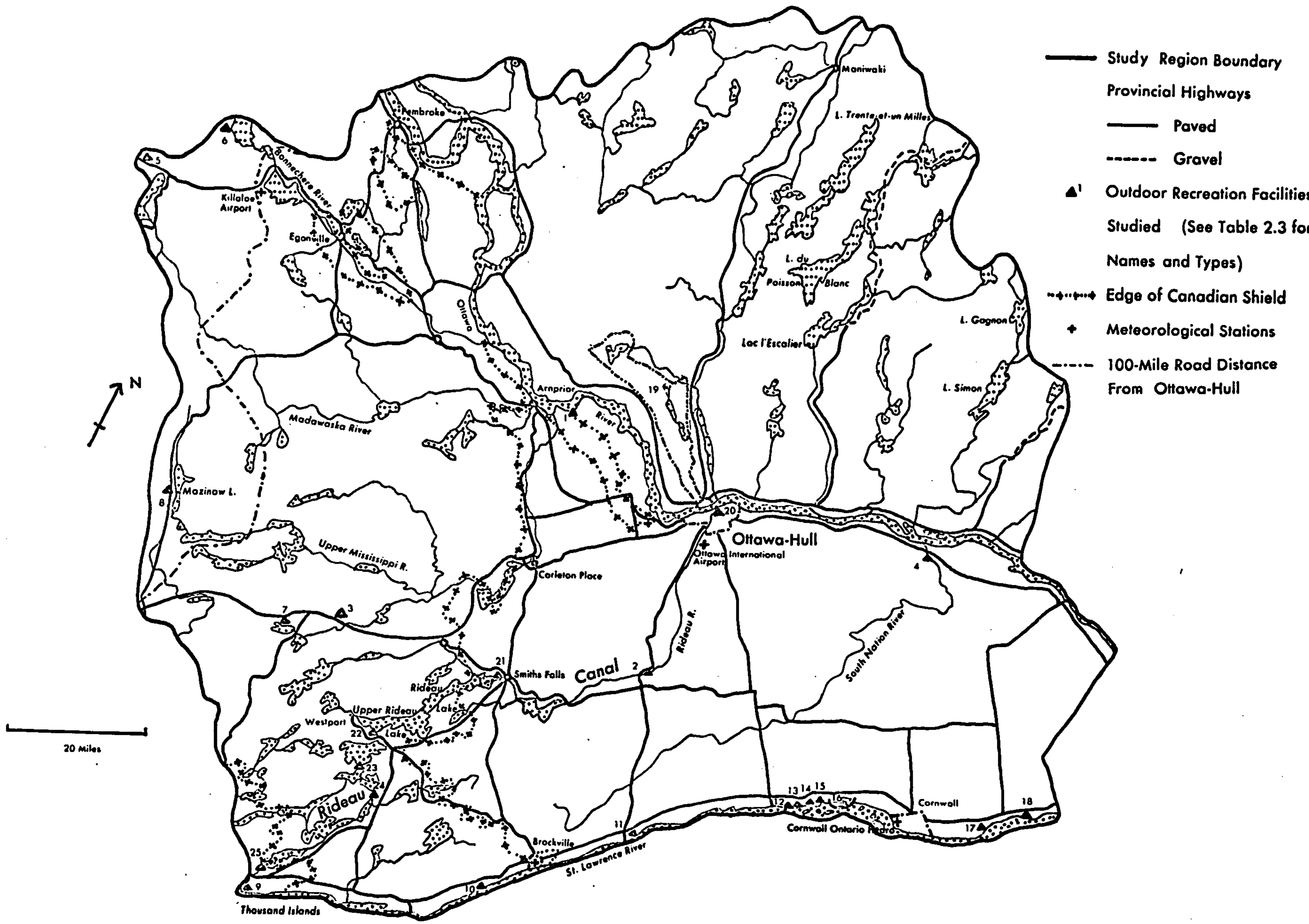
An important characteristic of the Edmonton area is the long, cold winter. A question to be resolved therefore is whether Edmontonians will tolerate lower temperatures for participation in summer outdoor activities than southern New Brunswick and Ottawa-Hull recreationists. Features of the

Alberta climate are dealt with later in this chapter, in a comparative section on the differing climatic regimes of the three study regions.

Delimitation of the Ottawa-Hull Study Region

Figure 2.5 shows the Ottawa-Hull day and weekend trip hinterland. The dashed line marks the 100-mile highway travel distance in the west, but the actual boundary is placed beyond 100 miles to include lake-strewn portions of the Bonnechere and Madawaska Valleys and the Bon Echo Provincial Park on Mazinaw Lake. On the southwest, the whole of the Rideau Lakes area is included, thus incorporating the southern entrance to the Rideau Waterway at Kingston Mills Locks, together with the famous historic park of Old Fort Henry across the Cataraqui River from Kingston. To the south the St. Lawrence River and the international boundary impose a barrier well within 100 miles' drive from Ottawa. In the east, pressure from the Montreal metropolis is not felt strongly over the Quebec border in the peninsula that separates the Ottawa and St. Lawrence Rivers; however, visitation by Montrealers to the easternmost parks of the St. Lawrence Parks Commission is just starting to increase rapidly.[4] North of the Ottawa River, pressure from Montrealers "escaping" to the Laurentians is so great that the regional boundary is compressed well within the 100-miles driving distance of Ottawa-Hull.

[4] *Pers. comm.*, interview with Mr. G.W. Arthurs, Public Relations Officer, St. Lawrence Parks Commission, Morrisburg, Ontario, October 1, 1969.



Source: Economic Atlas of Ontario

Figure 2.5 The Ottawa-Hull Study Region

The validity of the boundaries suggested for the Ontario sector is a little difficult to verify, since the writer is not aware of any surveys comparable to those for Edmonton on recreational excursions made by Ottawa-Hull residents. In Quebec, the boundary follows a significant line demarcated by Briere (1967); this is the border he drew between the Montreal Laurentians and Ottawa Laurentians tourist regions. Highway traffic patterns strongly suggest that in this area northeast of Ottawa-Hull, the hinterland is "compressed" by the influence of Montreal, and that there is very little overlap between the day and weekend trip zones of Montreal and Ottawa-Hull.

The Ontario sector of the Ottawa-Hull region includes the Ottawa River, eastern Ontario and the Rideau Lakes-Thousand Islands regions used by Wolfe (1956) in his early study of outdoor recreation in Ontario, together with a large tract of his Lakeland of Renfrew region. The United States border to the south seems a reasonable location for the hinterland boundary. Its closest point, the Johnstown-Ogdensburg International Bridge, is at least an hour's drive from Ottawa. Thus upstate New York seems very unlikely to receive much day use from Ottawans, and probably has very little weekend patronage either. The customs procedures would lengthen travel time, and attractive recreational alternatives exist within Canada. A limited number of Ottawans uses the St. Lawrence Seaway Valley for outdoor recreation. The Valley in fact forms the only significant resource within the study region lying south and southeast of the Ottawa-Hull metropolitan area.

Although various recreational research projects have been carried out within the Ontario sector of the study region, very little information on visitor origins is available at the time of writing.[5] The fragmentary data which are available still convey some impression of facility use patterns. Day-use of St. Lawrence Valley parks in the southern section of the study region is dominated by local urban centres. The St. Lawrence Islands National Park user survey (Taylor, 1967) found that the Mallorytown Landing day-use area was used most frequently by Brockville residents, while Ottawa users made up only about 5 per cent of the total. Day-use by Ottawans of other parks along the St. Lawrence is overshadowed by visitation from Kingston, Brockville and Cornwall.[6]

In his study of recreational travel patterns, Wolfe (1966) highlighted the tendency of Ottawans to move westwards rather than south or southeastwards. We would thus expect Ottawa-Hull residents to be among the most frequent day and weekend users of the Lakeland of Renfrew and the Rideau Lakes. Two surveys of overnight visitors in the Lakeland of Renfrew support this expectation. Bradley (1967) found that Ottawa City, excluding Hull, provided the second highest number of overnight

[5] Despite many efforts, the writer was unable to locate a copy of the report on the Ontario Provincial Parks User Survey, which would have furnished further information.

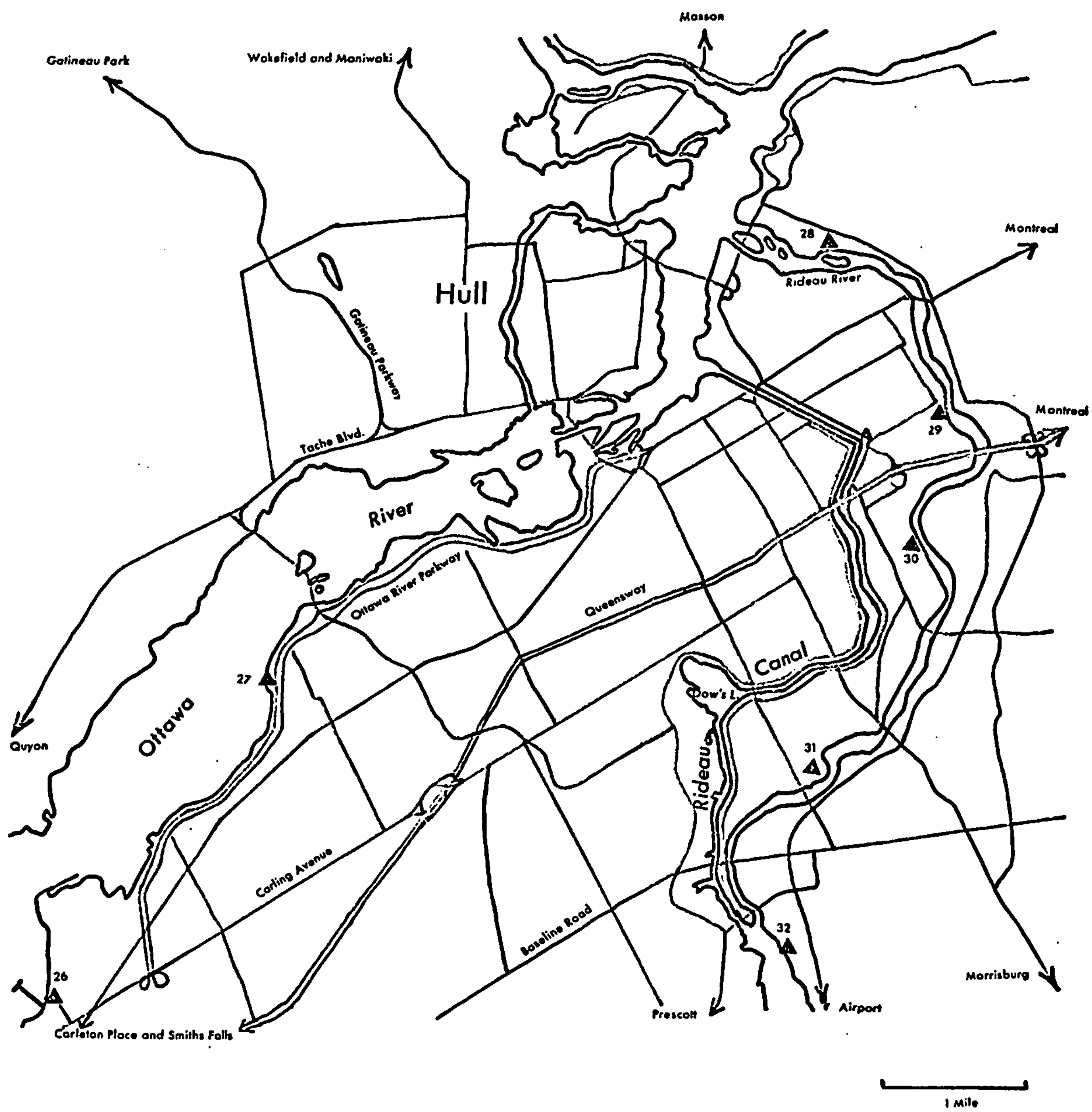
[6] _Pers. comm._, interviews with Mr. G.W. Arthurs, Public Relations Officer, St. Lawrence Parks Commission, Morrisburg, Ontario, October 1, 1969; and Mr. G.A. Balding, Superintendent, St. Lawrence Islands National Park, Mallorytown Landing, Ontario, October 2, 1969.

visitors (with Toronto first) in the Madawaska Valley section of the Lakeland of Renfrew. An earlier small-scale survey (Ontario, Department of Travel and Publicity, 1960) of Eganville showed 21 per cent of those staying overnight to be from eastern Ontario, presumably with Ottawa well represented. A similar survey of Westport in the Rideau Lakes (Ontario, Department of Travel and Publicity, 1961) found 27 per cent of visitors were from eastern Ontario. All three of these studies, however, drew attention to the significant numbers of tourists sampled from both the Toronto area and from the United States. Fully 60 per cent of Westport and 29 per cent of the Madawaska Valley visitors were Americans. Wolfe (1966, p. 29) showed that in 1964, eastern Ontario (including Ottawans) residents dominated camping use of provincial parks within the study region, but also that significant numbers of campers were from outside this region.

The surveys reviewed above suggest a frequent domination of facility use by local urban residents rather than Ottawans. A very sizeable summer influx of tourists into the study region is also implied. These two points suggest that many of the facilities studied are used by recreationists with diverse origins. Only facilities in close proximity to Ottawa-Hull and relatively unknown to tourists can be expected to be dominated by residents of the metropolitan area. These facilities are the Ottawa City swimming places, Luskville, Lac Lapeche, and Fitzroy and Rideau River Provincial Parks. They are the only facilities within the region where weather responses are likely to be truly characteristic of Ottawa-Hull residents. Other facilities within the region apparently have a diversity of user-origins, with tourists, residents of smaller local urban centres, and of Ottawa-Hull all represented.

The Ottawa-Hull Study Region - Description

Before broadly describing the study area, it is necessary to deal with the recreational characteristics of the section that falls within the province of Quebec. This section is remarkable for its lack of public outdoor recreation development. At least six thousand summer cottages are located in the Quebec sector of the study region, a large proportion of their owners living in Ottawa-Hull (Briere, 1967). Much of the three counties of Gatineau, Papineau, and Labelle, which contain 30 per cent of all Quebec's private hunting and fishing camps, lies within the region. While considerable outdoor recreation participation takes place here, very little of it is provided by public facilities. Some commercial developments open to the public exist. The Lafleche Caverns are well known, for instance. Surprisingly, only one major public park - the National Capital Commission's Gatineau - is found in the Quebec sector. There are no provincial parks or reserves. There is only one large campground outside Gatineau Park. It is a commercial development located near Hull. Summer cottaging is very much the dominant recreational use of the whole Quebec sector. Briere (1967) states that cottaging dominates overnight accommodations in this part of Quebec



Major Roads

▲ Outdoor Recreation Facilities Studied

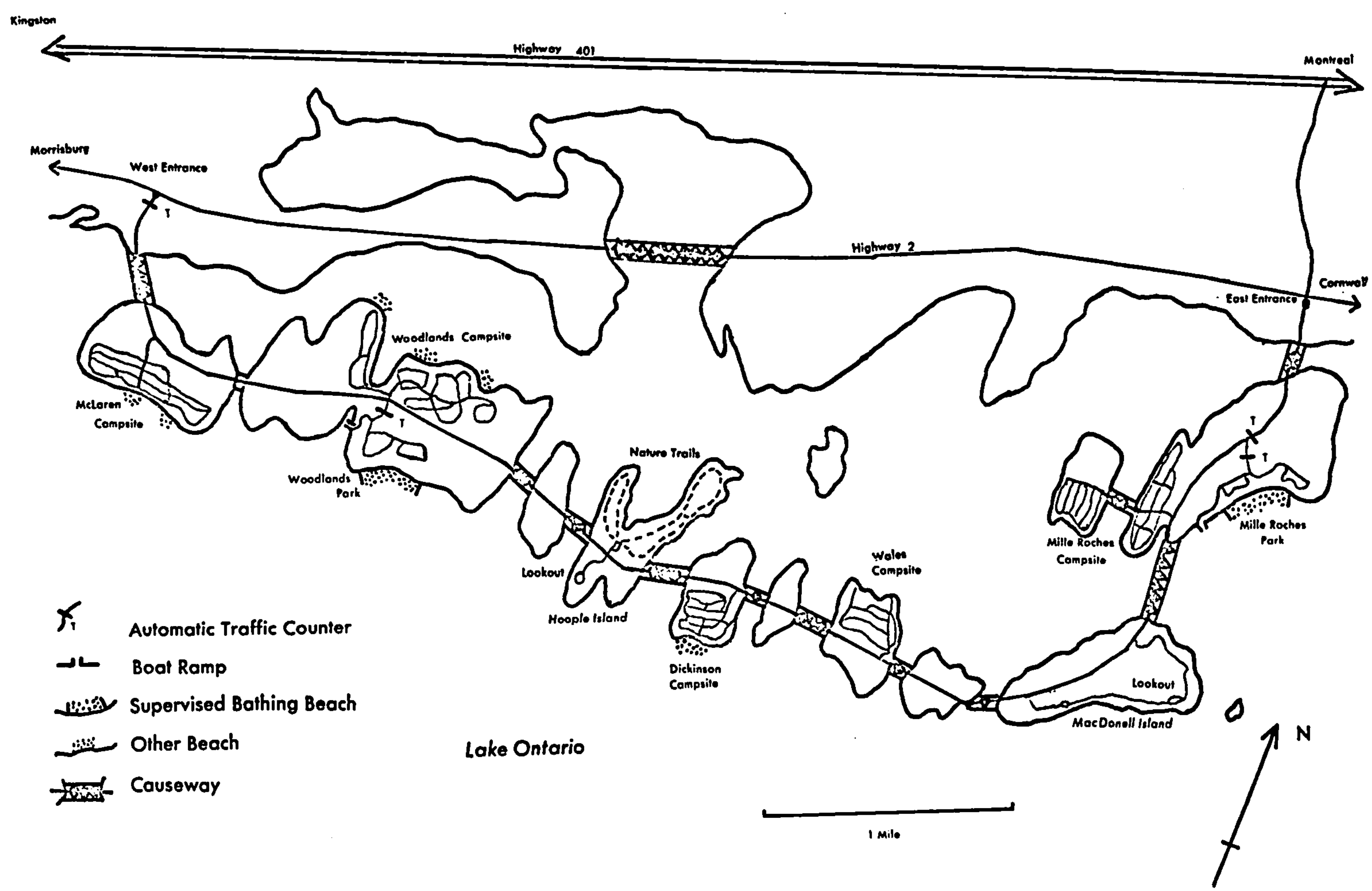
(See Table 2.3)

Source: National Capital Commission

Figure 2.6 City of Ottawa, Outdoor Swimming Facilities to an extent unknown elsewhere in the province. Daily participation data for outdoor recreation in the Quebec portion of the Ottawa-Hull study region are thus very hard to acquire. They would require a special survey which is beyond the scope of this project. With the exception of Gatineau Park, then, there is no choice but to concentrate on the Ontario sector of this study region.

Figure 2.5 shows the location of outdoor recreation facilities studied in the Ottawa-Hull region, together with the meteorological stations used. They are numbered in Table 2.3, which lists their names and the attendance records kept. Figure 2.5 also shows the highway network. In Figures 2.6, 2.7 and 2.8 are shown respectively the location of the City of Ottawa outdoor swimming facilities, details of Long Sault Parkway, and details of Gatineau Park.

The study area covers about 15,000 square miles, or slightly less than three-quarters of the area of the Edmonton region. It contains parts of two important geological provinces: the ancient crystalline rocks of the Canadian Shield and the younger sedimentary cover of southern and southwestern Ontario. The important boundary marking the edge of the Shield is seen in Figure 2.5. The Shield region is renowned for its lakes, forests, and rolling, rocky topography; it rises from heights of 250 feet above sea level to almost 2,000 feet near Algonquin Park. On the other hand, the lowland east of an Arnprior-Brockville line is very flat, with elevations of only 175 to 400 feet above sea level.



Source: St. Lawrence Parks Commission

Figure 2.7 Long Sault Parkway

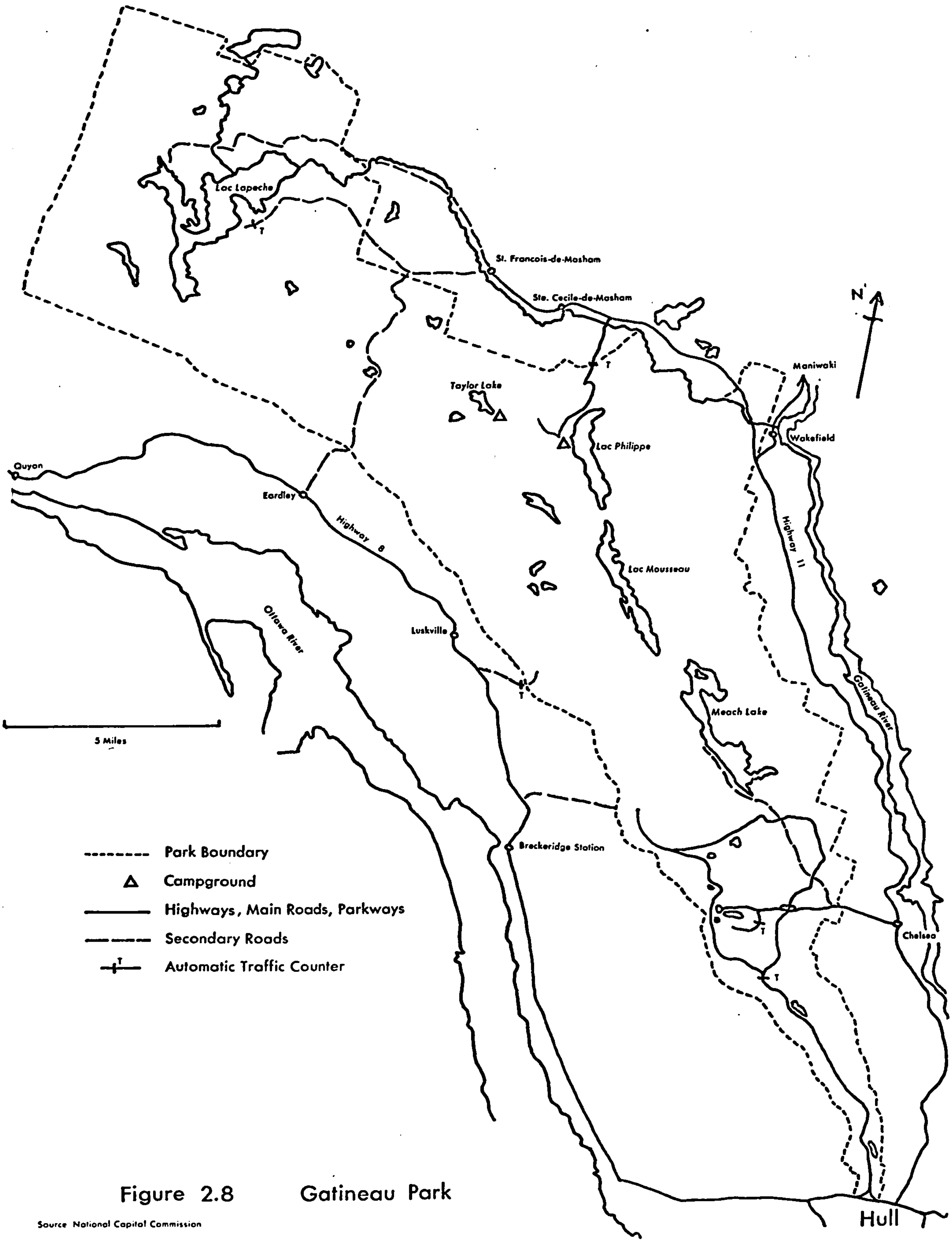


Figure 2.8 Gatineau Park

Source National Capital Commission

TABLE 2.3

FACILITIES STUDIED IN THE OTTAWA-HULL REGION

Name and Numbering System as in Figures 2.5 & 2.6	Type of Facility	Attendance Records
Ontario Provincial Parks:		
1 Fitzroy	Recreational parks	Nos. 1-8 have automatic traffic counters
2 Rideau River		
3 Silver Lake		
4 South Nation	Picnic, camping	
5 Carson Lake	Recreational parks	
6 Bonnechere		
7 Black Lake		
8 Bon Echo		
St.Lawrence Parks:		
9 Old Fort Henry	Historic	Nos. 9 & 13 have daily ticket counts of paid admission
10 Brown's Bay	Recreational parks	
11 Grenville		
12 Crysler Farm	Historic	
13 Upper Canada Village		
14 Morrison and Nairne Islands	Waterfowl Sanctuary	Nos. 10-12, 14,15, 17, 18, have auto. traffic counter records
15 Farran	Recreational parks	
16 Long Sault Parkway*		No. 16 has 4 auto. traffic counters*
17 Charlottenburgh		
18 Glengarry		
Nat. Capital Commission:		
19 Gatineau Park*	Recreational	Five auto. traffic counters*
Rideau Canal Locks:		
20 Ottawa		Nos. 20-25: daily numbers of boats locked through each lock-station
21 Smiths Falls Detached		
22 Newboro		
23 Chaffeys		
24 Jones Falls		
25 Kingston Mills		
City of Ottawa:		
26 Britannia Beach	Swimming beaches	Nos. 26,27,29-32 have lifeguard estimates of swimmers
27 Westboro Beach		
28 New Edinboro Pool	Outdoor pool	No. 28 has a daily ticket count of swimmers
29 Strathcona (Dutchy's)	Swimming beaches	
30 Brantwood Beach		
31 Brewer Park Pool		
32 Mooney's Bay Beach		

* Refer to Figures 2.7 and 2.8 respectively for the traffic counter locations at No. 16, Long Sault Parkway, and No. 19, Gatineau Park.

The region is not highly industrialized. Ottawa-Hull with a metropolitan population of 494,535 in 1966 (Canada, D.B.S., 1968, p. 197) forms by far the largest urban area. Only two other cities, Kingston and Cornwall, have more than 20,000 people each; the Shield area is particularly sparsely settled. However, both Toronto and Montreal are within two hours' drive of the edge of the study region, and might be expected to provide a significant proportion of the area's outdoor recreationists. Besides this, the local summer population is swelled by the ranks of cottage owners and tourists including many from the United States. In 1967, Ontario received well over half the annual total of non-resident vehicles entering Canada from the United States (Ontario, Department of Tourism and Information, 1968, p. 27).

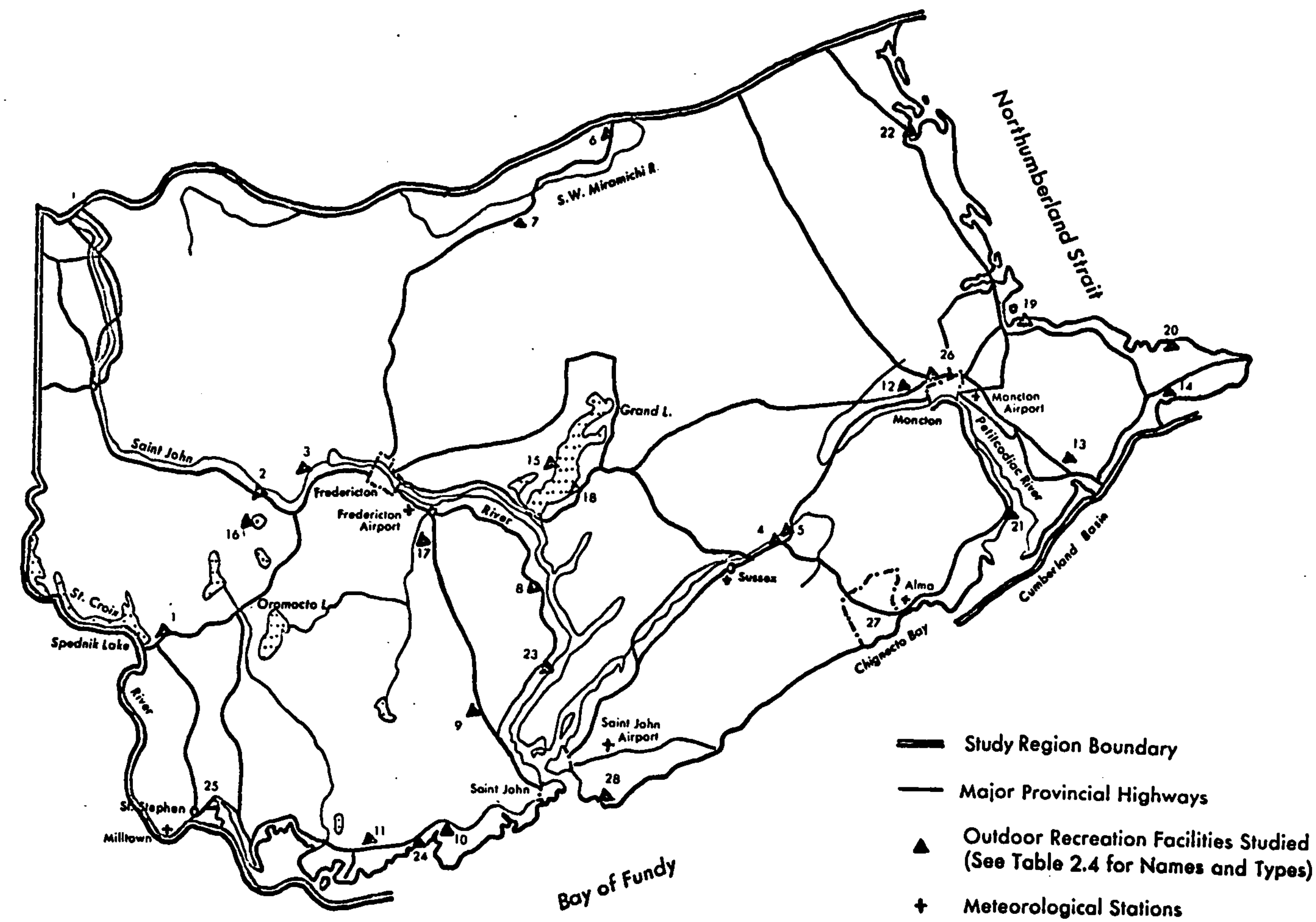
Recreation potentials within this region are numerous and include varied land and water scapes. The area as a whole is well endowed with surface water resources. Particularly well served are the Rideau Lakes - Thousand Islands and Renfrew County - Madawaska Valley regions, which have an abundance of lakes and streams providing for all types of water-based recreation activity. The Rideau Lakes-Thousand Islands area is within easy reach of Kingston, Ottawa, and Brockville, and is traversed by the Rideau Canal system, allowing long boat cruises. Here cottaging (Wolfe, 1966), recreational boating and fishing are important forms of outdoor activity. The lakes and streams of Renfrew County and the Madawaska Valley, Lake Ontario, and the Ottawa and St. Lawrence Rivers form a valuable recreation resource. Even in the east of the study region, which lacks suitable natural water bodies for recreation, the Ontario government has developed a series of water-oriented parks along the St. Lawrence Seaway. These provide local opportunities for swimming, boating, family bathing and associated activities. There is still, however, a shortage of good fishing in the extreme east of Ontario.

Other forms of outdoor recreation are well represented. A large amount of land in this region is not used for agricultural production and provides possibilities for hunting, hiking, wildlife observation, nature study, and rock-collecting. The Shield is most attractive from a scenic point of view. The road network permits easy access to the many scenic areas. The importance of highway use by recreationists in this region has received justifiable attention from the Research Branch of the Ontario Department of Highways (Wolfe, 1966; Boggs and McDaniel, 1968).

The climate of the Ottawa-Hull study region is discussed later in this chapter where comparisons are made of the climatic regimes of all three study regions.

Delimitation of the Southern New Brunswick Study Region

Figure 2.9 shows the southern New Brunswick study region and the boundaries adopted. The urban structure of the region is more complex than those of the other two areas. There are three major cities, Saint John, Moncton and Fredericton. Their combined population is less than half that of either



Source: New Brunswick Highways Map and Atlas of Canada

Figure 2.9 The Southern New Brunswick Study Region the Ottawa-Hull or Edmonton metropolitan areas. In 1966, the Saint John metropolitan area had a population of 101,192; the Moncton urban area (Moncton City, Dieppe, Gunningsville, and Riverview Heights), 55,169; and Fredericton City with Marysville and Nashwaaksis, 31,505 (Canada, D.B.S., 1967, pp. 9-5 - 9-7).

The northern boundary of the day and weekend trip hinterland is based on the 100-mile highway distance from either Moncton, the most northerly of the three cities, or Fredericton, the farthest west. However, it excludes the Newcastle-Chatham district where pressure from local urban dwellers seems likely to result in a "compression" of the Moncton and Fredericton hinterlands, as suggested by Anderson (1962) in the case of London, Ontario. The westward limit of the region is taken as the United States border, although a 100-mile range from either Fredericton or Saint John would include small segments of Maine. To the south, the Bay of Fundy, Chignecto Bay and Cumberland Basin define the margins of the study region, as does the Northumberland Strait coastline in the east. Southeast, the boundary with Nova Scotia forms a convenient, if not altogether realistic limit to the Moncton day and weekend trip zone.

The applicability of the boundaries adopted for the southern New Brunswick study region is hard to gauge. Research on trips made by residents of the three cities is lacking, at least as far as the writer is aware. There seems no reason to doubt the choice of the United States border in the west, and the south and east coasts. In the north the boundary follows the 100-miles road distance from Fredericton for the most part. In the northeast the boundary is drawn so as to exclude an area where use by Newcastle-Chatham recreationists is liable to be dominant. It therefore lies within 100 driving miles of Moncton. This is justifiable, because attractive destinations for day and weekend trips are plentiful closer to Moncton, and include the Grand Lake area, Fundy National Park, and the warm-water bathing beaches of Northumberland Strait. In the southeast, Moncton area residents surely cross into Nova Scotia, only forty miles away, on at least some outings. Most of the outstanding scenery of Nova Scotia, however, is further removed from New Brunswick than the adjacent Cumberland County, which is thus not likely to attract Monctonians in large numbers on day or weekend trips. Placing the Moncton hinterland boundary at the Nova Scotia border, a "convenience" decision, thus does not lead to a major omission of day and weekend trips originating in Moncton.

Provincial parks in New Brunswick are stated in the _Canada Yearbook 1968_ (Canada, D.B.S., 1968, p. 37) to receive 40 per cent of their day-use and 74 per cent of their camper-nights from outside the province. Presumably such figures also apply to the southern New Brunswick study region used in this project. This is a far cry indeed from the figures reported by Parlby (1968) in his study of four Edmonton region lakes. The only specific user survey available within southern New Brunswick at the time of writing is that by Taylor (1965) of Fundy National Park. Day-visitors, mainly New Brunswickers, were numerous only on summer Sundays; during the week, use of the park facilities was chiefly by tourists. Even on Sundays, New Brunswickers made up only half the users of the pool and recreation area. Most day-visitors entered the park via the east entrance at Alma (Taylor, 1965, p. 26). This suggests that Moncton, located 50 miles from Alma, is likely the major origin of day-visitors. Less than 10 per cent of Fundy's camping use in 1964 was recorded by New Brunswickers. Further information on campers in the provincial parks in 1969 was made available to the writer by the New Brunswick Provincial Parks Branch. It is quite apparent from these data again, that tourists are the major users of camping facilities. No concrete information, however, on the flow of tourists into and out of the southern New Brunswick study region is available. The only records systematically collected are of United States vehicles crossing the Maine border into New Brunswick.[7] No information at all is available on the important group of tourists from

[7] _Travel Between Canada, the United States and Other Countries_, published monthly in Ottawa, tabulates "non-resident vehicles other than commercial trucks entering Canada, by province of entry, for a stay of one or more nights". Thus 177,591 non-resident (presumably mostly American) vehicles crossed the United States border into New Brunswick in the May-September period of 1969 (Canada, D.B.S., 1969) for a stay of one or more nights in Canada. Unfortunately, not all the border crossing points are located within the southern New Brunswick study region. Neither are all the vehicles recorded being driven by tourists. Furthermore, there is no knowing how many among the tourists are simply passing through New Brunswick en route to Nova Scotia, Prince Edward Island, or the Gaspe Peninsula.

Ontario and Quebec. Nevertheless, it is evident from the brief review above that a number of facilities receives appreciable use from tourists in the region. The region also differs from the Edmonton study region in that the three source cities have less than one-half of the region's total population. These points suggest that Saint John, Fredericton, and Moncton users are less significant in the total use of the facilities analyzed than are users from Edmonton in the Edmonton study region.

The Southern New Brunswick Study Region - Description

Figure 2.9 shows the outdoor recreation facilities and sites whose attendance data are analyzed here. Highway links are also shown. The numbering system of facilities in Figures 2.9 and 2.10 (facilities within the cities) is as in Table 2.4. This lists names and the attendance records kept for each operation. Figure 2.11 shows details of Fundy National Park. Meteorological stations used in the study are shown in Figure 2.9.

The region covers approximately 15,000 square miles, or nearly 50 per cent of all New Brunswick. In 1966, it had a population of 400,000, or about 65 per cent of the population of the province (Canada, D.B.S., 1967). The topography is rolling and frequently hilly, with a number of large lakes in the southwest. Several very large river estuaries indent the coastline, notably those of the Richibucto, Petitcodiac, Saint John, and St. Croix. Agriculture and settlement are largely restricted to river valleys and lowlands, particularly

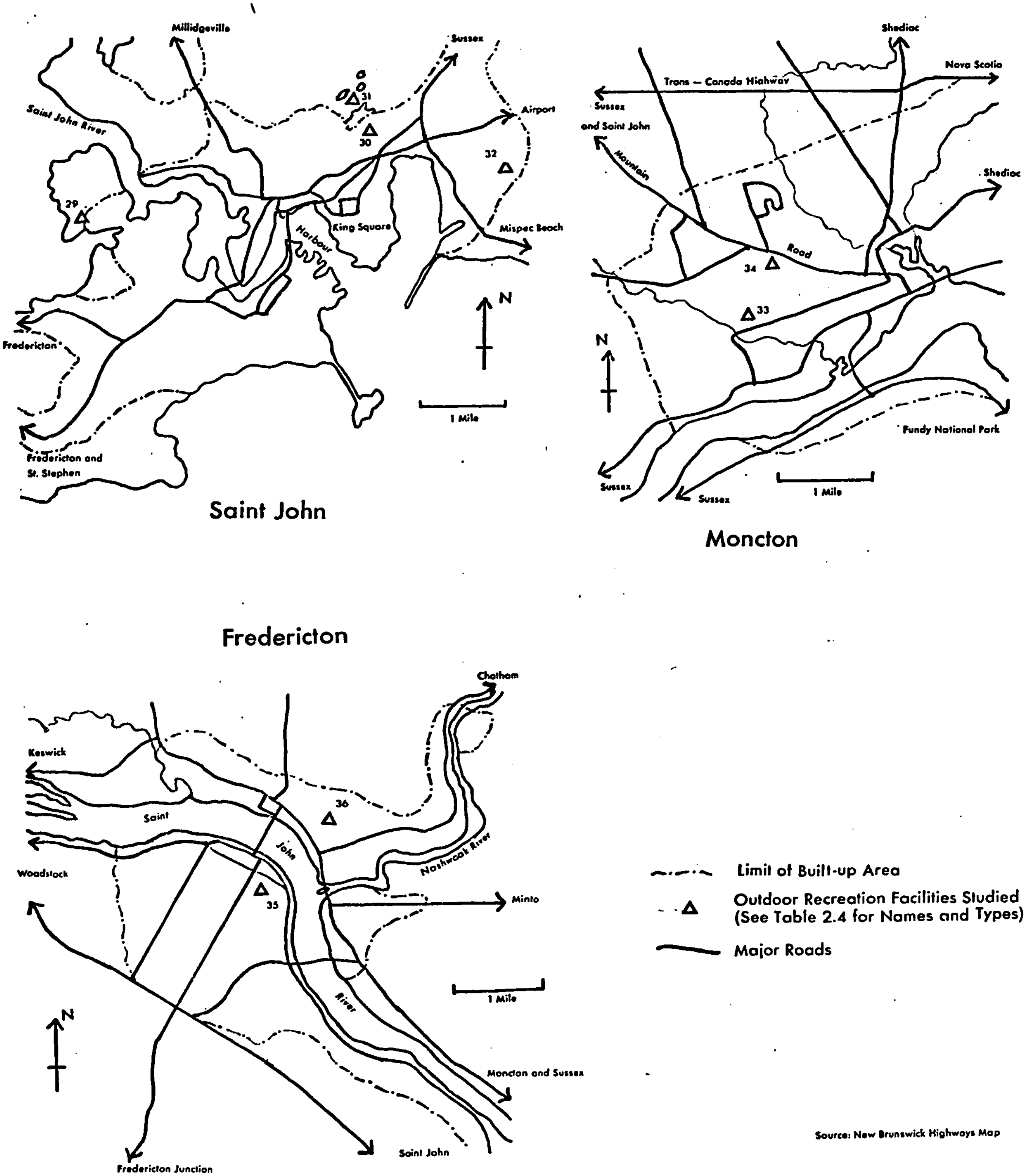


Figure 2.10 Fredericton, Moncton and Saint John Facilities

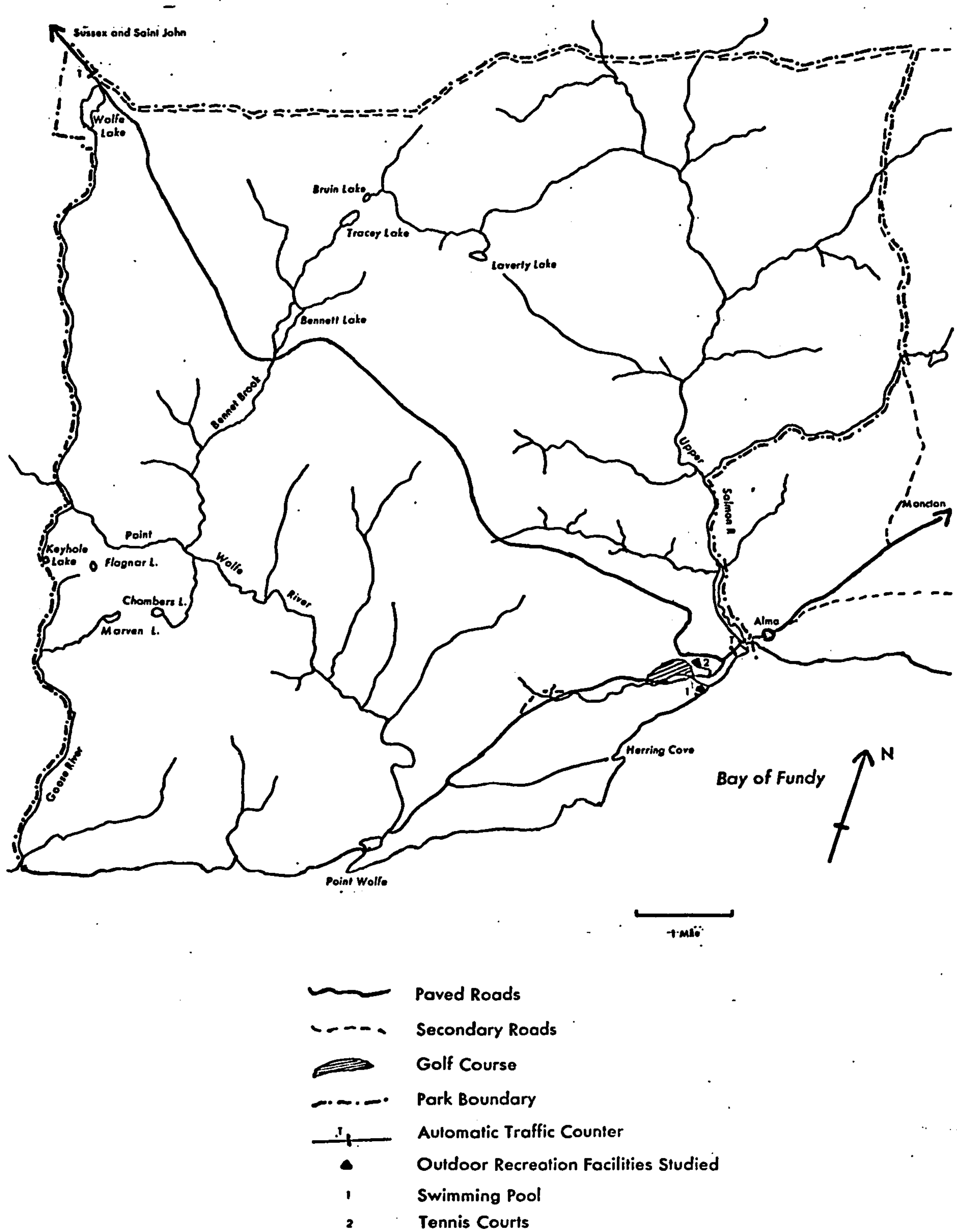


Figure 2.11 Fundy National Park

Source: National Parks Branch

TABLE 2.4

OUTDOOR RECREATION FACILITIES STUDIED IN SOUTHERN NEW BRUNSWICK

Name and Numbering System as in Figures 2.9 and 2.10	Type of Facility	Attendance Records
Provincial Parks:		
1 McAdam	Picnic ground parks	Nos. 1-26 have records of the 1 p.m. car count of all cars on the site, taken by the caretaker at 1 p.m.
2 Prince William		
3 York County Centennial		
4 Penobsquis		
5 Pine Grove		
6 Upper Blackville		
7 Doaktown		
8 Queenstown		
9 Eagle Rock		
10 Lepreau Falls		Nos. 3, 4, 13*, 15-25 have records from automatic traffic counters read daily in the early morning
11 Pennfield		
12 Steeves Mountain	Campground parks	
13 Beech Hill*		
14 Port Elgin		
15 Grand Lake	Recreational parks	
16 Lake George		
17 Sunbury-Oromocto		
18 Lakeside		
19 Parlee Beach		Nos. 15, 19, 22, 25 have lifeguard estimates of swimmers; Nos. 15 and 19 have beach recreation programmes with estimates of participants
20 Murray Beach		
21 The Rocks		
22 Jardine Park		
23 Oak Point		
24 New River Beach		
25 Oak Bay		
26 Magnetic Hill	Wildlife park	
National Park:		
27 Fundy	Multi-activity	Auto. traffic counters; outdoor pool; golf; tennis
City of Saint John:		
28 Mispec	Swimming beaches	Nos. 28-32 have lifeguard estimates of swimmers
29 Dominion Park		
30 Lily Lake		
31 Fisher Lakes		
32 Lakewood Heights		
City of Moncton:		No. 33 has estimated attendance at recreation area
33 Centennial Park	City park & pool	
34 Kiwanis Pool	Outdoor pool	
City of Fredericton:		Nos. 33-36 have ticket counts of swimmers
35 Queen Square	Outdoor swimming pools	
36 Henry Park		

* In 1969 No. 13 operated only as a picnic ground park.

along the Saint John to Moncton axis, the Northumberland Strait coast and the Saint John River valley. Much of the remainder of the area is in forest and scrub.

Opportunities for various forms of outdoor recreation abound. The region is the only one of the three selected for study which includes the sea among its resources for water-based activities. Extensive sandy beaches line the coast of Northumberland Strait, which has relatively warm water for sea-bathing. The Fundy coast is more rugged. There are a number of bathing beaches and the coast also provides cliff scenery, small rocky harbours and coves, and high potential for boating in the island-strewn Passamaquoddy Bay-Campobello Island section of the southwest. Extreme tidal ranges in the upper Bay of Fundy give rise to such well-known phenomena as the Petitcodiac tidal bore and the "Reversing Falls" at the head of Saint John harbour. Inland, water bodies from large lakes to mountain streams support boating, swimming and fishing. The forested areas with their swift-flowing streams and rivers provide opportunities for hiking, primitive camping, hunting, canoeing and nature study. There is also much of historical interest in this Atlantic region. The area in fact draws large numbers of tourists during the summer season, particularly from Ontario, Quebec, and the New England States.

Climates of the Study Regions

For comparative purposes Table 2.5 shows significant features of the climate experienced at three meteorological stations in each of the study areas. It is immediately apparent

TABLE 2.5

COMPARATIVE CLIMATIC STATISTICS FOR THE THREE STUDY REGIONS

Region	Station	Station order	Temperatures (°F) Mean annual	Mean January	Mean July	Mean daily max., June-July-August	Precipitation (inches) Mean annual	Mean total, June-July-Aug.
Edmonton Study Region	Edmonton Industrial Airport	1	37	6	63	71	18.6	9.1
	Lacombe CDA Experimental Farm	2	36	7	63	73	18.4	8.9
	Whitecourt	1	34	5	60	70	20.3	10.1
Ottawa-Hull Study Region	Ottawa International Airport	1	42	13	70	78	33.6	9.1
	Killaloe Airport	1	41	12	66	77	26.5	7.7
	Kingston Ontario Hydro	2	45	18	70	78	35.1	8.7
Southern New Brunswick Region	Fredericton Airport	1	42	16	67	76	43.2	10.5
	Moncton Airport	1	41	18	66	73	41.0	9.6
	Saint John Airport	1	42	20	63	70	53.6	11.3

Source: Climatic Normals (Canada, Department of Transport, 1968a); and Hourly Data Summaries (Canada, Department of Transport, 1967a, 1968b).

TABLE 2.5 (continued)

	Days with measurable precipitation		Mean number of hourly observations, June-July-August with:			Hours with bright sunshine	
	Mean annual	Mean June-July-August total as % of mean annual	Precipitation	Fog	Mean daily rel. humidity in %, June-July-August	Mean annual	Mean June-July-August total as % of mean annual
Edmonton Industrial Airport	121	31.4	226.2	27.9	62	2203	37.9
Lacombe CDA Experimental Farm	101	36.6	-	-	-	2094	38.1
Whitecourt	125	33.5	192.2	93.2	67	-	-
Ottawa Internat'l Airport	152	21.1	163.9	179.2	65	1939*	39.5*
Killaloe Airport	146	20.5	-	-	70	-	-
Kingston Ontario Hydro	133	19.5	-	-	-	2070	39.0
Fredericton Airport	135	25.9	244.5	335.1	70	1861	35.3
Moncton Airport	155	22.6	273.9	279.8	73	1948	34.8
Saint John Airport	156	23.1	328.3	706.2	80	1858	34.3

Source: Climatic Normals (Canada, Department of Transport, 1968a); and Hourly Data Summaries (Canada, Department of Transport, 1967a, 1968b).

*Ottawa CDA Experimental Farm statistics that central Alberta has lower annual mean temperatures than either the Ottawa-Hull area or southern New Brunswick. Continentality results in the Edmonton area winters being markedly colder, though less humid, than those of the other two study regions. In summer, however, the temperatures of New Brunswick's Fundy coast and the Edmonton area are comparable, although interior New Brunswick and the Ottawa-Hull area are several degrees warmer.

On the other hand, sunshine hours present a different picture. Mean annual totals are highest for central Alberta, slightly ahead of Ottawa-Hull, while southern New Brunswick holds third place. The higher latitude of the Edmonton study region results in a higher total of possible sunshine hours in summer than the other two regions. The proportion of the annual total sunshine hours received in the three months of June, July and August is 38 to 39 per cent for both Edmonton and Ottawa-Hull regions,[8] but only 34 to 35 per cent in southern New Brunswick. In terms of both temperatures and sunshine hours, then, summer contrasts less with winter in New Brunswick than in the other two study regions.

Annual precipitation in the Edmonton region is low, but because of continentality, June-July-August amounts are comparable with those of Ottawa-Hull and district, though less than those of southern New Brunswick. Central Alberta winters are very dry, in marked contrast to those of the other two

8 It should be noted that the Edmonton region, with over 100 more sunshine hours per year than the Ottawa-Hull region, thus experiences more sunshine during June, July and August despite the similar percentages quoted.

study regions. In the Ottawa-Hull area, 25 to 30 per cent of total precipitation falls in June, July and August, and in southern New Brunswick, only 20 to 25 per cent. This compares with a figure approaching 50 per cent in central Alberta.

Another parameter, days with measurable precipitation, again shows a somewhat different distribution among the three regions. Such days are equally prevalent during summer in both southern New Brunswick and the Edmonton region, but less frequent in the Ottawa-Hull area. On the other hand, annual totals are lowest in central Alberta, ranging from 101 to 125 days. This compares with 133 to 152 in the Ottawa-Hull region and the highest totals, 135 to 156, in southern New Brunswick. Thus in the Edmonton area, approximately 35 per cent of the days with measurable precipitation fall in June, July and August, compared with 20 per cent in the Ottawa-Hull region and 25 per cent in southern New Brunswick. Both precipitation and days with measurable precipitation are fairly evenly distributed throughout the year in southern New Brunswick, climatically the most equable of the three study areas.

Summer relative humidity is lowest in the Edmonton region. Thus values of human discomfort indices usually remain lower than in the other two areas. Since temperatures are also coolest here (with the exception of the Fundy coast), the mixing ratio or amount of water vapour actually present in the air is considerably lower than in the other two regions. Although southern New Brunswick has the highest summer relative humidities, the mixing ratio is greater in the Ottawa-Hull study region because of higher temperatures. Saint John illustrates the high summer relative humidity along the Fundy coast, a factor which is reflected in the unusual frequency of fog prevalent in this locale.

In summary, the Ottawa-Hull region has both the warmest and driest summers of the three. Southern New Brunswick, however, has the most equable climate on a yearly basis. Summers in its interior are almost as warm as those in the Ottawa-Hull area, while coastal summers are no warmer than those in the Edmonton region. In contrast, central Alberta has very cold winters, but they are characterized both by low snowfall and low humidity. Its cool summers also have a redeeming factor in the long hours of sunshine. The three study regions therefore provide a diversity of climatic situations to which the outdoor recreationist may react. Any regional variations in recreationists' behavioural response to weather conditions, resulting from this diversity, should thus be uncovered in the study.

CHAPTER III

DATA AND METHODOLOGY

Recreation Data

There is notorious lack of uniformity in procedures for collecting attendance records for outdoor recreation in North America. The 1969 records utilized in the present study are no exception. While the U.S. Recreation Advisory Council (1965) has recommended that the *visitor-day* should be adopted as the standard measure of recreation use,[1] reliable measurement in these units is not always possible. This would require information on visitors' length of stay, which is not usually available. In this project, however, non-uniformity in the collection of attendance data from area to area is not a major problem. Emphasis is directed to the degree of day-to-day variation characteristic of the use of each facility, rather than to absolute attendance figures which can be validly compared between areas.

The one major problem is whether or not the data collected are indicative of actual recreation use. In small outdoor recreation sites which are intensively used, and where money changes hands and tickets or permits are issued, quite accurate statements can be made about numbers of visits. But outdoor recreation is a commodity frequently provided by govern-

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[1] The Council defined the *visitor-day*, rather unusually, as "twelve visitor-hours, which may be aggregated continuously, intermittently, or simultaneously by one or more persons. Visitor-days may occur either as recreation visitor-days or as non-recreation visitor-days."

ments free of charge to the consumer. Often no full-time attendant is retained solely for the purpose of collecting user-fees. Attendance records then, even for many heavily-used sites such as campgrounds, lake beaches and picnic areas, are frequently only estimates. Since many such estimates are employed as recreation data in this thesis, discussion of their usefulness is worthwhile. The writer visited all but two of the facilities analyzed in order to familiarize himself with their exact methods of collecting and recording attendance.

Much research on measuring the use made of outdoor recreation areas has been concerned with the area-extensive or "dispersed" types of activity. The larger the land area, probably the greater are the difficulties in obtaining meaningful statistics on its use. Wilderness country in particular has received much attention from researchers. Thorsell (1967), using the approach taken by Wenger (1964) in Washington and Oregon, enumerated back-country users in Waterton Lakes National Park by placing self-registration stations on hiking trails. Measurement techniques for dispersed recreational uses of land in non-wilderness regions, such as goose-watching (Keith, 1961), goose-hunting (Hunt, Bell and Jahn, 1962), and fishing (Thompson and Hutson, 1950; Wollman, 1962), have also been analyzed. Other studies of this type are abundant.

We are mainly concerned with facilities offering area-intensive forms of outdoor recreation. Research on use measurement for such sites is also available. Tombaugh and Love

(1964) compared three methods of estimating number of visitors to National Forest campgrounds in the United States. Schell (1964) estimated use of the Tennessee Valley Authority's Norris Reservoir. James and Ripley (1963) were able to estimate successfully the amounts of fishing, boating, swimming and other uses made of a multi-purpose recreation area. The estimate was based on regression relationships between participation in the various activities and the record of vehicle entries to the area obtained by automatic traffic counters. James and Harper (1965) reported on the use of this technique in the Ocala National Forest of Florida, and it was subsequently modified by James (1966). The method is applicable to such varied sites as picnic grounds, campgrounds and beaches, but unfortunately requires a long period of intensive sampling with which to "calibrate" the regressions. Thus many of the vehicle entry records analyzed for multipurpose recreation areas are indicative only of actual visitation and not of participation in the various activities.

An excellent general summary of the outdoor recreation use measurement problem was prepared by Marcus, Gould and Bury (1961). Their classification of measurement techniques is utilized as the basis for the discussion that follows. They proposed subdivision into <u>direct-counting</u> and <u>indirect-counting</u> systems (Table 3.1). The direct count is broken down into <u>census counts</u> and <u>sample counts</u>, but the only indirect count to concern us is the automatic traffic counter. Table 3.1 categorizes all the counting methods in terms of the Mar-

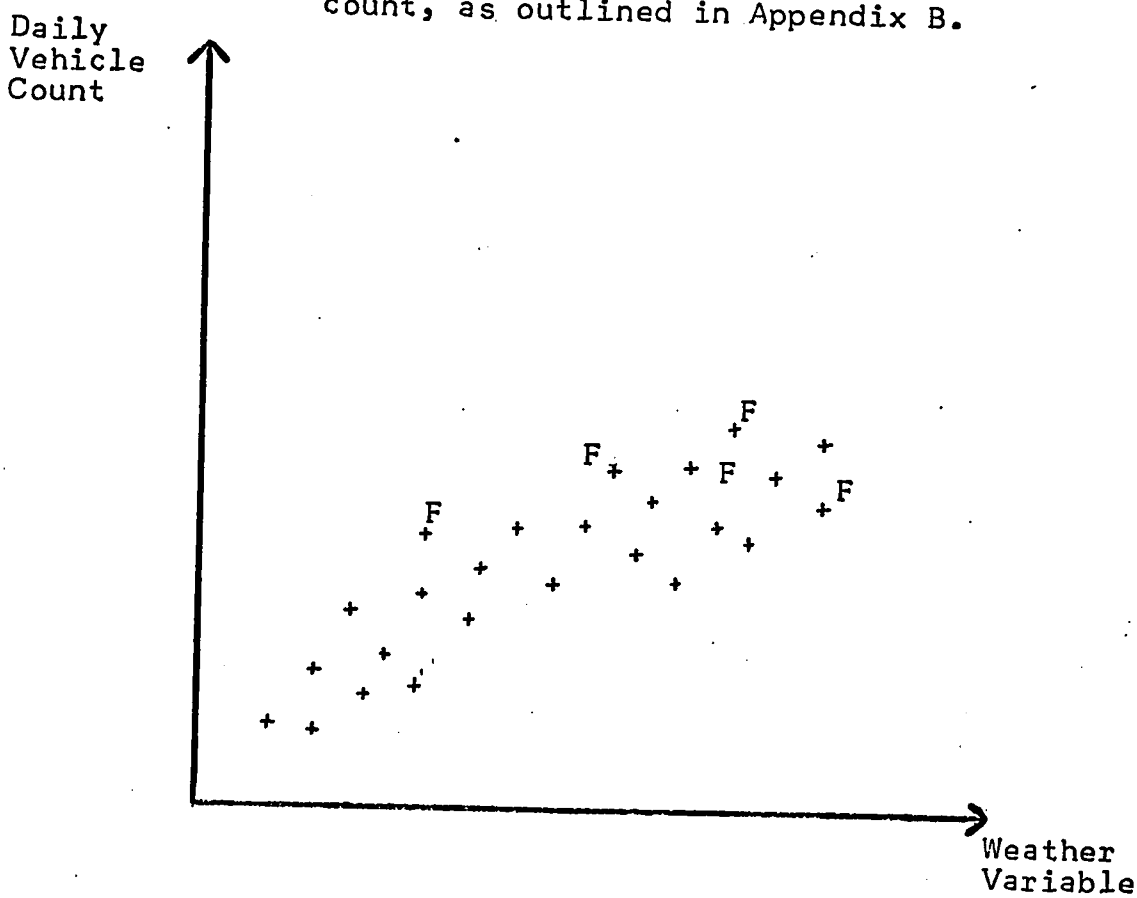
TABLE 3.1

CLASSIFICATION OF PROJECT RECREATION USE DATA IN TERMS OF THE MARCUS, GOULD AND BURY SYSTEM

Category and Count Type	Assessed Dependability	Units
DIRECT-COUNTING SYSTEMS		
i) Census Counts		
Ticket issues, e.g. for golf course, swimming pool	Very high	Number of persons using facility
Lock passages on the Rideau Canal	Double-count may occur	Lockages
Lifeguard estimates of swimmers	Medium to high	Swims taken, not no. of swimmers
New Brunswick Provincial Parks, recreational programmes	High	Number of persons participating
ii) Sample Counts		
New Brunswick Provincial Parks, 1 p.m. car counts	Poor for indicating total daily use	Cars
Peak daily use count, Britannia Beach, Ottawa	Medium	Swimmers
Peak use count converted to total daily use, Moncton	Medium	Users of recreation sectors of park
INDIRECT-COUNTING SYSTEMS		
Automatic traffic counters	Low to medium, though careful modification at particular localities may yield figures useful for comparing day-use with medium to high reliability	Vehicle passages

Source: Survey of administrative agencies by author, 1969.

A much higher percentage of vehicles entering the park on Fridays belongs to parties who will be camping, and arrive in the evening. Therefore, if the vehicle count is to be representative of day-use, the vehicles carrying campers must be eliminated from the count, as outlined in Appendix B.



F - Friday vehicle counts

Figure 3.1

THE APPARENT FRIDAY DAY-USE PEAK AT MULTI-ACTIVITY PARKS WITH CAMPGROUNDS cus, Gould and Bury system, and gives the writer's assessment of their dependability. This assessment is based on the 1969 survey of administrative agencies, and on the writer's experience of visits to the outdoor recreation facilities studied.

The census count is a method of directly counting all the use of an area. In some instances, census counts, such as those involving issue of tickets or camping permits, are extremely accurate. However, some of the census counts specified in Table 3.1 are less accurate. Consider for instance the estimates made by lifeguards of numbers of swimmers. Where there is a very high peak volume of visits and a rapid turn-over rate, such counts may be unmanageable. In this situation the census may be reasonably accurate up to a count of a few hundred swimmers per day, but will decrease in dependability as this level is surpassed. A census count of this type also has a tendency to "double-count". While such a count is an attempt at recording all persons swimming, in fact it tends instead to count "swims" or "user-occasions" (the latter, a term used by Doherty, 1967).

The sample count technique is employed where a census is not feasible. One example is the 1 p.m. car count in New Brunswick Provincial Parks, where all cars present on the site at this hour are noted. Unfortunately the ratio of the 1 p.m. car count to the daily automatic traffic counter record, where available, appears to fluctuate irregularly. The 1 p.m. car count is thus analyzed in this thesis only when no other data are available; this situation occurs in a few of the New Brunswick picnic ground parks.

Other sample counts are taken at times of known peak use. They may be recorded simply as "daily peak use" figures, as in the case of Britannia swimming beach in Ottawa, or multiplied by a conversion factor (Anon, 1962) to give an estimate of total daily attendance. This method essentially eliminates the problem of double-counting which plagues the census count system at a very heavily-used but unregulated area. In such instances it may well provide for more accurate day-to-day comparisons than an unreliable census count. This conversion technique is used for data collection in the City of Moncton Centennial Park recreation area.

Only one example of an indirect-counting system, the automatic vehicle counter, is found among the data of Table 3.1. However, data from these instruments comprise a large portion of the total recreation use data. The precepts of this mode of estimating attendance are fundamentally different from those of the direct-counting methods. The automatic vehicle (or traffic) counter will thus be explained in some detail at this point.

All traffic counter records used in this thesis are derived from the common pneumatic instrument which records the impulse of each axle of any vehicle to pass it. The counting mechanism is a simple cumulative recorder which must be read by an observer at specified times. At most parks the counter is read daily in the early morning, with the increase of the cumulative count over the previous reading being taken as equal to the number of vehicles passing the instrument on the previous day. If carefully located, properly installed and correctly operated, the machine performs a true census count function by counting the passage of every axle. One inherent problem still remains, however, when interpreting traffic counter records for multiple-purpose recreation areas which include campgrounds. If the data are to be used for examining variations in day-use of the area, an adjustment must be made as outlined below. The percentage of cars that are double-counted, or pull boat-trailers, will not vary in a systematic fashion from day to day at any one park, and thus can be neglected in our study of daily attendance variations. However, the percentage of cars belonging to parties who will camp for the night at the park very definitely does differ from day to day (Figure 3.1). This factor should be allowed for, by the technique devised by the writer and outlined in Appendix B. Those vehicles whose occupants are camping are thereby eliminated from the record, leaving the count indicative of vehicles visiting the park solely for day-use. Traffic counter records modified in this way are henceforth referred to as "adjusted traffic counter data".

In a few instances, vehicle counter information is indicative of participation in specific outdoor recreation activities, rather than being considered only as showing attendance at a site or area. An obvious example is the small picnic ground which has no other attractions for visitors. Traffic counter records will present a picture of how picnicking use of this particular site fluctuates from day to day. It should be kept in mind that they do not represent total attendance figures, but can be used to analyze percentage variations of the intensity of use received from day to day.

Naturally, the exact units in which an attendance or use count is recorded vary tremendously. The recommendation of the U.S. Recreation Advisory Council, that the use of outdoor recreation areas should be recorded in visitor-days, was mentioned earlier. A really accurate measure of this type involves obtaining not only the number of users but also the length of time they stay, in the same way that a parking lot charges its customers. In the case of the recreation area, what is usually recorded may be a boat, a car, or the number of tents and trailers in a campground at a certain time such as 11 p.m. The recreationist himself is only sometimes counted directly. While it may be desirable for inter-facility comparisons of use to have statistics in visitor-days, conversion of counts into such units involves making assumptions about length of stay, number of persons in a car, and so on. The accuracy of the original counts is diminished in this process. Since there is no need in this study for uniformity in units of attendance from park to park, no harm is done by the variety of units of measurement present in the recreation data displayed in Table 3.1.

Weather Records

It is presupposed that there are three sets of weather circumstances the recreationist may be reacting to. These are a) on-site weather, b) conditions at the user's starting point or origin, usually his home or temporary lodging, and c) the weather forecast. This study concentrates on the first two sets of weather circumstances, or on actual weather. The forecast is obviously important in framing the recreationist's expectation of weather, but it is not easy to study its effect on facility use. The effectiveness of communicating the forecast to the public, and their reaction to it are largely unknown factors (Maunder, 1970, p. 278). Furthermore, if the weather forecast is correct, then actual weather is identical to forecast conditions. It would thus be very difficult to ascertain whether recreationists react to the forecast or the actual weather.

The forms of outdoor recreation studied are generally those with short "participation periods" such as swimming, boating, picnicking and pleasure driving. Actual weather at the recreation site or at the user's origin is likely most important in these activities. The forecast is probably a larger factor in the decision to take a weekend trip. Many of these questions should be answered in a study being conducted at Michigan State University, which is examining in depth the relationship between the forecast and recreation activity participation.[2] This may provide valuable information

[2] Pers. comm., D.M. Crapo, Department of Park and Recreation Resources, Michigan State University, East Lansing, April 28, 1970.

complementary to the findings of the present thesis.

Questions arise as to which weather elements or combinations of weather elements should be related to recreation use figures and at which times of the day the elements should be measured. Ignorance of the answers to these questions, particularly the first, led to the decision to work with all recorded elements which might influence attendance at outdoor recreation facilities. This effectively restricts us to temperature, precipitation, wind, humidity, and sunshine. Many climatological stations record only maximum and minimum temperatures and daily precipitation totals, thus reducing the choice of which elements to consider.

First-order weather stations leave a choice of observations of several parameters taken at various times of the day. If temperature is studied first, we may establish that the daily maximum usually occurs in the afternoon when much outdoor recreation is taking place. As a reading taken at all Canadian weather observing stations and one which, on *a priori* grounds, is presumed to be significant to outdoor recreation use, daily maximum temperature is used throughout the project as the single temperature parameter.

Precipitation is measured in six-hour intervals at many first-order meteorological stations. Precipitation during any one six-hour period frequently does not correlate well with that of another six-hour period on the same day. Thus besides daily total precipitation, one other measure is tested as an independent variable in the relationship between outdoor recreation use and weather. This measure is the precipitation recorded in the six-hour period most closely approximating the afternoon period, when most outdoor recreation is expected to take place locally. The Canadian Meteorological Branch standardizes all precipitation observations throughout Canada at 1200, 1800, 0000, and 0600 hours GMT. It is unfortunate therefore that in the three study regions, which are all located in different time zones, standardization by local time is not possible. Thus the second precipitation measure is the total recorded between 0900 and 1500 hours ADT in southern New Brunswick, but between 1400 and 2000 hours EDT for the Ottawa-Hull region, and 1100 and 1700 hours MST for the Edmonton region. Other choices could have been made for this second precipitation measure, or more parameters could have been added, but the problem of non-standardization would still have existed. Consequently, in view of the resources of the project and the assumed significance of the mid-day six-hour period, no further selections were made.

Humidity, like daily maxima and minima of temperature and six-hourly precipitation amounts, is recorded on Meteorological Branch no. 4 punched cards for first-order climatological stations. The humidity parameter used is relative humidity (in per cent); maximum and minimum values for the day are recorded. From these two readings a mean value of daily relative humidity is computed for use in this project.

Hourly windspeeds at certain Canadian stations are also recorded on punched cards. Due to time limitations imposed on this project, it was decided to work with only one wind-speed parameter. This is the wind mileage summed for the ten-hour period from 0900 to 1900 hours local time. The period 0900 to 1900 hours covers the time of day when summer recreationists are most active in the outdoors, with the possible exception of campers. It thus seems a suitable variable for initial investigation.[3]

Very few observing stations report hours with bright sunshine. However, for the facilities where sunshine records are applicable, hours of sunshine experienced per day, and during the period 1100-1700 hours local time, are correlated with recreation use.

Some weather elements may be more important to a given form of outdoor recreation than others. Identification of their relative importance to particular activities is one aim of this project. The recreationist himself surely reacts to a total weather situation or to a combination of single weather elements existing at a given time. Two "comfort indices" (Appendix C) are chosen for correlation with recreation use. These indices combine two or more elements into a single numerical parameter representing the (dis)comfort sensation felt by the human body.

Thom's Discomfort Index (TDI) unites temperature and humidity. A mid-afternoon TDI is calculated from maximum temperature and minimum relative humidity (Appendix C).

[3] Comments similar to those made concerning selection of the second precipitation variable could also be made here regarding the windspeed parameter chosen.

Originally in this study, it had been planned to utilize a late-morning TDI as well, but time limitations unfortunately prevented this.

Sensible temperature, the sensation of heat recorded by the human body (Miller, 1965, p. 12), depends on conditions other than temperature. The most important of these are windspeed and humidity. One index of sensible temperature is Effective Temperature or ET (Appendix C). This is the temperature of calm saturated air which would produce the same sensation in the human body as the existing atmospheric conditions. A mid-afternoon value was computed for use in this study from daily maximum temperature, daily minimum relative humidity and 1500 hours local time windspeed.

Methodology of Analysis

It was stated earlier that two sets of weather circumstances, on-site and user-origin weather, would receive consideration in this analysis. The fact is that on-site weather was not observed directly. Hence, reliance is placed upon records from official stations of the Meteorological Branch. Actual on-site weather may be different from that experienced at the observing post a few miles away, both in terms of local microclimate and the extent of precipitation areas. There is little that can be done in this study to overcome the problem, but it can certainly be reduced by avoiding the extrapolation of values of weather parameters such as precipitation totals over great distances.

Outdoor recreation areas within or close to the central cities of each study region are related to the weather records of the first-order meteorological station of each city. Here on-site and user-origin atmospheric conditions are generally almost identical. Day-use from these cities is also usually dominant at facilities within about 50 miles of each major urban centre. Thus attendance records at parks within this range may be correlated with source city weather. Beyond 50 miles, users are less likely to be those taking day trips, though recreationists on weekend trips from each major urban centre may still make up the largest component of visitors to a facility. On-site weather at these facilities seems liable to be as significant as source city conditions. Thus those weather readings which may be usefully extrapolated from the closest meteorological station are related to the attendance and participation data. Appendix D gives details of the analyses performed with the data, showing the links between the attendance records and the weather observations to which they are related.

For each facility, the computer was programmed to plot scattergrams of daily attendance (Y) against the corresponding value of a single weather variable (X) (Figure 3.2). In order to eliminate much of the attendance variation resulting from day of the week, the 124 days in the period May 15 to September 15, 1969 were classified into three categories: Sundays and Statutory Holidays,[4] Saturdays, and weekdays. Preliminary analysis in 1968 of data from the Edmonton area

[4]The Statutory Holidays are Monday, May 19; Tuesday, July 1; Monday, August 4; and Monday, September 1, 1969.

Figure 3.2

COMPUTER PLOT AND PRINT-OUT FOR ONE FACILITY, ONE DAY-GROUPING AND ONE WEATHER VARIABLE

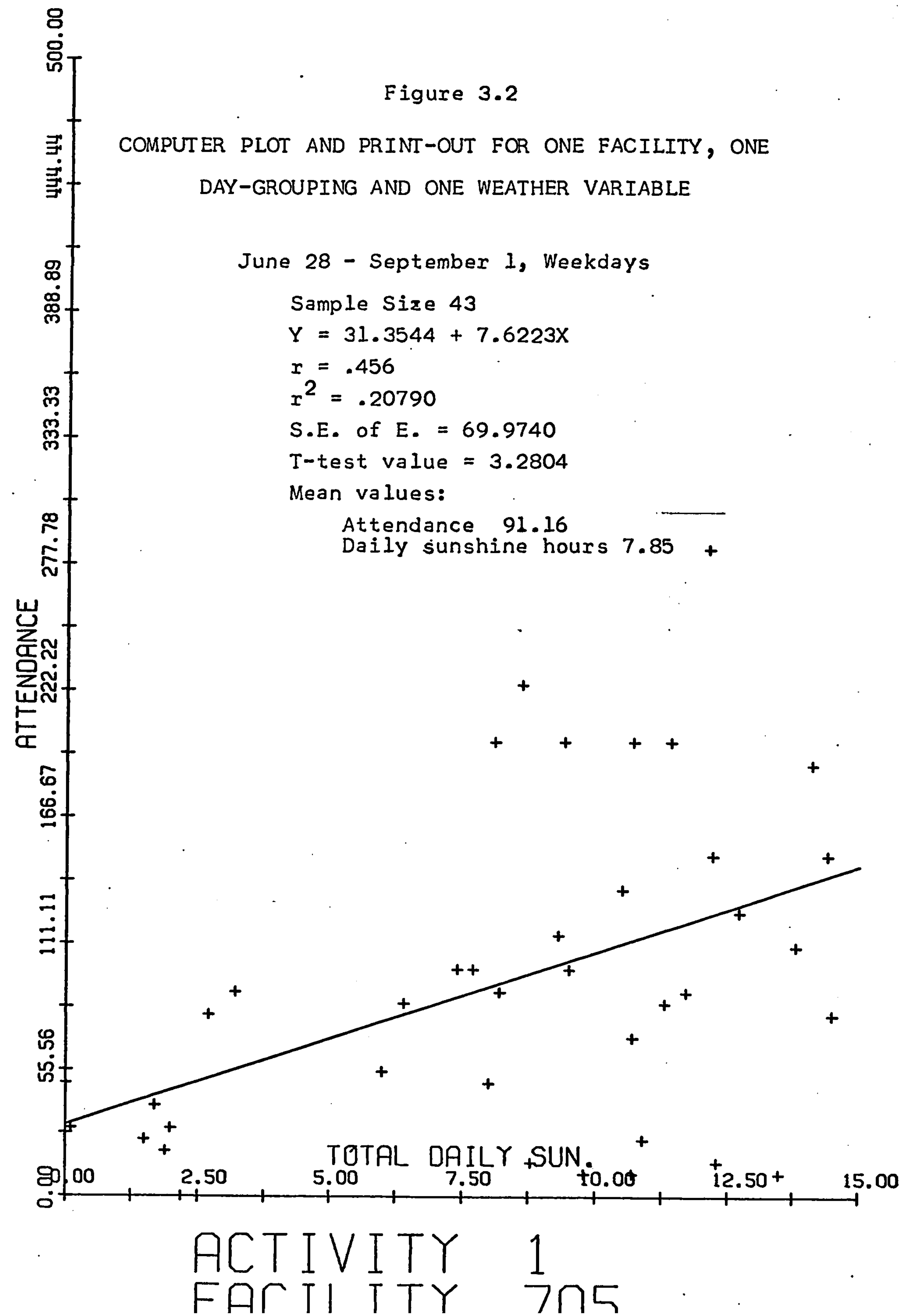


TABLE 3.2

THE SIX DAY-GROUPINGS OF THE 1969 SUMMER

Day-Grouping Number	Number of Days	Day	Period
(i)	13	Sundays and Statutory Holidays	June 28 - September 1
(ii)	10	Saturdays	June 28 - September 1
(iii)	43	Weekdays	June 28 - September 1
(iv)	9	Sundays and Statutory Holidays	May 15-June 27 and September 2-15
(v)	8	Saturdays	May 15-June 27 and September 2-15
(vi)	41	Weekdays	May 15-June 27 and September 2-15
Total days	124		

showed that there is also considerable attendance variation between the school vacation period and the remainder of the summer. Accordingly, the summer was divided into (i) the school vacation period, or "peak season", June 28-September 1, 1969, inclusive,and (ii) the "off-peak period", May 15-June 27 and September 2-15, 1969. Consequently the 124 days are subdivided into six "day-groupings" (Table 3.2). When daily attendance data for an outdoor recreation facility are separated into these six day-groupings, variations due to weather should be more easily identified.

If a facility has complete records for the whole summer, and if the effects of a single weather variable on attendance are to be studied, then six plots are produced by the computer, one for each day-grouping,as in Figure 3.2. In each case a set of attendance data is paired with a set of weather data, or, in the terminology adopted in this thesis, one "analysis" has been performed. A minimum of seven days within a grouping must have attendance data; otherwise the sample is regarded as too small, and no analysis is made. Thus if a facility has incomplete attendance data, perhaps because it was closed for part of the summer, it may not be possible to perform an analysis for each day-grouping. In fact, quite frequently only three or four analyses, instead of the possible six, can be made for one weather variable at one facility. Similar data plots are made for each of the weather variables.

One conclusion here is inescapable. The data collected do not provide an adequate basis for rigorous statistical analysis. Thus the primary output from the computer is simply a plot (scattergram) of attendance (Y) at each facility against a single weather variable (X). A multiple regression approach, with facility attendance as the dependent variable, cannot be taken because the weather variables selected for analysis are not entirely independent of one another. For instance, relative humidity is a function of temperature as well as of the water vapour content of the air. Thus we may only study weather variables and their effects on attendance one at a time.

Because this is an exploratory study, and because only a straightforward two-variable approach is taken, it was decided simply to test each analysis for linearity. Thus linear regressions ($Y = a + bX$) were calculated and plotted on the scattergrams for each analysis performed. This permits visual perception of the applicability of the straight-line relationship. A run-test on the deviations from this line then provides a statistical measure of the validity of linearity in the relationship (Crow, Davis, and Maxfield, 1960). If linearity is rejected, the scattergram indicates the kind of curve-form which should be proposed.

For each analysis, linear correlation (r) and determination coefficients (r^2), mean values, standard error of estimate and t-value are computed. Figure 3.2 shows both the computer plot and print-out for one analysis. If linearity in the relationship is not rejected, these statistics allow a more meaningful quantitative description of the association between X and Y. The t-test rates the significance of the regression coefficient (b) in the equation $Y = a + bX$ by testing the hypothesis that b is significantly different from zero, or that Y is related to X. The 95 per cent significance level is adopted as the criterion for statistical significance throughout the thesis. The determination coefficient (r^2) estimates the amount of variance in Y which is accounted for by variations in X.

Even the basic statistical methods outlined above cannot be applied validly to all the analyses performed here. One example occurs when precipitation amount is the weather variable. Precipitation amount is a discrete variable, and its value in any short period of time is often zero. A frequency distribution of precipitation totals is not normally distributed about an average value, as the daily temperature maximum for a number of days tends to be. Because of this distribution characteristic, it is not valid to perform significance tests on linear correlations and regressions. The linear regression may be calculated, but discussion must be confined to the sign of the regression coefficient (b). Investigations of precipitation influences are thus exploratory and based largely on visual inspection of the plotted scattergrams and regression lines.

Similar problems with t arise when there are few observations, as in day-groupings (i), (ii), (iv) and (v), where the maximum numbers of days possible range from eight to thirteen. Observations are so few that it is often difficult to ascertain whether they are normally distributed. Because of the small numbers of observations, other statistical methods are also difficult to apply. It is impractical, for example, to arrange our data in cellular matrix form and perform a chi-square or Spearman rank test, because of the number of empty cells. Simple linear regression thus seems to be the most applicable technique, in view of the difficulties presented by the project data. Thus the initial computer plots must be regarded as basic information and therefore be consulted in all cases.

Another important problem is that the relationships identified need not truly reflect the effect of the weather variable being analyzed. As previously stated, the weather variables selected for study are not completely independent of one another. Thus a negative correlation between attendance and relative humidity may result from a temperature influence on attendance, since relative humidity is an inverse function of temperature.

Despite problems in applying statistical techniques to some of the data, the several thousand plots provided considerable information on the weather-participation relationship. Careful and judicious interpretation of each scattergram allows derivation of the limiting values of weather parameters for various activities. Identifying these limitations is the second major aim of the project. This identification is unaffected by the difficulties associated with the statistical analyses. Study of the relationships between weather and use of outdoor recreation facilities must be made with these difficulties firmly in mind.

Interpretation of the data plots must indeed be "careful and judicious". Day of the week and not weather may, in some cases, for instance the closing of stores, be responsible for high use of a particular facility. Even with the day-groupings used in the project, factors other than weather are still evident in attendance variations within each of the groupings. All that has been done in interpreting the scattergrams is to bear these factors in mind and be wary of suggesting weather as the sole cause of attendance variations unless there is undeniable evidence to support the conclusions.

Some of the non-weather factors influencing the use made of recreation facilities are illustrated by the questions asked below. The institutional framework of our society, and the very personal human decisions made regarding outdoor recreation are not the least of these.

1. What is the effect on response to weather of visitations recorded by automatic traffic counters at two entrances to a park, where 70 per cent of Gate A's traffic is recreational compared with 95 per cent through Gate B?

2. Will recreation use in the early summer be greater or smaller than on a midsummer day with similar weather?

3. What is the effect of department store closing on a certain weekday or half-day in a city on attendance at nearby recreation facilities?

4. Does recreation participation in early September depend on whether the summer (or perhaps the previous month) has been a "good" one in terms of weather for outdoor recreation?

5. Does the fact that an area is a significant importer or exporter of tourists in July and August need to be considered?

Question 1 indicates the care needed in interpreting use measurements. Gate B's total traffic is liable to have a higher correlation with weather than Gate A's, even though the recreational traffic through both gates may bear exactly the same relationship to weather. Questions 2 to 5 suggest possible results of fluctuations during the summer in the effective market population for outdoor recreation. Department store closing increases this population on a particular day of the week. Questions 2 and 4 indicate that choice of activity may not simply be a function of weather on a given day.

Question 5 introduces an important topic worthy of further consideration. A net outflow of tourists from a region in July and August temporarily reduces the local population and therefore the demand for outdoor recreation. Even if the outflow is balanced by an equal inflow, the tourist's preferences for outdoor recreation may differ from those of the local resident. This again may result in a change in the local demand pattern. On the other hand, a visitor to an area experiences the same weather conditions as the residents. Some of the problems in assessing tourist flows have already been discussed in Chapter II. Special surveys are needed. Unless they are specifically designed for the problem at hand, however, even these surveys often fail to provide the exact information required. This was the case with two such surveys (Kates, Peat, Marwick and Co., 1967; British Columbia, 1963) consulted in an attempt to estimate tourist inflows and outflows in the Edmonton study region. It appears that at least in the mid 1960s, the two flows were of comparable magnitude. Efforts to locate similar material for the other two study regions proved fruitless. Moreover, the same problems as in the Edmonton region would probably have been encountered. This tourist question has relevance to our study, and must be borne in mind when drawing conclusions about the weather responses of outdoor recreationists.

While weather is undeniably an important factor in daily attendance at outdoor recreation areas, it must not be overstressed at the expense of other factors. People's time is not free so that they can wait for "ideal" weather before partaking of outdoor recreation. They are governed by social customs and institutions which leave only certain periods of time available to them to spend in leisure pursuits. Obvious instances are their hours of work and school holidays. And in their leisure time, they may or may not choose to be out of doors. Their perception of the weather, particularly the situation at the proposed destination, and of future short-term changes, is less than perfect. Furthermore, the attractiveness of a recreation facility may vary from day to day in response to its management, for instance the scheduling of special events. There is unlikely ever to be a 100 per cent correlation between weather and attendance at outdoor recreation facilities. Frequently there arises a case where weather alone cannot explain daily fluctuations in attendance; only examination of other factors can provide the solution.

CHAPTER IV

SWIMMING

"Swimming" is here classified as an activity involving entry into the water. For this reason beach attendance records alone are not indicative of swimmer numbers. Swimming records must be obtained by direct observation; Tables 2.2-2.4 supply information on the methods of observation employed. Swimming statistics are analyzed from twenty-seven facilities. Six of these are located in Alberta - the five Edmonton outdoor heated pools plus Sandy Beach at Elk Island National Park; seven in the Ottawa-Hull study region; and the remaining fourteen in southern New Brunswick. The Ottawa-Hull facilities, all within Ottawa itself, include five beaches on the Ottawa and Rideau Rivers, and the unheated pools in Brewer Park and at New Edinboro. The New Brunswick facilities comprise a greater diversity of swimming places. Fredericton and Moncton each have two heated outdoor pools, and a similar facility is located within Fundy National Park. Saint John has three lake beaches, plus Dominion Park Beach on the Saint John River, and Mispec Beach seven miles southeast of the city on the Bay of Fundy. The other four swimming areas studied are all in provincial parks: Oak Bay and Jardine Park beaches are on river estuaries, Parlee Beach is on the sea near Shediac, and Grand Lake is a large freshwater lake 30 miles east of Fredericton.

Maximum Temperature

Attendance at outdoor swimming areas is strongly related to daily maximum temperature. This seems true regardless of the type of water body involved.[1] Table 4.1 shows the frequency distribution of significance levels attained by the linear regression coefficient (b) in all the swimming-maximum temperature analyses performed.[2] Out of a total of 100, eighty have positive values significant at the 5 per cent level, indicating only one chance in twenty that maximum temperature and swimmer numbers are unrelated. Only one of the values not attaining statistical significance actually has a negative sign.[3] The general conclusion must be that use of outdoor swimming facilities varies directly with daily maximum temperature.

The actual nature of the relationship seems to vary from facility to facility. In the majority of analyses no evidence exists that linearity should be rejected. In some instances, however, there is evidence from the run-test for a non-linear function. An exponential curve seems common to most of the

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[1] A heated artificial pool here signifies a pool with water maintained at a temperature of around 74°F. It does not therefore apply to hot springs pools, which comprise a very special type of swimming pool. The writer did in fact analyze the daily attendances at Miette Hot Springs Pool, Jasper National Park, for the summer of 1969, and found that there was no particular relationship between them and the daily maximum temperature recorded at Jasper.

[2] The reader is reminded that one "analysis" is performed for each day-grouping at each facility, and that at least seven days in the grouping must have attendance data; otherwise no analysis is made.

[3] Day-grouping (i) at Borden Park Pool, Edmonton. This particular facility is an exception to the rule so often that the writer has some doubts about the accuracy of its attendance records.

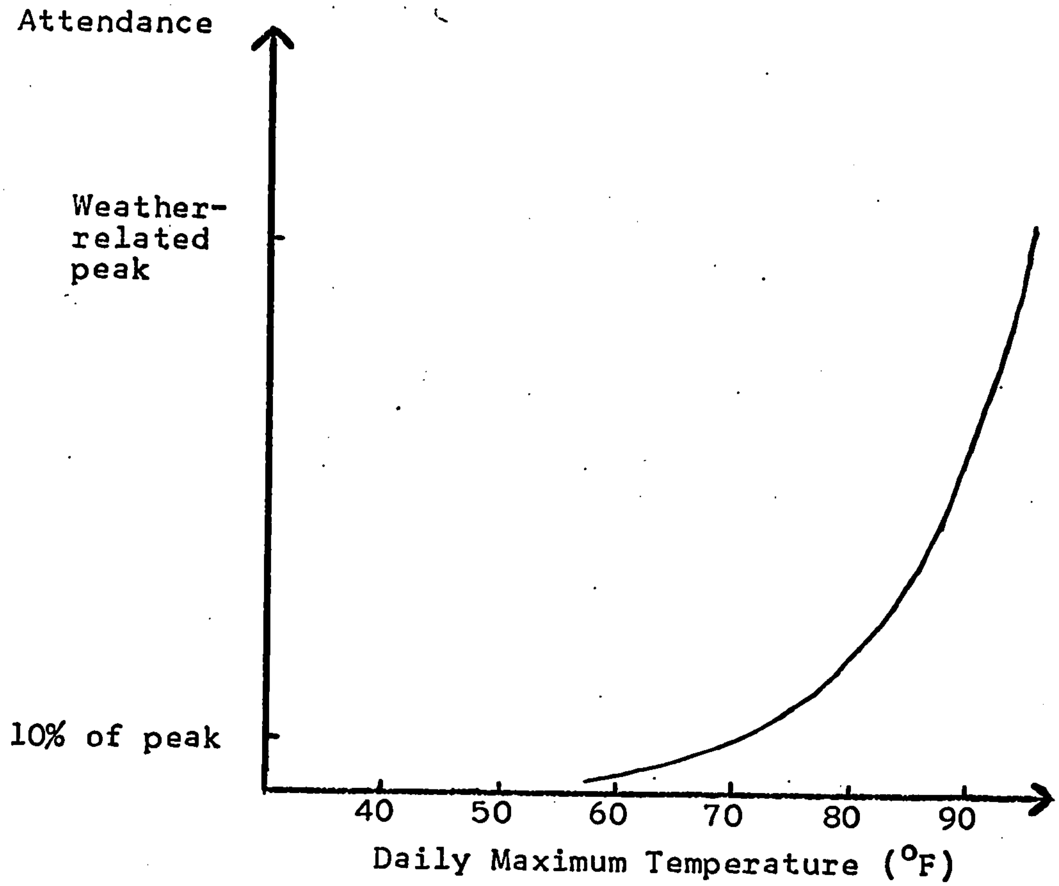

Figure 4.1

CURVE FORM COMMON TO THE WEEKDAY ATTENDANCE-MAXIMUM TEMPERATURE RELATION AT OTTAWA SWIMMING FACILITIES

TABLE 4.1

FREQUENCY DISTRIBUTION OF SIGNIFICANCE LEVELS OF LINEAR REGRESSION COEFFICIENT (b) FOR SWIMMING AND MAXIMUM TEMPERATURE

Significance Level	Number of Analyses
1 %	63
1-5 %	17
>5 %	20

Source: Computer analysis, 1970.

weekday analyses of Ottawa's swimming facilities (Figure 4.1).

If the relationship is considered by day-grouping and by geographical region, some conclusions may be drawn. Figure 4.2, the histograms of linear correlation coefficient (r) for the six day-groupings, shows that the range of r is greatest during the school vacation. The r-values are highest for weekday groupings, (iii) and (vi). The coefficient of determination (r^2) ranges from 0.27 to 0.72 for grouping (iii), with the exception of Borden Park Pool, Edmonton. Thus at least 27 per cent of variation in weekday attendance at swimming facilities from June 28 to September 1, 1969 is explained by a linear relation with daily maximum temperature. At seven of the eleven facilities with ticket counts, the most accurate attendance records, the amount of explained variation exceeds 50 per cent. For grouping (vi), r^2 ranges from 0.18 to 0.78, and exceeds 0.26 at all the facilities with ticket counts. Linearity seems to approximate closely the weekday relationship between attendance and daily maximum temperature.

The weekend situation is more complex. There seems to be a contrast between Saturday behaviour and that on Sundays and

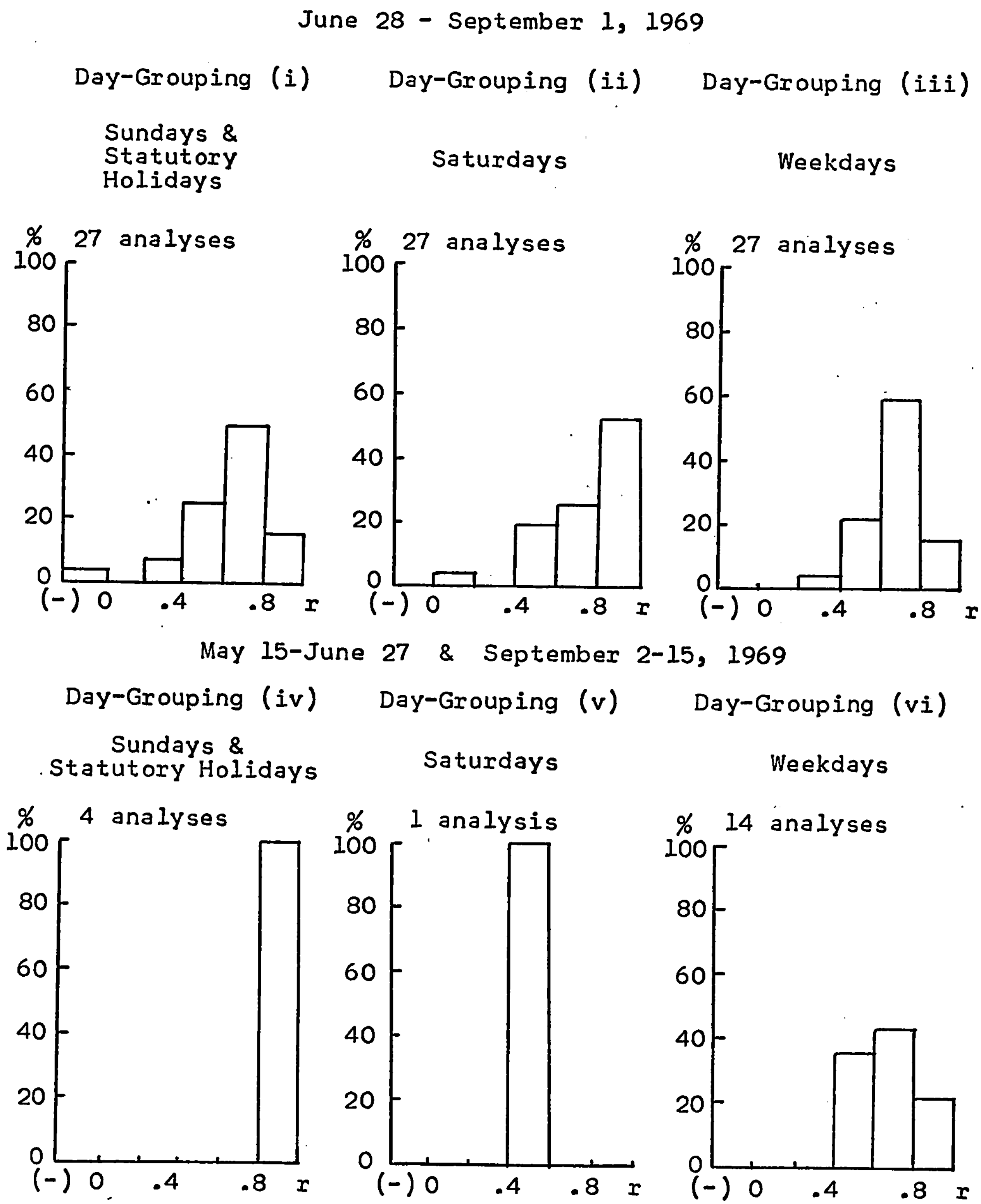

Figure 4.2

HISTOGRAMS OF r FOR SWIMMING AND MAXIMUM TEMPERATURE, BY DAY-GROUPING

Statutory Holidays, at least during the school vacation period. Due to the closure of pools or the removal of life-guard service from beaches, the off-peak period furnishes insufficient weekend data for analysis. There is, however, a marked difference between r-values for groupings (i) and (iv), if only four analyses in day-grouping (iv) are adequate to show this. All four have r-values in excess of 0.80 compared with only 15 per cent in grouping (i). This indicates a strong correlation between maximum temperature and swimmer numbers on Sundays outside the school vacation period, day-grouping (iv).

At most facilities, r-values are smaller for day-grouping (i) than for day-grouping (ii). Nine of the twenty analyses without significant associations at the 5 per cent level are among the twenty-seven analyses of day-grouping (i) for Sundays and Statutory Holidays. Thus in the peak season, attendances on Sundays and Statutory Holidays correlate much more poorly with maximum temperatures than the other day-groupings.

The most striking example of this occurs in the Edmonton study region. Edmonton area swimming facilities remain open for a greater part of the summer than do those in the other study regions, and, in fact, provide all the data for grouping (iv) and (v) analyses as shown in Figure 4.2. During the school vacation period, four of its six swimming facilities show no strong relationship between attendance and daily maximum temperature on Sundays and Statutory Holidays. This is in marked contrast to most of the facilities studied in

Ottawa and southern New Brunswick. One possible interpretation is that as temperature rises on Sundays and Statutory Holidays in the school vacation period, a large segment of the potential swimming population leaves the city of Edmonton, perhaps to visit lakes near the city. This trait does not extend to the remainder of the summer, when attendance at Edmonton pools on Sundays and Statutory Holidays once again becomes strongly related to daily maximum temperature.

Useful limiting criteria can indeed be identified for swimming, and pools and beaches in the same local area show substantial agreement in this respect. Figure 4.3 shows the ten linear regressions for day-groupings (i) and (ii) for the five swimming beaches of Saint John, New Brunswick. Three are on freshwater lakes, one on the Saint John River, and the fifth is located on the sea. Intercepts on the x-axis vary only from 60°F to 64°F. According to the data scatter of the original plots, however, the lower limit of daily maximum temperature for 10 per cent of peak use is about 65°F to 69°F for all ten analyses. Weekday analyses agree well with this figure.

Table 4.2 summarizes findings regarding the limiting criteria of daily maximum temperature for 10 per cent of peak attendance. The geographical variation is striking. Ottawa residents appear to require daily maxima of 70-73°F before many of them are prepared to utilize their city's swimming places, all of which have unheated water. In the other two study regions, comparable levels are 65-66°F, whether the

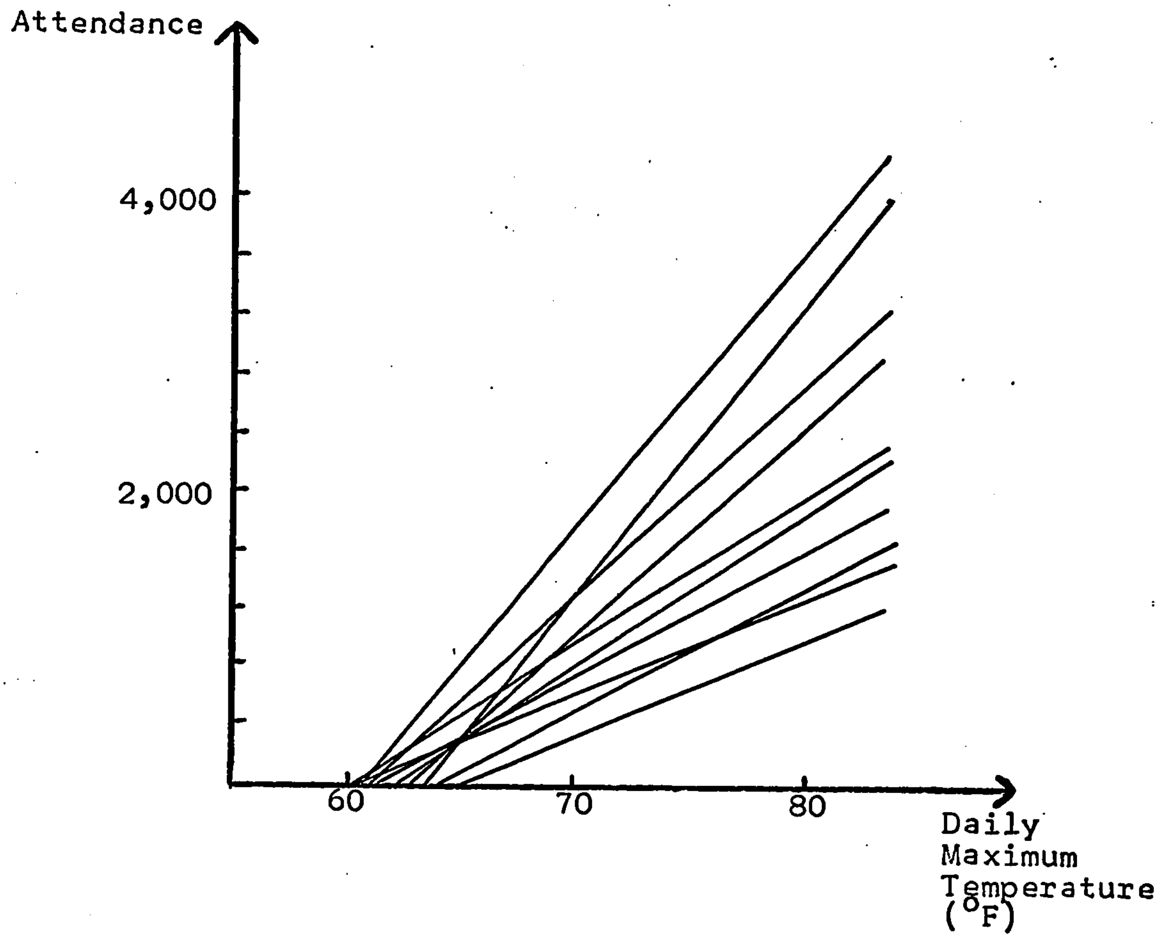

Figure 4.3

LINEAR REGRESSIONS OF SWIMMING AND MAXIMUM TEMPERATURE, PEAK-SEASON WEEKENDS, SAINT JOHN, N.B.

TABLE 4.2

LIMITING CRITERIA FOR SWIMMING, DAILY MAXIMUM TEMPERATURE

Swimming Facility	Day-Groupings (i)-(iii) School Vacation Period (in °F)	Day-Groupings (iv)-(vi) Remainder of Summer (in °F)
<u>Edmonton Study Region</u>:		
Fred Broadstock Pool, Edmonton	?	?
Borden Park Pool, Edmonton	63	56
Queen Elizabeth Pool, Edmonton	64-67	55-56
Mill Creek Pool, Edmonton	65-66	56
West End Pool, Edmonton	65-67	57
Sandy Beach, Astotin Lake, Elk Island National Park	67-68	56-57
<u>Ottawa City Facilities</u>:		
Brantwood Beach	76-77	65
Brewer Park Pool	73-77	?
Britannia Beach	74-76	?
Mooney's Bay Beach	76	?
New Edinboro Pool	70	?
Strathcona (Dutchy's) Beach	70	66
Westboro Beach	70-74	?
<u>Southern New Brunswick Study Region</u>:		
Centennial Park Pool, Moncton	64-65	?
Kiwanis Pool, Moncton	67	?
Queen Square Pool, Fredericton	64-67	59
Henry Park Pool, Fredericton	67	?
Fundy National Park Pool	63-64	62
Lily Lake Beach, Saint John	66-67	?
Fisher Lakes Beach, Saint John	64-65	?
Lakewood Heights Beach, Saint John	65-68	?
Dominion Park Beach, Saint John	67-70	?
Mispec Beach, Saint John	66-68	?
Oak Bay	67-69	59
Jardine Park	65-67	69
Parlee Beach	69	?
Grand Lake	67-69	?

Source: Computer plots, 1970.

water is heated or not. There is strong evidence that in the Edmonton region the value is even lower, 56-57°F, in the period outside the school holidays. This is true, somewhat surprisingly, of both the heated city pools and of Sandy Beach in Elk Island National Park. There is less conclusive evidence that this seasonal adaptation to lower air temperature is also present in the Ottawa-Hull and southern New Brunswick regions.

Precipitation

Results indicate that attendance at swimming facilities in general decreases with precipitation. Of ninety-five analyses performed on total daily precipitation, the linear regression coefficient has a negative value in eighty-three cases (87 per cent). Similarly, sixty-two out of seventy-one (87 per cent) b-values for the six-hourly precipitation amount are negative. The actual relationship takes the form shown in Figure 4.4, and holds true for both precipitation parameters used. This curve form is based on inspection of the computer plots. The vast majority of the scattergrams indicate this curvilinear decline of swimmer numbers with precipitation. In nearly 90 per cent of all the analyses, linearity could be rejected at the 5 per cent level after the run-test.

Where positive values of b were obtained, almost all are for weekend data. Only low reliance can be placed on weekend data as they include but a small sample of days with any precipitation. Many of the positive relationships have, among nine to thirteen days, only two to five with precipitation.

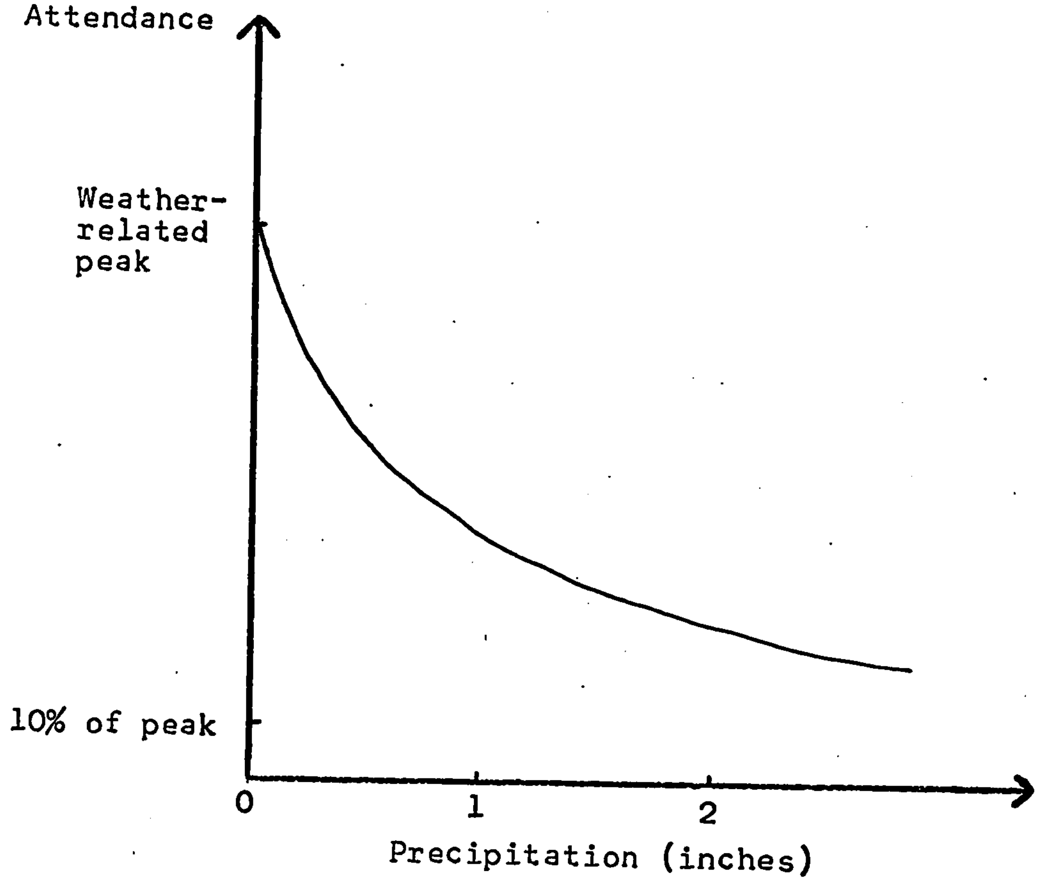

Figure 4.4

SCHEMATIZED RELATIONSHIP BETWEEN PRECIPITATION AMOUNT AND NUMBER OF SWIMMERS

Only one positive b-value was found for weekday analyses, apart from Borden Park Pool whose data are of dubious validity. One significant fact, however, is that five of the six analyses of day-grouping (ii) in the Edmonton study region have positive values for the regression coefficient (b), indicating rising attendance with increasing total precipitation. On one day an amount as large as 1.3 inches was received, with attendances still above average. Even so, none of the positive relationships is strong enough to be considered conclusive. One or two Saturdays when appreciable rains fell in the evening are the cause of this day-grouping (ii) anomaly in the Edmonton area.

Precipitation alone is not a good predictive variable for attendance. There were many instances when an inch or more of rain fell during one day, yet attendances at swimming places were not below average. Presumably this represents an evening rainstorm which had little or no effect on attendance for the whole day. We might therefore expect the six-hourly precipitation total to be a better predictor of attendance than the daily total. This is by no means the case; there is little difference between the two selected precipitation variables as attendance predictors. It is possible that duration, intensity and timing of precipitation would prove to be more relevant factors to the recreationist. Perhaps the amounts recorded at the meteorological stations are actually different from those experienced by users of the swimming areas.

Because of the apparent inadequacies of the two precipitation variables in accounting for swimming attendance, an attempt to establish limiting values for swimming participation would be meaningless. Nevertheless, this does not exclude the possibility that useful limiting values could be established for other precipitation parameters, as mentioned above. Unfortunately records of precipitation other than totals are not commonly collected.

Sunshine

Total daily sunshine hours is a variable that must be examined with care. Firstly, it is in part a function of day-length; the highest possible total of sunshine hours in one day in Canada occurs on June 22. It might therefore appear that the sunshine hour variable most representative of weather is the percentage of possible sunshine hours received on any given day. However, actual daily totals of hours of sunshine recorded were employed in this study. Total daily sunshine hours might intuitively be expected to be a good predictor of attendance, since it is a function both of the weather situation and of day-length. Recreation use is also a function of day-length. The second variable used is the number of hours of sunshine recorded between 1100 and 1700 hours local time. Sunshine hours data were available for analysis with all the swimming facilities in the Edmonton and Ottawa-Hull study regions, but only with the Fredericton pools and Grand Lake beach in southern New Brunswick.

Sixty-three analyses for sixteen swimming facilities were

TABLE 4.3

FREQUENCY DISTRIBUTION OF SIGNIFICANCE LEVELS OF b FOR TOTAL DAILY SUNSHINE HOURS AND SWIMMING

Significance Level:	Number of Analyses:		
	Edmonton Study Area	Ottawa-Hull Study Area	Southern New Brunswick Study Area
1 %	6	7	3
1-5 %	4	3	2
>5 %	18	14	6

Source: Computer analysis, 1970.

undertaken for total daily sunshine hours.[4] Twenty-five have positive values of the linear regression coefficient (b) statistically significant at the 5 per cent level (Table 4.3). Only four b-values are negative, and three of these are for Borden Park Pool in Edmonton. It must be concluded that, in general, use of swimming areas is directly related to total daily sunshine hours.

The actual nature of the relationship is vague. Figure 4.5 shows histograms of the correlation coefficient (r) for the various day-groupings. No r-value exceeds 0.80. The run-test gives no reason for rejecting a linear relation between swimming use and total daily sunshine hours. The considerable variation about the regression line, however, makes the sunshine variable unsatisfactory for predicting daily attendances.

Figure 4.5 indicates no strong systematic variation be-

[4] Eleven of the twenty-seven swimming facilities chosen for study are not close enough to meteorological stations which record sunshine hours to allow them to be meaningfully included here.

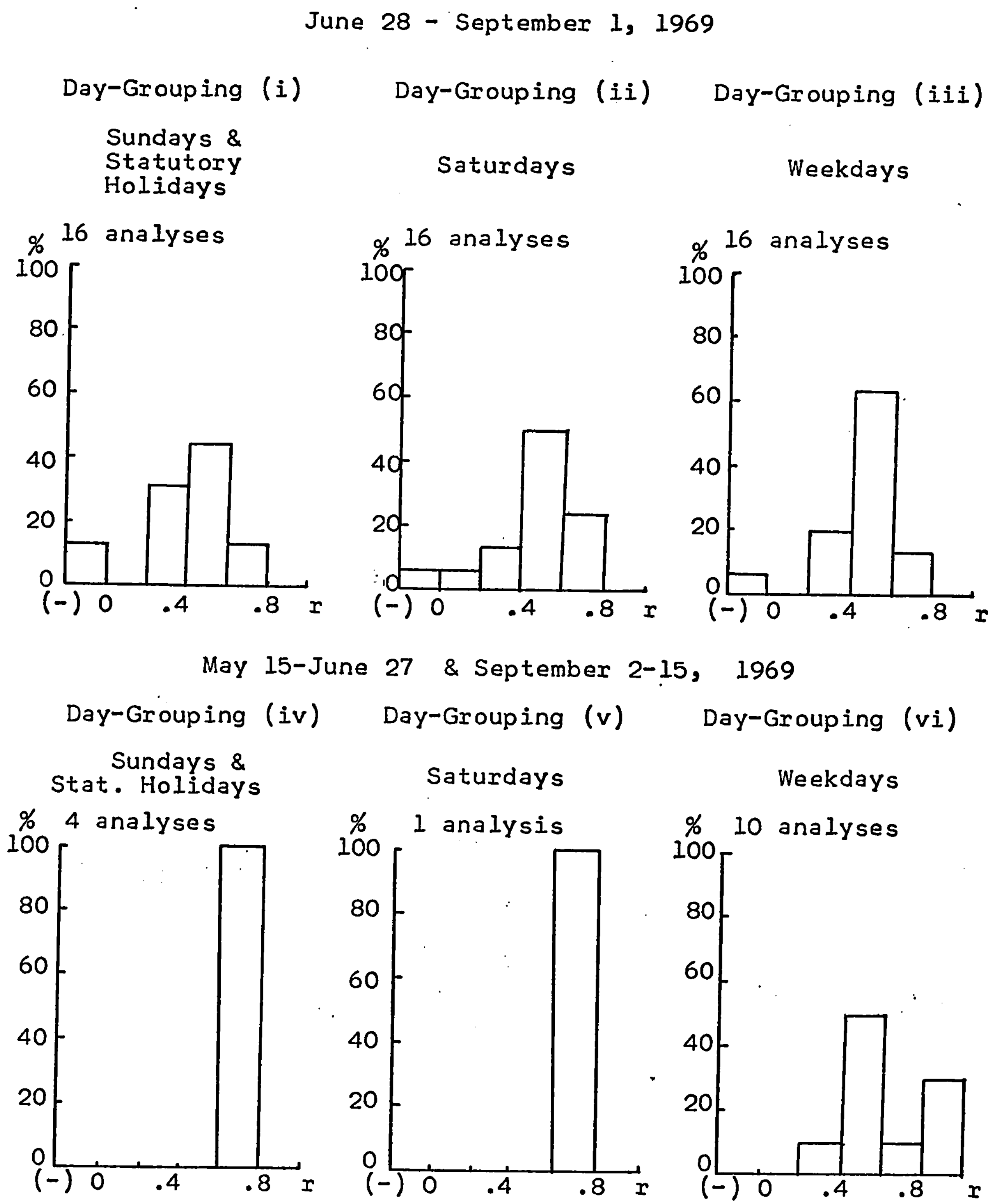

Figure 4.5

HISTOGRAMS OF r FOR SWIMMING AND TOTAL DAILY SUNSHINE HOURS, BY DAY-GROUPING tween the relationship for weekdays and that for weekends. In the Edmonton study region, however, the behaviour that characterized daily maximum temperature is found with sunshine too. For day-grouping (i), Sundays and Statutory Holidays during school vacation, the relation of swimming use to total daily sunshine hours is weaker than on Saturdays, or on Sundays and Statutory Holidays in the off-peak period. While this contrast is less marked than with daily maximum temperature, it might still be expected since there is some correlation between sunshine hours and maximum temperature.

Sunshine hours between 1100 and 1700 hours local time were analyzed and found to be less useful than daily total sunshine hours. A data problem was that a large number of days recorded the maximum possible 6.0 hours of sunshine. This feature apart, r-values in twelve of the twenty-four analyses performed were lower for 1100-1700 hours than for daily amounts. Although 1100-1700 hours is an important time of day to the recreationist, it seems that long days can encourage him to spend evening hours outdoors as well. This would naturally reduce the significance of the 1100-1700 hours local time total of sunshine hours.

The occurrence of sunshine does not appear to be critical to swimmers except in the Edmonton study region. It is interesting to plot all the linear regressions of swimming and total daily sunshine hours on one graph (Figure 4.6). Edmonton area lines (Borden Park Pool excluded) tend to intersect

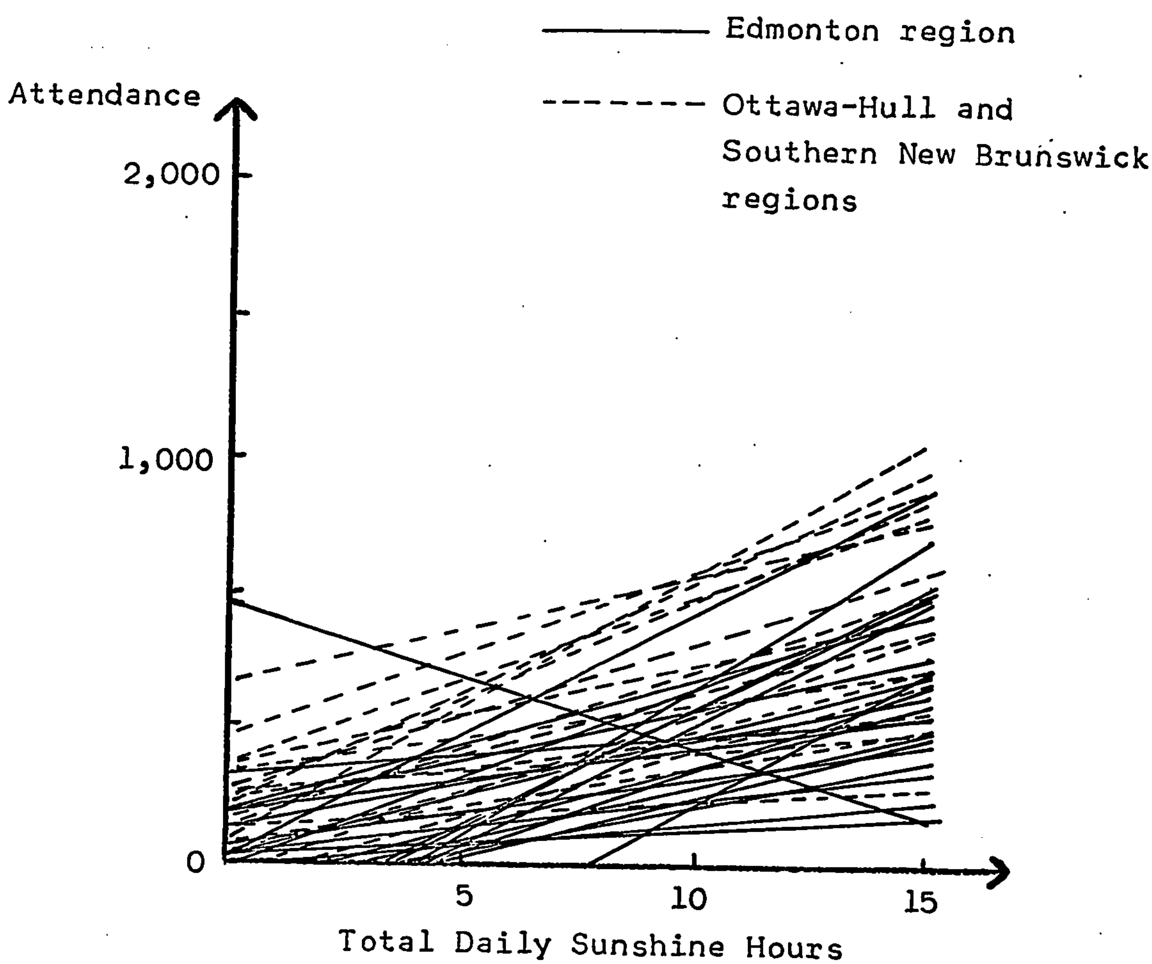

Figure 4.6

REGRESSION LINES, SWIMMING AND TOTAL DAILY SUNSHINE HOURS the x-axis, while those from the other regions for the most part cut the y-axis. All types of swimming facilities, whether with heated water, or on the sea, or a river or lake, show this characteristic. Edmontonians thus appear more "sun-conscious" than their eastern counterparts, a much larger percentage of whom are prepared to swim even if the day has almost no sunshine. In contrast, two or three hours of sunshine per day are required before any appreciable patronage is made of swimming facilities in the Edmonton region.

Relative Humidity

The effect of mean daily relative humidity was studied at all the swimming facilities in the Edmonton and Ottawa-Hull regions, but only at the Fredericton pools and Grand Lake beach in New Brunswick. The relationship is an inverse one; the higher the relative humidity, the lower is the number of swimmers. In the Edmonton region, twenty-five of the twenty-eight analyses have negative values of b. Only six of these achieve 5 per cent statistical significance, and all of them are for weekday analyses, with a maximum correlation coefficient of -0.621. There is no reason to reject linearity in the relationship, but as Table 4.4 shows, correlation coefficients are not high enough that relative humidity can be really useful as a predictive indicator for swimming attendance. With regard to upper limiting criteria, it seems that the critical value for 10 per cent of peak use at swimming facilities is readily identifiable at about 80 per cent mean daily relative humidity.

TABLE 4.4

CORRELATION COEFFICIENTS FOR SWIMMING ATTENDANCE AND MEAN DAILY RELATIVE HUMIDITY

Facility	Correlation Coefficients for Day-Grouping: (i)	(ii)	(iii)	(iv)	(v)	(vi)
Number of Days in Grouping	10-13	7-10	34-43	7	7	8-29
Edmonton Study Region:						
Fred Broadstock Pool	.289	-.313	-.578**	-	-	-
Queen Elizabeth Pool	-.252	-.322	-.454**	-.737	-	-.186
Borden Park Pool	.228	.555	-.104	-.753	-	-.214
Mill Creek Pool	-.426	-.326	-.614**	-.712	-	-.314
West End Pool	-.423	-.312	-.621**	-.717	-	-.413*
Sandy Beach, Elk Island Park	-.244	-.121	-.197	-	-.520	-.536**
Ottawa City:						
Brantwood Beach	-.076	-.361	-.167	-	-	-.439
Brewer Park Pool	-.280	-.202	-.211	-	-	-
Britannia Beach	-.344	-.418	-.159	-	-	-.136
Mooney's Bay Beach	-.425	-.473	-.162	-	-	-
New Edinboro Pool	-.129	-.602	-.334*	-	-	-
Strathcona (Dutchy's)	-.144	-.363	-.366*	-	-	-.182
Westboro Beach	-.251	-.562	-.151	-	-	.005
Southern New Brunswick Study Region:						
Queen Square Pool, Fredericton	-.629*	-.466	-.397*	-	-	-.619*
Henry Park Pool, Fredericton	-.570*	-.617	-.186	-	-	-.672**
Grand Lake	-.654*	-.620	-.349*	-	-	-

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.
** Statistically significant at the 1 per cent level.

Day-Groupings:

June 28-September 1, 1969:

(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:

(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays

Of the twenty-five analyses in the Ottawa-Hull region, twenty-four have negative values of the correlation coefficient (r) (Table 4.4). The scattergrams also show that the association between relative humidity and attendance at swimming facilities is very similar to that prevailing in the Edmonton region. There is an inverse relationship too, but only two of the twenty-four negative values of r attain the 5 per cent statistical significance level. Thus while linearity appears an adequate approximation to the relation, variation about the straight line is appreciable. The limiting mean daily relative humidity for 10 per cent of peak swimming use in the Ottawa-Hull area is slightly higher than for the Edmonton region, lying in the range of 82-85 per cent.

Judging from the proportion of analyses in southern New Brunswick having negative values of r significant at the 5 per cent level (seven out of eleven, as shown in Table 4.4), relative humidity is a more important variable here than in the other two study regions. Correlation coefficients are all negative and are generally higher than elsewhere. It is difficult from only three swimming facilities to identify limiting criteria at 10 per cent of peak attendance. It does appear, however, that mean daily relative humidity, while closely associated with swimming attendance, is hardly a limiting factor in southern New Brunswick. The 10 per cent limiting value is in excess of 96 per cent mean relative humidity. This feature may indicate a willingness of swimmers in the New Brunswick region to tolerate higher relative humidity than those in the other study regions.

Wind

Forty of the sixty-four analyses for 0900-1900 hours local time wind mileage made for swimming facilities have negative values of b. Ten of the twenty-four with positive values of b are for groupings where the maximum 0900-1900 hours wind mileage on any day is 135 miles or less, and eight of the others have correlation coefficients of 0.100 or less. On the other hand, only four of the negative relationships achieve 5 per cent statistical significance, and nine of the forty have r-values between 0 and -.100. More than a quarter of all the analyses have r-values between -0.1 and +0.1. The overall trend, however, seems to indicate a slight inverse relation between 0900-1900 hours wind mileage and attendance.

Regional variation is quite apparent. At the three facilities in southern New Brunswick (the two Fredericton pools and Grand Lake beach), all the analyses performed show negligible interaction between attendance and windspeed. This may be because the maximum mileages recorded in the various groupings do not exceed 140-150 miles. Probably wind mileage below a level which may be in excess of 150 miles is not important to swimmers, but above this level it does affect attendance (Figure 4.7).

In the Ottawa-Hull study region also, none of the wind-attendance relationships achieves statistical significance. While the four analyses for day-grouping (vi) all have positive b-values, these are not discussed here since the maximum

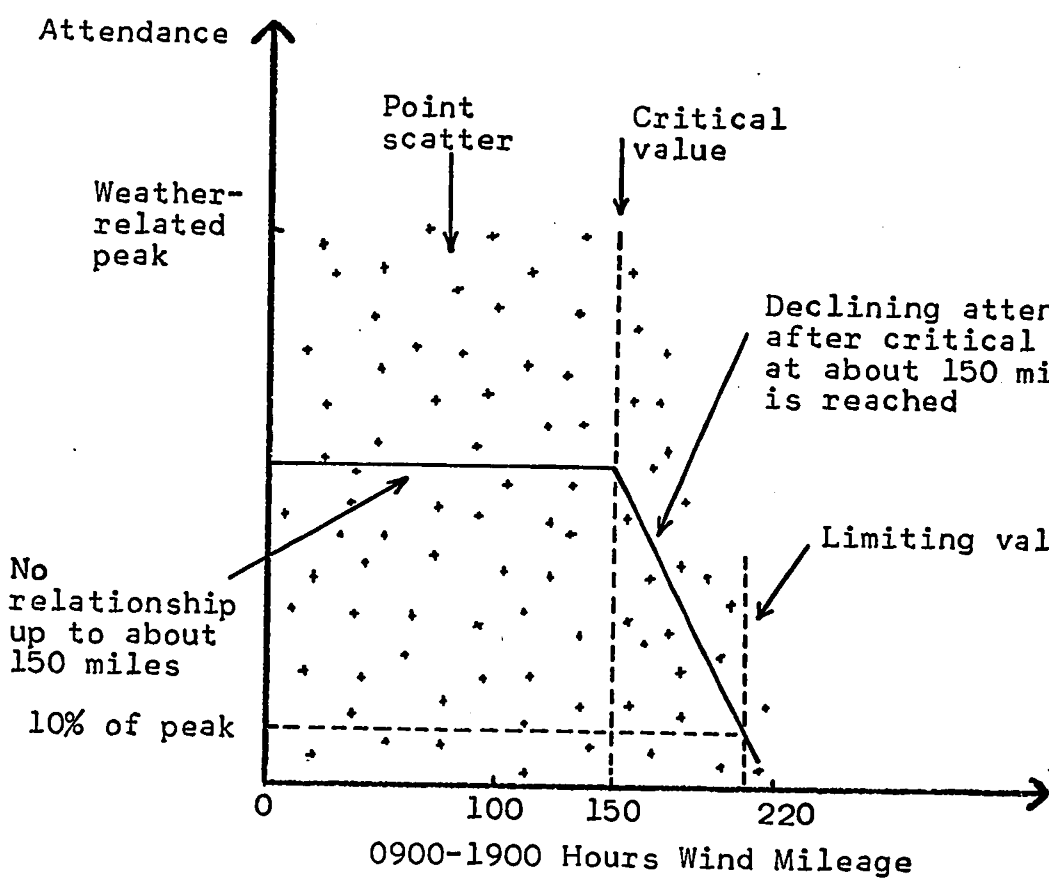

Figure 4.7

HYPOTHETICAL RELATIONSHIP BETWEEN SWIMMING AND WIND MILEAGE

0900-1900 hours mileage recorded is only 135 miles. However, as shown in Table 4.5, there is a substantial difference between the correlation coefficients for Sundays and Statutory Holidays and those for the other days. This suggests that people swimming at the Ottawa facilities on Sundays and Statutory Holidays pay more heed to wind than do Saturday and weekday swimmers.

The inverse relation between swimming numbers and wind is strongest in the Edmonton study region. The highest negative correlation coefficients are for the two Saturday groupings. For the five Edmonton city pools during the school

TABLE 4.5

CORRELATION COEFFICIENTS, SWIMMING AND WIND MILEAGE, OTTAWA-HULL REGION

Facility	Correlation Coefficients for Day-Grouping: (i)	(ii)	(iii)
Number of Days in Grouping	11-13	9-10	38-43
Brantwood Beach	-.285	-.016	.031
Brewer Park Pool	-.395	-.006	.038
Britannia Beach	-.530	-.024	-.055
Mooney's Bay Beach	-.490	.014	.002
New Edinboro Pool	-.465	.251	.302
Strathcona (Dutchy's) Swimming Hole	-.335	-.131	.258
Westboro Beach	-.450	-.111	-.064

Source: Computer analysis, 1970.

Day-Groupings:

June 28-September 1, 1969:
(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:
(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays

vacation, three Saturday r-values achieve at least 5 per cent significance, one other is close to significance with r equal to -0.619, and the fifth analysis is for the enigmatic Borden Park. On Sundays and Statutory Holidays and weekdays, however, the inverse relationship with wind is less convincing, in direct contrast to the findings for the Ottawa-Hull area.

Overall, the limiting value of 0900-1900 hours wind mileage is surprisingly high. The general relationship is schematized in Figure 4.7. There is only a very slight inverse relation with windspeed up to about 180 miles, above which attendance starts to decrease very rapidly. The 10 per cent of peak use criterion adopted in this study would thus fall somewhere in the 180-200 mile range, representing an average windspeed throughout the ten-hour period of 18-20 m.p.h.

Comfort Indices

The two indices of mid-afternoon Effective Temperature (ET) and Thom's Discomfort Index or TDI (Appendix C) are used as variables with respect to outdoor swimming. Both are fairly good predictors of attendance. Results obtained using both ET and TDI suggest that their associations with attendance are very similar to those of daily maximum temperature. In other words, the straight line usually appears to be a reasonable approximation to the relationship, while curves such as those suggested in Figure 4.1 still seem to apply to the Ottawa swimming beaches on weekdays. Also the distributions of r-values for the various day-groupings seem to be similar to those for daily maximum temperature.

The ET proves to be a slightly better indicator of attendance at swimming places than TDI. ET incorporates windspeed, while TDI does not. There are few grounds for suggesting other than linear relationships between either of the indices and attendance. Thus Table 4.6 is a straightforward comparison of statistical significance of the comfort index and maximum temperature correlations. In fact, taking the actual values from the original computer output, the r-value for ET exceeds that for TDI in forty-six of the sixty-four analyses (72 per cent). In terms of statistical significance, there is little to choose between the two indices. Both attain 5 per cent significance in forty-four of the sixty-four analyses, although ET attains the 1 per cent level in thirty-three instances compared with twenty-five for TDI. ET is therefore a more useful predictive variable in a linear relationship.

Comparing the two comfort indices with daily maximum temperature reveals that neither is as good a predictor, despite their incorporation of other weather elements with temperature. There is also a striking regional variation (Table 4.6). ET and daily maximum temperature are equally good predictor variables for Edmonton region swimming attendance. TDI is less useful. For swimming facilities in southern New Brunswick, 5 per cent significance is obtained in nine of eleven analyses for both ET and maximum temperature. However, maximum temperature is a better predictor. Its mean r-value

TABLE 4.6

SIGNIFICANCE LEVELS FOR SIXTY-FOUR ANALYSES OF SWIMMING WITH COMFORT INDICES AND MAXIMUM TEMPERATURE, BY REGION

Significance Level	Edmonton ET	TDI	T	Ottawa-Hull ET	TDI	T	Southern N.B. ET	TDI	T
1 %	15	10	15	10	8	14	8	7	9
1-5 %	6	10	6	4	7	7	1	2	0
>5 %	7	8	7	11	10	4	2	2	2

Source: Computer analysis, 1970.

ET - 3 p.m. Effective Temperature
TDI - 3 p.m. Thom's Discomfort Index
T - Daily Maximum Temperature

exceeds that for ET by approximately .050 and that for TDI by .100. In the Ottawa-Hull region only fourteen of twenty-five analyses reach 5 per cent significance for ET as opposed to twenty-one for daily maximum temperature. This is surprising in an area where humidity is popularly regarded as an important discomfort factor in midsummer.

Daily maximum temperature in general is a better explanatory variable than either of the comfort indices examined, and similar relationships exist between maximum temperature and attendance as between the comfort indices and attendance. Thus there seems little point in defining limiting criteria for swimming on bases other than the maximum temperature.

Discussion

It is evident that weather very strongly affects attendance at outdoor swimming facilities. Of the individual weather variables selected for investigation, daily maximum temperature proves to be the most closely related to numbers swimming. Even with maximum temperature, human choice factors obscure the relationship for day-grouping (i) at city swimming pools, particularly in Edmonton.

At this stage, limiting criteria at 10 per cent of the weather-related peak use must be summarized (Table 4.7). Over the range of weather conditions characterizing the 1969 summer, the functions relating weather variables to swimming attendance do not take the form suggested as a basic hypothesis in Figure 1.1, but incline more towards the straight line. Thus only one limit has been identified for each variable. Not all these limitations have to be satisfied on

TABLE 4.7

LIMITING CRITERIA AT THE 10 PER CENT LEVEL OF WEATHER-RELATED PEAK SWIMMING USE

Variable*	Study Regions:		
	Edmonton	Ottawa-Hull	Southern N.B.
Daily Maximum Temperature	66°F(56°F)	70-73°F(66°F)	66°F(59-62°F)
Total Daily Sunshine Hours	2-3	0	0
Mean Daily Relative Humidity	80%	82-85%	96-98%
0900-1900 Hours Wind Mileage	←—— 180-200	——→	

Source: Computer analysis, 1970.

Figures in brackets represent limits for the off-peak period of summer outside the school holidays, when there is evidence for a difference from the peak period.

* Although precipitation variables are not included in the table, it is possible that some precipitation parameter other than those studied does indeed have a limiting effect on swimming activity.

a given day for attendance to drop below 10 per cent of the peak use. Furthermore, there is no indication that the limitations shown truly reflect the effect of the variable they are given for. For instance, the mean relative humidity in excess of 80 per cent may represent low temperatures or the possibility of a prolonged period of precipitation; the humidity itself may not be a critical factor.

There are distinct regional variations in the interaction between weather conditions and attendance at swimming facilities. The maximum temperature effect may be taken as an illustration of this. Correlations with attendance at Ottawa pools and beaches, while in the main statistically significant, are lower than those prevailing at pools in Moncton, Fredericton, and Edmonton, or at the beaches in Saint John. With the exception of Grand Lake, swimmer numbers at the New Brunswick provincial parks also show lower correlations. In addition, the lower limits for maximum temperature are markedly more demanding in the Ottawa-Hull area than in the other two study regions.

Borden Park Pool is located in close proximity to the Edmonton Exhibition Grounds, but even with this counter-attraction it is difficult to see why its weather-attendance relations are so exceptional within the Edmonton region. There may be some problem with its 1969 attendance data.

The other variations noted in the earlier paragraph may be traced to two factors. The first is that the most accurate records often produce the highest weather correlations. A second factor is the distance between the user-origin and the swimming facility. Most of the beaches outside cities which were analyzed have lower correlations between maximum temperature and attendance. This perhaps reflects some discrepancy between weather at the origin and at the destination but the writer inclines toward another explanation. Visits to city swimming facilities are made mainly by local residents and their decision is likely to be almost a "spur-of-the-moment" choice, significantly affected by the prevailing weather. A trip to a swimming beach some distance from the city requires a longer period of leisure time. It is more likely to have been planned in advance, and will perhaps not be cancelled unless weather conditions are almost prohibitive.

Swimming participation often shows close relations to prevailing weather conditions. However, the use patterns of swimming facilities cannot be explained solely in terms of weather, even when the summer is divided into a number of day-groupings for purposes of analysis. At the same time, a very substantial portion of day-to-day attendance fluctuations at some swimming areas is explained by maximum temperature alone. Other facilities are more susceptible to the human decision process, and the weather effect in their attendances is subtly masked. Nevertheless, it has proved feasible both to identify the nature of the relationships between swimming use and weather parameters, and to specify critical values of these parameters which define the effective limits for enjoyable participation. Regional variations in the significance of the weather variables are also recognizable. Two instances are the response to sunshine in the Edmonton region, and the tolerance of very high relative humidities in southern New Brunswick.

CHAPTER V

BEACH USE

"Beach use" was defined in Chapter II as an expanded equivalent of the "family bathing" category listed in the ARDA classification. The new definition is "beach activity for groups of people or individuals including non-swimmers and children". The possible range of beach activity is very large, covering wading, loafing, swimming, sunbathing, ball games, surfboating, bird watching, nature study, boating, and all other recreational activities which take place on the beach. This broader definition of "beach use" is more appropriate than "family bathing" to the statistics reviewed in this chapter. "Family bathing" implies a fairly restricted range of activities. Yet most statistics on the use of a beach measure attendance, and not participation in "family bathing". Hence the term "beach use" is more appropriate to the set of activities being analyzed.

The data on beach use were collected in three ways. Where beach areas are maintained by provincial parks branches, automatic vehicle counters usually meter traffic at the access points. If the access road leads only to a beach, as is the case with Woodlands and Mille Roches Beaches on Ontario's Long Sault Parkway, then the vehicle count is directly indicative of beach use. It will not be an actual count, but the imperfections of the method are the same on all days. Therefore the vehicle count is a constant multiple of the actual numbers of cars visiting the beach. A second case is the monitoring by traffic counter of vehicles entering a major beach which has a campground as well, as at Wabamun Lake Provincial Park in Alberta and Lac Philippe Beach in Gatineau Park, Quebec. Here the "adjusted traffic counter data" obtained through the technique of Appendix B represent day-use made of the beach. They exclude the camper at this type of facility, who typically arrives on a Friday evening, camps, and remains in the beach area on Saturday and Sunday before returning home Sunday evening. Adjusted traffic counter data thus underestimate total use made of these beaches on Saturday and Sunday but are truly indicative of day-use. The third type of data on beach use is obtained from visual counts or estimates of the number of cars parked at the beach, either over the whole day as at Ma-Me-O Beach Provincial Park in Alberta, or at a specific time of the day as at Lake George and Parlee Beach in New Brunswick.

Other types of data on beach use are obtainable, though none is used in this analysis. Some New Brunswick provincial parks have estimates made by lifeguards of persons using beaches as well as estimates of persons actually swimming. There are private facilities such as Lake Eden Beach and Edmonton Beach, Alberta, which charge admission fees per car. However, the sample of beaches selected provides an adequate collection to analyze in this study.

The six beach parks from the Edmonton region are Aspen Beach, Ma-Me-O Beach, Miquelon Lake, Rochon Sands, Thunder Lake and Wabamun Lake Provincial Parks (Figure 2.2). Adjusted traffic counter records are used except at Ma-Me-O Beach where there is no campground and where a manual count of cars on the site is made throughout the day. Ma-Me-O Beach, Miquelon Lake and Wabamun Lake, all within about fifty miles of the Edmonton city limits, receive heavy day-use from Edmontonians. Aspen Beach receives appreciable day-use from residents of Lacombe and Red Deer, and some day-use and considerable weekend use from Calgarians and Edmontonians. Rochon Sands derives most day-use from Stettler residents, but some weekend use from Edmontonians and Calgarians. Thunder Lake receives day visitors mainly from Barrhead, Westlock and Edmonton.

In the Ottawa-Hull region, two beaches within Gatineau Park, and eight administered by the St. Lawrence Parks Commission are studied (Figure 2.5). Lac Philippe and Lac Lapeche are the two beaches in Gatineau Park used mainly by Ottawa-Hull residents. Adjusted traffic counter data are employed at Lac Philippe; at Lac Lapeche no adjustment is required, and direct traffic counter records are used. The other beaches are located in the St. Lawrence Seaway Valley. Mille Roches and Woodlands are along the Long Sault Parkway (Figure 2.7) near Cornwall, Ontario; Brown's Bay lies 15 miles southwest of Brockville; Crysler Beach is adjacent to Upper Canada Village and Crysler Farm Battlefield Park. These four beaches have no campgrounds, and their traffic counter records can be used without adjustment. The facilities are used mainly by residents of the Seaway Valley and tourists, though some Ottawa-Hull recreationists also visit them for the day. Charlottenburgh, Glengarry, Grenville and Farran beach parks contain campgrounds, necessitating adjustment of their traffic counter data for use here. The first two lie on the St. Lawrence River east of Cornwall, and Montrealers are beginning to visit them in increasing numbers.[1] Grenville is near Prescott and the Johnstown-Ogdensburg International Bridge, and Farran is located close to Morrisburg.

The southern New Brunswick study region supplies eight beaches for analysis. At Lake George, Parlee Beach and New River Beach, a caretaker counts cars at 1 p.m. each day; at Grand Lake, Murray Beach, Jardine Park, Oak Point and Oak Bay unadjusted traffic counter records are employed. The locations of these provincial parks are shown in Figure 2.9. Exact information on the traffic counter location at the latter five parks was not available to the author at the time of writing. Thus the requisite day-use adjustment to the counter records (Appendix B) could not be made. Non-adjusted vehicle records still provide some indication of total beach use and, although less consistent than the other records, are used for analysis. Some of the eight parks, Lake George and Oak Point in particular, are used almost exclusively by local residents. Others such as Parlee Beach, New River Beach and Oak Bay are well-known and located on major provincial highways; they are consequently visited by many tourists as well as inhabitants of southern New Brunswick.

[1] Pers. comm., interview with Mr. G.W. Arthurs, Public Relations Officer, St. Lawrence Parks Commission, Morrisburg, Ontario, October 1, 1969.

Maximum Temperature

One hundred and thirty-one analyses were performed for maximum temperature and attendance at the twenty-four beaches. This falls short of the potential total of 144 because at some beaches, day-groupings (iv),(v) and (vi) have fewer than seven days with attendance data. Only ten of the analyses have negative values of r. Forty-seven of the 131 analyses have r positive and significant at the 5 per cent level. In other words, in forty-seven cases, there is only one chance in twenty that beach attendance and daily maximum temperature are not directly related.

Figure 5.1 gives histograms of r-values for the six different day-groupings employed. Correlation coefficients are higher in general for the weekday groupings than for the weekend data, with the exception of day-grouping (iv), Sundays and Statutory Holidays outside the school vacation period. Since the weekday analyses usually have at least thirty days with data, and group (iv) contains only seven to nine days, the statistical significance of the correlations shown in Table 5.1 is no surprise. Two-thirds (thirty-two of the forty-seven) of the r-values significant at the 5 per cent level are for weekday analyses. Presumably many people who are able to visit beaches on weekdays have the opportunity of waiting for days with suitable weather. There is also an interesting variation with geographical region (Table 5.2). Twenty-one of thirty-nine (54 per cent) southern New Brunswick analyses have r significant at the 5 per cent level, compared

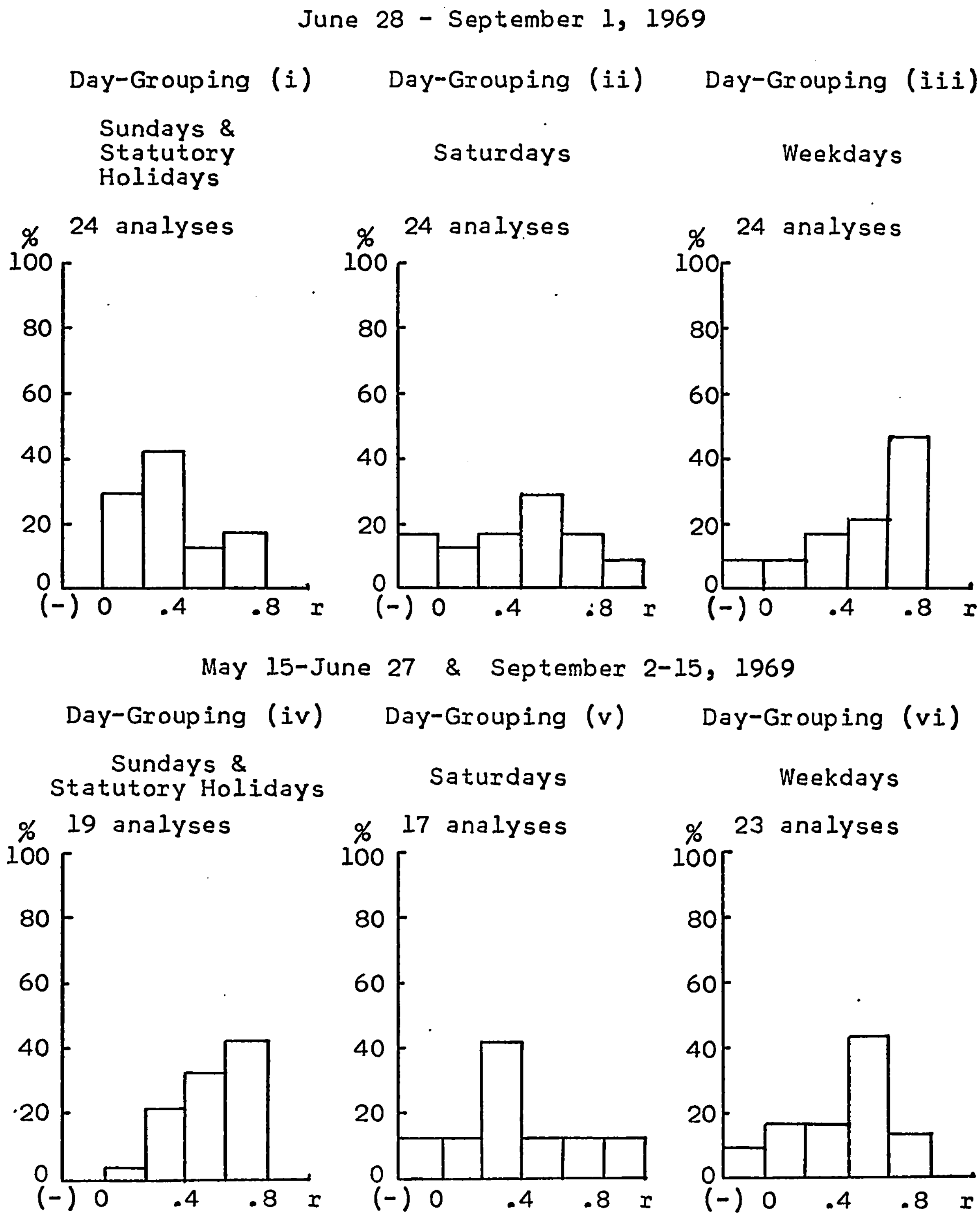

Figure 5.1

HISTOGRAMS OF r FOR BEACH USE AND DAILY MAXIMUM TEMPERATURE BY DAY-GROUPING

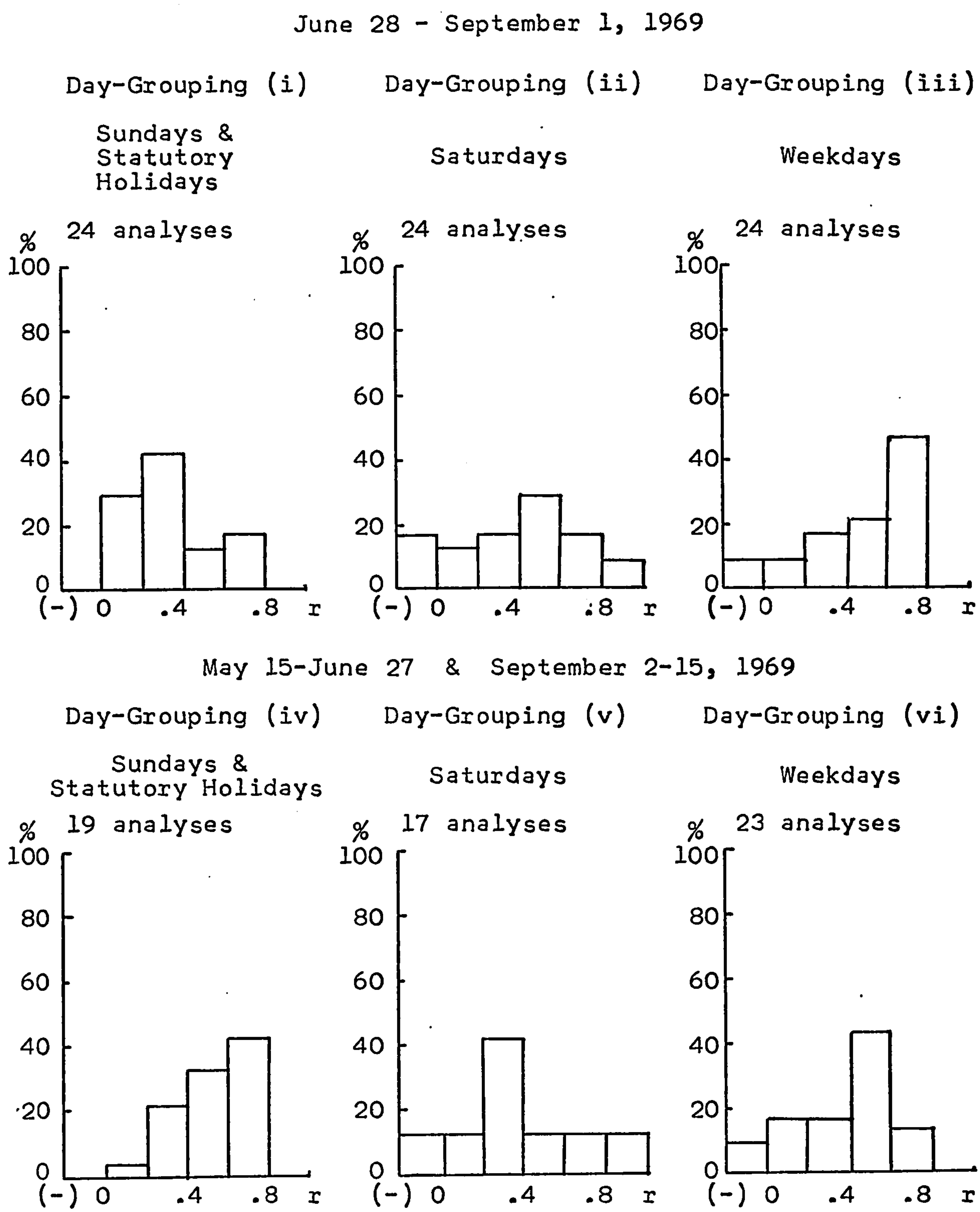

Figure 5.1

HISTOGRAMS OF r FOR BEACH USE AND DAILY MAXIMUM TEMPERATURE BY DAY-GROUPING

TABLE 5.1

STATISTICAL SIGNIFICANCE OF CORRELATION COEFFICIENTS, BEACH USE AND MAXIMUM TEMPERATURE, BY DAY-GROUPING

Significance Level:	Number of Analyses in Day-Grouping: (i)	(ii)	(iii)	(iv)	(v)	(vi)
1 %	1	3	16	0	1	10
1-5 %	3	2	2	3	2	4
>5 %	20	19	6	16	14	9

Source: Computer analysis, 1970.

Day-Groupings:

June 28-September 1, 1969:

(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:

(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays

with only 26 and 30 per cent in the other two study regions. A final point is that within each study region, the relationship of beach use to daily maximum temperature is stronger at some facilities than at others. Thus five of the six day-groupings investigated at both Wabamun Lake Provincial Park near Edmonton, and at New River Beach Provincial Park near Saint John have r significant at the 5 per cent level. All four day-groupings investigated at Grand Lake Provincial Park near Fredericton, four out of six at Jardine Park, and three out of six at Parlee Beach, Oak Bay and Brown's Bay near Brockville have r significant at 5 per cent. Thus twenty-seven of the forty-seven (57 per cent) analyses with statistical significance are found at only seven (29 per cent) of the twenty-four beaches. All seven are very heavily used beaches.

There is no reason to suggest a form other than linearity for the relationship of beach use to maximum temperature,

TABLE 5.2

STATISTICAL SIGNIFICANCE OF CORRELATION COEFFICIENTS, BEACH USE AND MAXIMUM TEMPERATURE, BY STUDY REGION

Significance Level	Number of Analyses per Study Region:		
	Edmonton	Ottawa-Hull	Southern N.B.
1 %	4	15	12
1-5 %	5	2	9
>5 %	26	40	18

Source: Computer analysis, 1970.

though it conforms much more closely to the straight line at some beaches than at others. Thus maximum temperature is not a consistently reliable predictive parameter for beach use. Only in four analyses did r exceed 0.8. At four heavily used beaches, for half or more of the day-groupings maximum temperature explains at least half of all the attendance variation, with $r^2 \geqslant 0.5$. Thus daily maximum temperature can be a valuable aid in predicting use on many days during the summer. These beaches are Wabamun Lake, Grand Lake, New River Beach and Jardine Park.

The interaction between attendance and maximum temperature is direct and strong enough that limiting values can be identified. The regression line frequently intercepts the x-axis at quite low values of daily maximum temperature. At the same time, below 65°F the data scatter follows the form shown in Figure 5.2. Over most of its length, the straight line suggested by the regression adequately reflects the relationship, but there tends to be a tapering-off at the lower end, as shown in the diagram. This probably results from a

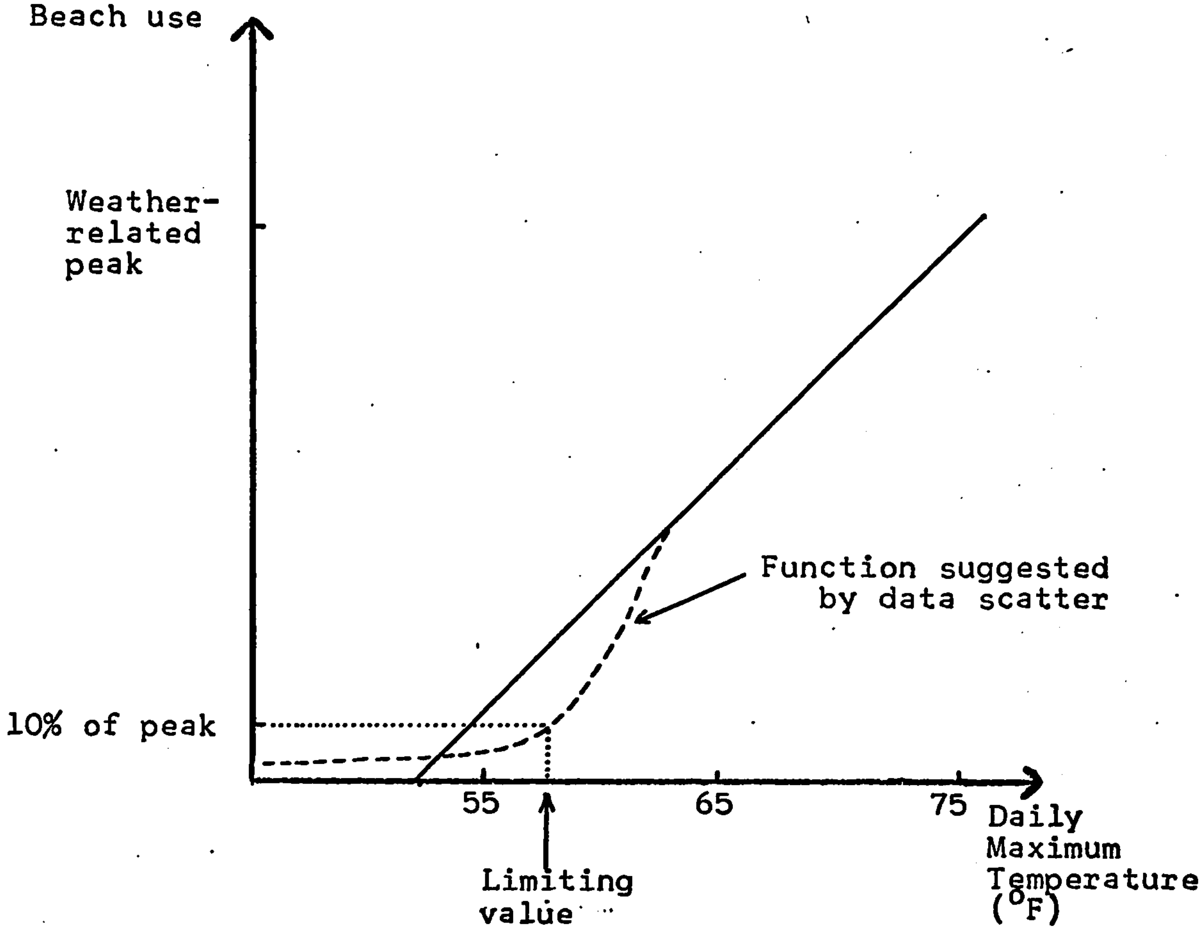

Figure 5.2

SCHEMATIZED RELATIONSHIP OF BEACH USE TO DAILY MAXIMUM TEMPERATURE higher number than usual of hardy people using the beaches. The maximum temperature coinciding with 10 per cent of peak use therefore can never be read directly off the regression line, which is often the case with swimming. The data scatter itself must be interpreted. Not all analyses allow sure identification of the lower limit of maximum temperature, but with the large number of beaches studied, limits can be clearly established.

In the Edmonton region the lower limit of maximum temperature for beach use appears to be in the 55-60°F range in the peak period of June 28-September 1, and approximately 55°F in the remainder of the summer. Only a slight suggestion exists of adaptation by beach users to somewhat cooler temperatures in the off-season. Considering the Ottawa-Hull region, a problem arises in that daily maxima in the 1969 school vacation period rarely fell below 65°F. The lower limit of maximum temperature is below this value, but more than this cannot be said. From May 15 to June 27, and from September 2 to 15, however, the limit coinciding with 10 per cent of peak use was in the 55-60°F range. Southern New Brunswick showed a lower limit of maximum temperature near 60°F for the school vacation period, with a very slight decrease to the high 50s in the remainder of the summer.

Precipitation

The problems of analyzing the two precipitation variables without recourse to statistical significance testing have been discussed in Chapter III. In the absence of any other procedure, inspection of the slope of the regression line provides some limited information on the beach use-precipitation relationship.

The "mid-day" six-hourly precipitation total was examined at eleven of the beaches. Because of the relative infrequency of days with precipitation recorded in this six-hour period, some day-groupings at certain beaches furnish insufficient information for interpretation. Consequently the total number of analyses made with six-hourly precipitation totals is thirty-four. Twenty-eight (82 per cent) have an inverse relation between six-hourly precipitation amount and beach use.

One hundred and ten analyses were made for total daily precipitation and beach use at twenty-one beaches. Eighty (73 per cent) have b negative. Of the other thirty, fifteen are day-groupings where the greatest total daily precipitation is only 0.8 inches. Some of the remainder have b positive because a single day had both high attendance and heavy precipitation. This likely represents an evening downpour after most people had already left the beach, or a situation where the meteorological station had more precipitation than fell either at the beach a few miles away or at the origin of most of the users.

Precipitation amount therefore bears a notable inverse relation to beach use. Nevertheless, it is impossible to set limits in terms of precipitation amount, either within the six-hourly mid-day period or over the whole day. The relation-

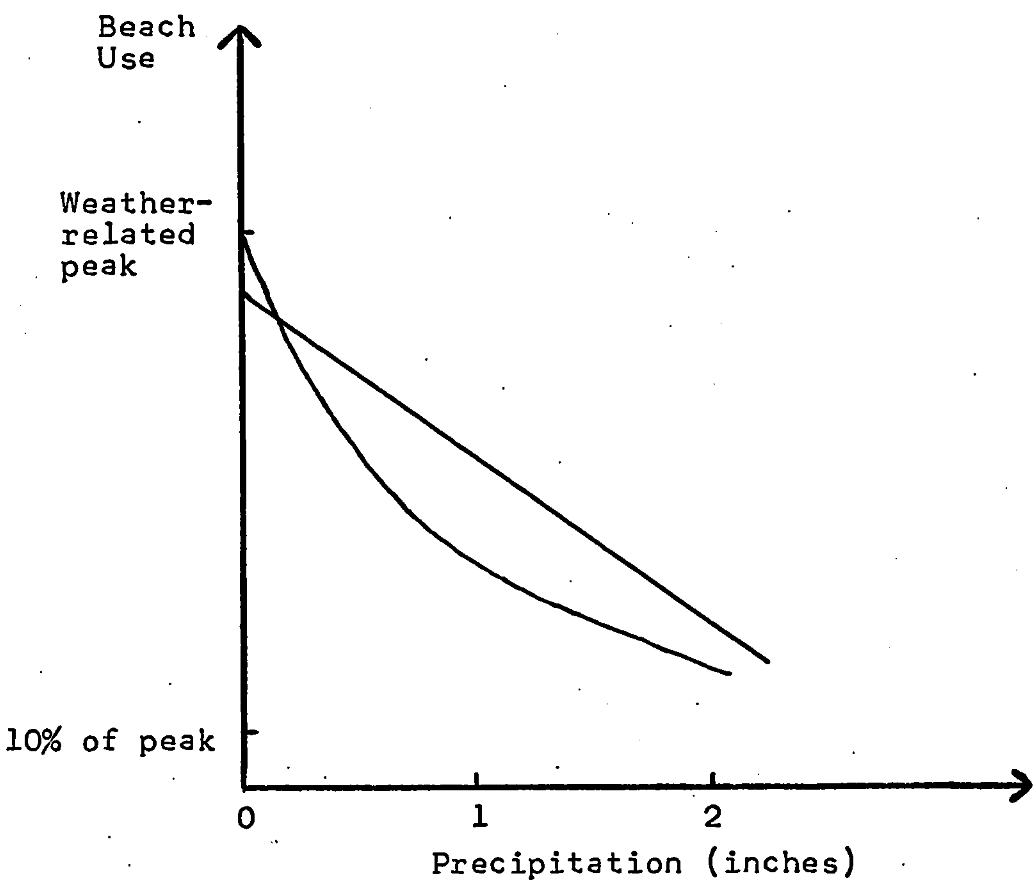

Figure 5.3

SCHEMATIZED RELATION BETWEEN BEACH USE AND TOTAL DAILY PRECIPITATION ship is that shown by the curve function in Figure 5.3. Several inches of precipitation would have to fall in the day before use would decline to 10 per cent of peak level. On the other hand, it is obvious that precipitation consistently causes decreasing attendances. Probably some precipitation variable other than amount is actually a more critical factor - timing, duration, and/or intensity, for example.

Sunshine

The two sunshine variables of 1100-1700 hours local time sunshine hours and total hours recorded daily were both examined. Only the latter will be discussed, as it is the more useful parameter. It is not characterized by the distribution difficulties shown by 1100-1700 hours sunshine hours.

Forty-six analyses of total daily sunshine hours and beach use were studied at nine beaches. These are Aspen Beach, Ma-Me-O Beach, Wabamun Lake, Miquelon Lake and Rochon Sands in the Edmonton region; Lac Philippe and Lac Lapeche in the Ottawa-Hull region; and Lake George and Grand Lake in southern New Brunswick. Only one analysis has a negative value of the linear regression coefficient (b). Sixteen of the forty-five cases with b positive have correlation coefficients statistically significant at the 5 per cent level. The r-values for all forty-six analyses are displayed in Table 5.3.

The 35 per cent of all analyses reaching at least 5 per cent statistical significance is comparable to the 36 per cent for maximum temperature. Also, eleven of the sunshine hour analyses at the five Edmonton region beaches have r significant

TABLE 5.3

CORRELATION COEFFICIENTS FOR BEACH USE AND TOTAL DAILY SUNSHINE HOURS, BY DAY-GROUPING

Facility	Correlation Coefficients of Day-Grouping: (i)	(ii)	(iii)	(iv)	(v)	(vi)
Number of Days in Grouping	8-13	7-10	33-43	7-9	7-8	8-41
Edmonton Study Region:						
Aspen Beach	.412	.550	.409**	.364	.833*	.336*
Ma-Me-O Beach	.632*	.252	.045	.568	.685	.292
Miquelon Lake	.506	.414	.282	.641	-	.012
Rochon Sands	.605*	.453	.092	.766*	.716	.299
Wabamun Lake	.511	.720*	.556**	.699*	.833*	.397*
Ottawa-Hull Study Region:						
Lac Philippe	.809*	.653	.423*	-	-	-
Lac Lapeche	.759*	.774*	.283	.153	.598	-.035
Southern New Brunswick Study Region:						
Lake George	.576	.003	.290	-	-	.313
Grand Lake	.637*	.437	.200	-	-	.292

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.
** Statistically significant at the 1 per cent level.

Day-Groupings:

June 28-September 1, 1969:
(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:
(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays

at the 5 per cent level compared with nine for the relevant maximum temperature analyses. In fact, at three of the Edmonton area facilities, Aspen Beach, Ma-Me-O Beach and Rochon Sands, r-values for total daily sunshine hours are generally higher than for maximum temperature. At Wabamun Lake and Miquelon Lake r-values for these two variables are very similar.

This is especially noticeable for day-grouping (i), Sundays and Statutory Holidays, June 28 to September 1, when by far the largest visitations occur. The day-grouping (i) values for sunshine are as high as or higher than those for maximum temperature, and two of them achieve 5 per cent significance while none do for maximum temperature. This trend also seems to exist at Lac Philippe and Lac Lapeche beaches in the Ottawa-Hull region, but not at the two southern New Brunswick beaches investigated.

If conclusions can indeed be drawn from this, then total sunshine hours are as good as or better than maximum temperature as a predictor of daily use of beaches in the Edmonton region, and perhaps also in the Ottawa-Hull region. This is not true of southern New Brunswick though. There is no evidence to reject the straight line hypothesis for total daily sunshine hours and beach use. However, r-values (Table 5.3) are not high enough in general to allow sunshine totals in themselves to be a good predictor of attendance; only in a few analyses do sunshine hours explain more than half of all attendance variation. Furthermore, sunshine hours do not seem to be critical as far as the 10 per cent of peak use threshold is concerned. A day with no sunshine at all can still have sizeable beach attendances in all three study regions. There is a hint in the Edmonton region that on weekends the promise of some sunshine is an important factor in beach use but this is definitely not so during the week. Realistic limiting criteria based on sunshine hours cannot therefore be set for beach use, despite the good positive correlation between total daily sunshine hours and visitation.

Relative Humidity

Table 5.4 shows the coefficients for the thirty-three correlations conducted on mean daily relative humidity and

TABLE 5.4

CORRELATION COEFFICIENTS FOR BEACH USE AND MEAN DAILY RELATIVE HUMIDITY, BY DAY-GROUPING

Facility	Correlation Coefficients for Day-Grouping:					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Number of Days in Grouping	8-13	7-10	33-43	7-9	7-8	21-41
Edmonton Study Region:						
Ma-Me-O Beach	-.486	-.516	.004	-.795*	-.045	-.335
Miquelon Lake	-.360	-.302	-.256	-.771*	-	-.081
Wabamun Lake	-.281	-.474	-.500**	-.837**	-.699	-.496**
Ottawa-Hull Study Region:						
Lac Philippe	-.743*	-.711	-.261	-	-	-
Lac Lapeche	-.550	-.836**	-.162	-.682	-.523	-.076
Southern New Brunswick Study Region:						
Lake George	-.360	-.184	-.185	-	-	-.021
Grand Lake	-.667*	-.497	-.126	-	-	-

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.
** Statistically significant at the 1 per cent level.

Day-Groupings:

June 28-September 1, 1969:
(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:
(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays

beach use. Only one analysis has a positive r-value, 0.004 for June 28-September 1 weekdays at Ma-Me-O Beach. Of the thirty-two negative r-values, eight are significant at the 5 per cent level. Thus although the evidence for an inverse relation is very strong, the correlation coefficients are not generally high enough to explain 50 per cent of the attendance variation. Only six exceed -.700.

It is evident that there is a closer association between humidity and beach use on the weekends than during the week. Only at Wabamun Lake do the two weekday analyses achieve statistical significance. All four of the day-grouping (iv) correlation coefficients are -.682 or greater, and it seems that relative humidity has its greatest influence here, with r-values exceeding those of the peak season weekends. This possibly indicates that high relative humidities are more critical in the cooler months of May, June and September than in the school vacation period. It may be that the greater influence of high relative humidity reflects the lower temperatures experienced. Part of the apparent relative humidity effect on beach use may be simply a temperature effect.

Limiting relative humidity criteria can clearly be set for 10 per cent of peak use in the Edmonton region. The limiting value is in the 85-95 per cent range during the June 28 to September 1 period, but falls to 75-80 per cent in the remainder of the summer. This contrasts with southern New Brunswick, where according to the few data plots available relative humidity is not a limiting factor at all in beach use. Unfortunately, it proved impossible to identify with certainty limiting criteria for the two Ottawa-Hull beaches. There is however a suggestion that the critical level is above 90 per cent mean relative humidity, certainly in the off-peak part of the summer, when the limit appears to be in the mid or upper 90s. If this is the case, it is another instance of the intriguing regional variations which characterize the weather response of outdoor recreationists.

Wind

Effects of 0900-1900 hours local time wind mileage were investigated for all the Edmonton region beaches except Thunder Lake; for Lac Philippe and Lac Lapeche in the Ottawa-Hull region; and for Lake George and Grand Lake in southern New Brunswick. At these nine beaches, forty-six analyses of 0900-1900 hours wind mileage and attendance are performed. Two-thirds (thirty-one of forty-six) have negative values of the linear regression coefficient (b), while thirteen of the fifteen with b positive have values of less than 0.2 for the correlation coefficient (r). On the other hand, twenty-five of the thirty-one inverse relations have r between 0 and -0.4. It therefore seems safe to suggest a weak inverse relationship between windspeed and beach use.

Although there is only a low negative correlation between wind mileage and beach use, it appears from 1969 data that a value limiting attendance to 10 per cent of peak use lies between 170 and 220 miles of recorded wind. When a definite limitation of beach use by windspeed can be identified despite only low correlation coefficients, the relation shown in

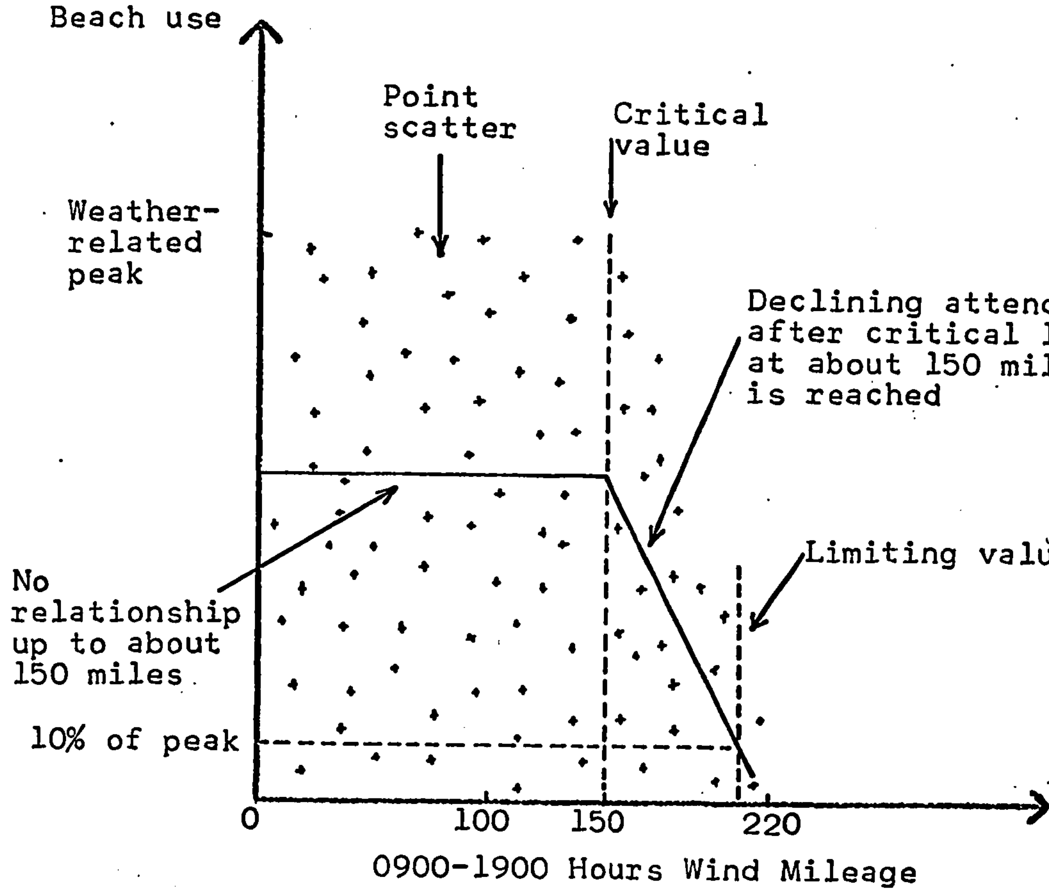

Figure 5.4

SCHEMATIZED RELATION OF BEACH USE AND 0900-1900 HOURS WIND MILEAGE

Figure 5.4 is suggested. There is no relation between wind and beach attendance up to about 15 miles per hour, but beyond this value a relatively rapid decline in attendance accompanies increasing windspeed. Eventually a windspeed is reached where attendance is cut to only 10 per cent of peak numbers; this is the limiting wind criterion for beach use, which as previously stated is between 17 and 22 m.p.h. during the day.

Comfort Indices

The Effective Temperature (ET) and Thom's Discomfort Index (TDI) were analyzed with attendance at Miquelon Lake, Ma-Me-O Beach and Wabamun Lake in the Edmonton region; Lac Philippe and Lac Lapeche beaches in the Ottawa-Hull region; and Lake George in southern New Brunswick. At all facilities r-values are almost identical whether the atmospheric variable be ET, TDI or maximum temperature (Table 5.5). In general, however, maximum temperature has slightly higher r-values than either comfort index, with those for TDI lowest of the three. Since no evidence suggests other than a straight line relationship between any of these variables and beach use, there is little need to expand the discussion of the comfort indices. Maximum temperature alone is equally as useful as, or even slightly more so than, either of the comfort indices in terms of both predicting attendance and identifying limits to beach use.

Discussion

Weather has a strong influence on beach use. The vari-

TABLE 5.5

COMPARISON OF CORRELATION COEFFICIENTS, BEACH USE WITH COMFORT INDICES AND MAXIMUM TEMPERATURE, BY DAY-GROUPING

Facility	r for:	Correlation Coefficients for Day-Grouping: (i)	(ii)	(iii)	(iv)	(v)	(vi)
Edmonton Study Region:							
Miquelon Lake	ET	.440	.511	.453	.483	-	.037
	TDI	.356	.468	.487**	.483	-	.023
	T	.441	.527	.469**	.544	-	.023
Ma-Me-O Beach	ET	.569*	-.015	-.068	.569	.388	.144
	TDI	.491	-.205	-.099	.540	.281	.023
	T	.636*	-.055	.055	.570	.315	.098
Wabamun Lake	ET	.080	.762*	.668**	.688*	.833*	.449**
	TDI	.077	.733*	.689**	.660	.700	.382*
	T	.105	.787**	.701**	.704*	.774*	.450**
Ottawa-Hull Study Region:							
Lac Philippe	ET	.361	.296	.610**	-	-	-
	TDI	.266	.244	.580**	-	-	-
	T	.418	.578	.668**	-	-	-
Lac Lapeche	ET	.316	.090	.514**	.102	.176	.087
	TDI	.253	.103	.467**	-.099	.000	.007
	T	.363	.505	.540**	.154	.185	.048
Southern New Brunswick Study Region:							
Lake George	ET	.007	-.182	.208	-	-	.475*
	TDI	-.035	-.216	.166	-	-	.536*
	T	.089	-.163	.238	-	-	.475*
Grand Lake	ET	.571*	.670*	.681**	-	-	.783*
	TDI	.445	.644*	.660**	-	-	.807*
	T	.623*	.718*	.695**	-	-	.781*

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.
** Statistically significant at the 1 per cent level.

ET - 3 p.m. Effective Temperature
TDI - 3 p.m. Thom's Discomfort Index
T - Maximum Temperature

Day-Groupings:

June 28-September 1, 1969:

(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:

(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays.

ables most closely correlated with attendance are maximum temperature, total daily sunshine hours, and the two comfort indices, especially ET. Relations between each of these four variables and beach use appear to be essentially linear in nature, and direct. Because maximum temperature is the parameter observed most frequently at meteorological stations, and because limiting values at 10 per cent of peak use can be readily identified, it is considered the single most relevant weather variable in beach use. However, correlation coefficients seldom are high enough to allow prediction of attendance. Values of r^2 vary considerably from facility to facility, and only rarely does maximum temperature explain more than 50 per cent of attendance variation. Maximum temperature appears to be most important at the most popular beaches: Wabamun Lake, Brown's Bay, New River Beach, Grand Lake and Parlee Beach in particular. There can be no doubt that in many instances factors other than weather play an important part in use fluctuations of each beach.

Precipitation and wind have definite inverse relationships with beach use. Neither appears to be linked in a straight line relationship with attendance. There is an exponential decay of attendance as precipitation amount increases, but it seems likely that other precipitation parameters could prove more useful than amount. Wind has little effect on beach use until a certain critical value is passed, when attendance begins to show a decline. There is some doubt about the on-site effects of wind at different beaches because microclimate factors affect windspeed very strongly. Aspect and local topography are particularly important. An exposed beach is likely to induce less use than a sheltered beach nearby, other factors being equal. There is thus a case for including wind direction as well as windspeed effects in a study of this kind.

Although relationships with weather are not as strong as for swimming, some limiting criteria for beach use are nevertheless evident (Table 5.6). Swimming is one of the major uses of beaches, but other activities are obviously factors too. For beach use, the temperature limitation is lower than for swimming; it also shows regional variation but to a lesser extent than for swimming. Beach users in the Edmonton region will tolerate lower maxima than those in the two eastern Canadian regions, but only by a matter of 3 to 4^{o}F. Adaptation to slightly cooler conditions in the off-peak season is again apparent. Edmonton area users however offset the lower maxima tolerated by reacting to sunshine occurrence. Although zero daily sunshine hours is not a limiting factor to beach use, at least in terms of the 10 per cent threshold, an increase in hours of sunshine has a more marked effect on Edmonton region beach attendance than in southern New Brunswick. Beach use in the Ottawa-Hull region also seems to be more strongly influenced by sunshine than in New Brunswick, though there is less convincing evidence for this. Perhaps this is an instance of residents of the study regions which experience most sunshine demonstrating their greater antici-

TABLE 5.6

LIMITING WEATHER CRITERIA FOR BEACH USE

Variable*	Study Region: Edmonton	Ottawa-Hull	Southern N.B.
Daily Maximum Temperature	55-60°F (55°F)	? (55-60°F)	60°F (55-59°F)
Relative Humidity	85-90% (75-80%)	? (95-97%)	No limitation
Daily Sunshine Hours	0 hours on weekdays; perhaps 1-2 hours on weekends	0 hours; no limitation	0 hours; No limitation
0900-1900 Hours Wind Mileage	←— 180-200 miles —→		

Source: Computer analysis, 1970.

? - Cannot be identified.

Figures in brackets indicate values for the off-peak season if these appear to differ substantially from those of the June 28-September 1, 1969 period.

* Although precipitation variables are not included in the table, it is possible that some precipitation parameter other than those studied does indeed have a limiting effect on beach use.

pation of it. Edmonton region recreationists expect more bright, sunny weather than those in southern New Brunswick especially, and therefore seem to demand that the weather "look" good as well as "feel" good. Finally, the limiting value for wind mileage is the same as for swimming. This suggests that wind is not an important factor while a person is swimming but may cause him discomfort when he is on the beach, just as it affects the general beach user.

CHAPTER VI

MULTI-ACTIVITY PARK USE

Those natural parks which allow participation in a broad range of outdoor pursuits are here classified as "multi-activity parks". They are difficult to define in precise terms. They are not wilderness areas, but neither are their amenities developed to the extent that they are well-known for one particular activity, as is the case with the beach park. Visitors are attracted by potential for activities such as fishing, boating, camping and nature study, and by the general outdoor environment, rather than by the mass-participation forms of outdoor recreation such as swimming. A weekend camping experience for these visitors is more pleasurable than at the beach park, where the campground is frequently overcrowded on summer weekends. Multi-activity parks often lie farther from large cities and are therefore less frequented than the more developed and heavily-used parks close to these cities.

The multi-activity park facilities are listed in Table 6.1. Their locations are shown in Figures 2.2, 2.5 and 2.9. Table 6.1 also indicates the type of visitation data available for analysis at each park. It should be noted that the two data types in fact count different users. The adjusted traffic counter data (Appendix B) indicate the day-use made of the facility; campers are excluded. The direct traffic counter record is indicative of total visitation to the park. It fails to differentiate between day-users and campers, and

TABLE 6.1

MULTI-ACTIVITY PARKS

Facility No.	Facility Name	Attendance Data*	Facility No.	Facility Name	Attendance Data*
Edmonton Study Region:			Ottawa-Hull Study Region:		
1	Big Knife	B	1	Fitzroy	A
7	Pembina River	A	2	Rideau River	A
8	Garner Lake	A	3	Silver Lake	A
9	Long Lake	A	5	Carson Lake	B
10	Cross Lake	B	6	Bonnechere	B
			7	Black Lake	B
			8	Bon Echo	B
Southern New Brunswick Study Region:					
17	Sunbury-Oromocto	B			
18	Lakeside	A			
27	Fundy National Park: West Gate	B			
	East Gate	B			

* Attendance data:

A - adjusted traffic counter record
B - direct traffic counter record

Facility numbers refer to Figures 2.2, 2.5 and 2.9, which show the locations of each park in the three study regions.

frequently conveys a false impression of the situation on Fridays and Sundays. Where possible, traffic counter records adjusted as in Appendix B are used, but if these are not available, then the direct vehicle counts are employed.[1]

Maximum Temperature

Sixty-two of the seventy-six analyses of maximum temper-

[1] The traffic counters at Fundy National Park's two entrances are a special case. Their data are included in this chapter because Fundy fits the category of multi-activity park better than that of beach park. The counters cannot provide data on use of the park because the existence of two entrances complicates matters, but they do indicate vehicle traffic at each gateway.

ature and attendance show a direct relationship. Only ten of these sixty-two achieve statistical significance at the 5 per cent level. All of them are analyses for weekdays in the off-peak period. Even where r is significant, its actual value is low. In general there is merely a weak positive relation between maximum temperature and attendance at multi-activity parks.

Figure 6.1 shows histograms of r-values by day-grouping. All the analyses undertaken for groupings of weekdays show an increase in park use with a rise in daily maximum temperature. This perhaps reflects that some of the people who are able to visit these parks on weekdays have more freedom of choice than the weekend visitors and can wait for a "good" day, in regard to the weather. An additional feature is that more than half of all the analyses with negative associations are for day-grouping (ii), Saturdays in the school holiday period. Figure 6.1 fails to show that six of these eight negative associations for day-grouping (ii) are found in the Ottawa-Hull study region. Other analyses for grouping (ii), and those for (i), (iv) and (v) display the tendency for the association to be positive. Values for weekend analyses are even lower than for weekdays.

Users of these parks seem prepared to accept a broad range of daily maximum temperature. Consequently it proves difficult to identify any lower limits of maximum temperature for multi-activity park visitation. This is especially true of the Ottawa-Hull region, where in 1969 at least, daily

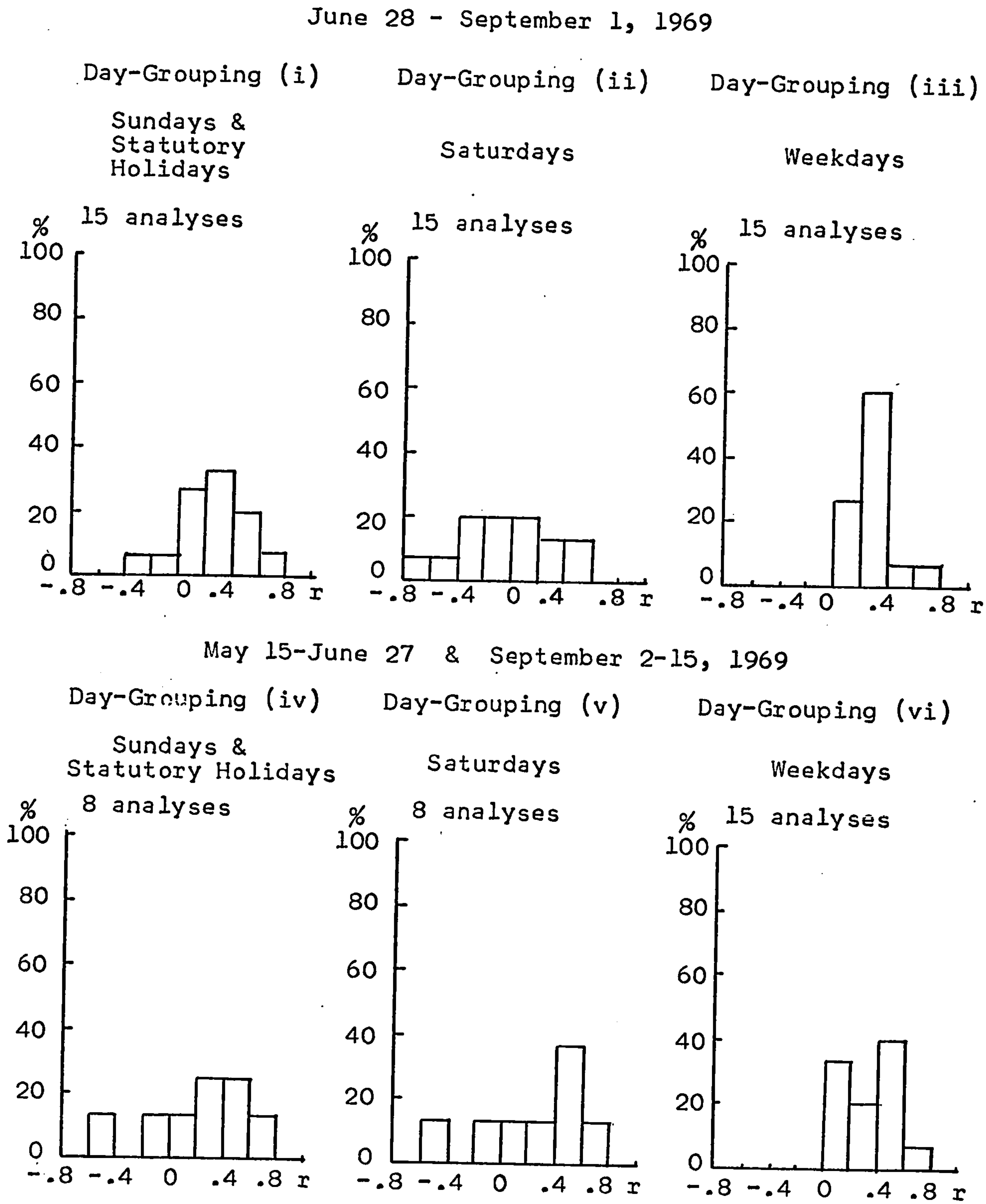

Figure 6.1

HISTOGRAMS OF r FOR MULTI-ACTIVITY PARK USE AND MAXIMUM TEMPERATURE, BY DAY-GROUPING

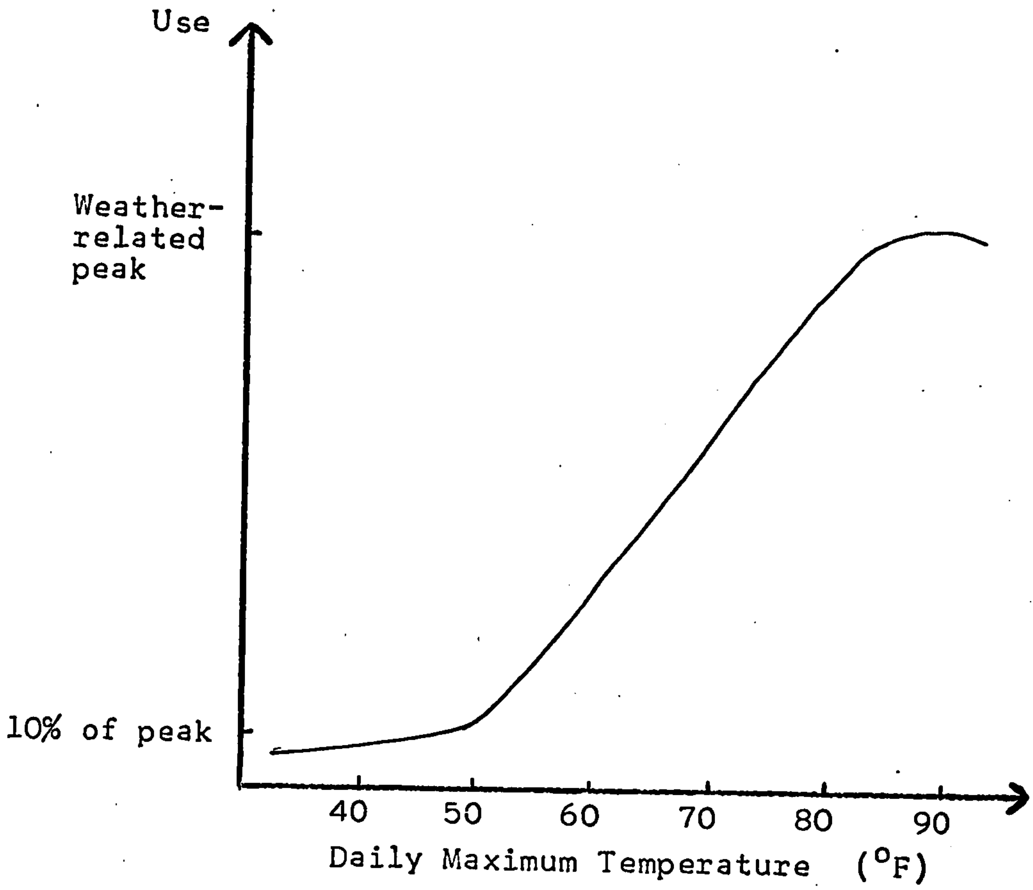

Figure 6.2

SCHEMATIZED RELATION BETWEEN MULTI-ACTIVITY PARK USE AND DAILY MAXIMUM TEMPERATURE maximum temperature during May 15 to September 15 apparently never dropped below the value coinciding with 10 per cent of peak use. One can only suggest that the limiting maximum temperature for park visitation lies in the broad range from 40°F to 55°F. The analysis does not indicate whether any regional variation occurs.

The nature of the relationship between maximum temperature and attendance at the parks is not as close as for some other activities, notably swimming and beach use. There is no reason to reject the straight line relationship in 85 per cent of the cases. In the other 15 per cent, there is evidence,however, for the form of a growth curve (Figure 6.2). This is noticeable in the Ottawa-Hull study region, where daily maxima in 1969 frequently exceeded 85°F. It may be that the levelling-off of the curve results from a tendency for people to choose facilities renowned for their swimming attraction when the weather becomes very warm, at the expense of visiting a multiple-activity park which may include a similar but less well-known amenity. It must be emphasized that this curve-function is suggested only at a few facilities and may result from competition with nearby beach parks for patronage. The maximum temperature influence on multi-activity park use is, in fact, not particularly strong.

Precipitation

The two variables of six-hourly mid-day amount and total daily precipitation are analyzed respectively at seven and ten parks. Of thirty-one separate day-grouping analyses conducted for six-hourly precipitation, just over half (seventeen) have negative linear regression coefficients. Thirty-seven of fifty-six analyses for total daily precipitation also show negative association. These figures indicate that precipitation tends to have a retarding effect on use of multi-activity parks; however, the proportion of analyses indicating this is not as high as for most other activities. It also seems that in the Ottawa-Hull region in particular there is very little relationship between precipitation and attendance at multiple-activity parks.

Sunshine

The variable of total daily sunshine hours is analyzed for seven parks. Table 6.2 lists these, and for each, shows the correlation coefficient by day-grouping. Twenty-six of the thirty-six analyses performed indicate a direct relationship between total sunshine hours and attendance, but the correlation coefficient attains 5 per cent or better significance in only six of the twenty-six cases.

One may conclude that in general there is a positive relationship between multi-activity park attendance and sunshine. However, with twenty-three of the thirty-six r-values falling between -0.25 and +0.25, positive relationships are far from convincing. The relatively low linear correlation coefficients mean that prediction of attendance from sunshine hour totals is meaningless.

Closer interpretation of Table 6.2 reveals very little interaction between sunshine hours and attendance in the off-

TABLE 6.2

CORRELATION COEFFICIENTS FOR ATTENDANCE AT MULTI-ACTIVITY PARKS AND TOTAL DAILY SUNSHINE HOURS, BY DAY-GROUPING

Facility	Correlation Coefficients for Day-Grouping:					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Number of Days in Grouping	9-13	8-10	34-43	9	7-8	19-41
Edmonton Study Region:						
Pembina River	.672*	.465	.086	-	-	.089
Ottawa-Hull Study Region:						
Fitzroy	.579*	.288	.034	.147	.677	.133
Rideau River	.234	-.039	-.187	.066	-.184	-.301
Silver Lake	.560	.004	-.051	-.188	-.047	.074
Black Lake	-.151	.055	-.322	.071	.148	.113
Southern New Brunswick Study Region:						
Sunbury-Oromocto	.578*	.732*	.417**	-	-	.228
Lakeside	.412	.683*	-.116	-	-	.167

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.
** Statistically significant at the 1 per cent level.

Day-Groupings:

June 28-September 1, 1969:
(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:
(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays

peak season, and on weekdays in the June 28-September 1 period. Peak period weekend use, however, shows a much greater association with sunshine. Nine of the eleven r-values which exceed +0.25 are among fourteen analyses made of June 28-September 1 weekends. Five of these nine are significant at the 5 per cent level. There is also a tendency for weekend attendance to correlate more closely with sunshine hour totals in the

Edmonton and southern New Brunswick study regions than in the Ottawa-Hull region.

Although sunshine does seem to be a factor in attracting people to multiple-activity parks on peak-season weekends, it seems never to be a limiting factor. In numerous instances large attendances on particular days coincide with a complete absence of sunshine. Nevertheless, it is interesting that sunshine appears to have more influence than maximum temperature on recreationists visiting the parks on peak-season weekends. During the week the situation is reversed.

Relative Humidity

Mean daily relative humidity is more closely correlated with multiple-activity visitation than any of the previous weather variables analyzed (Table 6.3). Thirty-six analyses are performed; twenty-four show an inverse relation between mean relative humidity and visitation. Nine of these have r-values significant at the 5 per cent level. Seven of the twelve positive r-values are less than +0.2. In all thirty-six analyses, the run-test produced no evidence to reject linearity in the relationship.

Further examination of Table 6.3 shows that the inverse relation of visits to mean relative humidity varies greatly from facility to facility. Thus eight of the nine significant cases are distributed among three of the parks. More striking still is that the inverse relationship is much stronger in New Brunswick than in either of the other two study regions.

TABLE 6.3

CORRELATION COEFFICIENTS FOR ATTENDANCE AT MULTI-ACTIVITY PARKS AND MEAN DAILY RELATIVE HUMIDITY, BY DAY-GROUPING

Facility	Correlation Coefficients for Day-Grouping:					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Number of Days in Grouping	9-13	8-10	34-43	9	7-8	19-41
Edmonton Study Region:						
Pembina River	-.489	-.481	-.141	-	-	-.091
Ottawa-Hull Study Region:						
Fitzroy	-.476	-.772	.107	-.796*	-.800*	.082
Rideau River	-.037	.156	.161	-.687*	.586	.326*
Silver Lake	-.338	-.417	.084	-.309	-.106	.306
Black Lake	-.217	-.081	.286	-.565	-.376	.158
Southern New Brunswick Study Region:						
Sunbury-Oromocto	-.747**	-.834**	-.385*	-	-	-.189
Lakeside	-.585*	-.695*	.107	-	-	-.306

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.
** Statistically significant at the 1 per cent level.

Day-Groupings:

June 28-September 1, 1969:
- (i) Sundays and Statutory Holidays
- (ii) Saturdays
- (iii) Weekdays

Remainder of the Summer, 1969:
- (iv) Sundays and Statutory Holidays
- (v) Saturdays
- (vi) Weekdays

Indeed, if Fitzroy Provincial Park were excluded from the Ottawa-Hull analyses, the relation between relative humidity and attendance in both the Edmonton and Ottawa-Hull regions would become quite inconclusive.

There is a tendency for high negative correlation coefficients to occur in the weekend day-groupings. Weekday groupings (iii) and (vi) show very little association with relative humidity. As is the case with sunshine hour relationships, weekend attendances seem considerably more influenced by weather conditions than those of weekdays.

Although relative humidity seems to bear a close inverse relation to attendance at some multi-activity parks, it is not a limiting factor. Many instances occurred when mean daily relative humdity was as high as 99 per cent, yet park attendance had not fallen below 10 per cent of the peak level.

Wind

Visitors to these parks in general seem to be almost indifferent to wind. Table 6.4 shows the correlation coefficients for the thirty-six day-grouping analyses performed at seven parks. Not one r-value attains statistical significance; twenty-five of thirty-six fall between -0.25 and +0.25, and only twenty of the thirty-six have negative values. There seems to be no systematic variation from region to region, nor from one day-grouping to another.

Examination of the scattergrams confirms the lack of a strong interaction between wind and attendance during the period 0900-1900 hours. Analyses for the Ottawa-Hull region suggest that a mileage of at least 190 must be recorded before attendance falls to 10 per cent of peak level. The single Edmonton area facility investigated indicates that the highest mileage recorded (220) still does not result in attendance falling below the 10 per cent level. None of the New Brunswick analyses had wind mileage greater than 160 between 0900 and 1900 hours local time. From the data studied, it seems

TABLE 6.4

CORRELATION COEFFICIENTS FOR ATTENDANCE AT MULTI-ACTIVITY PARKS AND 0900-1900 HOURS WIND MILEAGE, BY DAY-GROUPING

Facility	Correlation Coefficients for Day-Grouping:					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Number of Days in Grouping	12-13	9-10	35-43	9	7-8	19-41
Edmonton Study Region:						
Pembina River	.308	.113	.041	-	-	.021
Ottawa-Hull Study Region:						
Fitzroy	-.435	.177	-.039	-.362	-.149	.036
Rideau River	-.026	-.322	.040	-.616	-.311	.137
Silver Lake	.141	.474	.234	-.241	.031	-.239
Black Lake	-.295	.119	-.187	-.339	-.099	.109
Southern New Brunswick Study Region:						
Sunbury-Oromocto	.174	.339	-.070	-	-	-.226
Lakeside	-.159	.125	-.131	-	-	-.266

Source: Computer analysis, 1970.

Day-Groupings:

June 28-September 1, 1969:

(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:

(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays

that wind is a very unimportant factor in multiple-activity park visitation.

Comfort Indices

Table 6.5 compares values of the correlation coefficients for Effective Temperature (ET) and Thom's Discomfort Index (TDI) with those for maximum temperature at seven parks. As usual, ET gives r-values generally higher than those for TDI. It is quite evident that values for all three variables are

TABLE 6.5

COMPARISON OF CORRELATION COEFFICIENTS, COMFORT INDICES AND MAXIMUM TEMPERATURE VERSUS ATTENDANCE AT MULTI-ACTIVITY PARKS, BY DAY-GROUPING

Facility	r for:	Correlation Coefficients for Day-Grouping:					
		(i)	(ii)	(iii)	(iv)	(v)	(vi)
Edmonton Study Region:							
Pembina River	ET	-.168	.031	.157	-	-	-
	TDI	-.182	-.039	.294	-	-	-
	T	-.051	.062	.237	-	-	-
Ottawa-Hull Study Region:							
Fitzroy	ET	.137	-.517	.512**	-.126	-.127	.413**
	TDI	.005	-.413	.513**	-.441	-.299	.423**
	T	.111	-.103	.525**	-.166	-.132	.402*
Rideau River	ET	.309	.390	.235	.420	.564	.007
	TDI	.318	.491	.245	.119	.532	.075
	T	.383	.412	.217	.400	.443	.012
Silver Lake	ET	-.363	-.526	.180	.105	.565	.191
	TDI	-.446	-.530	.238	-.011	.452	.192
	T	-.369	-.344	.231	.103	.572	.134
Black Lake	ET	.324	-.164	.240	.295	.361	.526**
	TDI	.239	-.117	.204	.117	.213	.552**
	T	.266	-.105	.169	.332	.349	.546**
Southern New Brunswick Study Region:							
Sunbury-Oromocto	ET	.203	.404	.714**	-	-	.496**
	TDI	.050	.334	.643**	-	-	.466**
	T	.323	.554	.760**	-	-	.482**
Lakeside	ET	.269	.216	.235	-	-	.452
	TDI	.048	.069	.266	-	-	.430
	T	.225	.243	.226	-	-	.453

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.
** Statistically significant at the 1 per cent level.

ET - 3 p.m. Effective Temperature
TDI - 3 p.m. Thom's Discomfort Index
T - Maximum Temperature

Day-Groupings:

June 28-September 1, 1969:

(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:

(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays

very similar. The discussion of maximum temperature given earlier can therefore be extended to the two comfort indices without any major modifications. It is to be expected that if neither maximum temperature, relative humidity nor wind were to show high correlations, then the discomfort index and effective temperature would not do so either.

Discussion

Mean daily relative humidity is the weather variable most closely related to visitation to multi-activity parks. Visitation is found to be positively related to total daily sunshine hours, comfort indices and maximum temperature, but to be almost unaffected by wind. The reason for relative humidity's strong association may be that it is itself an index of two variables.

Weather has only a modest influence on total attendance at multi-activity parks. Low correlations between weather and visitation should be expected at this kind of facility. Within the parks themselves, visitors will tend to select the activity most suited to the current weather conditions. Data on participation in individual recreational activities at these parks would be very valuable, but at present are almost non-existent. These analyses show the need for a revision in the data collection techniques used at these parks, if more information on outdoor recreation behaviour is to be derived.

CHAPTER VII

PICNICKING

Records for daily picnicking use of recreational areas are difficult to obtain because very few sites are used solely for picnicking. Often a picnic is only part of an outing which includes another activity such as a pleasure drive. The picnicking data used here are obtained, with two exceptions, from the southern New Brunswick study region.

Many sites are simply roadside picnic grounds whose functions are twofold: to provide picnic spots for highway travellers, and to provide rest stops. It is possible to distinguish between those sites which are true destinations of picnicking outings and those which are essentially highway rest stops. The former show a marked concentration of use on weekends, suggesting that they are indeed used for recreational purposes. The others are used equally throughout the week, indicating that besides acting as picnic areas and rest stops for tourists, they are likely used as rest stops by highway travellers on non-recreational journeys as well.

The five true picnicking parks by this criterion are three of New Brunswick's "picnic ground parks" (Figure 2.9): York County Centennial, Doaktown and Queenstown; Luskville, Quebec (Figure 2.8); and South Nation, Ontario (Figure 2.5). South Nation is an Ontario Provincial Park adjoining Highway 17 between Ottawa and Montreal. It has a small campground but is located on land of relatively poor quality for other recreation, and its major day-use is therefore as a picnic and rest spot for highway travellers. Surprisingly, its use is greatest at the weekend. South Nation therefore would appear to receive most of its day-use from persons on recreational,or at least non-business trips, even though it is unlikely to be the actual destination of a picnicking excursion. It thus forms an exception to the two categories of picnic sites distinguished earlier. The other so-called "picnic ground parks" of New Brunswick,[1] while certainly used for picnicking, also serve as rest stops for highway travellers. These are McAdam, Prince William, Penobsquis, Pine Grove, Upper Blackville, Eagle Rock and Pennfield, all located on major provincial highways. Southern New Brunswick's other "picnic ground park", Lepreau Falls, has an additional attraction in its waterfall, which alone may draw recreationists. It is therefore excluded from picnicking analysis. Because its attractions are insufficient to justify placement in either the multi-activity or special sites categories, it is excluded from study entirely.

Steeves Mountain, Beech Hill and Port Elgin of the New Brunswick "campground parks" provide data indicative of picnicking activity. Beech Hill was operated only as a picnic ground park in 1969. It is located on the Trans-Canada Highway, and commands a fine vista of the Tantramar Marshes on the New Brunswick-Nova Scotia border. This, however, is not apparent to the motorist until he has turned off the highway

[1] Classification as a "picnic ground park" is by the New Brunswick Provincial Parks Branch, Fredericton.

into the park. Thus Beech Hill is essentially a highway picnic and rest stop. Steeves Mountain and Port Elgin, both located next to major highways, serve important functions as campground parks. At the same time, they are pleasant spots for highway travellers to picnic or rest. Their campers, however, stay just one night.[2] We might therefore conclude that the 1 p.m. car count at these parks provides satisfactory data for picnicking analysis.

The other two parks analyzed are located in the Ottawa-Hull region. At South Nation, adjusted traffic counter data (Appendix B) are representative of picnicking activity. Luskville (Figure 2.8) is a picnic area within Gatineau Park near Ottawa-Hull, but completely isolated from the remainder of the park and reached from Quebec Highway 8 between Hull and Quyon by a country road which terminates at the site. An automatic traffic counter records vehicles visiting the site.

The 1 p.m. car count is utilized where no other record is available or where it is the count most indicative of picnicking use. Obviously it is no more than an indicator of total picnicking use. Automatic traffic counter data are used where they are available. At McAdam and Upper Blackville, so little use is made of the sites, at least at 1 p.m. when the caretaker makes his sample car count, that they are not included in this analysis. Table 7.1 shows the count techniques employed for each of the picnicking facilities.

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[2] Information from the New Brunswick Provincial Parks Branch, Fredericton.

TABLE 7.1

RECORDS UTILIZED FOR ANALYSIS OF PICNICKING

Type of Record	Picnicking Facilities	Province
Automatic traffic counter	Luskville	Quebec
	York County Centennial Penobsquis Beech Hill	New Brunswick
1 p.m. car count	McAdam* Prince William Pine Grove Upper Blackville* Doaktown Queenstown Eagle Rock Pennfield Steeves Mountain Port Elgin	New Brunswick
Adjusted traffic counter data	South Nation	Ontario

Source: Survey of administrative agencies by author, 1969-70.
* Excluded from analysis because of very little use.

Maximum Temperature

The relationships of maximum temperature to attendance at thirteen picnicking facilities were investigated. There appears, by and large, to be no marked relation between daily numbers picnicking and maximum temperature. Forty out of fifty-nine analyses have positive values of b, but only ten of these forty have correlation coefficients statistically significant at the 5 per cent level. There appears to be a slight positive relation between picnicking and daily maximum temperature. Correlation coefficients range from -0.620 to +0.886 for individual analyses. Figure 7.1 shows histograms of r-values for the different day-groupings. Only one analysis has the linear correlation coefficient exceeding 0.80,

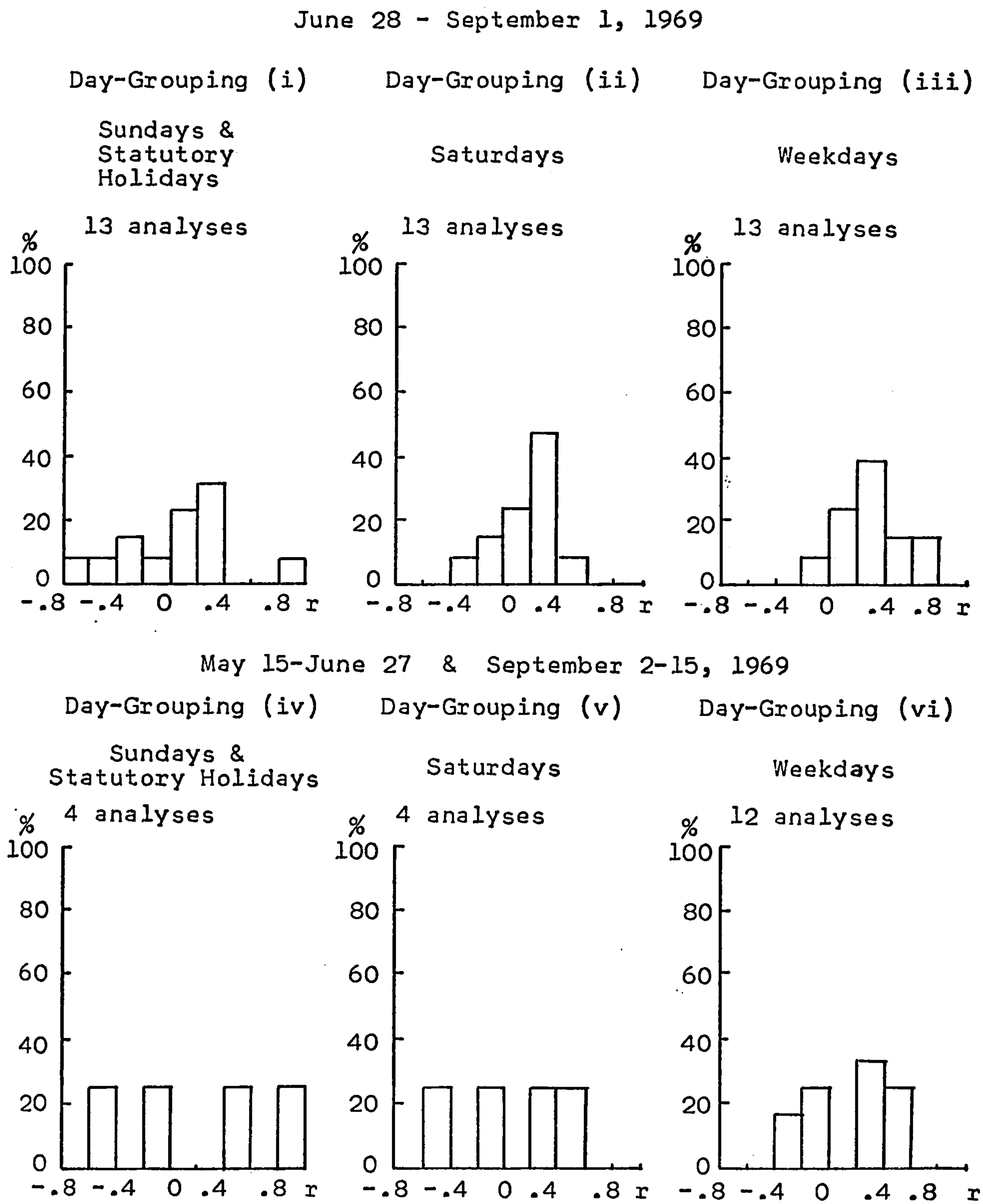

Figure 7.1

HISTOGRAMS OF r FOR PICNICKING USE AND MAXIMUM TEMPERATURE, BY DAY-GROUPING but there is no evidence in the run-tests that linearity should be rejected. The relationship between picnicking numbers and daily maximum temperature is apparently not a close one, and therefore is not useful in predicting picnicking activity at the facilities sampled.

The true picnic ground parks, Luskville, South Nation, York County Centennial, Doaktown and Queenstown contrast with those which function mainly as rest and picnic stops for highway travellers. Six of the twenty-five analyses for the true picnic areas show statistical significance for b at the 5 per cent level, a much higher proportion than for the remainder of the facilities analyzed. On the other hand, six of the twenty-five have negative values of b. Three of these, at Doaktown, Luskville and Queenstown, are for day-grouping (i), Sundays and Statutory Holidays during the school vacation. During the high summer period, all the true picnic parks excluding South Nation, have much lower r-values for Sundays and Statutory Holidays than for Saturdays. Possibly this reflects a tendency to regard picnicking as an activity suited more to Saturdays, when many people have only restricted leisure time. On Sundays when the weather is good, they are perhaps more likely to engage in activities requiring more time, such as visiting a beach or boating.

Temperature does not appear to be a critical factor to picnickers. Maximum temperature limits cannot meaningfully be identified from the data analyzed. Picnickers will tolerate a very broad range of temperatures. Within the range of maxima from the upper 40s to the mid 90s covered in the 1969 summer, no lower limit to picnicking activity was identifiable.

Precipitation

For all facilities except Doaktown, attendance can be related to total daily precipitation. While both this parameter and the six-hourly mid-day total are analyzed, results for both prove very similar. Hence only total daily precipitation will be discussed. Most results (thirty-one out of fifty-three) show b negative, or attendance declining as precipitation increases. In many of these cases, however, the slope of the regression line is very shallow (Figure 7.2, line A). This is well illustrated at Prince William Provincial Park, where all four analyses have a positive value for the regression coefficient (b). This results from two factors: (a) only small amounts of precipitation fell - for instance, the day with most precipitation in grouping (vi) had only 0.5 inches; (b) a heavy fall was experienced in one day in the late evening after most picnicking had already occurred.

The relationship tends to be a decline with increasing precipitation totals. Only in some of the weekend analyses is there evidence of deviation from the straight line in favour of a decay curve (as B in Figure 7.2). It seems likely that there is some other more relevant precipitation parameter applicable to picnicking use.

Sunshine

Attendance at five picnicking facilities was available

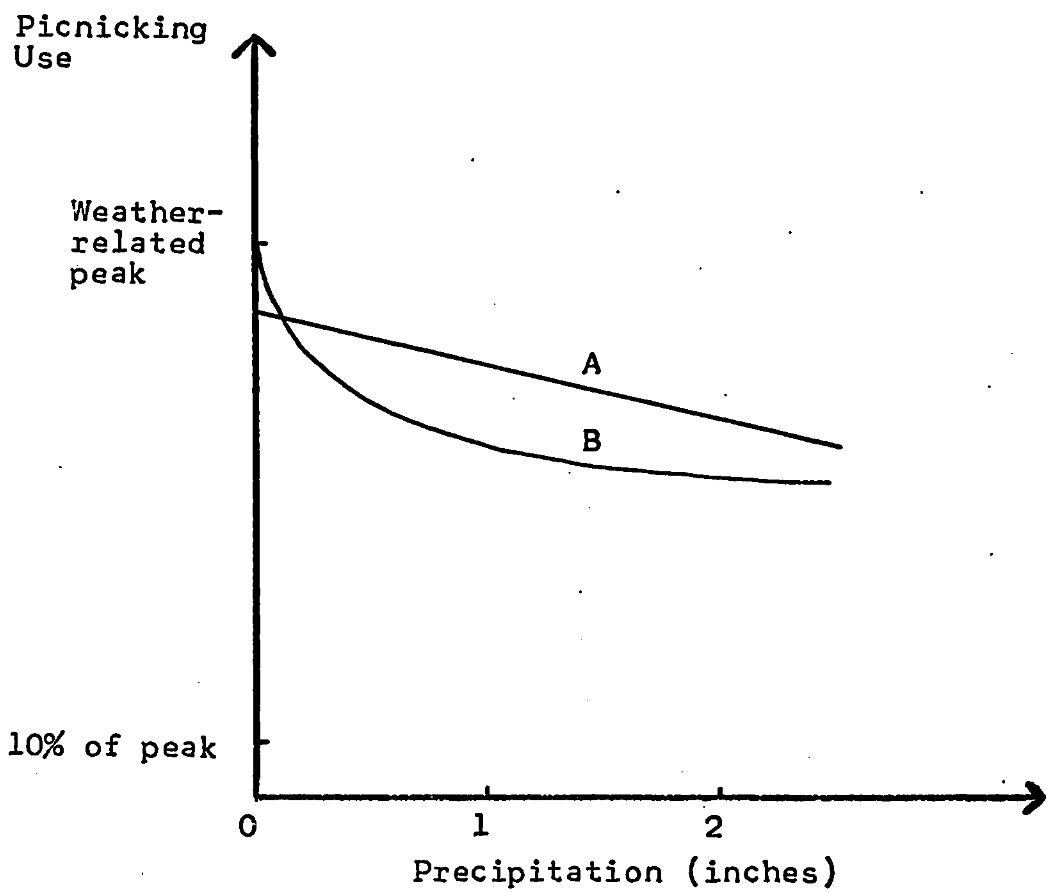

Figure 7.2

SCHEMATIZED RELATION BETWEEN PICNICKING USE AND PRECIPITATION AMOUNT for examination with respect to hours of sunshine. Only total daily sunshine hours were investigated. Fifteen of the twenty-three analyses have positive values of the linear regression coefficient, and only two of these are significant at the 5 per cent level. There is no justification for rejecting the straight line relationship, but the wide range of correlation coefficients (Table 7.2) indicates that variation about the straight line is so large that the predictive value of total daily sunshine hours is low indeed. In only one case does r^2 exceed 0.5, explaining 50 per cent of the variation in daily attendance.

All four analyses performed for Prince William Provincial Park show a negative correlation with total daily sunshine hours. The negative correlation coefficient for day-grouping (iii) is very low, but those for (i), (ii) and (vi) require comment in view of the values at the other picnicking facilities. Firstly, Prince William is the only site of the five whose use is not weekend-oriented. This is interpreted to mean that it is largely a highway rest stop, serving tourists and travellers during the week, and tourists and local recreationists (perhaps out on a pleasure drive) at the weekend. It seems probable that local recreationists take pleasure drives at weekends, and therefore are more likely to visit Prince William briefly if the weather is not hot. If it is warm and sunny, they are more likely to seek a specific destination at which to swim, to boat, or to recreate on the beach. Thus day-groupings (i) and (ii) at Prince William

TABLE 7.2

CORRELATION COEFFICIENTS FOR PICNICKING AND TOTAL DAILY SUNSHINE HOURS

Facility	Correlation Coefficients for Day-Grouping:					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Number of Days in Grouping	10-13	9-10	39-43	9	8	18-39
Prince William	-.513	-.337	-.061	-	-	-.316
York County Centennial	.776**	.681*	.004	-	-	.229
Queenstown	-.221	.200	.095	-	-	-
Luskville	-.200	.273	.037	.630	.629	-.021
South Nation	.542	.339	.280	.473	.303	-.011

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.
** Statistically significant at the 1 per cent level.

Day-Groupings:

June 28-September 1, 1969:

(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:

(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays

would be expected to show negative correlation coefficients. Surprisingly, so does day-grouping (vi). Fewer tourists travel in May, June and September, and large numbers of local people are unlikely to be picnicking or pleasure driving on weekdays. We might therefore anticipate almost no correlation with total daily sunshine hours. But the value of r at -.316, with eighteen days for analysis, indicates a slight tendency for a decline in visits with a rise in sunshine hours. This is not easy to explain.

York County Centennial, a true picnicking destination, shows a high correlation of visits with daily sunshine hours in peak-season weekends. Queenstown shows relatively little correlation in its three analyses. Luskville attendance is unrelated to sunshine hours except on off-peak season weekends. It seems that sunshine will not attract visitors to Luskville in midsummer, but will do so on off-peak weekends when visitors are perhaps less liable to participate in such activities as swimming, boating and beach use. South Nation shows positive relationships with sunshine hours except for day-grouping (vi), weekdays in the off-peak season. This is perhaps the most logical pattern of all five facilities. Used by tourists and business travellers on weekdays, and by tourists and those travelling between Ottawa and Montreal on weekends, it is more likely to receive visits on sunny days. But on off-peak weekdays, with fewer tourists on the road, there is no relationship between total daily sunshine hours and picnicking.

It seems therefore that the relationship between picnicking and total daily sunshine hours varies substantially from site to site. While some attempt has been made to explain these variations, it is very evident that the sunshine-picnicking relationship is not strong or consistent enough to lead to any meaningful identification of limiting sunshine criteria.

In conclusion, there seems to be no requirement that a day be sunny before people will picnic at the facilities studied. The relationship between total daily sunshine hours and picnicking is nebulous and inconsistent from one facility to another. This feature may indicate that picnicking facilities are arranged in a quasi-hierarchy in that some are more favoured than others under sunny conditions, although all are of course less favoured in warm weather than facilities with more "weather-demanding" activities.

Relative Humidity

Table 7.3 shows correlation coefficients for the twenty-three analyses of mean daily relative humidity and attendance at five picnicking sites. Fifteen are negative, six of these being significant at the 5 per cent level. This suggests an inverse relation between the humidity variable and picnicking. A more detailed examination of Table 7.3 reveals important differences among facilities and day-groupings.

Once again, Prince William shows up as an exceptional case. There is a definite tendency for attendance to be directly related to relative humidity. Furthermore, this tendency is strongest for day-grouping (i). In general, however, the weekday analyses at all five facilities indicate very little effect of relative humidity. The weekend situation, on the other hand, is quite different. Relationships with mean daily relative humidity are stronger on the weekend, except at Queenstown. This probably represents the greater influence of weather

TABLE 7.3

CORRELATION COEFFICIENTS FOR PICNICKING AND MEAN DAILY RELATIVE HUMIDITY, BY DAY-GROUPING

Facility	Correlation Coefficients for Day-Groupings: (i)	(ii)	(iii)	(iv)	(v)	(vi)
Number of Days in Grouping	10-13	9-10	39-43	9	8-9	18-39
Prince William	.602	.462	-.067	-	-	.344
York County Centennial	-.732**	-.780**	-.023	-	-	-.168
Queenstown	.297	-.257	-.220	-	-	-
Luskville	-.449	-.650*	-.234	-.795*	-.827*	.082
South Nation	-.381	-.427	-.081	-.718*	.108	.197

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.
** Statistically significant at the 1 per cent level.

Day-Groupings:

June 28-September 1, 1969:
(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:
(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays

on local picnickers, who comprise a larger proportion of weekend than weekday attendances. On weekend days with high humidity, the recreationist's inclination to swim or participate in other activities decreases, and he will look more favourably on picnicking, a pursuit less demanding of weather. Another point to note is that at Luskville and Queenstown, r-values are positive for day-grouping (i) but negative for grouping (ii). We might speculate that picnicking is a more favoured activity on Saturday than on Sunday. On Saturday many people do not have enough time for a trip of several hours to a beach or lake and may prefer a short drive and picnic instead. On Sunday they may prefer the trip to the beach or lake, but high relative humidity may deter them and cause them to opt for a picnic instead. However, such a tendency does not appear at South Nation or York County Centennial.

Mean daily relative humidity is not a limiting factor in picnicking. Even 99 per cent mean relative humidity does not always result in attendances dropping below 10 per cent of peak level. The association between relative humidity and picnicking activity seems to vary substantially from facility to facility and among day-groupings. This suggests that other factors in the decision to picnic may often outweigh the weather conditions. It is not possible to comment on regional disparities, with so few facilities being investigated. Relative humidity has a higher proportion of statistically significant correlation coefficients than maximum temperature, but as was the case with temperature, the relation between relative humidity and picnicking appears inconsistent. Thus the humidity variable is not valuable as an attendance predictor, nor is it able to indicate any limitations on picnicking activity.

Wind

Five picnicking facilities, Luskville, South Nation, Prince William, York County Centennial and Queenstown are available for windspeed analysis. Results are very inconclusive. Half (eleven) of the twenty-three analyses have negative values for the regression coefficient. The largest negative correlation coefficient has a value of -0.644, while the largest positive value is 0.306. Only two analyses achieve statistical significance at the 5 per cent level, one with a positive relationship, the other negative. Over the ranges of wind mileages covered, wind seems unimportant to picnickers. Twelve of the twenty-three correlation coefficients are between -0.2 and 0.2. There is no evidence to suggest other than a straight line relationship. Most of the analyses cover data up to 150 miles of wind recorded between 0900 and 1900 hours local time, or approximately a 15 m.p.h. average wind. There is evidence in one or two of the analyses that somewhere beyond this figure, wind-speed does become a factor in picnicking, but with the information available here, it is impossible to identify this value.

Comfort Indices

Comfort indices show very similar relationships with attendance to those of maximum temperature. Luskville, South Nation, Prince William, York County Centennial and Queenstown are the five parks to which the two indices can be usefully applied. Neither comfort index yields r-values as high as those achieved with daily maximum temperature, so that once again there is little point in considering these indices further. Thom's Discomfort Index and the Effective Temperature (ET) attain similar levels of correlation with attendance, so that ET's inclusion of windspeed seems of no advantage. As with the analysis of wind itself, the comfort index analysis also shows that windspeed is a relatively insignificant factor in picnicking, at least over the range of windspeeds encountered at Ottawa and Fredericton in the summer of 1969.

Discussion

Picnicking is less susceptible to weather than many other forms of outdoor recreation. The study finds that relative humidity and maximum temperature influence picnicking only slightly. Many picknickers will tolerate a very broad range of temperatures, even with daily maxima dropping to the upper 40s. Although precipitation amount has a deterrent effect on picnicking, its influence is less strong than for many other recreational activities, Many picnic ground parks have shelters for protection from rainy weather. Sunshine hours and the two comfort indices explain less of the variation in attendance at picnicking facilities than does maximum temperature. Wind displays only a weak inverse relationship with picnicking use. These observations imply then, that weather conditions alone are unlikely to prove useful in predicting the use made of picnic areas, and also that meaningful limiting weather criteria for picnicking activity are unidentifiable.

Many of the explanations suggested for the use patterns of the picnicking facilities have their roots in factors other than weather. When there is only a slight weather influence on a recreational activity, it appears that factors such as the characteristics of the activity and the precise location of the facility can exert a stronger influence on day-to-day attendance variations than the weather. The lack of predictability from weather indicates the importance of these other factors in the human decision process. The approach of investigating data from many recreation areas is beneficial in that the general relation between weather and picnicking numbers could never be gleaned from study of a single facility. Only examination of data from many facilities can yield information on relatively weak weather influences such as those characteristic of picnicking.

CHAPTER VIII

RECREATIONAL BOATING

Boating is an increasingly popular outdoor recreation activity in which participation is growing rapidly. Unfortunately data on the daily use of individual water bodies for boating are very sparse. For instance, Dowell (1970) had difficulty in finding data suitable for a study of weather effects on recreational boating on an Arkansas reservoir. He eventually devised his own method of counting boat launchings. His procedure is beyond the intent of this project, which relies entirely on attendance records collected by agencies administering recreation facilities.

The only existing records suitable for our purposes within the three study regions are those of the number of boats passing through locks on the Rideau Waterway, which links Ottawa and Kingston, Ontario (Figure 2.5). This information is systematically collected by the Rideau Canal Office of the Department of Transport. Problems arising from the use of the lockage data are discussed later.[1] One basic factor favouring the data is that all boats on the Waterway are used for recreational purposes only.

Unsuccessful attempts were made to solicit further information on pleasure boating, especially in the Edmonton and southern New Brunswick study regions. It transpired

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[1] One "lockage" equals one boat passing through a lock station in either direction.

that yacht clubs, power boat clubs and marinas do not in general keep records of the day-to-day use made of their facilities.[2] Also there are no counts of boats launched on water bodies within provincial and national parks. One may make the assumption that total visits to a facility where boating is a very important activity are indicative of boating use, but even this premise proves unproductive. Only at Wizard Lake Park in Alberta is the assumption justified, and despite an admission charge levied by the administering county of Leduc, no daily records of park entry are available.[3] Pleasure boating, then, is an activity for which more use data would be highly beneficial to those responsible for meeting outdoor recreation demands.

Even the Rideau Waterway lockage records fail to supply the most desirable data, since there are two groups of users who are counted in the lockages. These are cruising boaters and day-users. The cruising boaters travel on the system for periods lasting from a few days to perhaps two weeks; day-users own small boats and sail them on the Waterway for a few hours at a time.

[2] *Pers. comm.*, Mr. R.G. Lister, Secretary, Royal Kennebecasis Yacht Club, Millidgeville, Saint John, N.B., January 6, 1970; Mr. J.R. Radforth, Secretary, Fredericton Boat Club, Fredericton, N.B., February 1, 1970.

[3] *Pers. comm.*, interview with Mr. K. Pinkowski, County of Leduc, Leduc, Alberta, April 29, 1970.

Difficulty arises therefore in separating one group from the other, and especially in obtaining adequate data on day-users, many of whom may never pass through a lock. Even the sample of the Rideau Waterway user survey concentrates heavily on the cruising boater (Johnston, 1969, p. 50). The lockage statistics however do differentiate between Canadian and non-Canadian boat registrations. Most non-Canadian registrations are of United States origin. It may be assumed that non-Canadian boats will most often be cruising the system, while Canadian boats will include a much higher proportion of day-users. Thus the objective of assessing weather effects on both the day-user and the cruiser can at least partially be met by studying Canadian and non-Canadian craft separately.

There are a great many lock-stations on the Waterway, and a study of the records of all of them would be very time-consuming. The six lock-stations at Ottawa, Smiths Falls Detached, Newboro, Chaffeys, Jones Falls and Kingston Mills (Figure 2.5) were therefore selected for review. Eighty-six per cent of all lockages at these six stations between May 15 and September 15, 1969 were concentrated in the peak season of June 28-September 1 inclusive.[4] Discussion can thus validly be concentrated

[4] This figure of 86 per cent indicates that boating use of the Rideau Canal is strongly dictated by the traditional July and August summer vacation period. This trend in boating is even more marked than for many other activities; comparable figures are 63 per cent for vehicle entries to Elk Island National Park near Edmonton, and 70 per cent for visitation to Wabamun Lake Provincial Park.

on the peak period. Records from these six lock-stations are representative of the varied levels and types of daily traffic on the Canal. Ottawa and Kingston Mills Locks are the two ends of the system. Smiths Falls Detached Lock lies above the Smiths Falls Basin, where there is a large mooring in the only sizeable town along the Waterway between Ottawa and Kingston. Boats moving between Smiths Falls and the Rideau Lakes must be worked through this lock. The single locks at Newboro and Chaffeys are the only ones that must be traversed between three large lakes on the scenic Rideau Lakes section of the Waterway, and are the busiest in the entire system. They are traversed by many more day-users than other locks along the Waterway. The staircase of locks at Jones Falls very likely represents the upstream travel limit of day-users starting their voyage at Kingston. Since there is a difference in level of 58 feet, 6 inches, between Whitefish Lake below Jones Falls and Sand Lake above, the staircase requires considerable locking time and seems more likely to be used in the main by those cruising the system or at least undertaking a weekend's boating. Examination of lockage records reveals that the Ottawa Locks staircase by which the Canal descends to the Ottawa River is very little used, and that Kingston Mills Locks at the southern end of the Waterway receive seven times as much use. Cruises made by boats launched outside the Rideau system begin largely at the Kingston end, and apparently most do not penetrate beyond the Rideau Lakes. It also appears that very few cruises traverse the entire system from one end to the other. Much of the day-use seems to take place on the Rideau Lakes, judging from the records of lock-stations in this sector of the Waterway.

Another important factor in the Waterway use pattern is the degree to which use of each lock is concentrated on weekends.[5] The concentration of use at weekends is strongest at Ottawa Locks, followed by Newboro, Chaffeys, Kingston Mills and Smiths Falls Detached in that order. Only at Jones Falls are total lockages not concentrated on weekends. The subdivision of traffic into Canadian and non-Canadian boats reveals further information. Only at Kingston Mills are lockages of non-Canadian boats concentrated on weekends (index of concentration 1.80 in 1969), though at Ottawa, non-Canadian lockages are almost equally prevalent on all days (index of concentration 1.92). At the other four lock-stations, comparable index

[5] One might expect locks which have significant day-use to show a greater concentration of lockages on the weekend than those traversed mainly by cruising boaters. "Concentrated on weekends" refers to a higher number of boats being locked on a weekend day (i.e. a Saturday, Sunday or Statutory Holiday) than on a weekday. There were sixty-six days in the June 28-September 1 period, 1969, and forty-three of these were weekdays. If boating were just as prevalent on weekdays, we would expect 43/23 or 1.87 times as many lockages to be made on the forty-three weekdays combined as on the twenty-three weekend days combined. Dividing weekday lockages by weekend lockages thus will give an "index of concentration". Values greater than 1.87 show a concentration on weekdays, values lower than 1.87 on weekends.

values range from 2.38 at Jones Falls to 3.65 at Smiths Falls. We might construe this as indicating that many of the American boats are cruising the system and tending to pass through Kingston Mills or Ottawa on weekends, and the central portions of the Waterway on weekdays. Canadian boaters use the Canal much more extensively on weekends. The index of concentration for lockages of Canadian boats is as low as 1.11 at Newboro, and even at Jones Falls is only 1.61. Thus Canadians are more likely to be day-users than Americans. Lockage records also show that this group makes far more use of the scenic Rideau Lakes section than of the remainder of the system.

Because of the amount of information about the use pattern of the Rideau Canal which is available through detailed study of the lockage records, it is possible to be definitive about the behaviour of boaters not merely in relation to weather. This is not true of most of the other activities analyzed in this project, where it is possible only to speculate on the way that user behaviour often counters the weather-attendance relationship. This better user information is offset somewhat by the scarcity of weather data in close proximity to the Rideau Lakes lock-stations. Figure 2.5 shows the meteorological stations whose observations are used in the analysis. Data on weather elements other than temperature are sparse. Maximum temperatures can be analyzed for all six lock-stations. Smiths Falls is close enough to Ottawa to be studied with respect to Ottawa precipitation, sunshine hours, comfort indices, wind, and relative humidity. Ottawa and Smiths Falls Detached lockages are the only ones analyzed with regard to precipitation, due to difficulty in obtaining precipitation records over the remainder of the system. At the four southernmost lock-stations, lockages are studied with wind records from Main Duck Island, 15 miles southsouthwest of Kingston.

Maximum Temperature

Maximum temperature is not a useful predictive variable with respect to the total boats worked through each lock-station. Thirty-three analyses were made of total lockages against daily maximum temperature.[6] Only one, for off-peak weekdays at Chaffeys Lock, achieves 5 per cent statistical significance for the linear regression coefficient (b). Seven have negative values of b. Nineteen of the correlation coefficients (r) fall between -0.20 and +0.25. A weak positive relation between maximum temperature and total lockages is suggested. There is no evidence to support a non-linear function for the relationship. The large variation about the regression line makes it worthless for predicting total lockages. It is also very difficult to identify

[6] So few boats are locked through the Ottawa staircase in the off-peak period that the three analyses for this period were not worth performing.

limiting values for maximum temperature, because lockages recorded are rarely fewer than 10 per cent of the peak number, especially in the June 28-September 1 period. However, there is a suggestion from the off-season data that the limiting value is in the low 50s ^{o}F.

Weekday analyses for the school vacation period at all six lock-stations show weak positive relationships between total lockages and maximum temperature. Weekends display more variation; correlation is still low, but positive r-values on Sundays and Statutory Holidays, and also on Saturdays are highest at Newboro and Chaffeys Locks. Use of these two locks is the heaviest on the Waterway and, apart from the little-used Ottawa Locks, the most concentrated at weekends. Even here, none of the analyses is statistically significant. In the off-season period r-values in general are higher, particularly on Sundays and Statutory Holidays (r = .644 at Kingston Mills, .581 at Newboro, .563 at Chaffeys). This may reflect the higher proportion of Canadian users, and day-users especially. But as mentioned previously, the only analysis statistically significant at the 5 per cent level is for off-season weekdays at Chaffeys Lock.

Table 8.1 shows r-values for all the analyses of the two categories of Canadian and non-Canadian boats. Five correlation coefficients among the thirty-three analyses of Canadian lockages are both positive and significant at the 5 per cent level, compared with only one of twenty-four for non-Canadian boats. Of the thirty-three Canadian analyses, twenty-nine show a positive value of b and only four negative; comparable figures for the twenty-seven non-Canadian analyses are eighteen and nine respectively. Canadian boaters on the Rideau Waterway thus tend to be more strongly influenced by maximum temperature than their American counterparts. This is particularly true of boaters working through Newboro and Chaffeys Locks, where the incidence of day-users rather than cruisers is highest.

The nature of the relationship remains somewhat nebulous. As demonstrated in Table 8.1, correlation coefficients are not high enough to allow linear regressions to be used as predictive functions. Also the range of r-values is such that it seems that the traditional use patterns on the Rideau system are strong enough in some instances to obscure the maximum temperature influence. What evidence there is suggests only that a lower limit of maximum temperature at 10 per cent of the peak use is critical to boating, and that this maximum temperature is about 50-55^{o}F. Above this threshold there tends to be only a very weak positive correlation between maximum temperature and lockages of American boats, and a somewhat stronger but only moderate positive correlation for Canadian lockages.

TABLE 8.1

CORRELATION COEFFICIENTS FOR LOCKAGES AT RIDEAU CANAL LOCK-STATIONS AND MAXIMUM TEMPERATURE, BY DAY-GROUPING AND NATIONALITY OF BOAT REGISTRATION

Lock-Station	Boat Nationality	Correlation Coefficients of Day-Grouping: (i)	(ii)	(iii)	(iv)	(v)	(vi)
Ottawa**	Canadian	.053	.143	.128	-	-	-
	Non-Canadian	-	-	-	-	-	-
Smiths Falls Detached**	Canadian	.024	.080	.303*	.179	.276	.329*
	Non-Canadian	.057	-.308	-.090	-	-	-
Newboro	Canadian	.449	.321	.168	.691*	.499	.284
	Non-Canadian	.425	.007	.127	.305	-.439	.255
Chaffeys	Canadian	.364	.209	.255	.586	.045	.369*
	Non-Canadian	.112	.110	.115	.399	-.351	.255
Jones Falls	Canadian	.421	-.184	.239	.152	.622	.115
	Non-Canadian	-.220	-.149	.084	.625	-.412	.284
Kingston Mills	Canadian	-.095	-.560	.335*	.533	.299	-.028
	Non-Canadian	-.039	-.258	.057	.682*	.140	.174

Source: Computer analysis of 1969 data provided by Rideau Canal Office, Ottawa.

* Statistically significant at the 5 per cent level.

** Too few lockages to allow meaningful analyses at Ottawa of day-groupings (iv) to (vi) for Canadian boats and all day-groupings for non-Canadian craft; and at Smiths Falls Detached of day-groupings (iv) to (vi) for non-Canadian boats.

Day-Groupings:

June 28-September 1, 1969:

(i) Sundays & Statutory Holidays (13)
(ii) Saturdays (10)
(iii) Weekdays (43)

Remainder of the Summer, 1969:

(iv) Sundays & Statutory Holidays (9)
(v) Saturdays (8)
(vi) Weekdays (41)

Numbers of days per grouping, given in brackets, are the same for all six lock-stations.

Precipitation

The range of analyses made on precipitation is very limited. There is little value to be gained in giving the results in any detail. It does seem however that weekend lockages at Smiths Falls Detached Lock, which likely include a proportion of day-users, are inversely related to precipitation amount. Lockages at Ottawa and weekday lockages at Smiths Falls seem unrelated to precipitation. There is at least an indication that precipitation affects the two major Waterway user-groups in different ways. Precipitation deters the day-user, but fails to affect the cruiser, who often has a schedule of sorts to follow. This is not surprising at first glance, but on the other hand a number of cruisers might be expected to tie up on wet days in Smiths Falls and Ottawa, with their occupants availing themselves of the opportunities offered by these cities. Thus we might expect at least a slight inverse relation between precipitation and lockages of cruising boats too, but this does not seem to be the case. Details of the precipitation other than the actual amount received may or may not be more relevant to boating.

Sunshine

Little association was found between passages through Smiths Falls and Ottawa Locks and total daily sunshine hours, regardless of day-grouping or nationality of craft registration. Unfortunately, no correlations could be performed for Newboro and Chaffeys Locks, where day-use, and particularly use on the weekend are high. Because of a lack of sunshine records, sunshine analyses are confined to two lock-stations where cruising is likely to account for most lockages. It is therefore justifiable to say only that sunshine appears to have virtually no effect on boat cruising on the Rideau Waterway. Its effect on day-users could not be examined.

Relative Humidity

The influence of relative humidity on lockages could be studied only at Smiths Falls Detached and Ottawa Locks. The results are very inconclusive. Eight of twelve analyses have negative but non-significant values of b; but one of the four with b positive has r statistically significant at the 5 per cent level. The correlation coefficients are low, and examination of the scattergrams yields no further information. Mean daily relative humidity seems to have negligible effect on lockages, at least at Smiths Falls and Ottawa.

Wind

There are reservations about use of Main Duck Island wind records for correlation with boats locked through the four southernmost stations studied on the Canal. Main Duck Island is a very exposed observing post in Lake Ontario 15 miles southsouthwest of Kingston. However, it was felt that windspeed might be an important factor in pleasure boating, and Main Duck Island observations were the closest that could be obtained in 1969 to the southern portion of the Rideau system. Hence they were used.

The wind mileage for 0900-1900 hours local time is inversely related to boat lockages, only very slightly at Ottawa and Smiths Falls Detached Locks, and more strongly at the other four stations (Table 8.2). Thirty out of thirty-three analyses for Canadian boats have negative values of the correlation coefficient (r), five of them achieving 5 per cent statistical significance for r. Comparable figures for non-Canadian boats are twenty-one out of twenty-seven, with only one achieving 5 per cent statistical significance. No marked patterns appear in the differences between Canadian and non-Canadian boaters' responses to wind, however. At Newboro and Chaffeys, Canadian boaters are slightly more responsive to increasing wind than Americans, though not significantly so, but the same is true of Jones Falls, where we would not expect to find many day-users.

Wind seems to be equal as a predictive variable to daily maximum temperature, but its value must not be overstated. There certainly is a decline in lockages as recorded wind mileage increases, but on the other hand the critical value at 10 per cent of peak use seems higher than the maximum mileage studied here and thus cannot be identified. It is certainly in excess of 180 miles of wind recorded from 0900-1900 hours, or an average speed of 18 m.p.h. The effect of increasing

TABLE 8.2

CORRELATION COEFFICIENTS FOR LOCKAGES AT RIDEAU CANAL LOCK-STATIONS FOR 0900-1900 LOCAL TIME WIND MILEAGE, BY DAY-GROUPING AND NATIONALITY OF BOAT REGISTRATION

Lock-Stations	Boat Nationality	Correlation Coefficients of Day-Grouping: (i)	(ii)	(iii)	(iv)	(v)	(vi)
Ottawa**	Canadian	-.034	-.404	-.130	-	-	-
	Non-Canadian	-	-	-	-	-	-
Smiths Falls Detached**	Canadian	-.295	-.312	-.255	-.115	-.112	-.114
	Non-Canadian	-.102	.419	.063	-	-	-
Newboro	Canadian	-.269	-.580	-.357*	-.661	-.294	.090
	Non-Canadian	-.036	-.022	-.193	-.555	-.491	.198
Chaffeys	Canadian	-.277	-.612	-.251	-.673*	-.721*	.261
	Non-Canadian	-.356	-.157	-.243	-.467	-.574	.147
Jones Falls	Canadian	-.409	-.665*	-.147	.065	-.261	-.150
	Non-Canadian	-.117	-.278	-.053	-.776*	-.647	.254
Kingston Mills	Canadian	-.610*	-.365	-.112	-.264	-.306	-.002
	Non-Canadian	-.022	-.570	-.118	-.258	-.515	.176

Source: Computer analysis of 1969 data provided by Rideau Canal Office, Ottawa.

* Statistically significant at the 5 per cent level.

** Too few lockages to allow meaningful analyses at Ottawa of day-groupings (iv) to (vi) for Canadian boats and all day-groupings for non-Canadian craft; and at Smiths Falls Detached of day-groupings (iv) to (vi) for non-Canadian boats.

Day-Groupings:

June 28-September 1, 1969:

(i) Sundays & Statutory Holidays (13)
(ii) Saturdays (10)
(iii) Weekdays (43)

Remainder of the Summer, 1969:

(iv) Sundays & Statutory Holidays (9)
(v) Saturdays (8)
(vi) Weekdays (41)

Numbers of days per grouping, given in brackets, are the same for all six lock-stations.

wind mileage on lockages is most marked at the lock-stations receiving higher proportions of day-use, but is also recognizable at Jones Falls. Canadian boaters are only slightly more affected by increasing wind than non-Canadians. Although differences between the two groups do show up, they are not as marked as with maximum temperature.

Comfort Indices

The 3 p.m. Effective Temperature (ET) and Thom's Discomfort Index were examined at Ottawa and Smiths Falls Detached Locks only. They are correlated a little more closely with lockages than is maximum temperature. However, no more of the analyses achieve statistical significance, and thus the effort involved in calculating them does not produce commensurate improvement in prediction. Apart from daily maximum temperature, windspeed is the other important weather factor in boating use. Hence we might expect ET to be a slightly better predictor than maximum temperature alone. However, relationships between the comfort indices and lockages appear to be not dis-similar to those for maximum temperature. They are not strongly defined and there seems to be no reason to assume any non-linear form to the function.

Discussion

Boating activity on the Rideau Waterway shows some weather-related fluctuations but in general is not strongly influenced by atmospheric conditions. The July and August peak-season for boating seems to be one of the prime factors in the use pattern.

Two groups of Waterway users, Canadians and non-Canadians, demonstrate differing degrees of weather influence on their activity. This is due to the length of their trips and not to any basic differences in their weather tolerance. The Canadian boater is more likely to be a day-user, and this feature results in his greater responsiveness to weather conditions. However, even he is not influenced to a significant degree by them. The probability of his taking a sail is enhanced by high daily maximum temperatures and by low windspeeds, in that order, and is reduced by the occurrence of precipitation. He seems to be affected very little by relative humidity. The data analyzed do not highlight the influence of sunshine. Weather in itself is not a large enough factor in the complete use pattern to allow any valuable prediction of the number of lockages of day-use boats at a given lock-station on a particular day. This is truer still of cruising boats. Because most American users are cruising the Canal for several days at least, usually on a schedule which has in part been pre-planned, they do not react as responsively to a weather situation as the Canadian day-user who is not normally pre-committed to the trip. There is nevertheless some effect of maximum temperature and windspeed on lockages of American boats. Precipitation seems to have negligible effect. That American lockages do reflect a response to weather may indicate either of two possibilities. First, at least some of the American boats are being sailed by day-users; or secondly, some cruising boaters have a flexible enough schedule that they can tie up for a while if the weather is bad or travel further if it is good.

A lack of suitable data elsewhere means that findings for the Rideau Waterway cannot be compared with boating facilities in the other two study regions. The actual influence of weather on boating on the Rideau Canal is seen to be weak. Only one tentative limiting weather criterion can be proposed. This is a value of 50-55°F for daily maximum temperature, below which activity at lock-stations seems to fall to negligible levels. On the other hand, during the peak boating season in 1969, daily maxima as low as 55°F were not experienced.

This analysis has shown atmospheric conditions to exert only a modest influence on boating. Much of the fluctuation in daily lockages must be attributed to factors other than weather. Not least of these is the custom of many boaters to use the Rideau only during the peak season of July and August, regardless of weather. On many days with apparently "good boating weather" in June and early September, there is virtually no activity at the lock-stations on the Waterway.

In conclusion, this study has revealed problems in the existing records of boating use. Within the three study regions, only one water body was found to have daily records suitable for our purposes. Even in the case of the Rideau system, the assumption had to be made that lockages are indicative of pleasure boating use. Boating is a rapidly expanding pastime and a use of water which demands an extensive surface area. It will therefore require careful management if deterioration of available water resources is not to occur. A concerted effort should be made to keep and standardize records of boating volume at facilities across the country. Otherwise the current lack of basic information on the activity will continue to be an obstacle in the paths of outdoor recreation planners.

CHAPTER IX

DRIVING FOR PLEASURE

Pleasure driving is an almost univeral activity. A drive is part of nearly all trips undertaken for outdoor recreation. Even when the drive itself is the primary purpose of the trip, brief stops may be made at picnic sites and other points. It is difficult therefore to isolate the pleasure drive from the other pursuits which frequently accompany it within the framework of a single recreational outing. If pleasure driving is to be isolated, then it must be defined as a drive taken with no other activity in mind. Even then, meaningful data representing participation in this activity alone are difficult to collect or assess. Vehicle counter records are incapable of measuring pleasure driving except in the rare instances where the road on which the counter is located is used largely for this one activity. In order to provide more reliable records for this activity, only costly traffic surveys would seem to meet the need. To date, very few of these have been conducted anywhere.

Pleasure driving is an important pursuit deserving of participation analysis, the more so since it is identified by the Recreational Sector of ARDA (Canada, Dept. For. and Rural Devt., 1967, p. 6) as a significant activity in itself. In view of the difficulties of data collection and assessment, however, one must be prepared to make assumptions in order to obtain any pertinent data for analysis. This is the approach adopted here.

One facility where data can be usefully assessed is Gatineau Park in the Ottawa-Hull study region. Figure 2.8 shows this large park, which lies only a few miles from the federal capital. Access to its major nodes of recreational activity is gained by roads distinct from the Gatineau Parkway itself. This is a road designed specifically for pleasure driving purposes and for viewing of the scenery of parts of the Canadian Shield (National Capital Commission, 1967). Commercial traffic is banned from the Parkway. Consequently, the assumption is made that vehicles recorded by the traffic counter on the Parkway are mainly engaged in pleasure driving through the park.

A second facility in the same study region, Long Sault Parkway, 10 miles west of Cornwall, Ontario, connects a series of St. Lawrence parks located on islands which have resulted from the flooding of the Seaway. This parkway carries no commercial traffic. However, the traffic counters at both East and West Gates record total summer recreational traffic. The assumption previously made for Gatineau Park is similarly made here: that the traffic counter data can be considered as representative of pleasure driving activity.

The third facility considered in this analysis is Elk Island National Park near Edmonton (Figure 2.3). This is a very difficult park to classify. It contains a swimming beach, but visitors are no less attracted by such amenities as the golf course, picnicking, nature hikes, the buffalo paddock, and the campground. The park might therefore have been classified as a "multi-activity" park. It is not far enough from Edmonton however to avoid heavy use, and thus does not fit into this category as defined earlier (Chapter VI). Because it caters to a diversity of the popular outdoor activities, it does not fall into the "special sites" category either. The visitation pattern is unusual in that the heaviest use occurs at weekends outside the school vacation period. This is a basic difference from the use patterns of swimming sites, beach parks and other more specialized outdoor recreation facilities. Consequently, the relatively short drive from Edmonton for many users appears to be an important aspect of use of the park; such users do not generally expect to participate in the traditional summer activities during this off-peak period. Users entering through the South Gate must anticipate a half-hour drive through the park on a narrow, winding road before arriving at the recreational centre of the park. A strong similarity is therefore shown between this drive and the drive along the Gatineau Parkway. The drive through the park therefore seems to be an integral part of the visit to Elk Island. In addition, a proportion of visits made to Elk Island Park will qualify as pleasure drives in themselves. For these reasons, traffic counter data at Elk Island National Park are assumed to be representative of pleasure driving participation. Records from the South Entrance, the most frequently used of the three park entrances and the one which is accessible directly from the Yellowhead Highway, are thus chosen for the analysis.

These data on pleasure driving are few, and depend on the assumptions outlined above. They nevertheless represent the only information now available. There is a dearth of records on pleasure driving. Without the collection of a much larger volume of reliable data in the future, our lack of information on participation in this activity will continue.

Maximum Temperature

Table 9.1 shows linear correlation coefficients for the twenty-four maximum temperature analyses performed. Twenty-two of these are positive, seven being significant at the 5 per cent level. The obvious feature of Table 9.1 is the significance of the analyses for Elk Island National Park. At the other facilities, the only two analyses reaching 5 per cent significance are for Long Sault Parkway on weekdays in the school vacation period. In general there would appear to be a slight positive association between maximum temperature and pleasure driving. There is some evidence from the run-test and from the computer plots that linearity is not applicable, despite the relatively high linear correlations found in several of the analyses.

At Elk Island Park a very unusual situation prevails, in contrast to the weak positive correlations of the other facilities. The Elk Island scattergram for day-grouping (i) is shown in Figure 9.1. The other five day-groupings all have r significant at the 5 per cent level or higher, but in spite of this, there is a strong suggestion that the analyses

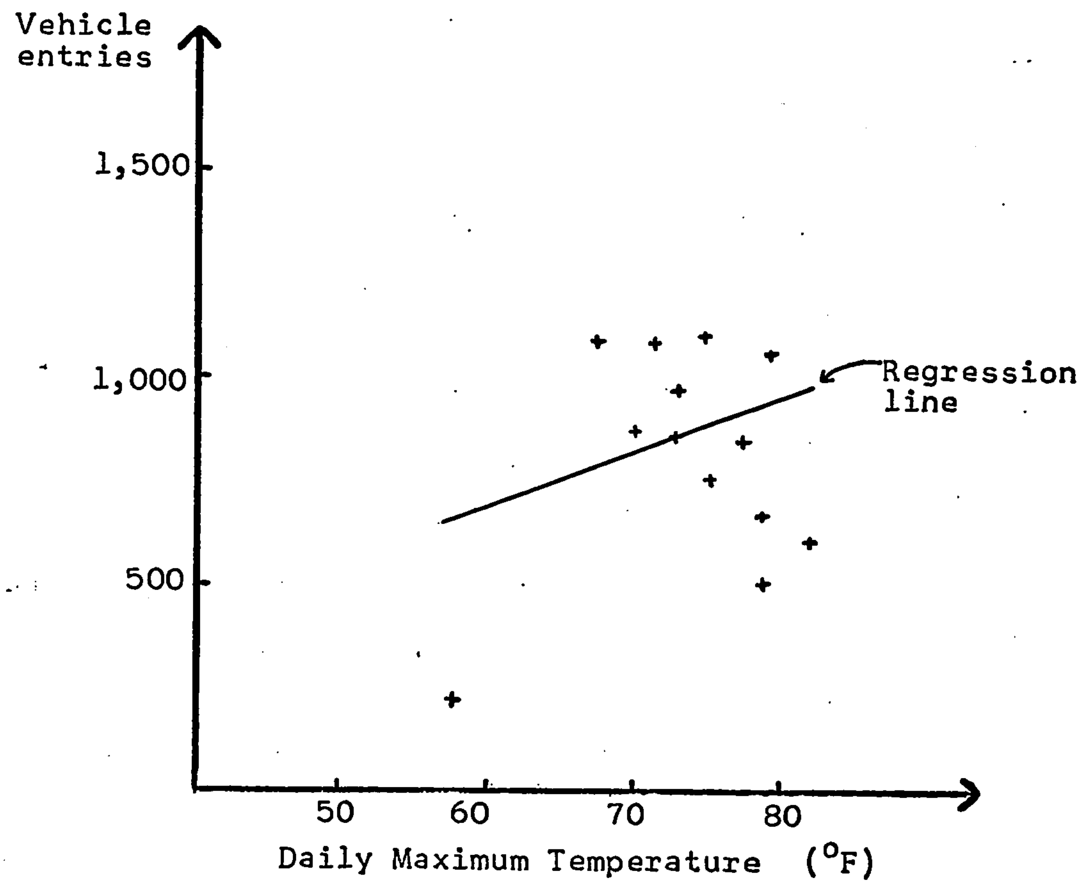

Figure 9.1

DATA PLOT, DAY-GROUPING (i), VEHICLE ENTRIES AT SOUTH GATE OF ELK ISLAND NATIONAL PARK AND DAILY MAXIMUM TEMPERATURE

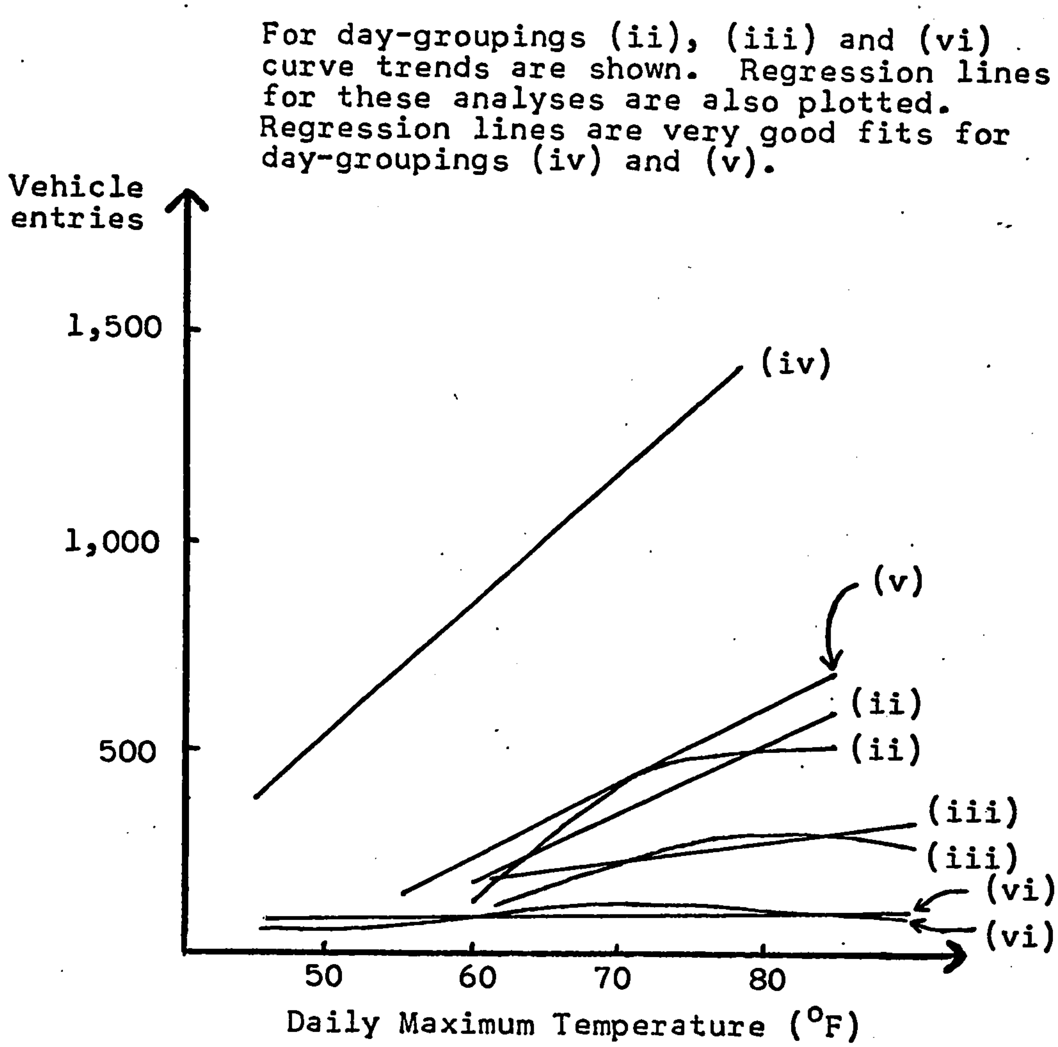

Figure 9.2

SUGGESTED TREND LINES, DAY-GROUPINGS (ii) - (vi), VEHICLE ENTRIES AT SOUTH GATE OF ELK ISLAND NATIONAL PARK AND DAILY MAXIMUM TEMPERATURE

TABLE 9.1

CORRELATION COEFFICIENTS FOR PLEASURE DRIVING AND MAXIMUM TEMPERATURE, BY DAY-GROUPING

Facility	Correlation Coefficients of Day-Grouping: (i)	(ii)	(iii)	(iv)	(v)	(vi)
Number of Days in Grouping	13	10	41-43	8-9	7-8	40
Elk Island Park, South Gate, Vehicle Entries	.274	.847**	.552**	.835**	.805*	.338*
Gatineau Parkway	.221	.049	.104	.681	-.170	.229
Long Sault Pkway., West Gate	.535	.003	.346*	.405	.170	.233
Long Sault Pkway., East Gate	-.122	.048	.343*	.144	.043	.289

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.
** Statistically significant at the 1 per cent level.

Day-Groupings:

June 28-September 1, 1969:
(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:
(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays

for day-groupings (ii) and (iii) deviate from the straight line (Figure 9.2). The situation in day-grouping (i) is identical with that occurring at two other facilities in the city of Edmonton, Storyland Valley Zoo and Riverside Golf Course. In the peak season, these two facilities are less likely to be visited when temperatures exceed 75°F than in the off-peak period. Elk Island National Park is actually visited more on off-peak weekends than during the June 28-September 1 period. These factors strongly suggest that Edmontonians tend to regard this park as a pleasant destination for a drive, but one which may be bypassed on very hot days, especially during the school vacation. They may be prepared, particularly on mid-summer Sundays, to go farther afield to parks more renowned for the swimming capability of their beaches.

Temperature limitations on pleasure driving do not appear to be too stringent. With so few facilities analyzed, very little can be said about regional variations. It appears from Elk Island scattergrams, however, that in the school vacation period, the maximum temperature coinciding with 10 per cent of peak pleasure driving is about 55°F. In the Ottawa-Hull region in June 28-September 1, 1969, maximum temperatures did not fall below 60°F, and use of Gatineau and Long Sault Parkways did not fall below 10 per cent of peak values. During the off-peak period, the limiting maximum temperature for 10 per cent use of Gatineau and Long Sault Parkways appears to be near 50°F. At Elk Island Park, the pleasure driving limit in the off-season is lower than 50°F and probably in the mid-40s. It seems also that the "optimum" maximum temperature for pleasure drives to Elk Island is in the mid-70s, and that if conditions are warmer than this, visitation shows a levelling-off or even a decline.

Precipitation

Six-hourly precipitation records were studied for only Elk Island and Gatineau Parkway, while total daily precipitation data are available for all facilities. Long Sault Parkway is within 20 miles of the Cornwall meteorological station, which records both temperatures and daily precipitation totals.

Weather data from Edmonton and Ottawa respectively are correlated with the Elk Island and Gatineau Parkway records.

Eight analyses made for six-hourly precipitation amount have five negative values of b and three positive. In fifteen of the twenty-three analyses for total daily precipitation, b is positive. Although two-thirds of all analyses therefore suggest a direct relation between daily amount and pleasure driving participation, one should be wary of accepting this as an established relationship. Instead, one should simply maintain that precipitation amount appears to be relatively unimportant to pleasure driving activity. On the basis of the few data presented here, high daily precipitation seems to be capable of driving outdoor recreationists away from the beaches and other types of facility into their cars for a pleasure drive. In this respect this activity is one of the very few in which precipitation may not be an inhibiting factor.

Sunshine

Total daily sunshine hours were analyzed with Elk Island and Gatineau Parkway records. The 1100-1700 hours of sunshine are studied for Elk Island but compare unfavourably as a predictive variable with the daily total, to which this discussion will therefore be confined.

At Gatineau Parkway, the daily vehicle count is almost unrelated to sunshine, with the exception of day-grouping (i), Sundays and Statutory Holidays in the peak period (Table 9.2). Here $r = -.554$ and this value is statistically significant at the 5 per cent level. It seems that sunshine on midsummer Sundays results in a decision to do something other than drive the Parkway. This effect is strikingly similar to that of high maximum temperature for Sunday and Statutory Holiday attendance at Elk Island Park from June 28 to September 1.

Total daily sunshine is significantly associated with attendance at Elk Island for all six day-groupings. The computer plots show strong adherence to the straight line relation of vehicle entries to total daily sunshine hours. Despite the close association, sunshine is not a limitation on pleasure driving, since a complete lack of sunshine does not coincide with vehicle entries falling below 10 per cent of peak use.

TABLE 9.2

CORRELATION COEFFICIENTS FOR PLEASURE DRIVING AND TOTAL DAILY SUNSHINE HOURS, BY DAY-GROUPING

Facility	Correlation Coefficients of Day-Grouping: (i)	(ii)	(iii)	(iv)	(v)	(vi)
Number of Days in Grouping	13	10	41-43	8	7-8	40
Elk Island Park, South Gate, Vehicle Entries	.727**	.711*	.547**	.818*	.727*	.377*
Gatineau Parkway	-.554*	.033	-.032	.164	-.404	-.018

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.
** Statistically significant at the 1 per cent level.

Day-Groupings:

June 28-September 1, 1969:

(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:

(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays

Relative Humidity

Table 9.3 shows correlation coefficients for the twelve analyses of mean daily relative humidity made for Elk Island National Park and Gatineau Parkway. Results are inconclusive. There is a definite inverse relation between relative humidity and visitation at Elk Island National Park, with four of the six analyses attaining 5 per cent significance for the correlation coefficient r. Gatineau Parkway use, on the other hand, is less strongly associated but shows a marked trend towards a direct association with mean daily relative humidity, especially for day-grouping (i) where r is statistically significant at the 5 per cent level.

These contrary relationships may reflect differences in kind between use of Gatineau Parkway and pleasure drives made to Elk Island Park. A vehicle on the Parkway is strictly on a pleasure drive, while the drive to Elk Island is more likely to involve some time spent outside the car, even though the outing is not necessarily made with any other specific recreational activity in mind. Thus precipitation occurrence or cooler temperatures, as may be indicated by high mean daily relative humidity, can be deterrent factors to Elk Island visitation but not apparently to use of Gatineau Parkway. Indeed high relative humidity on midsummer Sundays is a factor in the heavy use of the Parkway, probably because, as has already been shown (pp. 81 and 103), high humidity results in decreased participation in certain other outdoor pursuits in the Ottawa-Hull study region.

TABLE 9.3

CORRELATION COEFFICIENTS FOR PLEASURE DRIVING AND MEAN RELATIVE HUMIDITY, BY DAY-GROUPING

Facility	Correlation Coefficients of Day-Grouping:					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Number of Days in Grouping	13	10	41-43	8-9	8	40
Elk Island Park, South Gate, Vehicle Entries	-.649*	-.554	-.423**	-.883**	-.698	-.484**
Gatineau Parkway	.556*	.055	.083	-.161	.532	.218

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.
** Statistically significant at the 1 per cent level.

Day-Groupings:

June 28-September 1, 1969:
(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:
(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays

Despite the strong negative correlation at Elk Island Park, mean daily relative humidity even at 100 per cent is not a factor limiting facility use to the 10 per cent level. This is also true of the Gatineau Parkway, where the range of mean daily relative humidity covered during May 15 to September 15, 1969 was from 44 to 99 per cent, and no criteria could be set at either end of this range for the 10 per cent level of peak use.

Wind

The wind mileage during 0900-1900 hours local time was studied for Elk Island and Gatineau Parkway (Table 9.4). All twelve analyses show negative values of the linear regression

TABLE 9.4

CORRELATION COEFFICIENTS FOR PLEASURE DRIVING AND 0900-1900 HOURS LOCAL TIME WIND MILEAGE, BY DAY-GROUPING

Facility	Correlation Coefficients of Day-Grouping: (i)	(ii)	(iii)	(iv)	(v)	(vi)
Number of Days in Grouping	13	10	41-43	8	7-8	40
Elk Island Park, South Gate, Vehicle Entries	-.199	-.634*	-.114	-.313	-.234	-.086
Gatineau Parkway	-.286	-.461	-.147	-.500	-.615	-.112

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.

Day-Groupings:

June 28-September 1, 1969:
- (i) Sundays and Statutory Holidays
- (ii) Saturdays
- (iii) Weekdays

Remainder of the Summer, 1969:
- (iv) Sundays and Statutory Holidays
- (v) Saturdays
- (vi) Weekdays

coefficient (b), but only one r-value achieves 5 per cent statistical significance. It must be concluded that there is only a slight inverse relationship between pleasure driving activity and windspeed.

To impose any limitation on pleasure driving, wind mileage from 0900-1900 hours must apparently be substantially in excess of 220 miles. This implies that windspeed is rarely likely to be a critical factor in pleasure driving during the summer, unless regions are subject to considerably stronger winds than are typical of the Edmonton or Ottawa regions.

Comfort Indices

As is the case with most of the other activities examined,

TABLE 9.5

COMPARISON OF CORRELATION COEFFICIENTS, PLEASURE DRIVING WITH COMFORT INDICES AND MAXIMUM TEMPERATURE, BY DAY-GROUPING

Facility	r for:	Correlation Coefficients of Day-Grouping: (i)	(ii)	(iii)	(iv)	(v)	(vi)
Number of Days in Grouping		13	10	41-43	8	7-8	40
Elk Island Park,	ET	.284	.838**	.529**	.844**	.794*	.363*
South Gate,	TDI	.077	.788**	.526**	.804*	.788*	.263
Vehicle Entries	T	.274	.847**	.552**	.835**	.805*	.328*
Gatineau	ET	.283	.128	.128	.742*	.050	.253
Parkway	TDI	.357	.097	.144	.554	.088	.269
	T	.221	.049	.104	.681	-.190	.229

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.
** Statistically significant at the 1 per cent level.

ET - 3 p.m. Effective Temperature
TDI - 3 p.m. Thom's Discomfort Index
T - Daily Maximum Temperature

Day-Groupings:

June 28-September 1, 1969:
(i) Sundays and Statutory Holidays
(ii) Saturdays
(iii) Weekdays

Remainder of the Summer, 1969:
(iv) Sundays and Statutory Holidays
(v) Saturdays
(vi) Weekdays

the two comfort indices show essentially the same types of association with pleasure driving as does daily maximum temperature. Correlation coefficients for all three weather variables are given in Table 9.5.

In the case of Elk Island data, r-values for maximum temperature are as high as those for Effective Temperature and exceed those for Thom's Discomfort Index. At Gatineau Parkway, on the other hand, r-values are generally somewhat higher for both comfort indices than for daily maximum temperature. However, there is little advantage in using the comfort indices here either, when maximum temperature is not inferior as a measure. In any case, none of the three variables bears a strong enough relation to Parkway use to be of high predictive value.

Discussion

The remarks made in this chapter on pleasure driving suffer from a lack of concrete data on the activity. It seems unlikely that the data deficiency will be remedied in the near future, though pressure from pleasure driving on rural roads near major cities is beginning to be felt in the form of increased maintenance costs to rural municipalities which can least afford them.

Only two of the facilities could be analyzed concerning all weather variables. No information exclusive to pleasure driving was available for study in the southern New Brunswick region, and the data for the other two areas are too few to allow meaningful regional comparisons to be made.

Although some marked weather effects on pleasure driving participation have been identified, no limiting criteria were found to apply except in the case of maximum temperature. Weather seems to influence participation in driving for pleasure indirectly by dissuading recreationists from undertaking other activities requiring different weather. For instance, pleasure driving seems to be one of the few outdoor activities which is unaffected by precipitation. Explanations of many of the associations between weather variables and driving depend on the inherent characteristics of the activity. One instance is the way Edmontonians use Elk Island National Park almost as an extension of the city itself. The park entrance is only 20 miles from the city limits, and on hot midsummer Sundays the park appears to be bypassed, as are many of the outdoor recreation facilities within the city limits, in favour of a trip farther from the city.

CHAPTER X

VISITATION TO SPECIAL SITES AND OUTDOOR SPORTS PARTICIPATION

This chapter treats two outdoor recreation activities which have not officially been recognized as such in the past - visiting special sites and outdoor sports participation. This neglect is probably because these activities do not involve direct use of the natural environment in the same manner as do such pursuits as camping, boating, and skiing. Outdoor sports especially tend to be organized within urban areas. While many outdoor recreation researchers have excluded outdoor sports and visitation to special sites from their areas of study, this project includes them. The writer contends that they are valid subjects for research in the broad field of outdoor recreation. They are indeed worthy of study here by virtue of the contrast that they offer to other activities directly using the natural environment. This contrast is the reason for combining them into a single chapter which concludes the analytical section of the project.

VISITING SPECIAL SITES

Eight facilities studied are regarded as "special sites". The site may be an historical exhibit, an interesting landform, a zoo, or any other special feature. Each possesses some specific attraction other than the standard swimming, boating, camping and picnicking opportunities offered by many parks. A visitor to any of these eight sites finds an educational as well as a purely recreational experience.

One of the eight special sites is located in the Edmonton study region. Storyland Valley Zoo, managed by the City of Edmonton, is primarily a children's zoo, and though not a complete zoological collection, is a very popular attraction even for adults.

Five other special sites are found in the Ottawa-Hull study region: Moorside, Old Fort Henry, Upper Canada Village, Crysler Farm Battlefield Park (Crysler Park), and Morrison and Nairne Islands. Moorside, often known as the Mackenzie King or Kingsmere Estate, lies within the National Capital Commission's Gatineau Park. Its house and gardens receive many visits from Ottawans as well as from tourists to the capital region. The other four are operated by the St. Lawrence Parks Commission and are located in the Seaway Valley. Old Fort Henry and Upper Canada Village are two justly famous historic parks located near Kingston and Morrisburg respectively. Old Fort Henry overlooks the entrance to the Cataraqui River and the Rideau Waterway at Kingston Harbour. It was built to guard the harbour entrance at the time of the 1812 war. The St. Lawrence Parks Commission has restored it and manned it in the summer with a "garrison" dressed in period uniforms. They also provide a changing-of-the-guard ceremony. Upper Canada Village is a full-size replica of an early Ontario pioneering settlement. Crysler Park adjoins Upper Canada Village and commemorates the Battle of Crysler Farm in 1812. Morrison and Nairne Islands, a few miles upstream from the Upper Canada Village complex, are a wildlife sanctuary, for geese in particular.

The southern New Brunswick study region has two special sites, both Provincial Parks: Magnetic Hill and The Rocks. Magnetic Hill Park is a game farm on the outskirts of Moncton, very close to the famous tourist attraction of the same name.[1] The Rocks is situated at Hopewell Cape, and its attraction is the spectacular "flower-pot" rock formation resulting from wave action on the local sandstone.

Storyland Valley Zoo, Old Fort Henry and Upper Canada Village charge an admission fee and their daily attendance records are thus reliable. Attendance data at the other five sites are all derived from automatic traffic counters. Moorside is the terminus of a dead-end road leading from Quebec Highway 11 into Gatineau Park (Figure 2.8); the traffic counter record on this road should be truly indicative of visitation to Moorside. Likewise, no complications arise with the Crysler Park, Magnetic Hill and The Rocks vehicle counters, which are located at the facility entrance. At Morrison and Nairne, however, the traffic counter also records vehicles using the group campground. This is not too serious a problem since this campground is one catering exclusively to pre-booked groups such as scouts or church clubs. It therefore does not generate the same traffic as a public campground of comparable size.

Maximum Temperature

It is possible to perform maximum temperature analyses

[1] This is a stretch of rural road where a car in neutral gear with the brakes released is reputed to roll uphill.

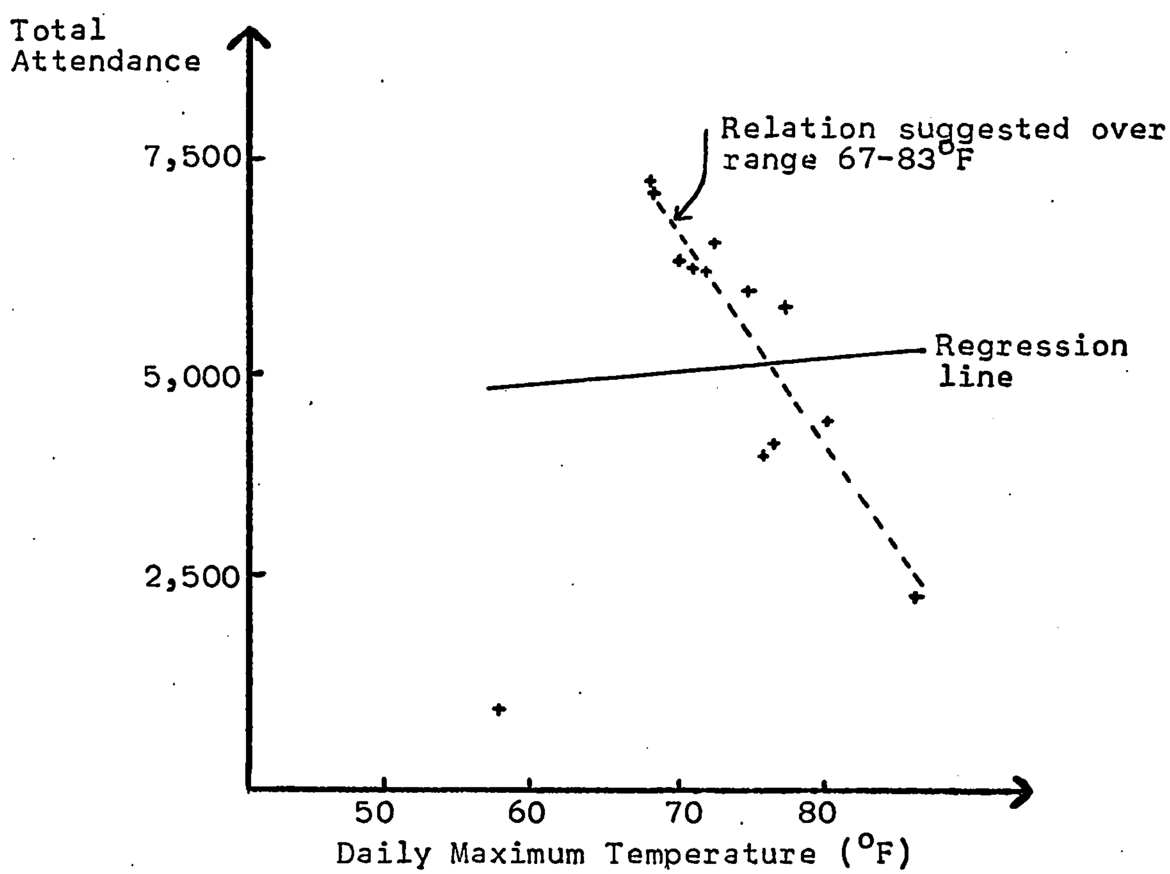

Figure 10.1

DATA PLOT, DAY-GROUPING (i), ATTENDANCE AT STORYLAND VALLEY ZOO, EDMONTON, AND DAILY MAXIMUM TEMPERATURE for all six day-groupings at each facility, and forty-eight analyses were therefore made. Of these only ten have positive values of the linear regression coefficient (b) and also achieve 5 per cent statistical significance or better. Twenty analyses, or almost half, have b negative. It seems that in general there is no strong relation with maximum temperature. Correlation coefficients lie between -0.4 and +0.4 in thirty of the forty-eight analyses. However, three facilities demanding further discussion are Storyland Valley Zoo, Old Fort Henry and Magnetic Hill Provincial Park (Game Farm).

Half of the total of ten significant positive correlations are found at Storyland Valley Zoo. The plot for the only non-significant analysis at this facility is shown in Figure 10.1. It is evident that over the range 67-83°F at least, the dashed line drawn, with a definite negative gradient, is the best approximation to the attendance-temperature relationship. This analysis is for Sundays and Statutory Holidays during the school vacation, and attendance appears to decline as temperature increases. The reason for this apparent anomaly may be suggested from the form of the other scattergrams for the Storyland Valley Zoo data (Figure 10.2). They show a tendency towards a bell-shaped curve, suggesting a relatively low daily maximum temperature of 70-75°F as the "ideal" for visiting Storyland Valley Zoo. The likely explanation for data in day-grouping (i) showing such a marked decline above about 65°F follows. On Sundays people have a significant amount of leisure time and during the peak season,

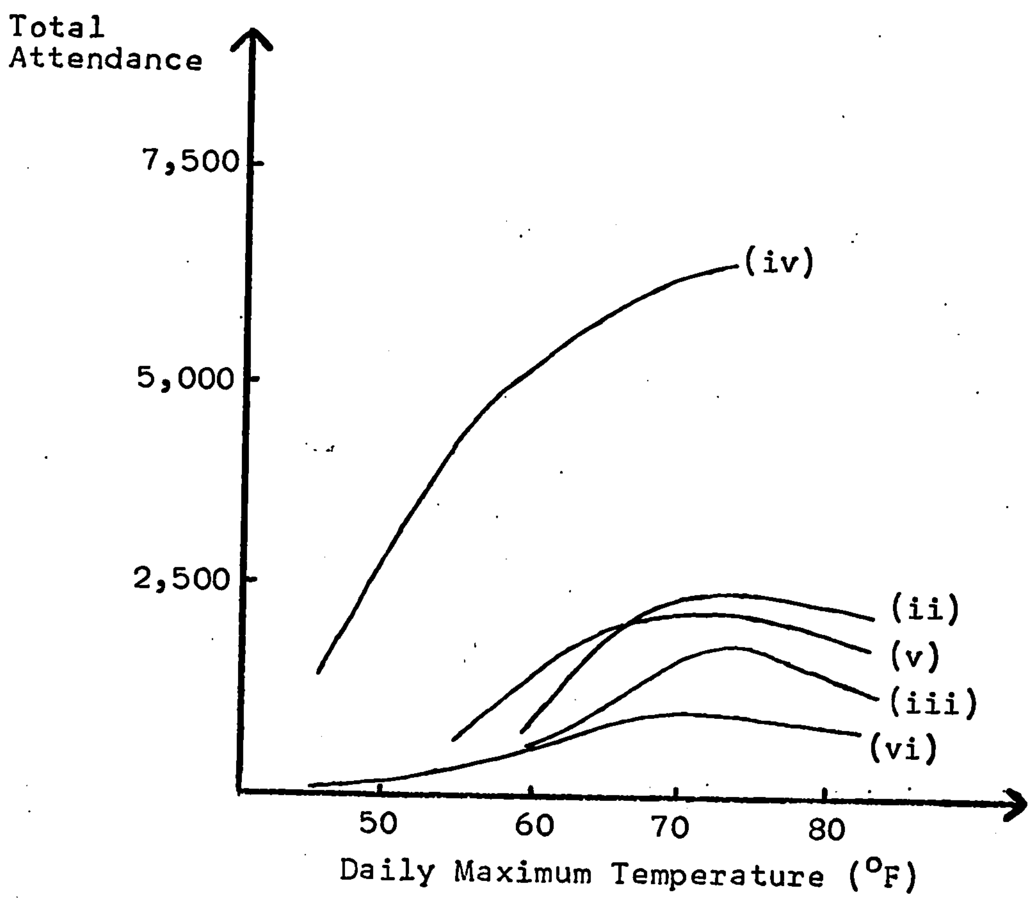

Figure 10.2

SUGGESTED TREND LINES, DAY-GROUPINGS (ii) - (vi), ATTENDANCE AT STORYLAND VALLEY ZOO, EDMONTON, AND DAILY MAXIMUM TEMPERATURE with warm weather, are perhaps more likely to visit facilities farther afield instead. On Saturdays less leisure time is available to most people, and Storyland Valley Zoo becomes a more favoured destination.

At Old Fort Henry, five of the six analyses have negative correlation coefficients, though none is statistically significant. All three for the peak season show declines in attendance as daily maximum temperature rises, but the range of maxima covered is only from 68 to 90°F (Figure 10.3); day-groupings (iv) to (vi) have the regression lines and ranges of maximum temperature shown in Figure 10.3. We might therefore suggest for visitation to Old Fort Henry a curve similar to those of Figure 10.2. The "ideal" maximum temperature for a visit to Old Fort Henry appears to be about 65-70°F, with attendance declining on both sides of this value. Daily maxima below the low 50s or in the 90s would likely result in less than 10 per cent of the weather-related peak visitation.

At Magnetic Hill, the two weekend peak-season analyses have b positive and achieve 5 per cent statistical significance, while the other four day-groupings show only low correlations. Warmer weather during the school vacation weekends thus attracts more visitors to Magnetic Hill Provincial Park. One reason for the absence of a strong temperature influence in the other day-groupings may be the proximity to both the famous Magnetic Hill tourist attraction and the Trans-Canada Highway. Tourists filter off the Highway to view "The Hill", and some also visit the Game Farm. Attendance may be related

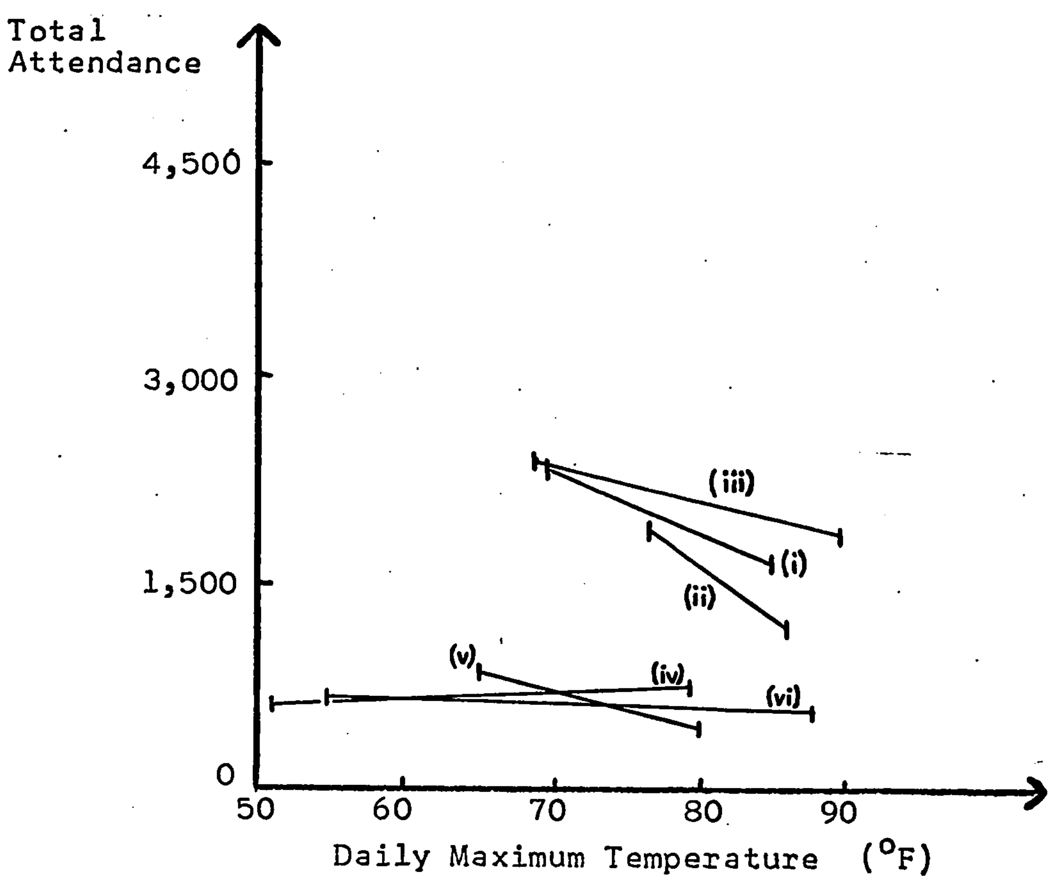

Figure 10.3

REGRESSION LINES AND RANGES OF MAXIMA COVERED BY THE SIX MAXIMUM TEMPERATURE ANALYSES, OLD FORT HENRY

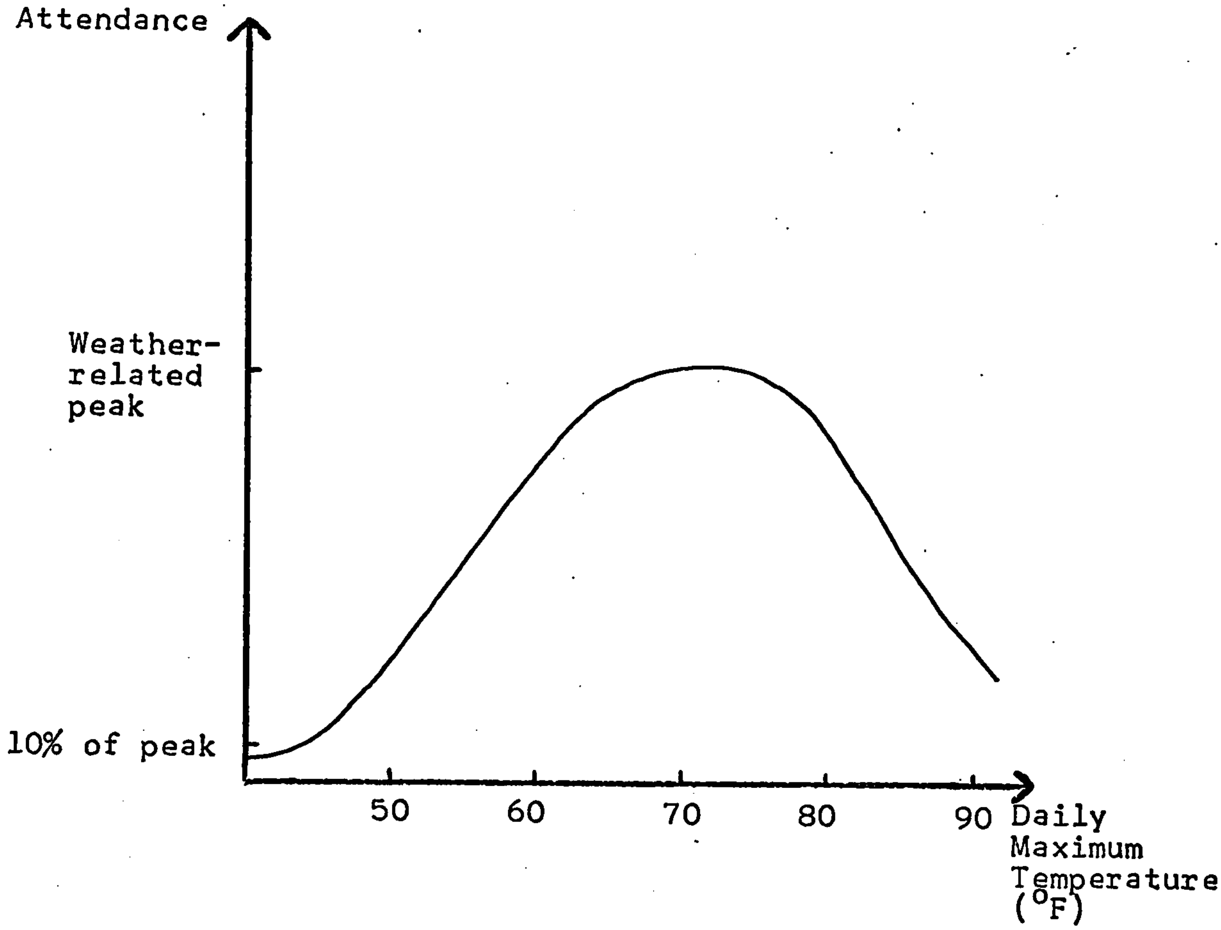

Figure 10.4

SCHEMATIZED RELATION BETWEEN VISITATION TO A SPECIAL SITE AND DAILY MAXIMUM TEMPERATURE to tourist traffic on the Trans-Canada rather than weather, with Monctonians coming out on warm weekends in the peak season and thereby increasing the temperature influence in day-groupings (i) and (ii). It is noticeable that the only three days with maxima above 80°F in groupings (i) and (ii) show a decline of attendance. This would support the suggestion of a curve function instead of a straight line for the relation between attendance and maximum temperature.

In summary, linear correlation coefficients are not high. There is a marked tendency for the curve function of Figure 10.4 to describe the effect of temperature on visitation to special sites. This is particularly true of Storyland Valley Zoo and Old Fort Henry, where walking around and seeing a variety of sights is an important part of the experience. Thus when for most people temperatures are too high or low for walking around, attendances will decrease. The curve is also strongly suggested by the scattergrams for Moorside and Upper Canada Village, and to a lesser extent for Crysler Park, Magnetic Hill and The Rocks. Morrison and Nairne attendance, however, seems to bear very little relation to maximum temperature. Perhaps a hard core of visitors who are nature watchers are prepared to tolerate a great variety of weather conditions. Thus Morrison and Nairne may have a specialized clientele whose weather response is different from that of the general recreationist.

The identification of limiting criteria for daily maximum temperature is relatively simple. There seems to be little regional variation. The lower limit corresponding to 10 per cent of the weather-related peak use (at approximately 70°F) is about 50-55°F and the upper limit 90-95°F. There is some evidence, from Storyland Valley Zoo in particular, that people will tolerate temperatures slightly cooler, perhaps 2-3°F, in the off-peak period of the summer.

Precipitation

All sites except Old Fort Henry were examined with total daily precipitation as a weather variable. Six-hourly totals were only available for Storyland Valley Zoo, Moorside, Magnetic Hill Provincial Park and The Rocks Provincial Park.

Once again, the relationship between precipitation and attendance does not seem strong, although the majority of the analyses do show a decline in visits with an increase in precipitation amount. Twenty-eight of thirty-nine analyses for total daily precipitation have negative values of b, as have ten of fourteen for six-hourly precipitation. However, some positive b-values are found among the group (vi) analyses, for weekdays.[2] Precipitation amount tends to be inversely related to attendance, but this tendency is not strong. The typical relation between special site attendance and precipitation is of the form shown in Figure 10.5. The run-test shows no likelihood that a form other than the linear relationship should be proposed. The gradient of the regression line also is very shallow, and in the odd case even a slightly

[2] Surprising in view of the large number of days in groupings (iii) and (vi).

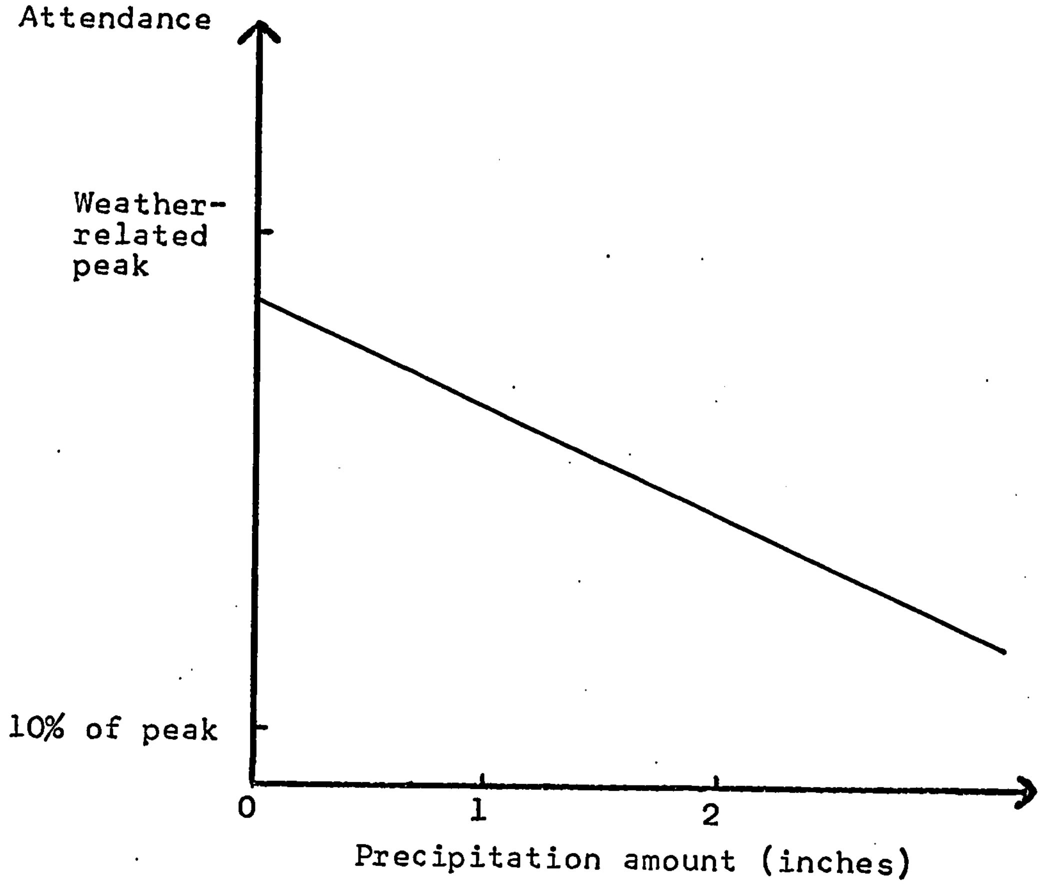

Figure 10.5

RELATION BETWEEN VISITATION TO SPECIAL SITES AND PRECIPITATION AMOUNT positive gradient is found.

Precipitation amount is obviously not a valuable attendance predictor for special sites. Where shelter is available, the possibility of showers does not deter visitors. However, 1.5 inches of rain received in a continuous day-long fall would have a marked deterrent effect on attendance, whereas a thunderstorm dumping 1.5 inches in the evening after most visitors had left the site would have no effect at all. There remains then the likelihood that such precipitation parameters as timing, duration and intensity are more valuable than the total amount.

<u>Sunshine</u>

Again, sunshine hours could be investigated for only two facilities. At Storyland Valley Zoo, total daily sunshine hours is the best explanatory variable of all. Of the six day-grouping analyses, five are statistically significant at the 1 per cent level, and one at the 5 per cent level. The two Saturday analyses, one for the school holidays, the other for the rest of the summer, have values of the correlation coefficients exceeding .83; hence total daily sunshine hours alone explains at least 69 per cent of daily attendance variation. The r-value of +.749 for day-grouping (i) is surprising. We recall that over the range 67-83^{o}F attendance is inversely related to maximum temperature. These two features exhibit the lack of correlation between maximum temperature and total sunshine hours which characterized this particular day-grouping for Edmonton in the summer of 1969.

The sunshine hours recorded between 1100 and 1700 hours MST again show less relation to attendance than do total daily sunshine hours. Total daily sunshine hours in fact appears to be the weather variable most significant to attendance at Storyland Valley Zoo. For three of the six day-groupings, the straight line relation and correlation coefficient are sufficiently useful to permit prediction of 60 per cent of all variation in daily attendance.

Despite the apparent usefulness of daily sunshine hours in prediction, people will certainly visit the Zoo on a cloudy day. Sunshine hour total is not a limiting factor in visitation to Storyland Valley Zoo. This is also the case at Moorside, where there appears to be only a weak positive relation between attendance and total daily sunshine hours.

Relative Humidity

Mean daily relative humidity is inversely and strongly related to attendance at Storyland Valley Zoo, with four of the analyses, those for Sundays and Statutory Holidays, and those for weekdays, reaching the 1 per cent significance level. Both Saturday analyses approach the 5 per cent level of significance. There are no grounds for rejecting the straight line relationship. Only one limiting value of mean daily relative humidity is indicated. This value seems to be about 95-96 per cent in the high summer (suggesting cool days with a very strong probability of prolonged precipitation) and 78-80 per cent in the off-season. The lower value in the off-season may perhaps be associated with an increased physiological feeling of cold with relative humidity above 80 per cent and with cool temperatures.

By contrast, visitation to Moorside shows only a low inverse correlation with mean daily relative humidity. Five of the six correlation coefficients are negative, but range only from -.118 to -.411; the sixth r-value is +.044. It is also clear from the computer plots that mean daily relative humidity is not a factor in limiting Moorside visitation to less than 10 per cent of its peak level.

Wind

Attendances at Storyland Valley Zoo, Moorside and Old Fort Henry were analyzed in terms of 0900-1900 hours wind mileage. Storyland Valley Zoo and Moorside are close to wind recording stations, but Old Fort Henry is 20 miles northnortheast of Main Duck Island, where the nearest wind records for 1969 were kept. Also, Main Duck Island is an exposed site in Lake Ontario, where winds can be expected to be persistently stronger than those at Kingston. However, assuming that a windy day at Old Fort Henry is also a windy day at Main Duck Island, without using actual windspeed values, an analysis of Old Fort Henry attendance and wind can be attempted.

Fourteen of eighteen analyses have negative values of the linear regression coefficient (b). All six at Storyland Valley Zoo have negative values, and the correlation coefficients indicate that this facility has the strongest inverse relation of wind and attendance; the analysis for grouping (iv) achieves 5 per cent statistical significance. However, none of the other correlation coefficients exceed -0.56, and over the range of wind mileages covered in 1969 (up to 220 miles), windspeed seems not to be a critical factor. For Moorside, four day-groupings show inverse relations with wind, but none is strong, and again there is no evidence of wind becoming a critical factor in visitation. By contrast, at Old Fort Henry, both peak-season weekend analyses have positive values of b, and grouping (iii) (r = -.051, with forty-three days in the grouping) shows almost no decrease in attendance as wind mileage rises. With the maximum temperatures ranging from 68 to 90°F, a breeze perhaps alleviates the sensation of heat and therefore increases the inclination to visit Old Fort Henry. In the off-peak period, r-values range from -.372 to -.163; there is a slight decline with increasing windspeed in this cooler period. Again, however, none of the relationships is significant.

It seems that wind mileage for 0900-1900 hours has only a small effect on attendance at special sites and that quite high winds can be tolerated by visitors to them. Moderate windspeeds may indeed enhance visits when maximum temperatures are very high.

Comfort Indices

Only two of the special sites are sufficiently close to first-order meteorological stations to allow their attendances to be correlated with the two comfort indices. These are Storyland Valley Zoo in Edmonton, and Moorside, just a few miles north of Ottawa-Hull. It is thus difficult to draw any general conclusions.

At Storyland Valley Zoo, the mid-afternoon Effective Temperature (ET) shows a relation to attendance similar to that of daily maximum temperature. However, for all five analyses where there is a definite positive relationship, the linear r-values are higher in all cases for ET than for daily maximum temperature. Once again, in spite of these high r-values, the bell-shaped curve, as in Figure 10.4, is indicated. It appears that this curve could be used to predict attendances at Storyland Valley Zoo, at least for day-groupings (ii) to (vi). Thom's Discomfort Index follows a similar relationship to attendance.

At Moorside, neither comfort index is as closely related to attendance as maximum temperature. It is interesting that at this facility the negative value of b found for day-grouping (iii) (weekdays during school holidays), for all three weather variables, achieves statistical significance at the 5 per cent level. There is a definite tendency for weekday attendance in midsummer to decline with hotter weather. No Moorside analyses display a marked positive gradient to the linear regression.

Discussion

Only daily maximum temperature could be studied for all eight sites. An hypothesis of its relation with visitation to special sites is proposed in Figure 10.4. This hypothesis best fits the highly developed special site of substantial historic or general interest.[3] A much lower relationship is exhibited by less developed sites such as Morrison and Nairne Island wildfowl sanctuary, The Rocks and Crysler Park. These are less likely to be specific destinations of recreational excursions, but probably receive brief visits from many persons who encounter them on a drive. They may therefore be less susceptible to temperature influences than sites which are the actual destinations of trips.

The possibility that the timing of low tide is important in visitation to The Rocks was explored. The "flower-pot" formations are best viewed from the beach itself, and the beach is only uncovered for two or three hours before and after low water. However, consultation of a tide-table showed there was no marked relationship between attendance and the time of low water.

It is noteworthy that Storyland Valley Zoo attendance declines with rising temperature on Sundays and Statutory Holidays in midsummer. This is reminiscent of the surprisingly small increase of attendance with temperature for the same day-grouping at the Edmonton swimming pools.

Precipitation amount proves to be of little use in predicting attendances. In fact the only other variables found to be valuable are 3 p.m. Effective Temperature, total daily sunshine hours, and mean daily relative humidity, all for

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[3] An interesting point is that the hypothesis also fits best those facilities which have entirely accurate visitation records, indicating that the less precise data from some of the other facilities may play a part at least in "masking" the weather-attendance relation.

Storyland Valley Zoo only. The requisite data were available for only one other site, Moorside. ET displays the best potential for predicting Storyland Valley Zoo attendances. A lower limit of around 35°F ET was identified for 10 per cent of weather-related peak use, a value certainly not contradicted by the Moorside data. While total daily sunshine hours is a useful predictive variable at Storyland Valley Zoo, it is by no means vital for appreciable visitation, and is definitely not strongly related to attendance at Moorside. The limiting values suggested in Table 10.1 therefore are not based on strong evidence, with the exception of daily maximum temperature. While precipitation and wind are excluded from this table,[4] this does not suggest that they are irrelevant to special site visitation. Instead it signifies an inability to produce any limiting values from this 1969 study.

We must not over-state the significance of daily weather in attendance variation at the sites investigated. Historic exhibits are frequently more attractive to visitors on some days than on others, depending on the scheduling of special events. Visitation to sites of national rather than local or regional significance is highest during the tourist season. Nevertheless, there are some definite relations between daily weather and special site visitation. A sense of proportion is easily kept if one bears in mind the experience of the

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[4] Again, we must note that timing, duration and intensity of precipitation could well prove far more informative than actual amount as regards influencing attendance at recreation areas.

TABLE 10.1

LIMITING VALUES OF WEATHER VARIABLES FOR VISITING SPECIAL SITES.

Variable	Study Regions: Edmonton	Ottawa-Hull	Southern N.B.
Daily Maximum Temperature	← 50°F lower: 90°F upper →		
3 p.m. Effective Temperature	35°F ET	35°F ET	N/A
Mean Daily Relative Humidity	95%(78-80%)	No limitation at Moorside	N/A

Source: Computer analysis, 1970.

The figures in brackets signify values for the off-peak season when there is a marked difference from those for the school vacation period.

writer when visiting The Rocks on a heavily overcast afternoon with light drizzle; an inquiry made of one visiting New Brunswicker as to why he had come "in the rain" elicited the reply, "Rain? It's just mist!"

OUTDOOR SPORTS

Five facilities offering opportunities for outdoor sports are analyzed here. Their grouping under the heading of "outdoor sports" is mainly for convenience. The five are Riverside Golf Course, Edmonton; the recreation (playground) area of Centennial Park, Moncton; Grand Lake and Parlee Beach Provincial Parks, New Brunswick (both of which have recreation programmes); and the tennis courts at Fundy National Park. The recreation programmes at the two New Brunswick provincial parks provide visitors with the opportunity of joining in games, races, and competitions. A daily estimate of the total number of persons availing themselves of the programme is made. Attendance at the recreation area of Moncton's Centennial Park is also estimated rather than actually counted. At Riverside, a total number of rounds played per day is available from ticket counts. The actual number of tennis players is recorded at Fundy Park. Only one of these facilities, Riverside Golf Course, furnishes data for analyses of all six day-groupings during the May 15-September 15 period; the others are open only for the school vacation period. All weather variables are available for correlation with the Riverside Golf Course and Grand Lake attendance records; at Centennial Park, Parlee Beach and Fundy National Park, only temperature and precipitation parameters can be studied.

Maximum Temperature

Of eighteen analyses made, only one has a negative value of the linear regression coefficient. Seven of the seventeen

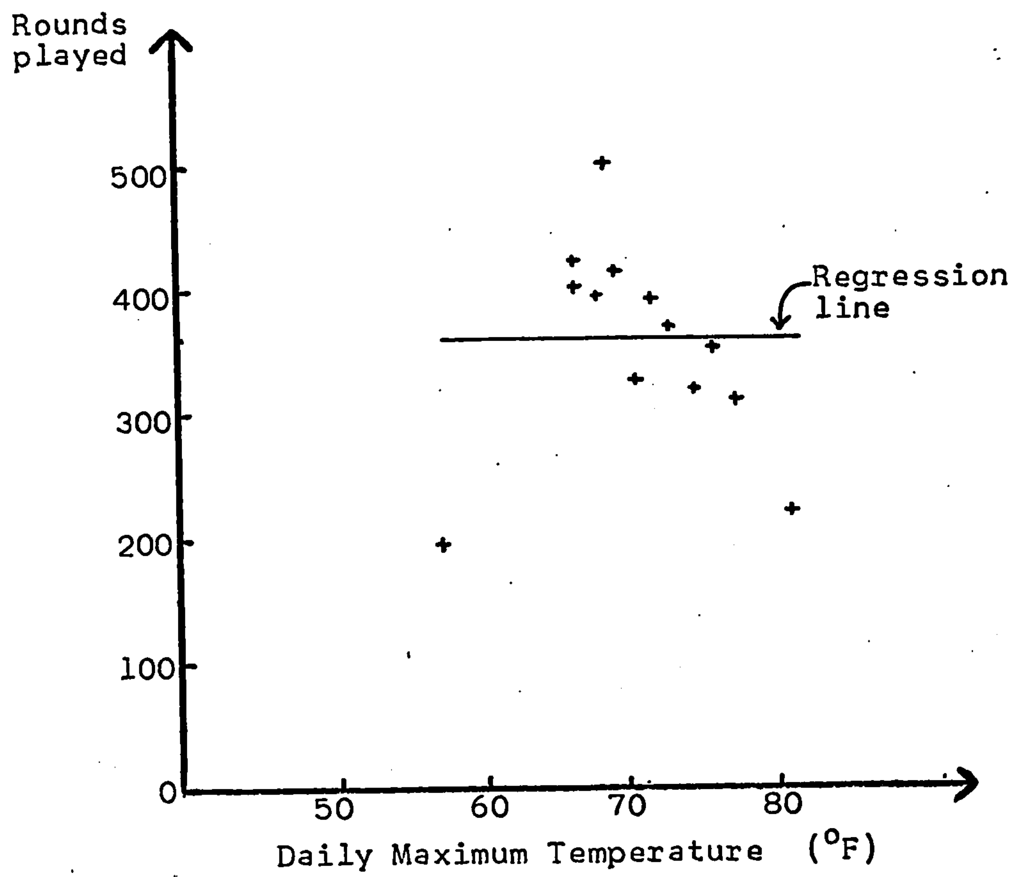

Figure 10.6

DATA PLOT, DAY-GROUPING (i), ROUNDS PLAYED AT RIVERSIDE GOLF COURSE, EDMONTON, AND DAILY MAXIMUM TEMPERATURE positive relationships achieve statistical significance at the 5 per cent level. Thus there seems to be a direct association between numbers taking part in sporting activities and daily maximum temperature.

Some analyses fail to show this relationship at all. At Riverside Golf Course, five of the analyses have positive r-values exceeding 0.40. The other, day-grouping (i), has a correlation coefficient of -.004. However, there is strong evidence from its scattergram (Figure 10.6) that, at least over the range 67-83°F, the relationship between rounds played and daily maximum temperature is strongly negative. This grouping is for Sundays and Statutory Holidays during the school vacation. It is interesting that this same trend is apparent for Storyland Valley Zoo. This would tend to support the hypothesis that in the peak summer season, rising temperatures persuade many Edmontonians to leave the city; there are consequently reductions in Storyland Valley Zoo and Riverside Golf Course attendance, but high visitations to areas outside the city, especially those offering water-based activities. However, on all other days during the summer, this tendency is absent. Instead, at Riverside Golf Course, there is a tendency for a curve function as in Figure 10.7. Particularly on weekdays, most people have only limited leisure time, and the potential number of golfers at Riverside is unlikely to be reduced by decisions to leave the city. Thus even without competition from other activities such as swimming, very high temperatures reduce golfing attendance.

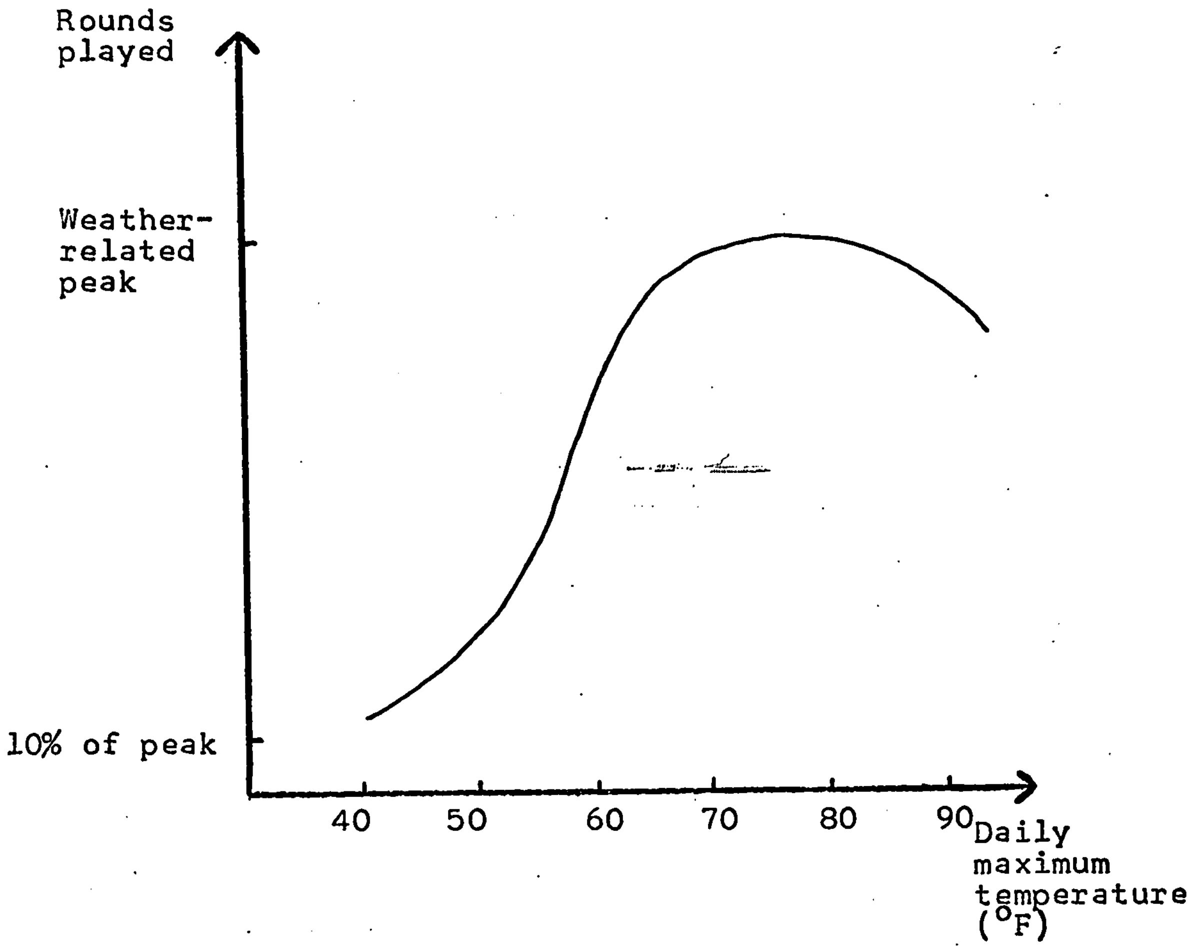

Figure 10.7

SCHEMATIZED RELATIONSHIP FOR DAY-GROUPINGS (ii) -(vi), ROUNDS PLAYED AT RIVERSIDE GOLF COURSE, EDMONTON, AND DAILY MAXIMUM TEMPERATURE

One other point to be borne in mind is that golf courses have a definite capacity, which varies with day-length. Although the two weekday analyses achieve 1 per cent statistical significance, the highest correlation coefficient for rounds played at Riverside and daily maximum temperature is only 0.665. This fact together with the form of the scattergrams suggests that the straight line should be rejected in favour of a curve as shown in Figure 10.7.

While there is a definite relationship with temperature, no critical value of daily maximum temperature can be identified for golfing. At the lower end of the range, the critical value for 10 per cent of the weather-related peak use appears to be less than 50°F. The optimum maximum temperature for golfing seems to be approximately 70-75°F. But the range of temperatures covered in the 1969 summer is insufficient to allow even a suggestion as to the critical upper maximum temperature, which is certainly in excess of 90°F.

At Fundy National Park there is only a slight positive correlation between number of tennis players and daily maximum temperature (Table 10.2). Tennis court use is not weekend-oriented and therefore is likely dominated by the touring visitor to Fundy. Weekend visitors from Moncton and other local points probably do not play tennis at Fundy, when they can do so nearer to home. The relation between tennis playing and daily maximum temperature is very slight.[5]

[5] Perhaps if tennis and maximum temperature were to be correlated at city courts, where their users are close by, a higher correlation would be apparent.

The recreation area at Centennial Park, Moncton, shows a fairly strong positive correlation between attendance and daily maximum temperature for all three of the analyses conducted. Two have b significant at the 5 per cent level, and the third, while not significant, has a correlation coefficient of 0.696. The straight line,at least up to 85^{o}F, seems to be a reasonable approximation to the relationship, which is very similar for all three analyses. At least during the school holiday period, use made of this sports and recreation area is not weekend-oriented. The lower limiting value of daily maximum temperature appears to be 60-65^{o}F.

The recreation programmes at the two New Brunswick Provincial Parks are also operative only during school vacation time. They show very similar relationships with daily maximum temperature (Table 10.2), with fairly high correlations on Sundays and Statutory Holidays and on weekdays, and low correlations on Saturdays. This is similar to the relationship shown by attendance at these parks. A study of the attendance records reveals that a roughly constant percentage of visitors to these parks engages in the recreation programmes regardless of the weather. Thus a prediction of visitors to the park itself will also result in a prediction of those participating in the recreation programme. The 10 per cent threshold critical value for daily maximum temperature appears to be in the low 60s.

TABLE 10.2

CORRELATION COEFFICIENTS FOR OUTDOOR SPORTS AND DAILY MAXIMUM TEMPERATURE, BY DAY-GROUPING

Facility and Activity	Correlation Coefficients for Day-Grouping: (i)	(ii)	(iii)	(iv)	(v)	(vi)
Number of Days in Grouping	7-13	7-10	33-43	9	8	41
Riverside Golf Course, Edmonton	-.004	.577	.402**	.570	.665	.510**
Southern New Brunswick Study Region:						
Centennial Park, Moncton, recreation area	.696	.832*	.665**	-	-	-
Grand Lake Provincial Park, recreation programme	.596*	.057	.599**	-	-	-
Parlee Beach Provincial Park, recreation programme	.579	.166	.434**	-	-	-
Fundy National Park, tennis	.325	.267	.083	-	-	-

Source: Computer analysis, 1970.

* Statistically significant at the 5 per cent level.
** Statistically significant at the 1 per cent level.

Day-Groupings:

June 28-September 1, 1969:
- (i) Sundays and Statutory Holidays
- (ii) Saturdays
- (iii) Weekdays

Remainder of the Summer, 1969:
- (iv) Sundays and Statutory Holidays
- (v) Saturdays
- (vi) Weekdays

Precipitation

Precipitation dampens enthusiasm for outdoor sports. Every analysis both for total daily precipitation and six-hourly precipitation has a negative value of b. The scatter-grams also indicate that the negative relation is a convincing one regardless of the range of precipitation totals under

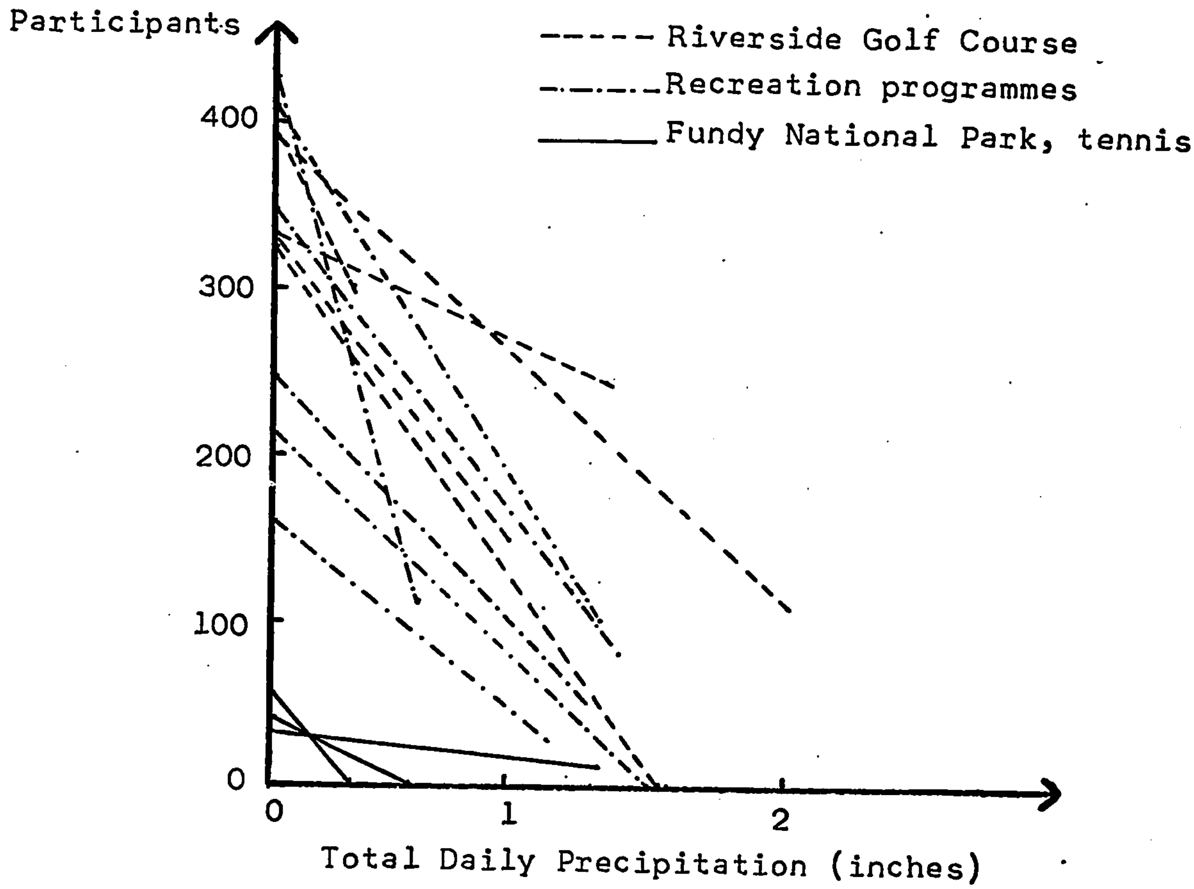

Figure 10.8

LINEAR REGRESSIONS FOR PARTICIPATION IN OUTDOOR SPORTS AND PRECIPITATION AMOUNT

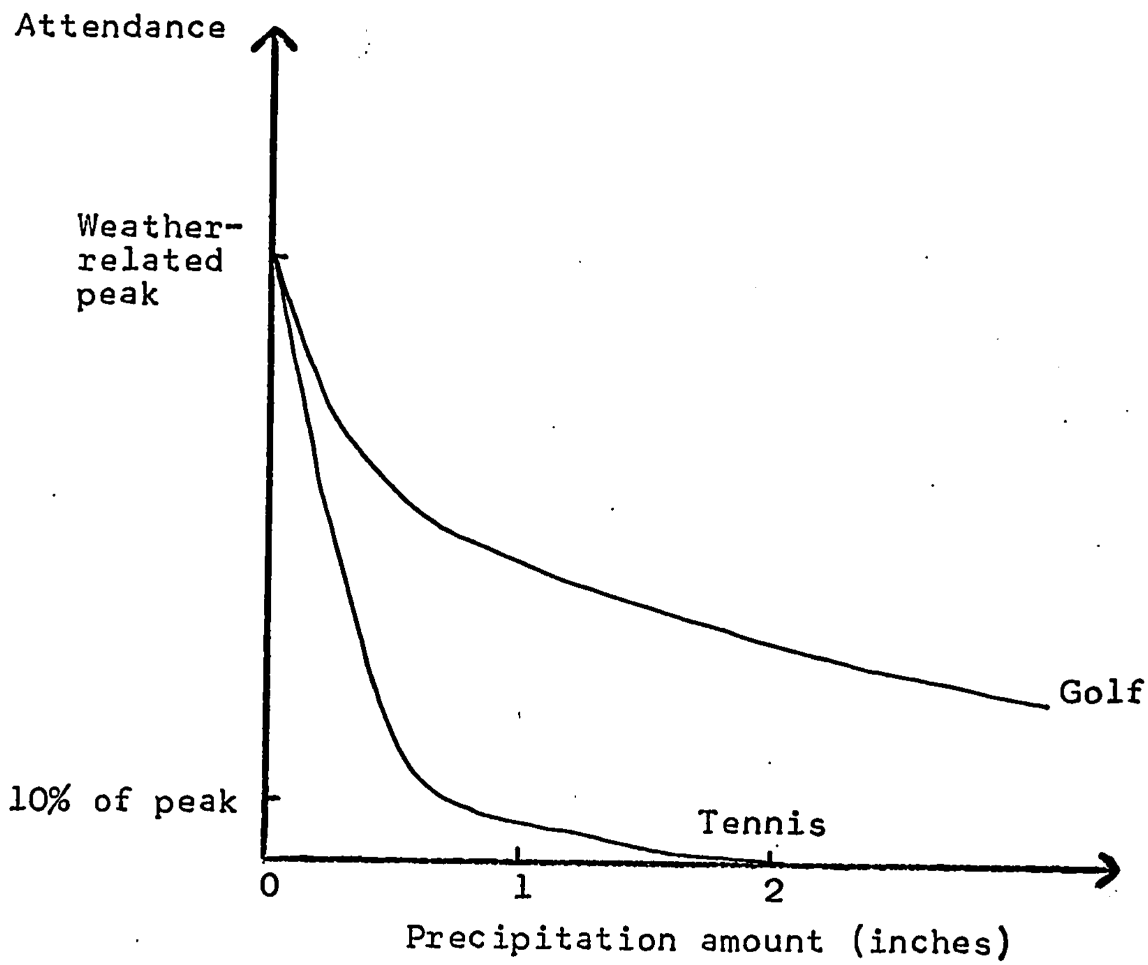

Figure 10.9

SCHEMATIZED RELATIONSHIP BETWEEN OUTDOOR SPORTS PARTICIPATION AND PRECIPITATION AMOUNT review. Since both six-hourly and total precipitation show similar characteristics, they are discussed together below.

Figure 10.8 shows the various regression lines for analyses of attendance and total daily precipitation. While there is a marked inverse relation between precipitation amount and attendance, at Riverside Golf Course there are several instances of over an inch of rain falling without the attendance dropping below perhaps a third of capacity. Thus the critical value for 10 per cent of peak use of the course would appear to be in the vicinity of 2 inches, indicating a rain of some intensity and duration. Decline of attendance with precipitation amount is most marked with the tennis records at Fundy National Park.

This probably represents the susceptibility of tennis playing to any precipitation at all. The regressions for the recreation areas and programmes fall between the tennis and golf lines on Figure 10.8, indicating that participants will tolerate small amounts of precipitation.

While the usual problems of working with precipitation amounts prevail, there is definite indication of a decay curve for all facilities, as shown in Figure 10.9. The nature of the relationship thus suggests that even small amounts of precipitation are strong deterrents to participation in outdoor sports. Once again, however, there may be other precipitation variables more relevant than amount.

<u>Sunshine</u>

Only two of the outdoor sports facilities are close enough to sunshine-recording meteorological stations to allow meaningful analysis. These are Riverside Golf Course and Grand Lake Provincial Park. Total daily sunshine hours is the variable used.

Four of six analyses at Riverside Golf Course have positive values of b significant at the 5 per cent level (Figure 10.10). The remaining two have positive correlation coefficients of 0.473 and 0.661. There is no evidence to suggest a curve function for the relation between rounds played and total sunshine hours, in contrast to the trend for maximum temperature. The r-values for total sunshine hours at Riverside are generally higher than those for maximum temperature. Total sunshine hours thus appears to be one of the better weather variables for predicting attendance at Riverside. On the other hand, sunshine does not appear to be a critical factor in golfing. Some days with no sunshine at all still had sizeable attendances.

Participation in the Grand Lake recreation programme is related positively to sunshine hours in all three analyses (Figure 10.11). In day-grouping (iii), weekdays, the 5 per cent significance level for b is just reached. None of the correlation coefficients exceeds 0.5 or is less than 0.3. Thus there is no really convincing relation to daily sunshine hours, and there is also no evidence to suggest non-linearity. Again, sizeable attendances were recorded on completely overcast days, so that sunshine is not a critical factor in participation here either. It is noteworthy how all the regression

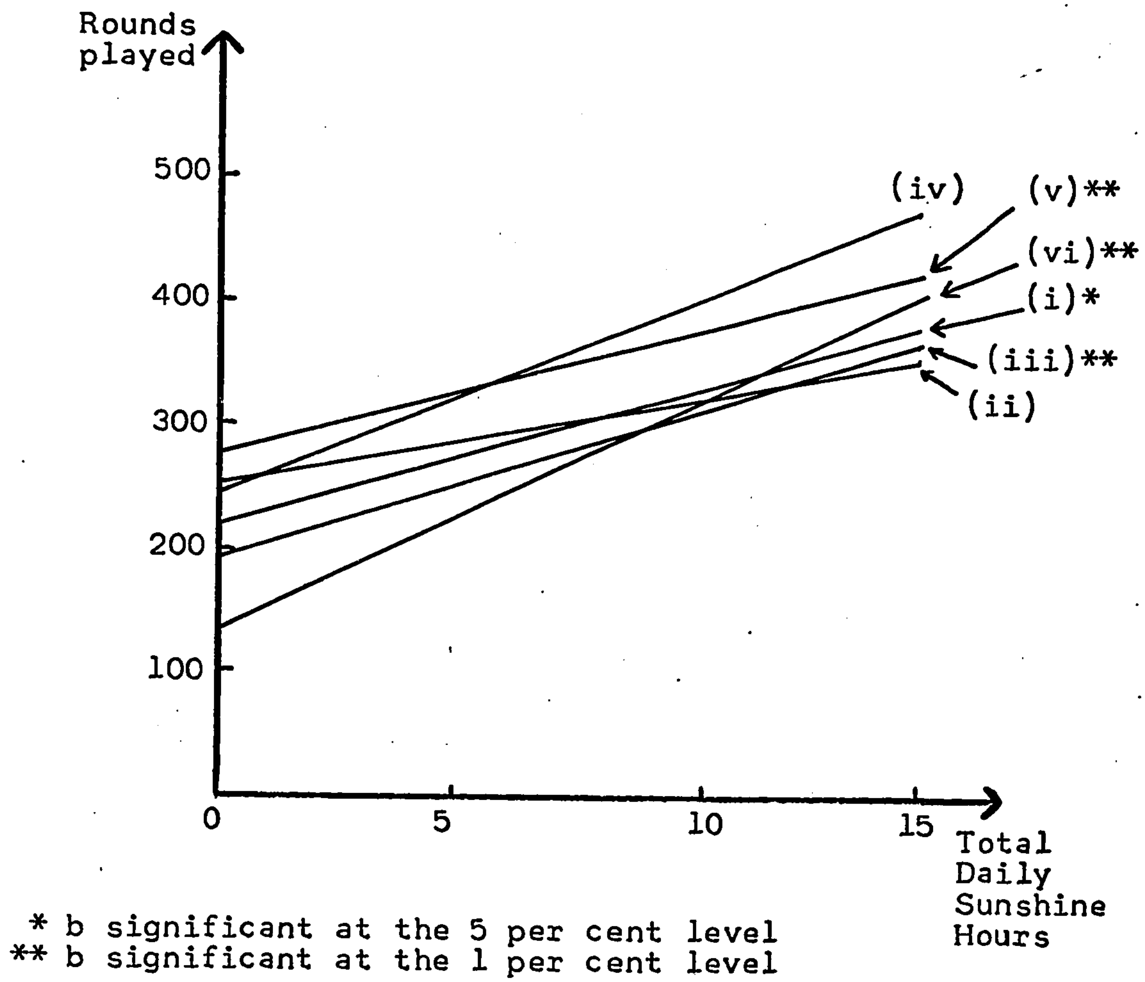

Figure 10.10

LINEAR REGRESSIONS OF ROUNDS PLAYED AT RIVERSIDE GOLF COURSE, EDMONTON, AND TOTAL DAILY SUNSHINE HOURS

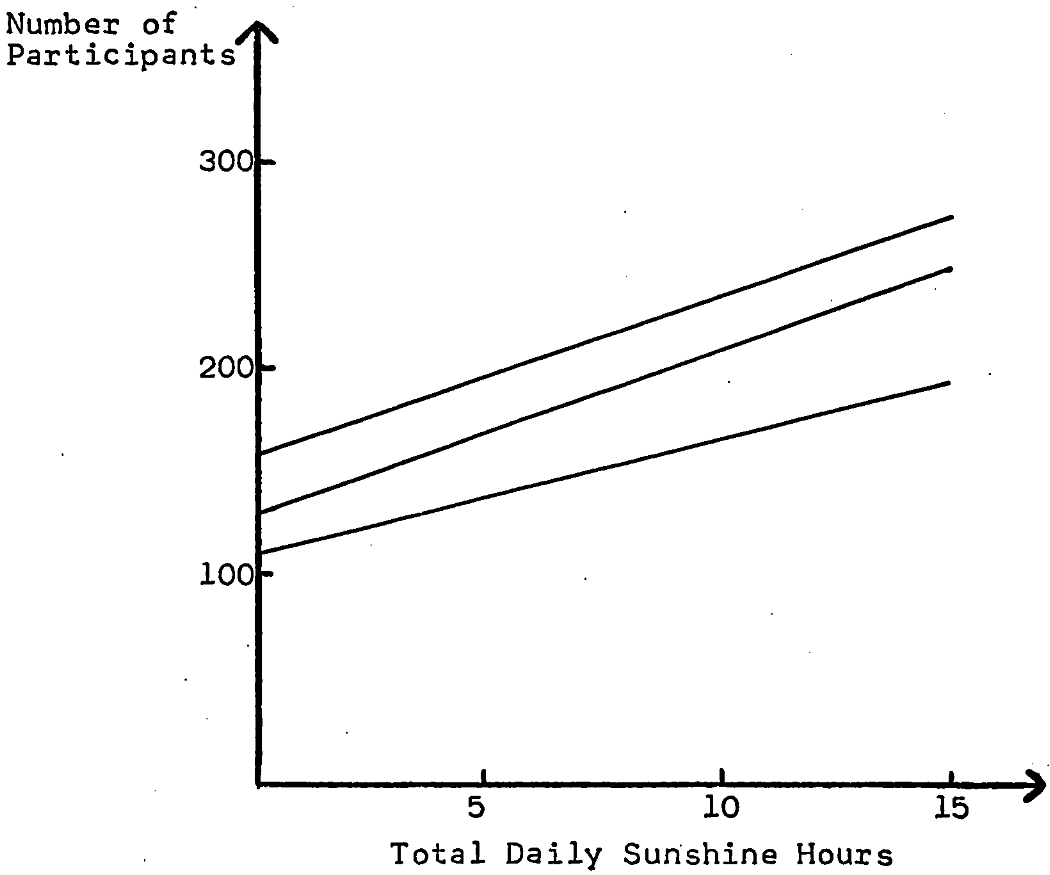

Figure 10.11

LINEAR REGRESSIONS OF PARTICIPANTS IN GRAND LAKE RECREATION PROGRAMME AND TOTAL DAILY SUNSHINE HOURS lines intercept the y-axis (Figure 10.11), supporting this observation. Sunshine hours appear to be a factor in attendance, indeed a strong one at Riverside Golf Course, yet on the other hand, zero sunshine is not critical to attendance at either Riverside or the Grand Lake recreation programme. The stronger relation at Riverside seems to support the earlier suggestion that the Edmonton region users tend to demand more sunshine than the others in their decision to use facilities.

Relative Humidity

Mean daily relative humidity again could be applied only to Riverside Golf Course and Grand Lake Provincial Park. In both cases there is a definite negative interaction with attendance. Once more, four of the six b-values at Riverside attain 5 per cent statistical significance. There is no evidence for non-linearity, and r-values are almost as high (with a negative sign) as are those for total daily sunshine hours. The critical level of mean relative humidity for 10 per cent of peak use appears to be in the 95-100 per cent range. Mean relative humidity is able to predict when attendance will be less than 10 per cent of peak, while daily sunshine hours is not. A mean daily relative humidity of this magnitude in Edmonton usually represents a prolonged rain, so that the relative humidity reflects a significant precipitation influence. Since correlation coefficients for mean relative humidity are almost equal to those of daily sunshine hours, it is suggested that mean daily relative humidity is the best single weather variable for predicting Riverside Golf Course attendance.

The Grand Lake recreation programme is offered only during the peak season. Mean daily relative humidity is significantly and inversely correlated to participation on Sundays and Statutory Holidays. For day-groupings (ii) and (iii) however, correlation coefficients are only -.228 (ten Saturdays) and -.230 (forty-three weekdays) respectively. Although the relationship with relative humidity is apparently not as strong as at Riverside Golf Course, it is still possible to suggest a tentative limiting value of 96-98 per cent mean daily relative humidity as coincident with 10 per cent of peak programme participation.

<u>Wind</u>

Again, the wind mileage for 0900-1900 hours could be investigated only at Riverside Golf Course and Grand Lake. All the analyses have negative values of b, although at Grand Lake the inverse relation between wind mileage and attendance is weak. At Riverside Golf Course, however, all three analyses for day-groupings (iv) to (vi) have correlation coefficients significant at the 5 per cent level. Windspeed thus seems to be a larger factor in the off-peak portion of the summer than in the school holiday period. There are no grounds for suggesting curve functions for the relationship, and it is also difficult to identify any limiting value for 10 per cent of peak use of the golf course. There is a suggestion,however, that 200 miles of wind or an average speed of 20 miles per hour throughout the 0900-1900 hours period would roughly mark this limit.

Wind influence on Grand Lake recreation programme numbers is present but not marked. It certainly does not appear to be an important factor influencing participation in the recreation programme. Many organized recreation centres have adequate shelter space where users may find alternatives when wind and other climatic elements are unfavourable.

Comfort Indices

Again these are applicable only to Riverside Golf Course and Grand Lake Provincial Park. At both facilities, the comfort indices analyses show the same kind of relation to attendance as does daily maximum temperature. Also, in both cases, the 3 p.m. Discomfort Index does not appear, from its scattergrams, to be a very useful explanatory variable. For the Grand Lake recreation programme, 3 p.m. Effective Temperature (ET) and daily maximum temperature produce almost identical scattergrams. Thus there seems little advantage in using either comfort index at Grand Lake.

ET bears a much closer relation than daily maximum temperature to attendance at Riverside Golf Course. However, the ET analyses show the same bell-shaped curves as representations of the actual relationship as do those for maximum temperature. Thus ET is not as useful a predictor of attendances as relative humidity because, like temperature, it seems unable to produce a critical limit for 10 per cent of peak use.

Discussion

Although these data are few in number, they indicate a substantial variety of response to weather by participants in different outdoor sports activities. At Riverside Golf Course, the most useful weather variable in terms of effect on number of rounds played proves to be mean daily relative humidity.[6] Next comes total daily sunshine hours, a parameter which is a function of day-length and therefore might be expected to be a good predictor for golfing. Maximum temperature and comfort index relationships for Riverside Golf Course seem to be of the bell-shaped form shown in Figure 10.7. Windspeed also is an important factor, especially outside the school vacation. At Grand Lake, participation in the recreation programme seems to be most affected by temperature and precipitation. Even daily maximum temperature is significantly related to attendance in only two of the three analyses, and the variables of relative humidity, total sunshine hours and windspeed have lesser influences still on attendance.

At the other three facilities, only temperature and precipitation are available for investigation. Precipitation amount has a strong influence on participation in the New Brunswick Provincial Parks recreation programme at Parlee Beach, and on attendance at Centennial Park recreation area, Moncton. It is even more of a deterrent to tennis players at

[6] It would be interesting to learn whether this factor is equally important in the other two regions where relative humidity is frequently higher than in the Edmonton study region.

Fundy National Park. Only a slight association exists between daily maximum temperature and numbers playing tennis, at least over the range of maxima from 62°F to 85°F covered by the three analyses made för the 1969 summer. In contrast, attendance at Moncton's Centennial Park is quite strongly related to daily maximum temperature.

It is paradoxical that the analysis for Riverside Golf Course for day-grouping (i), over the range 67°F to 83°F, shows a marked inverse relationship of attendance with mean daily relative humidity and also with daily maximum temperature. This situation also occurs at Storyland Valley Zoo. For these thirteen days at the Edmonton Industrial Airport, there was in fact an unusual non-correlation between daily maximum temperature, total sunshine hours, and mean relative humidity.

In conclusion, it is evident from the few diverse outdoor sports reviewed that the response of their adherents to weather conditions demonstrates differences from the activities analyzed in earlier chapters. There is great variety in the effects of weather on participation in the different sports. Truly conclusive findings would require a much larger body of data than was available for study here. Nevertheless, it appears that new variables move to the forefront of the total weather situation. Examples are precipitation amount in the case of tennis, relative humidity and effective temperature for golf. The weather effect on outdoor sports is as marked as for any other activity, but the dominant position of maximum temperature within the weather situation for many other outdoor recreational pursuits appears to have receded. These analyses of outdoor sports are illustrative of the great variety of factors inherent in the weather influence on recreationists. The correlation of outdoor sports and weather demonstrates that the entire weather picture must be considered. For some outdoor recreation activities, maximum temperature alone may be used as a reasonable predictive variable. But for others, particularly for outdoor sports, a wider range of weather elements must be considered.

CHAPTER XI

SUMMARY AND APPLICATIONS

In the foregoing treatment, an attempt was made to explore quantitatively the weather response of recreationists engaged in eight classes of outdoor activity. The response to pre-selected weather variables was tested. In this chapter, the eight classes of activity are drawn together in an effort to synthesize the findings and emphasize any definite conclusions that can be stated.

Analyses of the results can best be introduced by considering the relative popularity of the facilities in each study region on sample days during the 1969 summer (Figures 11.1 to 11.6). Attendance figures on the maps are expressed as percentages of the peak attendance at each facility over the whole summer regardless of day of the week.

A comparison is made of Saturday, July 5, and Sunday, August 10, 1969 in the Edmonton study region (Figures 11.1 and 11.2). Neither of these days was part of a long weekend and both fell within the school vacation period. August 10 was a much warmer day than July 5 except in the extreme north of the study region. Edmonton's maximum temperature was 79°F on August 10 and 62°F on July 5, but Athabasca's maximum temperatures on the same days were 72°F and 70°F respectively. Edmonton received 0.34 inches of precipitation on August 10 and 0.04 inches on July 5. Mean daily relative humidity at Edmonton was 65 per cent on August 10, and 85 per cent on July 5; 13.1 and 3.9 hours of sunshine were recorded on these

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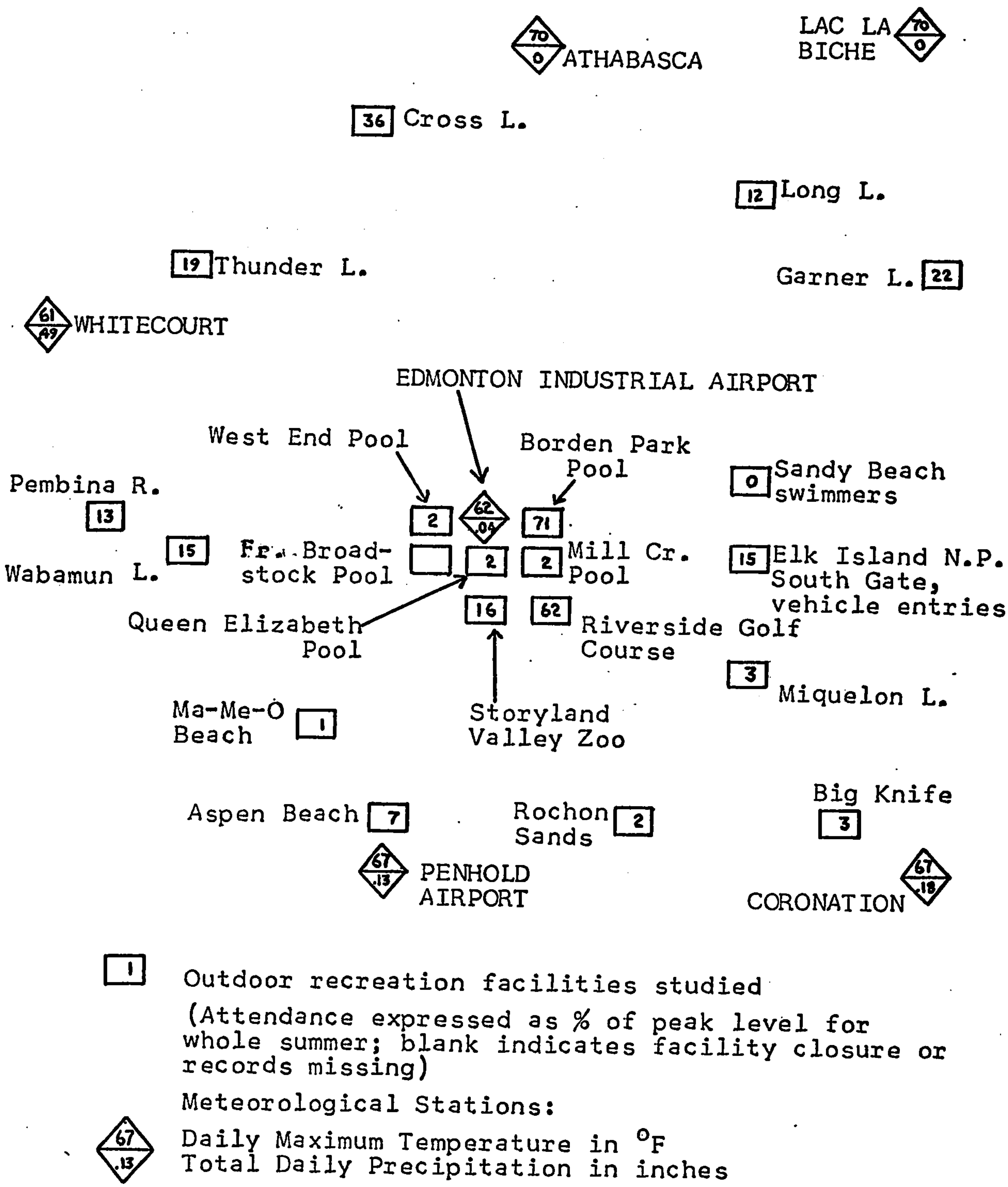

Figure 11.1

WEATHER AND THE SPATIAL DISTRIBUTION OF OUTDOOR RECREATIONISTS, EDMONTON STUDY REGION, SATURDAY, JULY 5, 1969

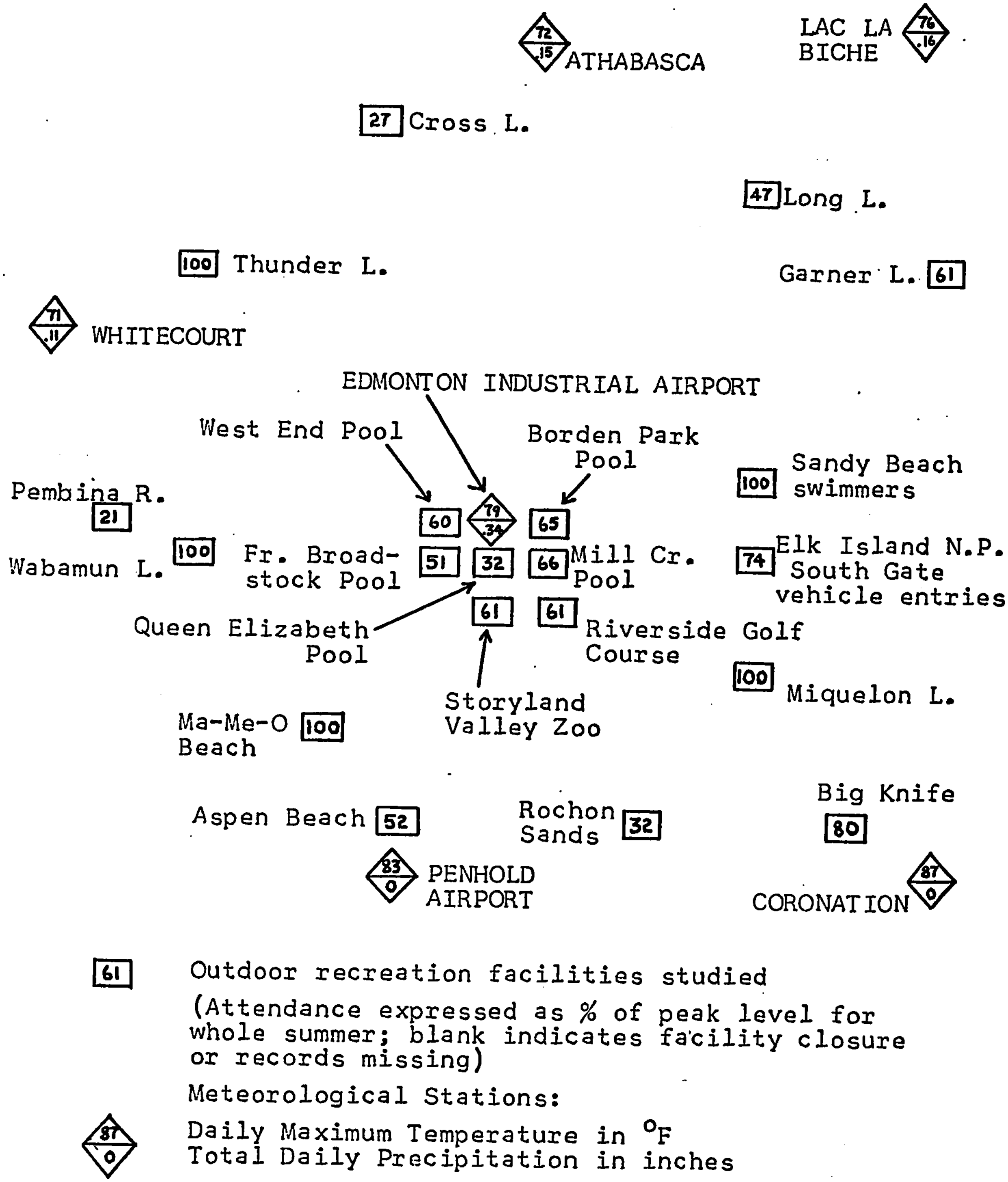

Figure 11.2

WEATHER AND THE SPATIAL DISTRIBUTION OF OUTDOOR RECREATIONISTS, EDMONTON STUDY REGION, SUNDAY, AUGUST 10, 1969 two days respectively. The two days studied in the Ottawa-Hull region are Sunday, August 31 (Figure 11.3) and Monday, July 28, 1969 (Figure 11.4). Ottawa reached 90°F on August 31, and 9.5 hours of sunshine were recorded; mean relative humidity was 71 per cent, and no precipitation was received. In contrast, July 28 was cloudy, though still warm (Ottawa maximum, 79°F). No sunshine was recorded at Ottawa, and the mean daily relative humidity was 86 per cent, with 0.83 inches of precipitation falling. In southern New Brunswick, Monday, July 14 (Figure 11.5) was cool and cloudy. Maximum temperatures were 62°F at Saint John Airport and 61°F at Fredericton. Saint John had 0.21 inches of precipitation and a mean daily relative humidity of 93 per cent; these compare with the Fredericton values of 0.28 inches and 92 per cent. No sunshine was recorded at Fredericton. The other sample day, Saturday, June 28, 1969 (Figure 11.6) was very hot in interior New Brunswick but cool on the Fundy coast. Fredericton reached 95°F and had 11.0 hours of sunshine, but at Saint John Airport, 55 miles away, the maximum was 64°F. Mean relative humidity was 61 per cent at Fredericton and 94 per cent at Saint John, but neither station had any precipitation. Further details of the weather on each of these days are shown on the maps themselves.

On July 5 (Figure 11.1) attendance was very low at all swimming facilities and beach parks in the Edmonton region. None of the outdoor swimming places received more than 2 per cent of its peak use.[1] The beach parks fared slightly better than this, the highest figure being 19 per cent at Thunder Lake, but 7 per cent or less for the other four facilities. The multi-activity parks at Cross Lake and Garner Lake attracted 36 and 22 per cent respectively of their peak use.[2] On the other hand, Edmonton's Riverside Golf Course was relatively popular. Rounds played were 62 per cent of the total on the busiest day of the summer.

On August 10 (Figure 11.2) almost all facilities had more visitors than on July 5. The significant difference on this day is the relative popularity of various types of facility. Sandy Beach in Elk Island Park, the one swimming site outside Edmonton, and four of the region's six beach parks recorded their peak attendances for 1969. Swimmers at pools in the city of Edmonton, however, ranged from 32 to 66 per cent of the 1969 maximum. Day-use of the multi-activity Cross Lake, and number of rounds played on Riverside Golf Course were lower on August 10 than on July 5. These figures provide strong support for the view that recreationists do respond to weather conditions in their choice of trip destinations. Whether consciously or not, recreationists appear to favour particular activities over others, depending on the

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[1] The figure of 71 per cent for Borden Park Pool should be ignored. As has been demonstrated previously, there seems to be a problem with this pool's 1969 attendance records.

[2] Cross Lake and Garner Lake are both in the north of the Edmonton study region, which experienced warmer and drier weather than the remainder of the region on July 5.

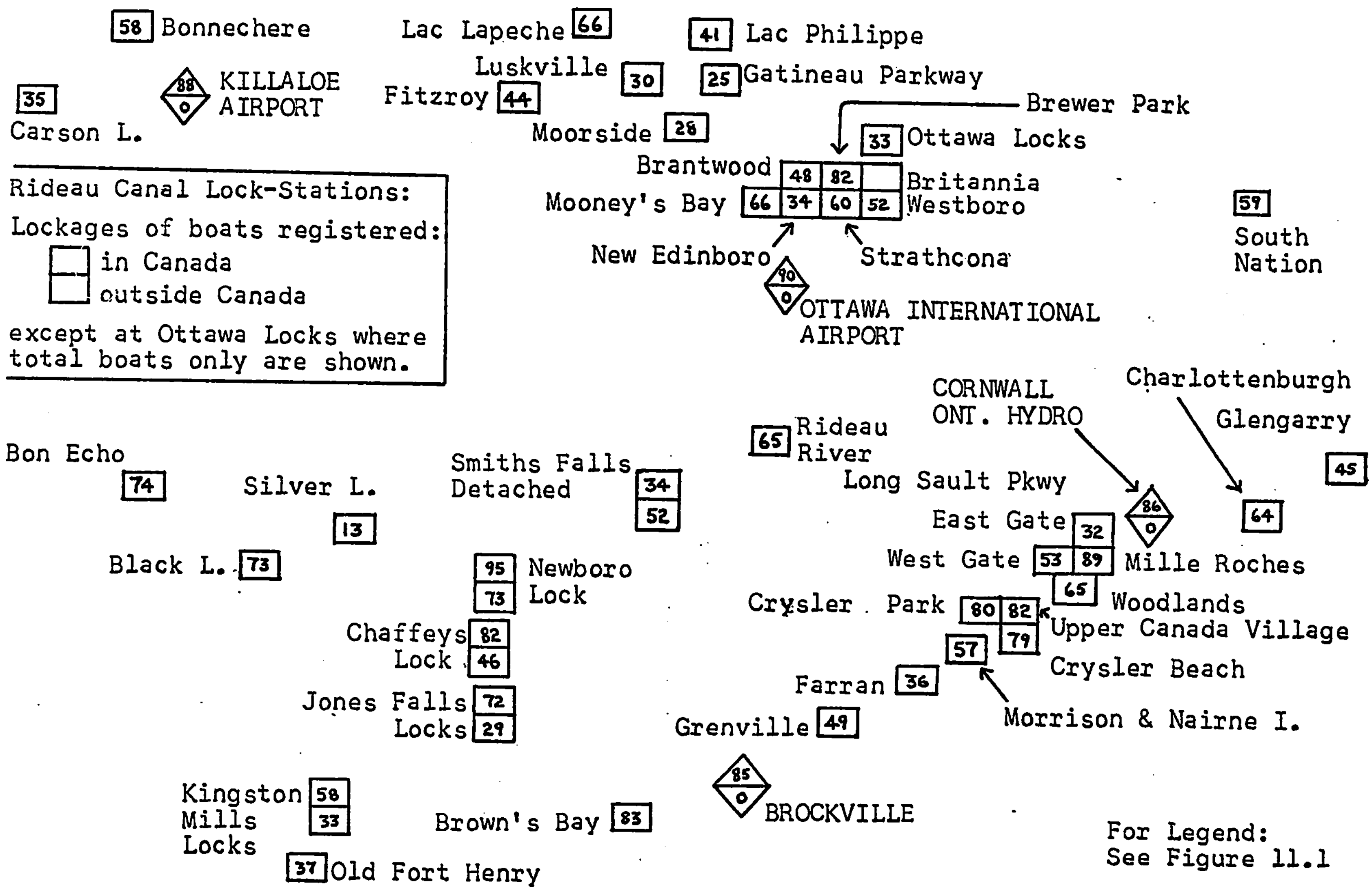

Figure 11.3 WEATHER AND THE SPATIAL DISTRIBUTION OF OUTDOOR RECREATIONISTS, OTTAWA-HULL STUDY REGION, SUNDAY, AUGUST 31, 1969

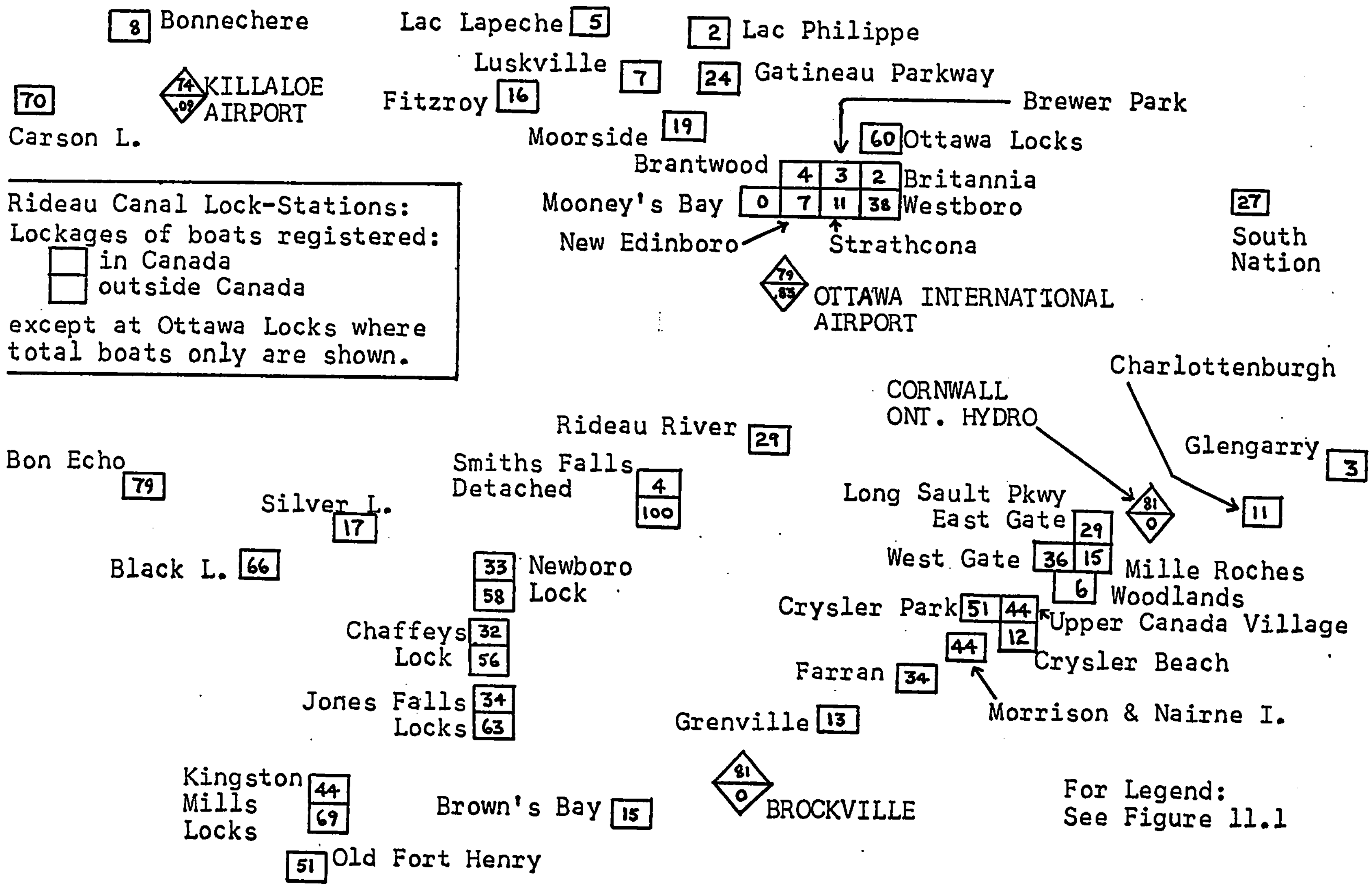

Figure 11.4 WEATHER AND THE SPATIAL DISTRIBUTION OF OUTDOOR RECREATIONISTS, OTTAWA-HULL STUDY REGION, MONDAY, JULY 28, 1969

prevailing weather situation. Thus weather is a factor in the choice of a trip destination.

Similar influences of weather on the relative spatial distribution of facility day-users are indicated in the Ottawa-Hull study region. The swimming areas of Ottawa City and the beach parks of the region were much more intensively used on August 31 than on July 28. This was not true for some of the other recreation sites. Vehicle entries at the East and West Gates of Long Sault Parkway reached only 32 and 53 per cent of their maxima respectively on August 31. These figures were scarcely higher than the values of 29 and 36 per cent respectively on July 28. Pleasure driving or facilities such as the picnic areas and nature walks were more attractive to Parkway visitors on July 28 than were Mille Roches and Woodlands beaches. These two beaches received 89 and 65 per cent respectively of peak use on August 31, but only 15 and 6 per cent on July 28.

In southern New Brunswick on Monday, July 14, 1969, a cool, wet day, the only appreciable attendances were at picnicking parks (Figure 11.5). In contrast, on June 28, 1969, although use of picnic sites was greater than on July 14, facilities such as swimming pools, beaches and multi-activity parks were strongly favoured (Figure 11.6). The most favoured destinations on July 14, picnic areas were given lower preference on June 28. An interesting feature of June 28 is the very low attendance at the Saint John and Bay of Fundy beaches. There is a sharp contrast between these attendances and the

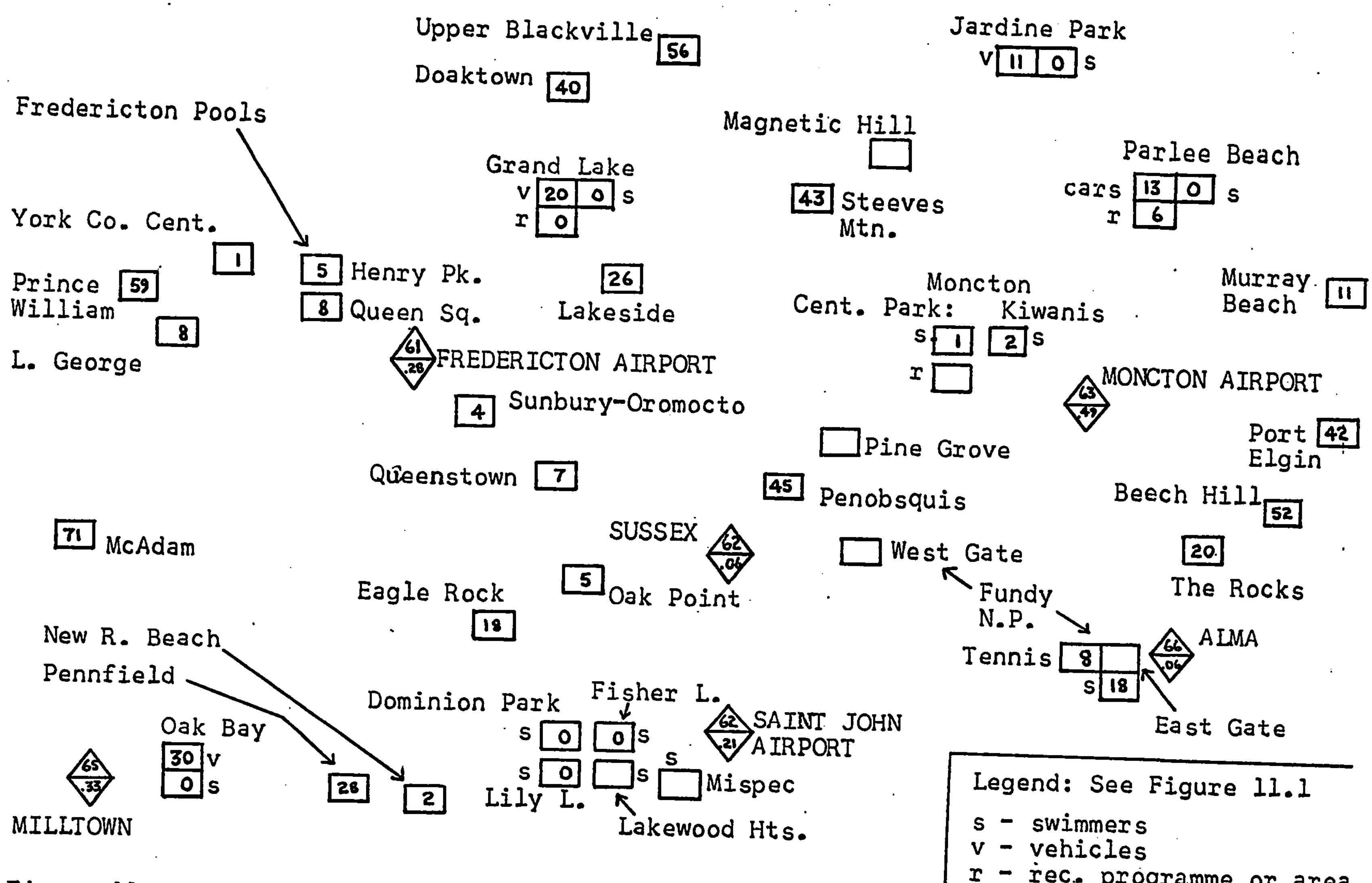

Figure 11.5 WEATHER AND THE SPATIAL DISTRIBUTION OF OUTDOOR RECREATIONISTS, SOUTHERN NEW BRUNSWICK STUDY REGION, MONDAY, JULY 14, 1969

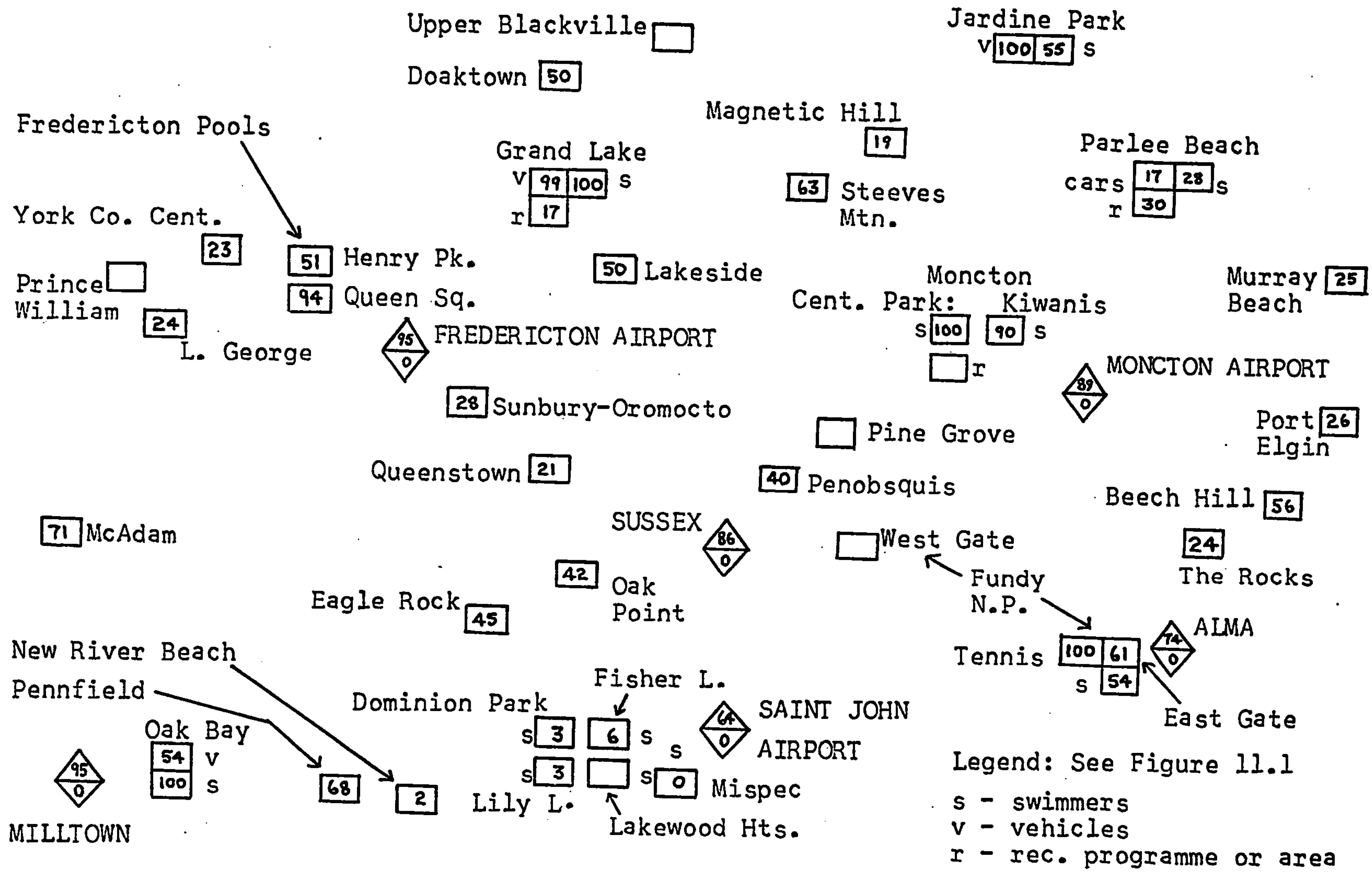

Figure 11.6 - WEATHER AND THE SPATIAL DISTRIBUTION OF OUTDOOR RECREATIONISTS, SOUTHERN NEW BRUNSWICK STUDY REGION, SATURDAY, JUNE 28, 1969

peak levels for the whole summer reported on the same day at several swimming and beach facilities in interior New Brunswick. There was a very strong temperature gradient across southern New Brunswick. Maxima were 64°F at Saint John Airport, 74°F at Alma, 86°F at Sussex, and 95°F at Fredericton Airport. Attendances at swimming and beach facilities reflect this temperature differential. The maximum temperature at Saint John Airport on June 28 was thus just below the limiting value suggested for swimming in Table 4.7 (p. 87). An additional factor, not analyzed in this thesis, may have been the fog reported at Saint John on this day. This played a role in keeping the temperature down, and was presumably also a factor in the small beach attendances in the Saint John area.

As is clearly demonstrated in the series of maps, the decision to participate in outdoor recreation is not affected in a mere yes-no fashion by the weather. Weather in fact plays a major role in shaping the choice of activity and the location of the recreational facility to be used. Figures 11.1 to 11.6 strongly support the conclusion from the earlier activity analyses that some outdoor pursuits are more influenced by weather conditions than others. A hierarchy of relationships between activity participation and the more significant weather variables may be developed. Figure 11.7 provides a summary of findings concerning the associations between use of various types of facility and the individual weather variables analyzed. In most instances, maximum

Activity	Maximum Temperature	Precipitation	Sunshine Hours	Wind	Relative Humidity	Comfort Indices
Swimming	straight line often with high correlation	decay curve	straight line, lower correlation than max. temperature	weak inverse relation	straight line, variation of r-values great	straight line often with high correlation
Beach Use	straight line with fairly high correlation	decay curve	straight line, higher correlation than max. temperature	weak inverse relation	straight line, great variation of r-values	straight line with fairly high correlation
Multi-Activity Parks	low linear r-values; some rejection of linearity	very shallow decay curve	straight line, weak positive relation	almost no relation	inverse relation, linearity not rejected	very similar to relation for max. temperature
Picnicking	very little association; no rejection of linearity	straight line, weak inverse relation	almost no association	almost no relation	weak inverse linear relation	very little association

Source: Computer analyses, 1970

Figure 11.7

SUMMARY OF GENERAL RELATIONSHIPS FOUND BETWEEN ACTIVITY PARTICIPATION AND WEATHER VARIABLES

Activity	Maximum Temperature	Precipitation	Sunshine Hours	Wind	Relative Humidity	Comfort Indices
Boating	very little association	difficult to identify	almost no relation	weak inverse relation	almost no relation	little association
Pleasure Driving	slight positive relation	almost no relation	almost no relation	weak inverse relation	difficult to identify	slight positive relation
Visiting Special Sites	bell-shaped curve	shallow linear decay	straight line, moderate correlation	weak inverse relation	inverse linear relation	bell-shaped curve
Outdoor Sports	bell-shaped curve	decay curve	straight line, varying r-values	inverse relation	straight line, fairly high negative correlation	bell-shaped or growth curve

Source: Computer analyses, 1970

Figure 11.7

(Continued)

SUMMARY OF GENERAL RELATIONSHIPS FOUND BETWEEN ACTIVITY PARTICIPATION AND WEATHER VARIABLES

The attendance axis has different scales for each activity. The actual proportion of the total population which participates in each activity varies. Golf and tennis are less popular than beach use, and the actual peak numbers for these sports are much smaller than the numbers of persons engaged in beach use on its peak day.

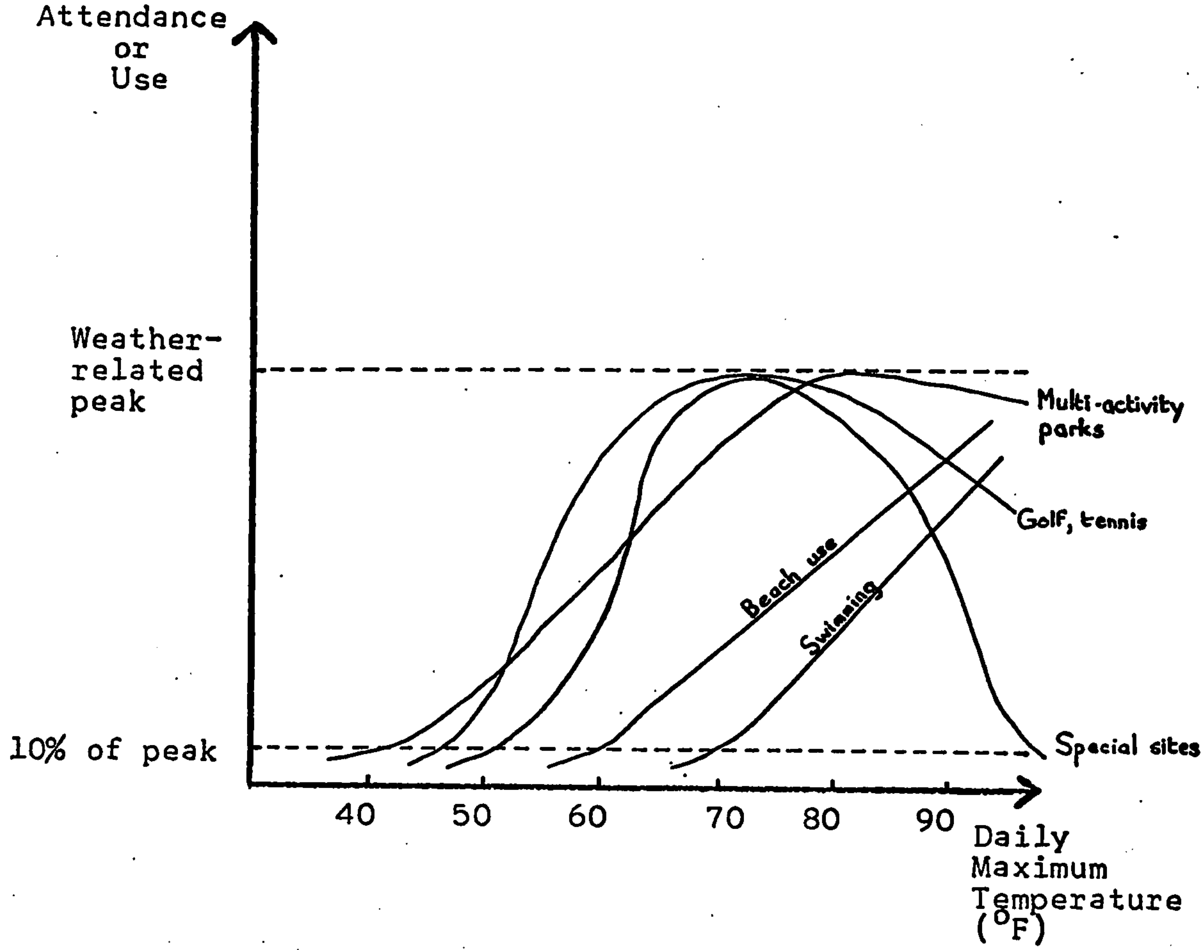

Figure 11.8

ILLUSTRATION OF THE WEATHER-SELECTIVENESS OF OUTDOOR RECREATIONISTS temperature is the single variable most closely related to use. Based on the information in Figure 11.7, a hypothesis for the choice of a recreational activity under different temperature conditions is proposed in Figure 11.8. This diagram is a schematic illustration of the "weather-selective" behaviour of outdoor recreationists.

The figure depicts a simplified situation of a fixed population of recreationists confined to a region where only five types of facility are available for patronage. The relationships between participation in the individual activities and maximum temperature have been plotted on one set of axes. They represent summary versions of those identified in Chapters IV to X for the school vacation period. With maxima below 60°F, only multi-activity parks, golf and tennis, and special sites receive any significant patronage. These activities are still most favoured between 60 and 70°F, but in this range of maximum temperature, beaches and swimming areas begin to be used. Use of golf courses, tennis courts and special sites peaks in mid-70 temperatures, and that of multi-activity parks at about 80°F. Beach use and swimming are selected by increasing numbers of outdoor recreationists above 70°F and above 80°F are strongly favoured activities. A decrease in use of outdoor sports facilities, special sites and multi-activity parks sets in as temperatures climb to the 80s and 90s. It is likely that the concept of alternative opportunity explains part of this decrease. A number of those who would choose golf, tennis or special sites at 65°F are likely to swim or visit a beach at 85^{o}F if they can.

This weather-selectiveness of outdoor recreationists has an important implication for the facility operator. It suggests that though outdoor recreation areas may truly compete with one another in the quality of experience and services that they offer, the weather situation strongly affects their competitive position. The commercial operator who offers at his facility a range of outdoor activities favoured under the widest range of weather conditions has a distinct advantage over one who offers only a single attraction such as the special site or the beach.

Weather is by no means the only factor in variations of daily attendance at outdoor recreation facilities. Features such as user characteristics and preferences can obscure and even counter weather influences on facility use patterns. On Monday, July 28, 1969 (Figure 11.3), attendances at Carson Lake, Bon Echo, Silver Lake and Old Fort Henry were greater than on August 31; so too were lockages of American boats through all the Rideau lock-stations studied except Newboro. The higher use of all these facilities on July 28 is surprising in view of the warmer, sunnier weather of August 31. However, tourists make up an important component of the users of these facilities, and it appears that the traditional tourist season is chiefly responsible for this situation. A further example is the decline in attendance at facilities in the city of Edmonton on midsummer Sundays as the weather apparently improves. Such use patterns reflect a tendency for increased numbers of Edmontonians to leave the city on such days during this period to seek their recreation further afield. This tendency is not present outside the school vacation period.

Variations in use patterns and user characteristics apart, there are some very definite regional variations in the responses of outdoor recreationists to weather. In the Edmonton region, large numbers of people will swim out of doors in air temperatures which seem to be considered too cold by most swimmers at Ottawa beaches. Beach users in southern New Brunswick will tolerate higher relative humidities than their counterparts in the other study regions. Lack of sunshine inhibits Edmonton recreationists most of all, and has least effect in New Brunswick. In accounting for these variations, one may tend first to speculate that they result from differences in the climatic conditions to which the recreationist is accustomed. For instance, the tolerance of lower temperatures for swimming found in the Edmonton region might be explained by the fact that Edmonton's mean annual temperature is $5^{o}F$ cooler than that of Ottawa.

There are other factors that might also explain these regional variations. These variations may exist not because there are regional differences in climate but because there are regional differences in recreationists. It may be that the socio-economic characteristics of the regional populations are playing a role in these differences. Such characteristics have already been recognized as factors in varying rates of participation in outdoor recreation (ORRRC, 1962:20, pp. 10-29). One may rationalize that immigrants to Canada from Africa and from Britain will view their new climate differently. Ottawa's international community is uniquely constituted because of the city's position as the federal capital. The strong affinity of Edmontonians for lakes in summer may be a reflection of their prairie landscape and their distance from the sea.

Another possibility in the regional variation in weather response is the composition of the user-group within each region. It was shown in Chapter II that more tourists are counted among the users of the facilities studied in the Ottawa-Hull and southern New Brunswick regions than in the case of the Edmonton region. The inclusion of both local residents and tourists among the users of the recreational facilities analyzed is beneficial to the study. This provides a wider selection of recreationists than the three geographic regions can supply from their residents alone. Although tourists may have different outdoor recreation preferences, they nevertheless are responding to the same weather situations as local residents. Therefore recreationists in the two eastern Canadian regions may show different responses to weather from those in the Edmonton region where few tourists utilize the facilities studied.

It is now appropriate to review the process by which the outdoor recreationist considers weather factors when deciding on an activity and a destination. It was previously stated

(p. 54) that there are three sets of weather circumstances to which the recreationist may react. These are conditions on-site, conditions at the user-origin, and forecast conditions. There is a strong case for adding a fourth set of circumstances, the anticipated conditions. The recreationist may or may not be aware of the forecast, or he may even disregard an unfavourable forecast in the hope that it will be revised more favourably.

The summer recreationist is also affected by what the weather has been like prior to his proposed outing. His reaction to an unusual 80°F day in May is likely to differ from his response to a day with a similar temperature in July preceded by several other warm days. The stage of the summer is therefore important. Division of the analysis into peak and off-peak periods of the summer has shown that very different weather responses characterize these two periods. There is also the possibility that the weather may be eminently suitable for a visit to a particular facility, but that the prior conditions at the facility itself may deter visits. A golf course still flooded from the severe thunderstorm of the previous evening is a relevant example.

It was not possible to take factors such as these into account in the project. However, this study of weather-participation associations reveals very significantly that maximum temperature occupies a dominant position among the weather parameters examined. Maximum and minimum temperatures are prominent among the items that receive mention in the daily public forecasts reported by the communications media. One is safe in considering weather forecasts to be at least 80 per cent accurate. Such reliability and the pre-eminence of maximum temperature in the activity analyses (Figure 11.7) strongly suggest that forecast maximum temperature may be an important factor in decision-making for trips on the day to which the forecast refers. It may be questioned whether the recreationist makes his decision on the basis of the forecast maximum temperature, or from his own interpretation of the existing weather situation. Since forecasts of maximum temperature have such a high level of accuracy, it is difficult to tell whether the forecast or the actual maximum temperature is the more significant factor.

Further research in this field is obviously required, and further discussion here would be mere speculation. It is expected that the study previously mentioned at Michigan State University (Crapo, 1970) will supply some of this needed information.

Factors apart from weather are also operative in the process of selecting recreational activity and location. These are ultimately exhibited in the patterns of use at outdoor recreation facilities. Two of these factors, day of the week and the school vacation period, are fundamental and have been taken into account by the subdivision of attendance records into six day-groupings for analysis. There is no pretence, however, that such classification into day-grouping eliminates all non-weather variation in facility attendances. Other factors less important than the two mentioned may locally be capable of countering the weather effects in recreation use. This suggests that the predictability of attendances from weather parameters alone, on a day-to-day basis, is limited, the degree of limitation varying at different facilities.

There is no doubt that the outdoor recreationist, and the facility manager especially, would be greatly aided by a weather forecast which emphasized the weather parameters most pertinent to the industry. These parameters, besides the current emphasis on temperatures, might include the approximate timing and possible duration of precipitation, total daily sunshine hours and mean daily relative humidity. The Meteorological Service of the Quebec Department of Natural Resources has already shown that specialized forecasts of value to skiers can be provided (Villeneuve, 1969). It is likely only a matter of time before similar efforts are extended towards all other forms of outdoor recreation.

One may speculate on the effects that anticipated improvements in weather forecasting might have on the outdoor recreationist's reaction to the forecast. More reliable weather forecasting for outdoor recreation is likely to lead to greater dependence being placed by the public on the meteorologist's predictions. Communication of the forecast to the public is also likely to become more effective because both the media and the public at large will consider it their business to be aware of the forecast. If outdoor recreationists were to share fully in this increased awareness, an almost inevitable effect would be an even more unmanageable crowding at facilities during good weather than occurs in many regions at present.

If successful weather modification on a large scale ever becomes both technologically and economically feasible, it could have a worse effect than present forecasting. Modification would imply per se a perfectly accurate forecast of good weather. Overcrowding of outdoor recreation facilities would again be serious, unless many recreationists deliberately travelled further afield to avoid the congestion (Hastings and Tolley, 1966, pp. 92-93). In actual fact, weather is never likely to be managed to satisfy all outdoor recreationists completely, for the demands of some on weather conflict with those of their non-recreational activities.[4] Each desires different weather for his different outdoor pursuits.

The predictability of daily attendances by specifying relationships between weather and attendance is one of the topics set out for examination in this thesis. Brief discussion of the nature of the weather-attendance interactions is necessary before the success or otherwise of such predictions can be assessed.

The weather-attendance relationship will never exactly or wholly follow a straight line, though over restricted ranges

[4] An interesting illustration is the litigation in the case of Slutsky vs. City of New York (Morris, 1966). A resort owner, Slutsky, sued on the grounds that cloud-seeding operations undertaken in an effort to alleviate the city's 1965 water shortage had resulted in excessive rainfall. This weather condition, he claimed, resulted in loss of revenue to himself.

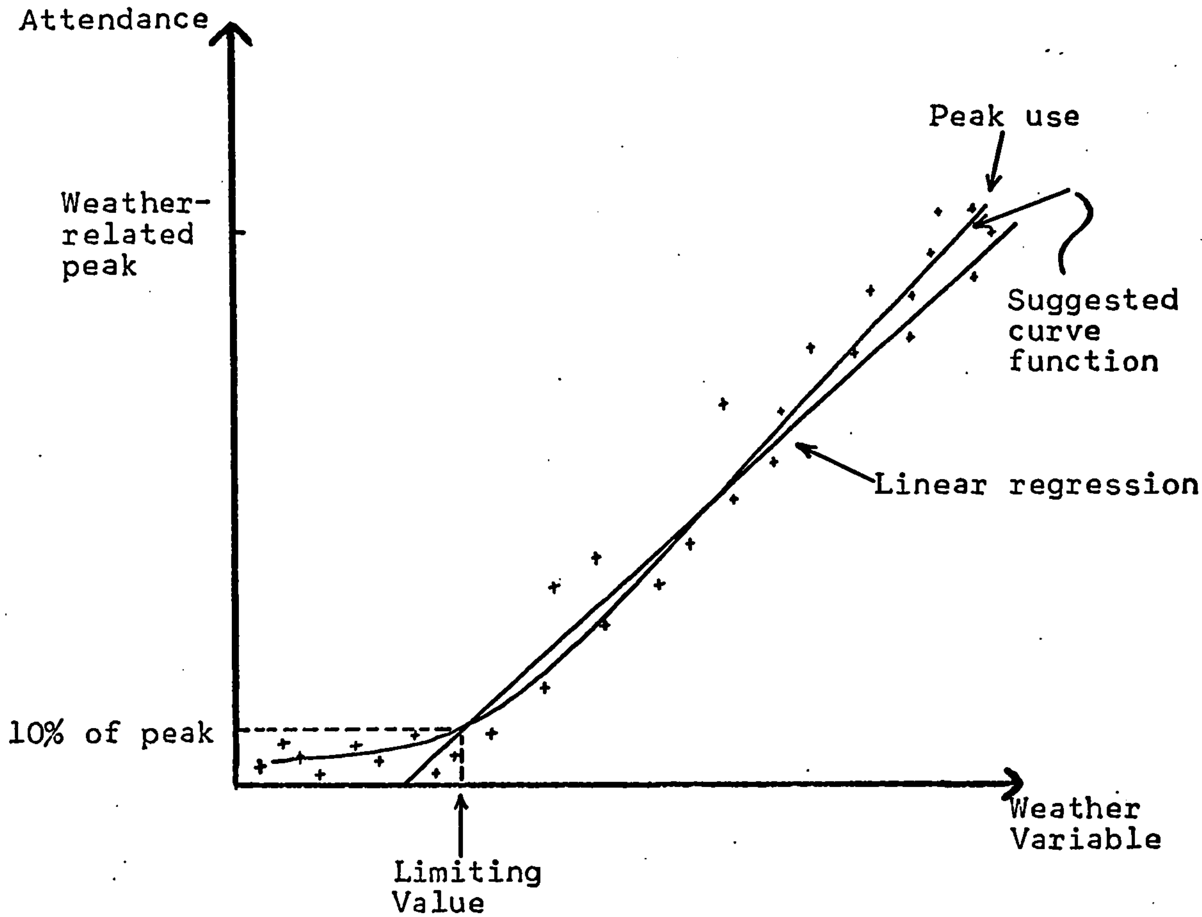

Figure 11.9

ATTENDANCE-WEATHER FUNCTION WITH HIGH LINEAR CORRELATION COEFFICIENT of a weather variable it may conform fairly closely to one. Thus for swimming, under the conditions experienced in the Canadian summer, the straight line is often the best fit for the association with maximum temperature. Even when linear correlation coefficients are high, as with swimming, the lower end of the line will always tend to taper as shown in Figure 11.9. In the cases of special sites and outdoor sports, the relations between facility use and some of the weather variables are more akin to an exponential decay curve, the Gaussian curve, or a growth curve (Figure 11.10). The reader is referred to Figure 11.7 for details of cases where these curves and not the straight line were suggested by scattergrams.

The value of being able to incorporate weather parameters in a predictive model of daily attendance at outdoor recreation facilities is undeniable. The possibility of doing so will now be assessed. Such a model depends upon the relative dominance of weather among the entire group of factors governing daily attendance. Day of the week and stage of the summer are two important factors whose effects have been recognized by subdivision of the May 15 to September 15 period into the six day-groupings. These two factors apart, weather frequently assumes a significant rôle in the remaining attendance variation.

In some instances, the accuracy of daily attendance predictions based on weather is high. However, if a prediction technique is to be of value to the facility manager, it must

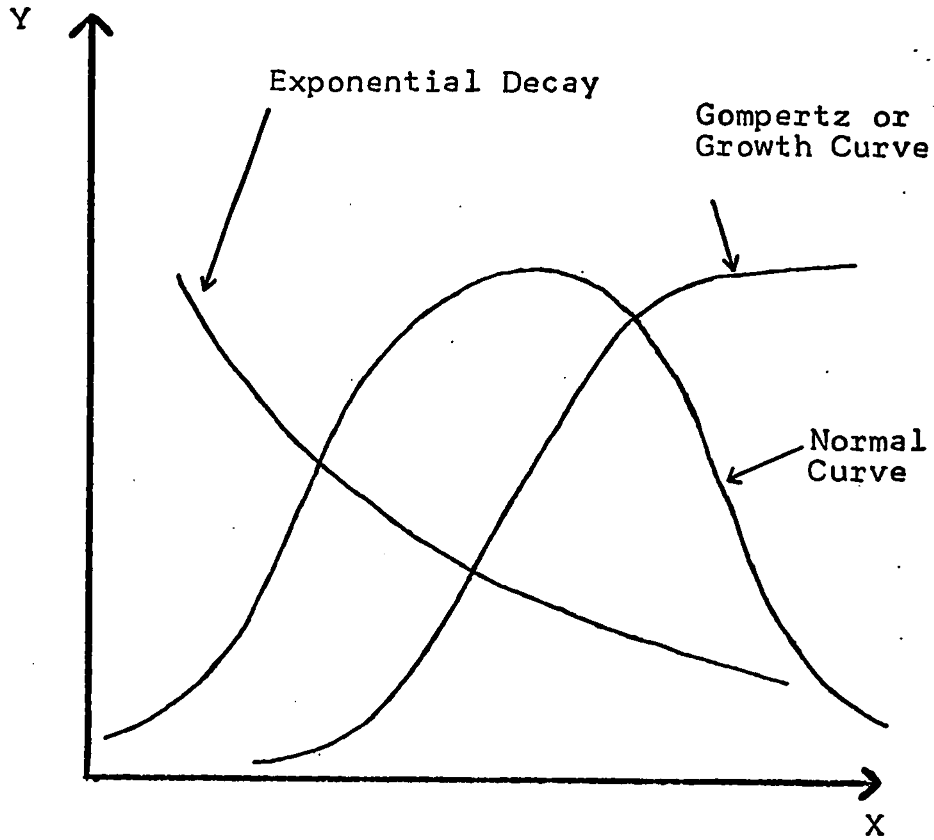

Figure 11.10

THE CURVE FUNCTIONS DISCUSSED

be quick to apply and simple to use. Swimming may be employed as an example, using maximum temperature as the weather variable. The straight line relationship fits fairly well over the range of temperatures normally experienced. With high linear correlation coefficients, accurate predictions can be rapidly made from maximum temperature, day of the week and stage of the summer. Ratios of standard error of estimate to mean attendance are as low as 1:3. Assuming normal distribution of deviations from the regression line, then 68 per cent of all predictions based on maximum temperature alone will be within 33 per cent of the actual attendance. The addition of other information such as expected precipitation or windspeed will improve the prediction still further. The three variables: day of the week, stage of the summer, and one relevant weather parameter are sufficient to allow useful prediction of daily attendances only at swimming facilities, beaches and outdoor sports areas. More complex procedures would be required at other types of facility, involving detailed considerations of two or three further weather variables.

Caution must be exercized in predicting attendances from the weather relationships identified. One problem is that at least one season of "calibration" is required for every facility, even where weather parameters are highly significant. A second is that predictive indices can be no more accurate than the data from which they are developed. Errors exist in recreation use data even where these are "reliable", but such errors will be minimized in the future when the findings and recommendations of researchers in this field are incorporated in a standardization of procedures for data collection. A third difficulty involves the detailed application of the weather-attendance relation to a forecast of actual numbers of visitors to a given recreation area. This is a task for those conversant with recreation area management and especially the trends being shown at the individual facility concerned. It will be necessary to take into account such factors as the continued growth of participation in outdoor recreation in Canada, local population changes, changes in transportation networks, and many other factors.

The limiting weather criteria identified for participation by the majority of outdoor recreationists in particular activities may also be used in defining the capability of the climate of a given area to support such activities. Thus Table 11.1 shows the 1969 temperature capability of the three study regions to support outdoor swimming. This is expressed in terms of the number of days at several stations in each region which met the peak season requirements for maximum temperature,[5] as outlined in Table 4.7 (p. 87). If a classification into seven categories similar to that of the present ARDA method (Appendix A) is required, then the number of days

[5] The reason for not tabulating the mean number of days per year which meet the maximum temperature requirements is that such data are published in Canada only in the Annual Weather Summaries for a very restricted number of first-order weather stations. 1969 was a warmer than average summer at Edmonton's Industrial Airport but a little cooler than normal in the rest of the Edmonton study region. June and July, 1969, were cooler than normal in the Ottawa-Hull region, but August was significantly warmer. In southern New Brunswick the 1969 summer was slightly warmer than normal.

TABLE 11.1

NUMBER OF DAYS WARM ENOUGH FOR OUTDOOR SWIMMING AT LOCATIONS WITHIN THE THREE STUDY REGIONS, 1969

Meteorological Station	Maximum Temperature, Lower Limit, in °F*	No. of days with Lower Limit Equalled or Exceeded**
Edmonton Ind. Airport	66	102
Coronation	66	106
Athabasca	66	94
Lac La Biche	66	89
Penhold Airport	66	99
Whitecourt	66	91
Ottawa Inter. Airport	70	97
Cornwall Ontario Hydro	70	102
Brockville	70	106
Killaloe Airport	70	95
Fredericton Airport	66	108
Moncton Airport	66	107
Saint John Airport	66	84
Alma	66	88
Milltown	66	116
Sussex	66	111

Source: * Analysis of data plots, 1970.
** Monthly Record, 1969 (Canada, Department of Transport, 1969)

suitable for swimming could simply be grouped in the fashion shown and each location placed in one of the seven classes.

Certain problems arise in the application of the kind of weather information shown in Table 11.1. Many of these are inherent in the development of any classification of land for recreational capability, and need not be detailed. Such problems have already been recognized by the Recreation Sector of the Canada Land Inventory. The difficulty caused by regional variations in recreationists' demands on weather is similar to the regional variation in perception of scenery which was experienced in developing the ARDA classification. Despite these difficulties, maps have been prepared on a nationwide scale from criteria for land and water resources which vary from region to region, and presumably maps can be prepared in like manner for weather.

Two other problems specifically related to weather must be brought out. The first is that recreationists' demands of weather appear to vary with the stage of the summer, at least for two or three of the activities studied. For example, in the off-peak season, maximum temperature requirements for beach use are 3-5^{o}F lower and tolerance of mean relative humidity extends by a value of 5-10 per cent, compared with the July and August peak period (Table 5.6, p.110). The issue can be partly avoided, as was done in deriving the data for Table 11.1, by using the limiting weather criteria for the peak period only. This is partly justified because the limiting criteria were defined in Chapters IV to X by the 10 per cent level of weather-related peak use, or of the peak use level experienced within each individual day-grouping. If instead the limiting criteria had been defined in terms of peak use during the whole summer, or the highest use reported from any one of the 124 days within the May 15-September 15 period, the off-peak criteria would approximate more closely those of the school vacation period. However, this question requires more detailed investigation for application of these criteria towards a system of mapping outdoor recreation capability.

The second problem concerns the application of weather criteria as developed here to the specific area analyses planned for Stages 2 and 3 of the Recreation Sector of the Canada Land Inventory (see footnote 1, p.3). Some of these small local areas will be subject to microclimatic influences which will reduce the validity of assessing the area's climatic capability from climatological observations made at points some distance away. These problems will in general be greatest where the density of observing posts is low, as in the North West Territories, or where the weather element to be observed is one such as sunshine hours. Fortunately such problems are minimal in the populated southern portions of Canada where careful planning for, and management of, outdoor recreation are at present most urgent.

CHAPTER XII

CONCLUSION AND RECOMMENDATIONS

Weather affects participation in specific outdoor pursuits to different degrees. Outdoor recreationists are "weather-selective" in that many of them will choose to participate in one activity at the expense of others under a given weather situation. Weather-selectiveness has a striking effect not only on activity choice, but also on the outdoor recreationist's choice of location on given days of the summer. The fact that certain pursuits are favoured on certain days will result in locations with the best potential for these pursuits being preferred also. This has obvious implications concerning the flow of recreational traffic on highways. The analyses carried out in this study allow an hierarchy of activity responses to be devised. At one end of the scale, participation in driving for pleasure and picnicking shows only slight response to weather during the summer season, while at the other end, beach use and swimming are profoundly affected.

A hypothesis has been set up in Figure 11.8 based on two premises: first, application of curve functions to the weather-attendance relationship, and second, the hierarchy of activities suggested by their varying degrees of weather influence. Weather limitations on outdoor activities were also studied. Criteria which result in use falling below 10 per cent of the peak value observed in a particular day-grouping under consideration were identified, and it proved possible to ascribe numerical values to these criteria for several activities. For swimming, a number of weather variables (maximum temperature, sunshine hours, relative humidity) can be chosen to specify these criteria. In the cases of pleasure boating and picnicking, only daily maximum temperature can be used for this purpose. For some activities, especially swimming and beach use, regional variations were deduced from the limiting values of some weather variables, notably maximum temperature, sunshine, and mean relative humidity. It was concluded that spatial differences may result from regional variations in climate and perhaps also from the different adaptations, tolerances and preferences of the facility users.

Only limited comparison is possible with the findings of other workers in the field. To the best of the writer's knowledge, only one truly comparable study (Dowell, 1970) has been completed to date. Dowell, whose study was confined to day-use boating, analyzed the effects of daily mean temperature, precipitation amount, total wind and pressure change on weekend boat-launchings at Dardanelle Reservoir near Russellville, Arkansas, during the period from December 1968 to November 1969. He concluded that temperature and precipitation were the most important weather variables, but that launchings exhibited a definite seasonality irrespective of local weather conditions. In the present study, maximum temperature is found to be the most important weather factor influencing day-use of boats worked through Newboro and Chaffeys Locks on the Rideau Waterway. This agrees with Dowell's findings. The precipitation element was not analyzed for Newboro and Chaffeys Locks. The studies of both the Rideau Waterway and Dardanelle Reservoir indicate that weather is secondary to a marked seasonal concentration of boating use. This concentration occurs mainly in the school vacation period of July and August, both in Canada and the United States.

This study set out to explore the nature of the relationships between weather and participation in a number of outdoor recreation activities, and to define quantitatively limiting weather criteria for the enjoyable pursuit of each activity engaged in. Besides deriving information on these two objectives, it has attempted a review of the role of weather in the process of selection of activity and destination by outdoor recreationists. The findings highlight a number of potential practical applications as discussed in the previous chapter. However, the inevitable limitations imposed on the present study lead the writer to make recommendations for further study as well as the collection of more pertinent data. These recommendations are set out below.

The ultimate responsibility for recreation administration throughout any country developing recreation facilities for its leisure-seekers must lie in the hands of the central government. Though regional governments may be charged with immediate responsibility for regional recreational development, these governments are affected by the philosophy and policies of the central government. Liaison is therefore needed among all levels of government for the standardization and improvement of recreational data collection. These data must also be stored and tabulated in a systematic and useful format. Nationwide standards should be set for these procedures as is done in the case of weather observations. Otherwise, data collection will continue to be of widely disparate quality. Studies like the present one which investigate recreational characteristics from region to region will become much more meaningful when recreation use measurements are comparable and homogeneous because of a set of nationwide standards.

Emphasis in the analyses of participation has been upon relationships with actual weather conditions. Future studies should also examine the influence of the "forecast weather" on outdoor recreation behaviour. The recreationist's interpretation of the forecast, and indeed, even his frequent ignorance of it, seem to have a marked bearing on his decision-making. Research under way at Michigan State University (Crapo, 1970) should expand our knowledge in this respect as it is concentrating on the recreationist's responses to the forecast weather. This research, however, is treating a rather restricted range of recreational activities; thus there still remains a need for numerous regional studies based on techniques similar to those developed here and in Crapo's current study.

In such continuing studies, there should certainly be attempts at multivariate analysis of the weather-recreation interaction. Although several weather variables were investigated in this study, they were tested separately. Limiting criteria for each activity were identified for individual variables and relationships were studied essentially in this way, rather than in terms of a total weather situation experienced by the recreationist. The use of data plotting and linear regression has given valuable insight in this exploratory research attempt. More sophisticated analyses should encompass a multi-factor, non-linear approach with a greater number of relevant weather variables. All the deeper analytical work required is unlikely to be feasible in the near future, mainly because it will require systematic collection of data superior in quality to current records of daily recreation use. When more specific data are available for a longer period of time than a single year, it would be useful to repeat the correlations performed in this study.

Specific recommendations must include improvement in the gathering of daily records of attendance or use. Administrative agencies should in many cases re-examine their policies on the statistics they will collect and the purpose these data will serve. Daily attendance data are the most important of all the use information, yet they are often destroyed after a year or two. Daily records can be easily punched on to IBM cards and stored indefinitely at minimal cost. This procedure is being followed by very few agencies. If universally adopted, it should soon solve one basic problem encountered by the writer, viz. the frequent lack of daily records for several years of operation at facilities.

More attention must be given to the accuracy and utility of the use statistics collected. If one were to judge from the high percentage of facilities attempting to obtain daily estimates of use volumes, one would conclude that agencies administering outdoor recreation believe there is benefit to be gained from this information. It may be suggested that if a record can serve a useful purpose, then it should be maintained at the highest possible level of accuracy. While there is no shortage of facilities at which use is estimated, data of high quality are lacking. Improvement of the quality and storage of existing daily records should be emphasized. There is also a marked imbalance between information on use of government-run recreation areas and that of commercial operations. If private operators were to report their daily attendance records - often jealously-guarded secrets - a large body of priceless data would become available to recreation researchers and planners.

If meteorological services too are to be tailored to the needs of the recreationist, the planner and the facility operator, there must be a greater emphasis on the observations and tabulations of weather elements such as those found in this study to have most significance. Besides maximum temperature, which already receives adequate coverage, they include total daily sunshine hours, duration and timing of precipitation, and hourly relative humidity. These admittedly require very detailed observations which would have to be made by means of self-recording instruments. Efforts should also be made to obtain records of the selected parameters at recreation areas themselves, thus providing information of true on-site conditions. Information on the mean values of the parameters specified is useful to the general outdoor recreation planner, but the facility operator and the recreationist himself will be more concerned with the forecasting of immediate day-to-day values of these variables.

Forecasts for the outdoor recreationist should include the parameters mentioned above, but should go further than the traditional weather forecast in detailing conditions. There is admittedly a growing tendency for meteorological services to orient forecasts towards important social and economic activities. The growing awareness that specialized weather information is of great economic and social value, both to the recreationist himself and to recreation management, will ultimately result in directives to Meteorological Services to provide pertinent weather information. Studies of the kind made in this thesis are of value in the formulation of specialized weather services for outdoor recreation. It is necessary that the meteorologist/climatologist be aware of the characteristics and responses of recreationists if these services are to be successful.

This project has been able merely to pioneer a useful philosophy for the weather-participation relationship of activities based on data for only one short season. Much cogitation was involved before the approaches and techniques used could be decided upon. These techniques and approaches may be applied to the whole complex of outdoor recreation-weather studies. They can be manipulated to provide helpful information for recreation administrators whatever the activity of their concern. Although extension of the present study will doubtlessly be necessary, a climatic capability classification for outdoor recreation can be developed from them. A complete classification, however, will be the enormous task of the future.

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APPENDIX A

THE ARDA LAND CAPABILITY CLASSIFICATION FOR OUTDOOR RECREATION

Seven capability classes of land are recognized. These are detailed in the ARDA Manual (Canada, Dept. of Forestry and Rural Development, 1967, pp. 8-9):

Class 1 LAND UNITS IN THIS CLASS HAVE A VERY HIGH CAPABILITY FOR OUTDOOR RECREATION
These lands have natural capability to engender and sustain very high total annual use based on intensive activities.

Class 2 LAND UNITS IN THIS CLASS HAVE A HIGH CAPABILITY FOR OUTDOOR RECREATION
These lands have natural capability to engender and sustain high total annual use based on intensive activities.

Class 3 LAND UNITS IN THIS CLASS HAVE A MODERATELY HIGH CAPABILITY FOR OUTDOOR RECREATION
These lands have natural capability to engender and sustain moderately high total annual use based usually on intensive or moderately intensive activities.

Class 4 LAND UNITS IN THIS CLASS HAVE MODERATE CAPABILITY FOR OUTDOOR RECREATION
These lands have natural capability to engender and sustain moderate total annual use based usually on dispersed activities.

Class 5 LAND UNITS IN THIS CLASS HAVE MODERATELY LOW CAPABILITY FOR OUTDOOR RECREATION
These lands have natural capability to engender and sustain moderately low annual use based on dispersed activities.

Class 6 LAND UNITS IN THIS CLASS HAVE LOW CAPABILITY FOR OUTDOOR RECREATION
These lands either lack natural attractiveness or present severe obstacles to their enjoyment, but have the natural capability to engender and sustain low total annual use based on dispersed activities.

Class 7 LAND UNITS IN THIS CLASS HAVE VERY LOW CAPABILITY FOR OUTDOOR RECREATION
These lands have very little capability for any popular types of recreation activity. There may, however, be some capability for very specialized activities with recreation aspects, or they may merely provide open space.

The detailed guidelines for classifying land units for mapping purposes avoid specific reference to the role that weather and climate play in determining the capability of these units. The only firm reference to the role of climate occurs in the guidelines (p. 124) for a narrative to accompany each 1:250,000 Recreational Inventory Map. Recommendations for a 50-150 word treatment of climate take up seven lines of the page.

On the statement that "climate merits separate treatment", one may comment that it is doubtful whether this treatment should be "separate". Shortcomings of the classification result from the lack of knowledge of the nature of weather influences in outdoor recreation activities. Before any more adequate classification can be devised, knowledge of the nature of weather influences with respect to each activity must be available.

APPENDIX B

ATTENDANCE COUNT PROBLEMS

Reference has been made at various points to the problem of using automatic traffic counter records from outdoor recreation facilities with campgrounds. The procedure followed by most authorities which use these data is to have the counter read daily at 8 a.m. The increase in count over the previous day is taken to be indicative of the number of vehicles using the facility on the previous day. If the counter hose stretches across the whole access road to the facility, the count is divided by two in recognition of the fact that both ingoing and outgoing vehicles are counted. If the hose is arranged to record only either incoming or outgoing vehicles, halving of the count is not required.

Use on Fridays as recorded by this method tends to be higher than that on other weekdays because the count will include a number of vehicles arriving on the Friday evening. Occupants of these vehicles may be using only the campground (Figure 3.1). One factor in this method of counting which has a systematic variation is the ratio of campers to total users. This ratio can be taken to be constant on all weekdays except Friday. Unlike the other imperfections of the method, which may be neglected in a study of attendance variation, the variability of this ratio cannot be neglected. In the generation of data for a study of weather effects on the daily use made of such parks, adjustment must be made for this characteristic of their vehicle counts. This may be accomplished by the following adjustment technique.

The adjustment procedure requires records of the number of camping groups in the park each night as well as the daily vehicle count. If the number of camper vehicles is subtracted from the total traffic count, the difference is indicative of actual day-use and is called here the "adjusted vehicle count". Table B.1 is an example of the case of a count of incoming vehicles only.

One hundred vehicles entered the park on Wednesday; no one camped overnight. We therefore assume that all 100 vehicles also left the park on Wednesday. Day-use may be computed as 100 - 0 or 100 vehicles. On Thursday, 200 vehicles entered the park and 20 camping groups remained over Thursday night. Thus 200 - 20 or 180 were day-use vehicles. On Friday 400 vehicles entered the park; 120 groups camped and remained overnight. The adjusted vehicle count for Friday would therefore be counted as 400 - 120 or 280. If none of the groups which camped on Thursday night had left on Friday,then only 100 "new" camping groups would have arrived. In this case the number of day-use vehicles would be 400 - (120 - 20) or 300. The best estimate lies somewhere between 280 and 300. This best estimate can be obtained because information on average length-of-stay, which is related to camper turnover, is available or may be assumed for most campgrounds. The turnover is calculated by dividing the number of campers of the night before by the number of days of the average length-of-stay. Taking the example of

TABLE B.1

PROCEDURE FOR ADJUSTING VEHICLE COUNTER DATA AT FACILITIES WITH CAMPGROUNDS

Day	Daily Vehicle Count	No. of Camping Groups	Day-Use Vehicles Assuming: No turn-over of campers	Day-Use Vehicles Assuming: Complete turnover	Best Estimate*
Wednesday	100	0	100	100	100
Thursday	200	20	180	180	180
Friday	400	120	300	280	290
Saturday	1700	170	1650	1530	1590

* Calculated by using an average length-of-stay for campers of two days.

Table B.1, the best estimate of day-use vehicles for Friday is 400 - (120 - 20/2) or 290.

With these weekdays as examples, it is evident that the vehicle count actually taken cannot be considered representative of daily variation in day-use because to do so would assume that there were never any overnight campers. This cannot be accepted. Consequently, the modified data take this factor into account.

APPENDIX C

COMFORT INDICES

The two comfort indices employed are Thom's Discomfort Index (Thom, 1959) and the Effective Temperature (Amer. Soc. HRAE, 1961).

Thom's Discomfort Index (TDI) is calculated from the formula:

$$TDI = 0.4\ (T_D + T_W) + 15$$

where T_D and T_W are the dry and wet-bulb temperatures respectively in degrees Fahrenheit. This is an index combining temperature and humidity effects into a single numerical parameter. In this study, a value assumed to be representative of mid-afternoon (3 p.m. local time) is calculated from daily maximum temperature and minimum relative humidity, using tables to obtain wet-bulb temperature.

Effective Temperature (ET) incorporates the effects of temperature, humidity and windspeed into a single variable. A nomogram for its calculation from dry-bulb and wet-bulb temperature and windspeed is given in Figure C.1. ET is the temperature of saturated still air found by subjective comparisons to give the same sensation of comfort or discomfort as the existing conditions of temperature, humidity and windspeed. For use in the study, an assumed mid-afternoon value is calculated from daily maximum temperature, minimum relative humidity and 3 p.m. windspeed.

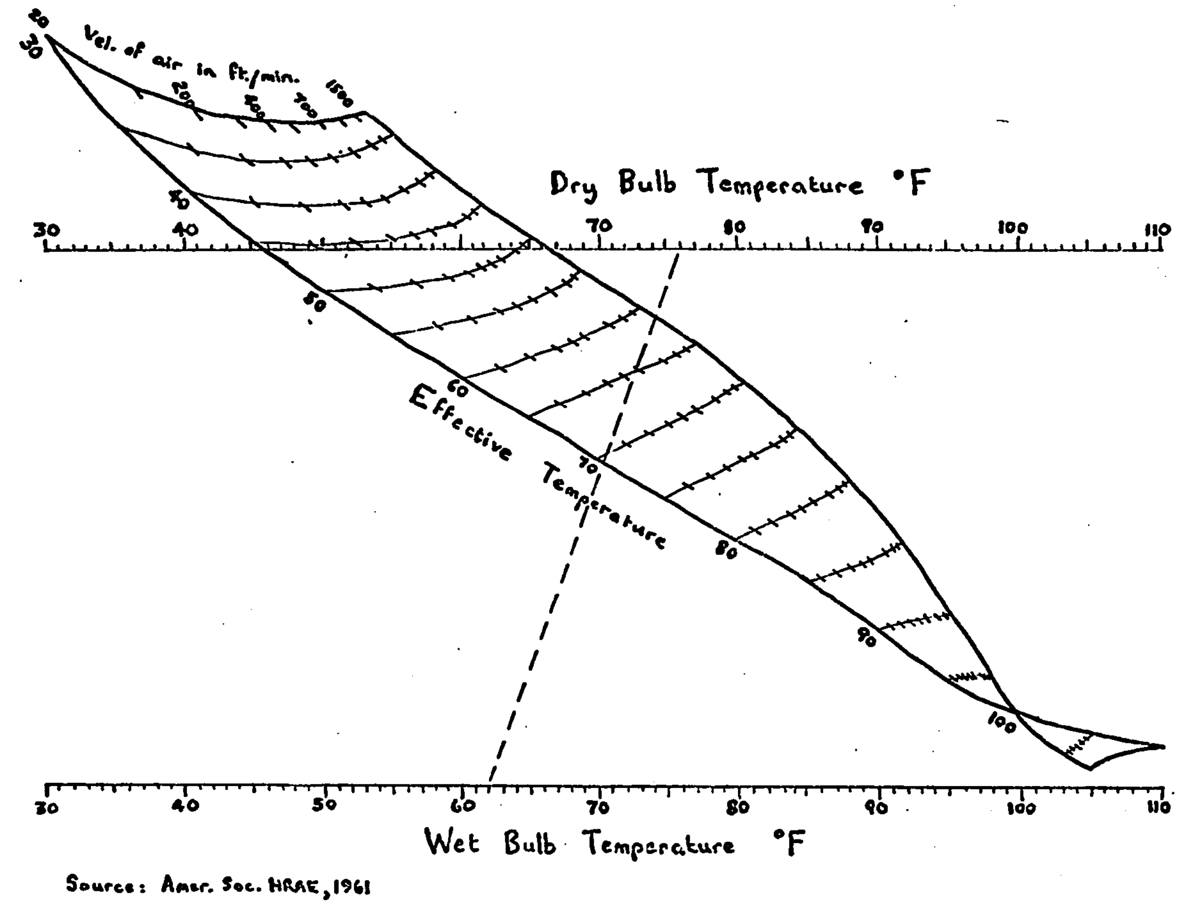

Figure C.1 Effective Temperature

APPENDIX D

METEOROLOGICAL STATIONS AND RECREATIONAL FACILITIES SHOWING ELEMENTS ANALYZED

EDMONTON STUDY REGION:

Facility	Meteorological Station and Weather Element																	
	Edmonton Ind. Airport									Lacombe			Penhold	Coronation	Athabasca		Lac La Biche	Whitecourt
	T	P	P_1	R	S	S_1	W	ET	TDI	S	S_1	W	T	T	T	P	T	T
Edmonton City	x	x	x	x	x	x	x	x	x									
Ma-Me-O Beach	x	x	x	x	x	x	x	x	x									
Miquelon Lake	x	x	x	x	x	x	x	x	x									
Pembina River	x	x	x	x	x	x	x	x	x									
Wabamun Lake	x	x	x	x	x	x	x	x	x									
Elk Island Park	x	x	x	x	x	x	x	x	x									
Aspen Beach										x	x	x	x					
Rochon Sands										x	x	x	x					
Big Knife														x				
Cross Lake															x	x		
Long Lake															x			
Garner Lake																	x	
Thunder Lake																		x

T - daily maximum temperature

P - total daily precipitation

P_1 - six-hourly "mid-day" precipitation

R - mean daily relative humidity

S, S_1 - total and six-hourly sunshine hours

W - wind mileage, 0900-1900 hours

ET - mid-afternoon Effective Temperature

TDI - mid-afternoon Thom's Discomfort Index

OTTAWA-HULL STUDY REGION:

Facility	Ottawa Int. Airport									Cornwall Ont. Hydro			Brockville		Killaloe Airport			Main Duck I.
	T	P	P_1	R	S	S_1	W	ET	TDI	T	P	P_1	T	P	T	P	P_1	W
Ottawa City	x	x	x	x	x	x	x	x	x									
Ottawa Locks	x	x	x	x	x	x	x	x	x									
Fitzroy	x	x	x	x	x	x	x	x	x									
Rideau River	x	x	x	x	x	x	x	x	x									
Silver Lake	x	x	x	x	x	x	x	x	x									
South Nation	x	x	x	x	x	x	x	x	x									
Black Lake	x	x	x	x	x	x	x	x	x									
Gatineau Park	x	x	x	x	x	x	x	x	x									
Smiths Falls Locks	x	x	x	x	x	x	x	x	x									
Upper Canada Vill.										x	x	x						
Crysler Pk & Beach										x	x	x						
Morrison & Nairne										x	x	x						
Farran										x	x	x						
Long Sault Pkwy.										x	x	x						
Charlottenburgh										x	x	x						
Glengarry										x	x	x						
Old Fort Henry													x					x
Brown's Bay													x	x				
Grenville													x	x				
Newboro Lock													x					x
Chaffeys Lock													x					x
Jones Falls Locks													x					x
Kingston Mills Locks													x					x
Carson Lake															x	x	x	
Bonnechere															x	x	x	
Bon Echo															x	x	x	

SOUTHERN NEW BRUNSWICK STUDY REGION:

Facility	Fredericton Airport									Saint John Airport			Moncton Airport			Milltown		Sussex		Alma	
	T	P	P_1	R	S	S_1	W	ET	TDI	T	P	P_1	T	P	P_1	T	P	T	P	T	P
Fredericton City	x	x	x	x	x	x	x	x	x												
Prince William	x	x	x	x	x	x	x	x	x												
Lake George	x	x	x	x	x	x	x	x	x												
York Co. Cent.	x	x	x	x	x	x	x	x	x												
Sunbury-Oromocto	x	x	x	x	x	x	x	x	x												
Grand Lake	x	x	x	x	x	x	x	x	x												
Lakeside	x	x	x	x	x	x	x	x	x												
Queenstown	x	x	x	x	x	x	x	x	x												
Doaktown	x																				
Upper Blackville	x																				
Saint John City										x	x	x									
New River Beach										x	x	x									
Oak Point										x	x	x									
Eagle Rock										x	x	x									
Moncton City													x	x	x						
Steeves Mountain													x	x	x						
Magnetic Hill													x	x	x						
Beech Hill													x	x	x						
Jardine Park													x	x	x						
Parlee Beach													x	x	x						
Murray Beach													x	x	x						
Port Elgin													x	x	x						
The Rocks													x	x	x						
Fundy National Park													x	x	x					x	x
Oak Bay																x	x				
McAdam																x					
Pennfield																x					
Penobsquis																		x	x		
Pine Grove																		x	x		

DEPARTMENT OF GEOGRAPHY

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