

# Visitor experience at the Waitomo Glowworm Cave

SCIENCE FOR CONSERVATION: 95

Stephen Doorne

Published by  
Department of Conservation  
P.O. Box 10-420  
Wellington, New Zealand

*Science for Conservation* presents the results of investigations by DoC staff, and by contracted science providers outside the Department of Conservation. Publications in this series are internally and externally peer reviewed.

© March 1999, Department of Conservation

ISSN 1173-2946  
ISBN 0-478-21750-1

This publication originated from work done under Department of Conservation contract 2068 carried out by Stephen Doorne, Wrighton Doorne & Associates, P.O. Box 6029, Wellington. It was approved for publication by the Director, Science & Research Unit, Department of Conservation, Wellington.

Cataloguing-in-Publication data

Doorne, Stephen Michael  
Visitor experience at the Waitomo Glowworm Cave / Stephen Doorne.  
Wellington, N.Z. : Dept. of Conservation, 1999.  
iv. ; 30 cm. (Science for conservation, 1173-2946 ; 95.)  
ISBN 0478217501  
1. Tourist trade--New Zealand--Waitomo Caves. 2. Waitomo Caves  
(N.Z.) I. Title. II. Series: Science for conservation (Wellington,  
N.Z.) ; 95.

790.099338 20  
zbn99-014134

## CONTENTS

Abstract	5
<hr/>	
1. Introduction	5
<hr/>	
1.1 Background and history of the Waitomo Glowworm Cave	5
1.2 Legislation and management	6
1.3 Tourism growth at the Waitomo Glowworm Cave	7
1.4 A review of relevant issues	7
2. Research methodology	
<hr/>	
2.1 Aims and objectives of the study	7
2.2 Research methods	9
2.3 The survey instrument	10
3. Qualitative data and survey results	11
<hr/>	
3.1 Key issues raised by stakeholder groups	11
Cave guides	11
Supervisors	12
Cave Management Committee	12
Tourism Holdings Ltd.	12
Tour companies and tour guides	12
Summary	13
3.2 Analysing the data	13
3.3 Visitor profile	13
3.4 Visitor expectations	14
3.5 Satisfaction results	16
3.5.1 Measuring satisfaction against expectations	16
3.5.2 Interpreting satisfaction scores	16
3.6 Crowding results	19
3.7 Crowding scores	20
4. Traffic and crowding management issues	24
<hr/>	
4.1 Visitor traffic patterns and congestion issues	24
4.2 Perceived crowding	26
5. Managing the visitor experience	28
<hr/>	
5.1 General recommendations	28
5.2 Visitor experience management—general concepts	29
5.3 A visitor experience monitoring programme for the Glowworm Cave	29
5.4 Management approaches and recommendations	32
5.5 Other possible management options	33
6. Summary	33
<hr/>	
7. Acknowledgments	36
<hr/>	

Appendix 1	
Isometric diagram of the Glowworm Cave	39
Appendix 2	
Waitomo Glowworm Cave Visitor Survey	41
Appendix 3	
Test for statistical validity for summer/winter combined samples	43

# Abstract

Current tourism growth policies in New Zealand suggest that issues surrounding congestion, crowding and their relationship to the quality of the visitor experience will emerge as significant problems in the future of tourism development and tourism management. Overcrowding at tourist sites has the potential not only to pose problems for environmental management but also to erode the visitor experience to the extent that commercial sustainability is threatened. For sites receiving visitors from a range of markets and countries, the measurement of satisfaction based on crowding levels is complex and problematic. The identification of a visitation threshold or 'magic number' beyond which the visitor experience will diminish may not, therefore, be a helpful approach for managers. This report examines issues of satisfaction, crowding and the visitor experience at the Waitomo Glowworm Cave and suggests a framework for management of the visitor experience.

## 1. Introduction

This study examines current levels of visitor use of the Waitomo Glowworm Cave with particular reference to the issue of congestion and crowding. The study was commissioned by the Ruapuha-Uekaha Hapu Trust and the Department of Conservation in 1995, and was conducted by Wrighton Doorne and Associates on contract to the Science and Research Division of the Department of Conservation. This report details the results of this research, provides an analysis of the Glowworm Cave product, and presents a management framework for monitoring the visitor experience.

### 1.1 BACKGROUND AND HISTORY OF THE WAITOMO GLOWWORM CAVE

The Waitomo Glowworm Cave is situated on the edge of Waitomo Caves village in the King Country. Waitomo Caves is approximately 202 km South of Auckland and 80 km South West of Hamilton. The village lies 6 km West of State Highway 3 between Te Kuiti and Otorohanga.

The Waitomo Glowworm Cave has been one of New Zealand's major tourist attractions for over 100 years. In December 1887, British Surveyor Fred Mace and local Maori Chief Taane Tinorou became the first people to explore the subterranean river entrance to what was called by local Maori 'Waitomo', or 'water entering a hole in the ground'. In 1889, the Department of Crown Lands conducted the first mapping and photographing of the caves and about this time the first commercial tours into what is now known as the Glowworm Cave were conducted by Taane Tinorou. In the 19 months between June 1889 and

the end of 1890, there were 360 visitors to the cave. A map of the Glowworm Cave is shown in Appendix 1.

The Cave was regarded as being of major interest to international tourists and ranked equal in importance to the Pink and White Terraces of Rotorua. The destruction of the terraces in the 1886 eruption of Mount Tarawera highlighted the need for preservation of other unique natural environments. The Waitomo Glowworm Cave subsequently became the Government's first acquisition under the Scenery Preservation Act of 1903. The acquisition was intended to prevent damage or deterioration of the cave resulting from overuse or excessive tourist traffic. It was widely understood that the Act was introduced expressly for the purpose of acquiring the Waitomo land and the Glowworm Cave (Arrel 1984).

The Glowworm Cave, which later came under the jurisdiction of the Tourist Department, became the most profitable of all the Government's tourism concerns within New Zealand (Arrel 1984). In 1957 the Tourist Department handed over control of all its business at Waitomo to the Tourist Hotel Corporation.

In 1990, the Waitangi Tribunal returned 75% of the Waitomo Glowworm Cave and associated land to Maori ownership, the remaining 25% of ownership remained with the crown under the administration of the Department of Conservation. Maori ownership is represented by the Ruapuha-Uekaha Hapu Trust which comprises of two families descended from Taane Tinorou. As part of the Tribunal settlement, the management of the Glowworm Cave, the THC Waitomo Caves Hotel and the Waitomo Tavern, became subject to a 32 year lease. In 1991 this lease was sold to the South Pacific Hotel Corporation (SPHC) and in 1996, SPHC subsequently on-sold the lease to Tourism Holdings Ltd.

## 1.2 LEGISLATION AND MANAGEMENT

The Glowworm Cave is located within Scenic Reserves established under the Reserves Act 1977. In 1981 a Management Plan was produced detailing the management implications and requirements of the Tourist Hotel Corporation with respect to the reserves it administers at Waitomo under the Act. Renewal of the Licence by the leaseholder is subject to compliance with the Management Plan and the Act.

The Leaseholder pays an annual fee for a Licence to operate commercial cave guiding and souvenir shop operations at the cave. For the first five years of the term of the Licence, and for each subsequent period of five years, the Licence holder prepares and submits an Operation Plan to the Licencing Agency under Schedule B of the Licence. The Licencing Agency is represented by the Cave Management Committee comprising representatives of the Ruapuha-Uekaha Hapu Trust and the Department of Conservation. The Operation Plan provides for 'the maximum opportunity for public access to the extent compatible with best protecting and preserving the Maori, scenic, historic, geological, biological and scientific values within the Licence Area' (Department of Conservation 1990: 20). The Plan also provides for maintaining, upgrading and developing the facilities in the Licence Area and the services provided to the public.

The Operation Plan for the Waitomo Glowworm Cave Licence specifies that carbon dioxide levels in the cave will be measured continuously and tour operations will cease if the carbon dioxide content exceeds 2400 parts per million. Above this level the carbon dioxide causes the speleotherms to corrode and at levels above 5000 parts per million there is a slight risk to visitors. That part of the cave known as the Organ Loft has very poor ventilation and carbon dioxide accumulates there when visitor numbers exceed 90 people per hour. It is necessary to close this part of the cave every day between 10.30 am and 3.00 pm.

### 1.3 TOURISM GROWTH AT THE WAITOMO GLOWWORM CAVE

As a tourist destination, Waitomo Caves can be likened to Queenstown up to the 1960s, and Te Anau, Omarama and Tekapo (Kearsley 1990). Waitomo also features as a destination for the rapidly growing, high-volume short-stay market. These visitors commonly stay in New Zealand for around three to five days and spend most of their time in and around the Auckland - Rotorua area (NZTB 1996). The location of the Glowworm Cave makes it a useful short stopping point for passengers leaving either centre in the morning.

Waitomo Caves village has a population of around 500 people (Waitomo Caves Museum Society 1994) and an estimated tourist population of around 450 000 international visitors per annum, most of whom visit the Waitomo Glowworm Cave (NZTB 1996). There is no reliable information to indicate the number of domestic visitors although data provided by the THC Waitomo Caves Hotel indicate the New Zealand market to be around 8% of total visitors, i.e. between 40 000-50 000 per annum. Visitation to the Glowworm Cave is characterised by peaks and troughs. The peak tourist season is between November and April and the cave receives the bulk of its visitors between 11 am and 2 pm daily (NIWA 1996).

The Department of Conservation estimated that current national tourism marketing policies will result in a 27% increase of international visitors by the year 2000 (DOC & NZTB 1993). The New Zealand Tourism Board, however, is targeting a 49% increase in international visitors over the same period (DOC & NZTB 1993). In the 1992/93 Tourism Board International Visitor Survey, Waitomo Caves ranked as the fastest growing tourism centre in New Zealand with a growth rate of 90% for the period 1990/92 to 1992/93 (see NZTB 1994).

### 1.4 A REVIEW OF RELEVANT ISSUES

The issues of crowding, congestion and satisfaction are necessarily all part of the visitor experience, but they present significant problems when attempts are made to 'unbundle' them. Measuring satisfaction is problematic in that the factors which satisfy people are generally different from those which dissatisfy them. Similarly, satisfaction is not necessarily achieved by removing sources of dissatisfaction, nor does dissatisfaction necessarily occur through failure to deliver satisfaction (Hamilton-Smith 1995). The concept of satisfaction should be regarded as an assessment of whether or not a visitor's expectations were

met (Barskey 1992; Hamilton-Smith 1995). Visitor satisfaction therefore is an evaluative judgement on the part of the individual. By providing certain cues these judgements can be directed towards particular issues.

The issue of visitor crowding with respect to the quality of the visitor experience implicitly suggests that some sort of social carrying capacity can be identified. In tourist settings, however, the identification of a social carrying capacity or 'magic number' beyond which quality diminishes has been the focus of much controversy (Williams and Gill 1994). Environmentally based carrying capacity concepts assume a direct relationship between numbers of visitors and particular outcomes. Difficulties arise with numerical indicators of carrying capacity (such as volume, density or market mix of visitors) when attempts are made to link them to specific tourism impacts.

A number of approaches have been formulated as management tools for natural environment and recreational settings. These include: the Limits of Acceptable Change Framework (LAC) developed by Stankey et al. (1985), the Visitor Activity Management Process (VAMP) used by Parks Canada (Graham 1989), the Visitor Impact Management Process (VIM) of Graefe et al. (1990) and the Visitor Experience and Resource Protection Process (VERP) developed by Hof et al. (1994). Although each is useful for the monitoring and management of visitors in particular settings, the concept of carrying capacity emerges as a central element, and with it are some implicit problems, not least the issue of how appropriate visitor levels are set, and by whom (Williams and Gill 1994).

There are a number of potential complications to the application of the carrying capacity concept particularly with respect to the issue of crowding. The relative disturbance of interaction between visitors, for example, greatly influences the level to which the enjoyment of the environment is disrupted (Twight et al. 1981). Similarly, the characteristics of others are a further consideration affecting perceptions of crowding (Manning et al. 1996). From a sociological perspective, a number of authors suggest that the carrying capacity concept is not generally considered helpful in overcoming crowding problems at high use sites such as the Glowworm Cave (Graefe, Vaske, and Kuss 1984; Manning 1985, 1986; Shelby and Haberlein 1986; Shelby et al. 1989; Hamilton-Smith 1994; Manning et al. 1996). Instead, these authors suggest perceived crowding is a more accurate and responsive indicator of the quality of the visitor experience.

Perceptions of crowding can be measured in a number of ways. Perhaps the most widely used instrument for measuring visitor crowding has been the nine-point crowding scale, first developed by Haberlein and Vaske (1977). The scale is accompanied by an interpretive table of management responses corresponding to aggregate scores (see Table 6). Although it can be argued that in a sociological context the carrying capacity concept is unworkable, from an economic perspective the concept can still be used with some validity, i.e., visitor overuse in the form of crowding in natural environments diminishes the quality of the experience, resulting in reduced revenue (Butler 1980; Plog 1991). For natural environment products high visitor densities erode visitor enjoyment (Shelby et al. 1989; Higham and Kearsley 1994). The perception of visitor crowding, therefore, should be regarded as a negative characteristic and should be treated as undesirable for both visitors and management (Higham and Kearsley 1994).

Haberlein and Vaske's (1977) nine-point crowding scale has been used in a variety of settings in New Zealand, including wilderness environments (Kliskey and Kearsley 1994; Coughlan and Kearsley 1996) as well as with reference to particular products or geographical environments (Palmer 1993; Kearsley and O'Neill 1993; Cessford 1994). The management issues of crowding for particular businesses, and the implications for the management of different cultural groups, have not been specifically addressed in the literature. These issues form the primary focus of this study.

## 2. Research methodology

### 2.1 AIMS AND OBJECTIVES OF THE STUDY

The objectives of the study as defined in the research investigation brief are as follows:

- to profile cave visitors including different nationality groups;
- to assess their respective expectations and satisfactions with their visit;
- to assess their perceptions of visitor impacts (e.g. crowding, conflict);
- to summarise the major issues raised by departmental staff, cave management, and onsite guiding staff; and
- to define methods which could be used to monitor social experience conditions in the future.

The study was conducted between September 1995 and December 1996.

### 2.2 RESEARCH METHODS

The study employed a range of complementary visitor research techniques based around a quantitative visitor survey. The survey provided the core of the research data although a number of other methodologies were used to provide a depth to the survey data and give a wider context for analysis. The qualitative and other methods include:

- qualitative interviews with visitors to the cave, cave guides and management, tour group escorts, coach drivers. These interviews were 'semi-structured', that is, they took the form of free-ranging discussions based around the common themes of visitor satisfaction, cultural perceptions of crowding, and the demographic and market characteristics of the particular tour groups in question. These elements reflected the themes addressed in the survey instrument. Around thirty individuals were interviewed as part of the qualitative approach. On occasions a number of discussions were conducted with the same groups and individuals involved in guiding or supervising at the Glowworm Cave;
- meetings and consultation with owners, managers, supervisors, domestic tour operators, inbound tour operators, and representatives of 'upstream' and 'downstream' tourism businesses, i.e. those businesses that cater for visitors before and after their visit to the Glowworm Cave. These meetings

were also loosely structured around the themes addressed by the survey instrument;

- participant observation approaches including of tour group characteristics, movements and behaviour in and around the Glowworm Cave. In this approach the researcher accompanied tour groups both in an obviously 'researcher' role, and as a candid observer. Around thirty tour groups were accompanied through the cave during the study period. Given the language barriers to interpreting comments in some groups, body language and visible actions were observed to provide insight into intra-group relationships, inter-group relationships, and relationships between guides and their tour groups. Observed data was recorded and coded in note form following tours. It should be noted that participant observation methodologies are inherently subjective. The interpretation of data gathered in this way should, therefore, also take into account the observer's role and perception of events (for an extended discussion on this point see Evans 1988);
- static observation of traffic flows and visitor behaviour in which the researcher observed behaviour of passing groups from a number of stationary positions within the cave;
- secondary data collection including studies of crowding in New Zealand and overseas, and regional and national tourism statistics (Section 1.4).

### 2.3 THE SURVEY INSTRUMENT

The quantitative visitor survey was used as the main instrument of data collection for addressing issues of visitor satisfaction, crowding and demographics (Appendix 2). The satisfaction indicators were chosen in consultation with the Cave Management Committee, and the crowding scale used in the survey was the same as that used in a number of other visitor research studies in New Zealand (Section 1.4).

Attempts were made to gain a representative sample of cave visitors by nationality composition. Although there are no comprehensive background data available, information provided by the THC Waitomo Caves Hotel indicates that the demographic and cultural composition of the samples gathered be taken as 'typically representative' of visitors to the Glowworm Cave during the survey period. Group sizes for all visitors were constant at around 50 persons per group.

The survey schedule was translated into the six languages of the major nationality groups visiting the Cave (English, Korean, Japanese, Chinese, Indonesian, Thai) and used a self completion tick-box format. The survey was administered twice during the study period, once in summer (22–26 January) and once in winter (23–30 June). The capture occurred during peak periods (between 10 am and 3 pm each day). Visitors were asked to participate in the survey after they had completed the cave tour.

There were a number of difficulties associated with the task including the time constraints of some tour groups, and a degree of 'passive inertia' on the part of some visitors, both of which needed to be overcome in order to encourage visitors to complete the survey. Bad weather during the winter capture also

interfered with enthusiasm to participate. Overall the survey obtained a high response rate. The sample size and depth facilitated comprehensive analysis of the issues specified in the research objectives.

## 3. Qualitative data and survey results

This section outlines the key issues raised by stakeholder groups and the results of the visitor survey at the Waitomo Glowworm Cave. It should be noted that in the absence of previous studies of crowding and visitor numbers at the Glowworm Cave, the variable of time is unable to be included in the quantitative analysis. As such, the survey results give no indication of whether the demographic characteristics of visitors have changed significantly or whether levels of satisfaction or perceived crowding have deteriorated, improved, or remained the same over any given period other than the period of this research. As such, the qualitative data are not presented as discrete results but are used to give a more informed understanding of key issues emerging from the survey results.

### 3.1 KEY ISSUES RAISED BY STAKEHOLDER GROUPS

Interviews were conducted with various stakeholder groups including cave guides, supervisors, Cave Management Committee, tour companies, and cave management (Tourism Holdings Ltd.). The key issues raised were as follows:

#### **Cave guides:**

- relationships with tour guides especially when sharing guiding responsibilities. When the cave guides' spiel is then translated by the tour guide the tour can be slowed considerably, causing traffic and congestion problems;
- traffic congestion and controlling interactions between nationality groups also occur when tour guides conduct cave tours. It was often felt that their schedule pressures resulted in these groups hurrying through the cave and creating traffic problems from irregular pulses of groups within the cave;
- changing patterns of demand and visitor groups resulting in fewer English-speaking groups and increasing numbers of tour guides conducting tours;
- preventing the touching of formations by visitors in the cave;
- preventing the taking of photographs and videos by visitors. In low light conditions there is an increased chance of visitors tripping on stairs if they are distracted from the tour by taking photographs or videos;
- reducing visitor noise in the Glowworm Grotto so as not to diminish the visitor experience;
- concerns about uniforms, torches etc.

### **Supervisors:**

The issues raised by cave guides were also shared by supervisory staff. Other issues included:

- tour groups not turning up on time but demanding immediate entry to the cave when they arrive;
- visitor safety, especially encouraging visitors not to cross the road but use the underpass;
- queues at the toilets when a number of buses arrive at once;
- mixing English and non-English speakers in groups;
- the spiel of tour guides so as to standardise tour times within the cave;
- weather, when river levels rise tour groups must exit through the main entrance creating traffic and congestion problems in the narrower passages and on the stairs;
- general traffic congestion and high crowding levels causing some groups to wait for other groups in the cave.

### **Cave Management Committee:**

The Committee incorporates representatives from the Department of Conservation and the Ruapuha-Uekaha Hapu Trust who commissioned the study. Their main concerns were as follows:

- crowding levels in the cave possibly eroding the visitor experience;
- if so, finding ways to measure the visitor experience and incorporating crowding issues into ongoing management programmes.

### **Tourism Holdings Ltd.:**

- stability of demand and the prediction of international market fluctuations, i.e., should the cave be managed for increased demand, decreased demand or stable demand, and in which market segments is the demand reflected;
- visitor safety issues in line with those expressed by guides and supervisors;
- streamlining operations management of tours at the Glowworm Cave.

### **Tour companies and tour guides:**

- the adequate provision of toilet facilities, queues at the toilets resulting from several buses arriving at once ultimately reflected badly on the tour and interrupted the tour schedule;
- a turnaround of less than one hour at the Glowworm Cave with few holdups within the cave.
- visitor safety issues consistent with those identified above;
- opportunities for tour groups to purchase souvenirs. The shop was considered too small to cater for large numbers of visitors at once;
- the need for adequate shelter for tour groups when waiting for tours to start. It was considered that only limited shelter was available and that it was inadequate for large numbers of visitors.

### Summary:

The issues identified above became guiding elements for the development of the survey instrument. In particular the following key concerns can be identified which are common to all stakeholder groups:

- increased visitor numbers;
- traffic and congestion issues emerging from increased visitor numbers;
- the maintenance of satisfaction with the visitor experience as result of increased visitor numbers.

## 3.2 ANALYSING THE DATA

Statistically significant samples and subgroups were taken as those with 80 or more responses and comparisons are presented as mean percentage scores of statistically significant subgroups by summer, winter, and summer/winter combined. Results represented by 'n/a' indicate the sample size was too small to be used as representative of the subgroup. For purposes of brevity the combinations of variables featured in this report are those with notable differences in responses between subgroups.

The survey data were analysed with assistance from the Internal Consulting Service of the Institute of Statistics and Operations Research (ISOR) at Victoria University of Wellington. Data processing was conducted using SYSTAT and Excel spreadsheets

## 3.3 VISITOR PROFILE

The nationality composition of the visitors surveyed is shown in Table 1.

TABLE 1. COMPOSITION OF SURVEY RESPONDENTS BY NATIONALITY.

NATIONALITY	SUMMER	WINTER	COMBINED	SUMMER	WINTER	COMBINED
New Zealand	156	78	234	10	12	10.4
United Kingdom	209	77	286	12	12	12.7
North America	139	13	152	9	2	6.8
Australia	112	114	226	7	17	10.1
South Korea	422	150	572	27	23	25.5
Japan	251	131	382	26	20	17.0
Taiwan	105	26	131	7	4	5.8
Asia other	70	35	105	4	5	4.7
Europe other	106	10	116	7	2	5.2
Other	20	23	43	1	4	1.9
Total	1590	657	2247	100	100	100.0

The following points should be noted about the composition of the above nationality groups:

- Asia other includes: Indonesia, Thailand, Hong Kong, Mainland China, Singapore, Malaysia, Philippines, India, Pakistan, Macau, Brunei;
- Europe other includes: Germany, Netherlands, France, Italy, Denmark, Sweden, Norway, Finland, Belgium, Luxembourg, Switzerland, Spain, Greece, Austria, Ireland;
- Other includes: all other countries.

Figures 1-6 show the demographic and tourist type characteristics of the visitor sample for summer/winter combined. The following observations can be made about the data:

- most respondents were travelling South from Auckland (to Rotorua if travelling by bus);
- most respondents had not already visited Queenstown;
- there was a relatively uniform age distribution, the largest group being in the 20-29 age group;
- only 54% of respondents knew anything about the Glowworm Cave prior to visitation;
- most respondents completed their tour with a cave guide as their only guide;
- the most common form of transport of the respondents was a bus tour.

### 3.4 VISITOR EXPECTATIONS

According to Barskey (1992) an assessment of satisfaction should be regarded as a measure of how well an individual's expectations were met. Satisfaction, therefore, was regarded as a more significant measure of expectations for this study in that an individual's assessment of satisfaction implicitly includes an evaluation in relation to their expectations. Thus, visitor expectations about their visit were not measured in the visitor survey. Pilot data also indicated that a significant proportion of visitors to the Glowworm Cave had little or no knowledge of the site prior to arrival, making an overall assessment of expectations difficult. Nevertheless, semi-structured interviews conducted as part of this study provide some insight into the expectations of some visitor groups. Language barriers allowed only English speaking responses to questions of expectations to be recorded. Nevertheless, some generalised comments about expectations are worth noting.

The interviews suggested that expectations were dependent on whether the visitor (or members of the visitor's group) had visited the cave previously. New Zealanders, for example, were most likely to have visited the cave before, and their expectations were commonly informed by 'childhood memories' of the site. By contrast, overseas visitors who had some prior knowledge of the site gained this information mostly from their tour guides but on occasions from promotional material. On this point it should be noted that one of the most cited pictorial sources of prior knowledge was a photograph originating from a Waitomo News promotional publication depicting a cave guide conducting a tour with three visitors (see Waitomo News 1994). Given the contemporary reality of 50 persons per tour group the continued use of this material was considered by some interviewees to be an inaccurate depiction of the tour.

## 3.5 SATISFACTION RESULTS

### 3.5.1 Measuring satisfaction against expectations

Questions were asked to determine how well elements of the cave tour and facilities matched the expectations of the visitors. A five-point Likert scale ranging from very dissatisfied (score 1) to very satisfied (score 5) was used to categorise responses.

Before examining satisfaction results some basic assumptions should be clarified:

- use of the Likert scale to measure satisfaction is based on the disconfirmation paradigm in which satisfaction is measured through the eyes of the customer. It has four components: expectations, perceived performance, disconfirmation, and satisfaction (Barsky 1992);
- for some cultural groups the expression of dissatisfaction is not always considered polite. For Japanese, for example, expressing dissatisfaction face to face is not considered appropriate (S. Inoue, Professor of Sociology, Osaka University, pers. comm.). The self-completion format of the survey overcame this difficulty of measurement. Background research prior to the study indicates that for all groups surveyed the responses given will, as far as possible, accurately reflect the assessment of the individual.

### 3.5.2 Interpreting satisfaction scores

The following points should be observed when interpreting satisfaction scores:

- scores generated by the Likert scale are presented as mean aggregates for summer and winter samples combined. The scores are more usefully analysed in relation to one another rather than as discrete units;
- the right hand column of the tables (% scoring 3 or less) indicates the proportion of visitors not satisfied with the product and its elements, i.e. those who scored between 1 (very dissatisfied) and 3 (neutral).

### 3.5.3 Overall satisfaction scores

Tables 2, 3 and 4 show the percentage scores for all respondents in summer, winter and summer/winter combined respectively:

The above results suggest a high level of satisfaction with the raw product (Glowworm Cave, glowworms) but that this level of satisfaction is not reflected in responses to other elements of the product such as:

- the number of groups in the cave (e.g. 45% in summer were not satisfied);
- waiting for other groups during the tour (e.g. 44% in summer were not satisfied);
- the facilities such as the toilets and the size of the shop.

TABLE 2. MEAN PERCENTAGE SATISFACTION SCORES—SUMMER.

PRODUCT ELEMENT	SATISFACTION INDICATOR						
	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied	Average Score	% scoring 3 or less
The cave tour overall	2	0	6	43	48	4.33	<b>8</b>
Waiting before the cave tour	1	4	28	40	27	3.83	<b>33</b>
Waiting to buy your cave ticket	1	2	30	36	37	3.66	<b>33</b>
The size of the cave tour group	2	8	25	39	25	3.66	<b>35</b>
The number of groups in the cave	3	12	30	33	22	3.37	<b>45</b>
Waiting for other groups in the cave	3	10	31	34	22	3.44	<b>44</b>
Waiting for the boat	1	3	23	40	32	3.87	<b>27</b>
The duration of the tour	2	9	19	42	27	3.65	<b>30</b>
The number of toilets	1	6	32	29	31	2.96	<b>39</b>
Cleanliness of the toilets	1	3	29	31	35	2.98	<b>33</b>
The size of the shop	1	7	37	27	28	2.9	<b>45</b>

TABLE 3. MEAN PERCENTAGE SATISFACTION SCORES—WINTER.

PRODUCT ELEMENT	SATISFACTION INDICATOR						
	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied	Average Score	% scoring 3 or less
The cave tour overall	1	0	9	40	49	4.36	<b>10</b>
Waiting before the cave tour	1	2	20	44	32	4.04	<b>24</b>
Waiting to buy your cave ticket	1	2	22	36	37	4.07	<b>25</b>
The size of the cave tour group	1	3	20	38	37	4.08	<b>24</b>
The number of groups in the cave	1	5	23	39	31	3.93	<b>29</b>
Waiting for other groups in the cave	1	5	25	37	30	3.94	<b>30</b>
Waiting for the boat	1	3	19	39	37	4.07	<b>24</b>
The duration of the tour	2	8	19	39	32	3.92	<b>29</b>
The number of toilets	2	4	34	36	24	3.77	<b>40</b>
Cleanliness of the toilets	2	3	34	37	23	3.78	<b>39</b>
The size of the shop	1	5	41	35	17	3.62	<b>47</b>

In general, satisfaction levels were lower during the summer period than in winter. This is especially noticeable for elements relating to the level of visitation such as:

- waiting before the cave tour;
- waiting to buy cave tickets;
- the size of the cave tour group;
- the number of groups in the cave;
- waiting for other groups in the cave.

TABLE 4. MEAN PERCENTAGE SATISFACTION SCORES—SUMMER/WINTER COMBINED.

PRODUCT ELEMENT	SATISFACTION INDICATOR						
	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied	Average Score	% scoring 3 or less
The cave tour overall	2	0	7	42	48	4.34	9
Waiting before the cave tour	1	4	26	41	28	3.89	30
Waiting to buy your cave ticket	1	2	28	36	37	3.78	31
The size of the cave tour group	2	7	24	39	28	3.78	32
The number of groups in the cave	2	10	28	35	25	3.53	40
Waiting for other groups in the cave	2	9	29	35	24	3.59	40
Waiting for the boat	1	3	22	40	33	3.93	26
The duration of the tour	2	9	19	41	28	3.73	30
The number of toilets	1	5	33	31	29	3.19	39
Cleanliness of the toilets	1	3	30	33	32	3.21	35
The size of the shop	1	6	38	29	25	3.11	46

For some aspects of the cave tour satisfaction levels were not dependent on the season such as:

- the duration of the tour;
- the number of toilets;
- the cleanliness of toilets;
- the size of the shop.

The combined summer/winter satisfaction scores by nationality are shown in Table 5.

TABLE 5. SATISFACTION SCORES BY NATIONALITY—SUMMER/WINTER COMBINED.

Product element	SATISFACTION INDICATOR										
	New Zealand	U.K.	U.S.A.	Australia	Korea	Japan	Taiwan	Asia other	Europe other	Other	Total
The cave tour overall	4.5	4.4	4.6	4.4	4.1	4.4	4.2	4.3	4.3	n/a	4.4
Waiting before the cave tour	4.2	4.1	4.4	4.1	3.6	3.7	3.8	3.6	3.9	n/a	4.0
Waiting to buy your cave ticket	4.2	4.0	3.7	3.9	3.6	3.4	3.6	3.6	3.4	n/a	4.1
The size of the cave tour group	4.1	3.8	4.2	3.8	3.6	3.6	3.7	3.5	3.6	n/a	4.1
The number of groups in the cave	3.7	3.5	3.8	3.7	3.4	3.5	3.3	3.5	3.0	n/a	3.9
Waiting for other groups in the cave	3.9	3.7	3.9	3.6	3.4	3.4	3.3	3.3	3.5	n/a	3.9
Waiting for the boat	4.3	4.0	4.2	4.1	3.6	3.7	3.8	3.7	4.1	n/a	4.1
The duration of the tour	4.0	4.1	4.1	3.9	3.4	3.5	3.4	3.6	3.7	n/a	3.9
The number of toilets	3.6	2.4	3.0	3.3	3.1	3.0	3.3	3.4	2.3	n/a	3.8
Cleanliness of the toilets	3.4	2.3	3.0	3.1	3.2	2.9	3.4	3.3	2.4	n/a	3.8
The size of the shop	3.3	2.6	2.8	3.3	3.0	2.9	3.1	3.1	2.3	n/a	3.6

The following observations can be made from the data:

- satisfaction levels with the cave tour overall were relatively uniform across nationality groups;
- UK and Europe other markets were the least satisfied with the toilet facilities and the size of the shop;
- Asian groups (Korea, Japan, Taiwan) were the least satisfied with waiting either before the tour, during the tour, or waiting for the boat);
- New Zealanders' expectations of the cave tour were more consistently met than for other nationality groups.

### 3.6 CROWDING RESULTS

The quantitative data on visitor crowding was gathered using the nine-point crowding scale featured in Figure 7 (see Section 1.4). Respondents are asked to indicate a number which corresponds to their perception of crowding in the Glowworm Cave. Table 6 details a series of capacity judgements and comments corresponding to each of the scores.

FIGURE 7. THE NINE POINT CROWDING SCALE.

Not at all crowded		Slightly crowded			Moderately crowded		Extremely crowded	
1	2	3	4	5	6	7	8	9

The following points should be noted with reference to the crowding scale and interpretive table:

- scores of 3 or more indicate some level of crowding is perceived by the individual;
- crowding can be perceived in two ways: from the perspective of the individual (i.e. encroachment on personal space) and/or with respect to the environment as a whole (i.e. the number of visitors is too high for the cave).

Qualitative data suggests that the former interpretation was most commonly adopted by respondents although ultimately both interpretations, when expressed as a score, are a reflection of the individual's assessment of visitor densities.

TABLE 6. CROWDING SCALE INTERPRETIVE TABLE.

% FEELING CROWDED (SCORE 3 OR HIGHER)	CAPACITY JUDGEMENT	COMMENTS
0-35	Suppressed crowding	Crowding limited by management of situations and/or factors, may offer unique low density experience.
35-50	Low/normal	Problem situation does not exist at this time; as with the above category, may offer unique low density experience.
50-65	High/normal	Should be studied if increased use is expected, allowing management to anticipate problems.
65-80	More than capacity	Studies and management necessary to preserve experience.

80-100	Much more than capacity	Manage for high density or sacrifice area.
--------	-------------------------	--

### 3.7 CROWDING SCORES

Perceptions of crowding varied by nationality groups. Tables 7, 8 and 9 present crowding scores by nationality for summer, winter and combined summer/winter samples. The right hand column (% 3+), indicates the management response score corresponding to individual nationality groups based on the interpretive criteria shown above:

TABLE 7. SUMMER MEAN CROWDING SCORES BY NATIONALITY.

	1	2	3	4	5	6	7	8	9	% 3+
New Zealand	15	5	11	9	9	20	19	5	7	<b>80.5</b>
United Kingdom	20	12	9	12	3	18	14	3	3	<b>61.6</b>
United States	8	2	21	11	4	24	18	4	1	<b>83.0</b>
Australia	15	12	22	9	13	15	5	3	6	<b>72.7</b>
Korea	22	17	18	8	6	10	8	1	9	<b>60.9</b>
Japan	17	16	40	9	5	8	3	1	1	<b>66.7</b>
Taiwan	21	12	30	21	2	7	0	1	0	<b>60/4</b>
Asia other	n/a	<b>n/a</b>								
Europe other	10	9	9	20	9	18	7	4	7	<b>73.3</b>

TABLE 8. WINTER MEAN CROWDING SCORES BY NATIONALITY.

	1	2	3	4	5	6	7	8	9	% 3+
New Zealand	29	12	10	9	4	12	9	3	0	<b>46.2</b>
United Kingdom	n/a	<b>n/a</b>								
United States	25	20	19	4	8	10	4	4	0	<b>48.2</b>
Australia	43	10	14	3	9	8	3	3	0	<b>39.0</b>
Korea	33	17	12	5	3	8	3	1	0	<b>32.0</b>
Japan	24	24	21	5	9	2	1	1	0	<b>39.7</b>
Taiwan	n/a	<b>n/a</b>								
Asia other	n/a	<b>n/a</b>								
Europe other	n/a	<b>n/a</b>								

TABLE 9. COMBINED SUMMER/WINTER MEAN CROWDING SCORES BY NATIONALITY.

	1	2	3	4	5	6	7	8	9	% 3+
New Zealand	19	3	10	9	7	16	15	4	4	<b>66.7</b>
United Kingdom	6	11	10	13	3	17	13	3	3	<b>61.5</b>
United States	17	11	20	7	7	17	11	4	0	<b>67.4</b>
Australia	22	11	20	7	11	13	4	3	4	<b>61.3</b>
Korea	25	16	16	8	6	10	7	1	1	<b>48.2</b>
Japan	14	19	33	8	7	6	3	1	1	<b>58.4</b>
Taiwan	17	13	26	16	2	8	0	3	1	<b>56.1</b>
Asia other	9	10	14	14	10	21	7	5	0	<b>70.5</b>
Europe other	12	8	10	18	8	17	8	5	6	<b>73.1</b>

Table 10 shows the mean crowding scores for all visitors during summer, winter and for summer/winter combined. It is also presented in graphic form in Figure 8.

TABLE 10. MEAN CROWDING SCORES FOR ALL VISITORS.

	1	2	3	4	5	6	7	8	9	% 3+
Total Summer	16	13	22	11	7	15	10	3	3	<b>70.6</b>
Total Winter	30	18	17	8	7	10	4	3	0	<b>49.5</b>
Year Total	20	14	21	10	7	13	8	3	2	<b>84.8</b>

FIGURE 8: MEAN PERCENTAGE CROWDING SCORES FOR ALL VISITORS.

Figures 9, 10 and 11 show crowding scores by nationality for summer, winter and summer/winter combined respectively. Scores for each nationality group are compared with the mean scores for all nationality groups for the period indicated. The chi-square test reveals that differences in responses are statistically significant when crowding scores were grouped around the response numbers 2, 4, 6 & 8 (details of statistical testing for the total sample are shown in Appendix iii). When viewed separately, the data for the winter sample has an error margin of +/- 2.2%, the data for the summer sample has an error margin of +/- 3.5%. The survey results by nationality are presented simply as average percentage scores of subgroups.

The following should be noted about this report's treatment of crowding with levels of satisfaction:

- The expression of satisfaction is dependent on a number of variables other than visitor numbers. Assumptions about the management of one factor relative to the other may not be helpful in this context. For this reason this report avoids direct comparison between crowding and satisfaction but instead suggests that both factors be considered as separate management issues.

FIGURE 9. MEAN PERCENTAGE CROWDING SCORES BY NATIONALITY—SUMMER.

FIGURE 10. MEAN PERCENTAGE CROWDING SCORES BY NATIONALITY—WINTER.

FIGURE 11. MEAN PERCENTAGE CRPOWDING SCORES BY NATIONALITY—  
SUMMER/WINTER COMBINED.

The following observations can be made from the above data:

- crowding should be considered a problem during peak periods (summer);
- crowding should not be considered a problem in off peak periods (winter);
- the responses of most nationality groups displayed a bivariate (dual peak) structure indicating disparities within each group;
- visitors from New Zealand, United Kingdom, Europe Other and Asia Other consistently registered higher perceptions of crowding than other nationality groups for all periods;
- Japanese, Korean and Taiwanese visitors registered the lowest perceptions of crowding.

## 4. Traffic and crowding management issues

The most immediate factor affecting visitors' perceptions of crowding is visitor traffic within the cave. This section details the characteristics of visitor traffic flows and the characteristics of perceived crowding in order to provide a 'snapshot' of the key issues identified by stakeholder groups outlined in Section 3.1. The data presented in this section forms the basis for discussion of management approaches in Section 5.

### 4.1 VISITOR TRAFFIC PATTERNS AND CONGESTION ISSUES

The Glowworm Cave is a finite space and normally tour groups move through the Cave following a prescribed route in groups with a maximum of 50 persons (25 persons per boat in the Glowworm Grotto). The route is for the most part circular although it involves some doubling back through the Cathedral to access the boat ramp. During wet periods when the water level of the Waitomo Stream prohibits the use of the normal exit, groups leave the cave via the point of entry.

The major characteristics of visitor traffic in the Glowworm Cave are bunching of successive groups, two-way passing, groups transiting between tour elements, and static gatherings of groups at scheduled points of interest during the tour. Table 11 details the characteristics of visitor traffic throughout the Glowworm Cave tour. The priority ratings are based on a combination of survey data as well as qualitative and observational methods outlined in Section 2.2. The priorities indicated can be used as a guide for future management.

The following definitions of relevant terms should be noted:

- 'Pulse' refers to the groups entering and moving around the cave;
- 'Density' refers to the concentration of visitors in the available space;
- 'Frictional contact' refers to the movement of groups past one another;
- 'Bunching' refers to the uneven regularity of groups following one another.

The following points should be noted about visitor traffic at the Glowworm Cave:

- the tight time schedules of tour operators places pressure on management to take tours as they arrive in addition to the scheduled tours every half hour throughout the day;
- adopting the traffic management procedures outlined in Table 11 may prove to be the most immediate and easily implemented solution to many of the issues which register as high perceptions of crowding.
- Traffic management approaches may address some of the symptomatic issues but do not address the cause, i.e. the number of visitors to the cave. Nevertheless, traffic management represents the most cost effective and readily implementable approach to a number of congestion and crowding issues.

TABLE 11. WAITOMO GLOWWORM CAVE—VISITOR TRAFFIC ANALYSIS.

ISSUE	TYPE	PERIODICITY	CONTRIBUTING FACTORS	POSSIBLE INDICATORS	DESIRED CONDITION	PRIORITY
<b>Bunching</b>	<ul style="list-style-type: none"> <li>• Between consecutive groups</li> </ul>	<ul style="list-style-type: none"> <li>• Year round except low density periods (winter/off peak)</li> </ul>	<ul style="list-style-type: none"> <li>• Irregular start frequency</li> <li>• Variation between booking and arrival times</li> <li>• Demand for immediate entry</li> </ul>	<ul style="list-style-type: none"> <li>• Frustration with waiting</li> <li>• Move at speed of slowest group</li> </ul>	<ul style="list-style-type: none"> <li>• Regular frequency pulses</li> <li>• Punctual group arrivals</li> </ul>	<ul style="list-style-type: none"> <li>• High</li> </ul>
	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• Irregular guide talk duration</li> <li>• Tour (coach) guides omitting detail to reduce tour duration</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• As one group leaves another arrives</li> </ul>	<ul style="list-style-type: none"> <li>• High</li> </ul>
	<ul style="list-style-type: none"> <li>• Amongst individuals within groups</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• Narrow or single file transitional areas/structures</li> </ul>	<ul style="list-style-type: none"> <li>• Static queuing in transition spaces</li> <li>• Move at speed of slowest individual</li> </ul>	<ul style="list-style-type: none"> <li>• Smooth and continuous movement</li> </ul>	<ul style="list-style-type: none"> <li>• Medium</li> </ul>
<b>Two way passing</b>	<ul style="list-style-type: none"> <li>• One group static the other in transit</li> </ul>	<ul style="list-style-type: none"> <li>• High density period (summer/ peak)</li> </ul>	<ul style="list-style-type: none"> <li>• Group size relative to floor space</li> <li>• Cultural differentiation</li> </ul>	<ul style="list-style-type: none"> <li>• Distraction from guide narrative</li> <li>• Group shuffling</li> <li>• Inter group rivalry</li> <li>• Erosion of group dynamic</li> </ul>	<ul style="list-style-type: none"> <li>• Transition occurs with minimal interruption to other groups</li> </ul>	<ul style="list-style-type: none"> <li>• High</li> </ul>
	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• Medium/low density period (winter/off peak)</li> </ul>	<ul style="list-style-type: none"> <li>• High river levels (groups enter and exit the same way)</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• Transition occurs with minimal interruption to other groups</li> </ul>	<ul style="list-style-type: none"> <li>• Medium</li> </ul>
	<ul style="list-style-type: none"> <li>• Both groups in transit</li> </ul>	<ul style="list-style-type: none"> <li>• Year round except low density periods (winter/off peak)</li> </ul>	<ul style="list-style-type: none"> <li>• Cultural differentiation</li> <li>• Period of visitation</li> </ul>	<ul style="list-style-type: none"> <li>• Unstructured queuing</li> <li>• Competition for space/priority</li> </ul>	<ul style="list-style-type: none"> <li>• Transition occurs with minimum conflict over space/priority</li> </ul>	<ul style="list-style-type: none"> <li>• High</li> </ul>
<b>Transit</b>	<ul style="list-style-type: none"> <li>• Channelled movement of groups and individuals</li> </ul>	<ul style="list-style-type: none"> <li>• All year (peak/off peak)</li> <li>• Winter/peak sensitivity</li> <li>• Medium frequency pulse</li> </ul>	<ul style="list-style-type: none"> <li>• Steps, stairs, paths, jetties</li> <li>• Medium/long distance</li> <li>• Groups must move in single/double file</li> <li>• Groups must move at speed of slowest ahead</li> </ul>	<ul style="list-style-type: none"> <li>• Perceived low interest value</li> <li>• Occasional delays (2-way traffic)</li> <li>• Frequent delays (bunching)</li> <li>• Disruption of other groups</li> </ul>	<ul style="list-style-type: none"> <li>• High safety environment</li> <li>• Ease of use by all ages</li> <li>• Efficient movement of groups</li> </ul>	<ul style="list-style-type: none"> <li>• Medium/high</li> </ul>
	<ul style="list-style-type: none"> <li>• Clustered movement of groups</li> </ul>	<ul style="list-style-type: none"> <li>• All year (peak/off peak)</li> <li>• Medium frequency pulse</li> </ul>	<ul style="list-style-type: none"> <li>• Cathedral floor and demonstration chamber</li> <li>• Short distance of movement</li> <li>• Medium/high density pulse</li> <li>• Individuals determine own speed of movement</li> </ul>	<ul style="list-style-type: none"> <li>• Low/high incidence of intergroup contact</li> <li>• High contact irritation</li> <li>• Disruption of other groups</li> </ul>	<ul style="list-style-type: none"> <li>• Minimal contact with other groups</li> <li>• Minimal disruption to others</li> <li>• Available space for movement</li> </ul>	<ul style="list-style-type: none"> <li>• Low/medium</li> </ul>
	<ul style="list-style-type: none"> <li>• Boarding boats (inside jetty)</li> </ul>	<ul style="list-style-type: none"> <li>• Summer/peak sensitive</li> <li>• Low/medium frequency pulse irregular feed</li> </ul>	<ul style="list-style-type: none"> <li>• Low/medium density pulse</li> <li>• Individuals board in single file</li> <li>• Limited absorption capacity (3 boats, 25 persons max. each)</li> </ul>	<ul style="list-style-type: none"> <li>• High anticipation</li> <li>• Medium/high risk perception</li> <li>• Heightened frustration with delays (boredom)</li> <li>• Individual/close contact with guide</li> </ul>	<ul style="list-style-type: none"> <li>• High safety environment</li> <li>• Ease of movement by all ages</li> <li>• High interest environment</li> </ul>	<ul style="list-style-type: none"> <li>• Medium/high</li> </ul>

ISSUE	TYPE	PERIODICITY	CONTRIBUTING FACTORS	POSSIBLE INDICATORS	DESIRED CONDITION	PRIORITY
	<ul style="list-style-type: none"> <li>Disembarking boats (outside jetty)</li> </ul>	<ul style="list-style-type: none"> <li>All year/peak and off peak</li> <li>No activity when river is high</li> <li>Low-medium frequency pulse</li> </ul>	<ul style="list-style-type: none"> <li>Limited volume (25 persons max.)</li> <li>High density pulse</li> </ul>	<ul style="list-style-type: none"> <li>Medium/high risk perception</li> <li>Readjustment to outside conditions (weather, itinerary, etc.)</li> <li>Individual/close contact with guide</li> <li>Individual and interactive evaluation of tour</li> </ul>	<ul style="list-style-type: none"> <li>High safety environment</li> <li>Ease of movement by all ages</li> <li>Positive farewell situation</li> </ul>	<ul style="list-style-type: none"> <li>Low/medium</li> </ul>
<b>Static gathering</b>	<ul style="list-style-type: none"> <li>Formal congregations (features of tour format)</li> </ul>	<ul style="list-style-type: none"> <li>All year/peak and off peak</li> <li>Winter/peak sensitivity when river is high</li> <li>Summer peak sensitivity when visitation is high</li> <li>Feed frequency seasonally sensitive</li> </ul>	<ul style="list-style-type: none"> <li>Structure of spaces (developed, confined, open)</li> <li>Nature of contact with other groups</li> <li>Socio-cultural differentiation</li> <li>Rapport with guide</li> <li>Linguistic fluency (translation, comprehension)</li> </ul>	<ul style="list-style-type: none"> <li>Irritation from other groups (passing, noise, behaviour, socio-cultural composition, visible movement)</li> <li>Low tolerance to contact</li> <li>Distraction</li> <li>Overhearing talk of the guide preceding or following (when it repeats their own)</li> </ul>	<ul style="list-style-type: none"> <li>High interest /quality experience</li> <li>Low contact with other groups</li> <li>Cater to niche markets/segments</li> <li>Maintain customer satisfaction</li> </ul>	<ul style="list-style-type: none"> <li>High</li> </ul>
	<ul style="list-style-type: none"> <li>Queuing</li> </ul>	<ul style="list-style-type: none"> <li>All year/peak and off peak</li> <li>Summer peak sensitivity when visitation is high</li> </ul>	<ul style="list-style-type: none"> <li>Formal structured space spilling to informal transit areas</li> <li>Presence/activity of other groups</li> <li>Long, narrow groupings</li> </ul>	<ul style="list-style-type: none"> <li>Body language</li> <li>High level boredom</li> <li>Low interest</li> <li>High degree of frustration with delays</li> </ul>	<ul style="list-style-type: none"> <li>No/short duration delays</li> <li>High interest spaces</li> </ul>	<ul style="list-style-type: none"> <li>High</li> </ul>
	<ul style="list-style-type: none"> <li>Boat trip</li> </ul>	<ul style="list-style-type: none"> <li>As above</li> </ul>	<ul style="list-style-type: none"> <li>Confined space (max. 25 persons)</li> <li>Socio-cultural group composition</li> <li>Group behaviour (noise)</li> <li>Satisfaction with glowworm display</li> <li>Duration of boat trip</li> </ul>	<ul style="list-style-type: none"> <li>Vocal expression of satisfaction/dissatisfaction</li> <li>Body language</li> <li>Verbal feedback to guides</li> </ul>	<ul style="list-style-type: none"> <li>High quality natural environment</li> <li>High quality experience</li> <li>High level satisfaction</li> <li>Safe environment</li> </ul>	<ul style="list-style-type: none"> <li>Medium</li> </ul>

## 4.2 PERCEIVED CROWDING

There is a range of factors influencing perceptions of crowding at the Waitomo Glowworm Cave. Table 12 details: the range of variables that impact on visitors' perceptions of crowding; identifies contributing factors and indicators of perceived crowding; suggests desired conditions; and provides management priority guidelines.

The following points should be noted about crowding:

- The most significant issue to emerge from the data is the relationship between perceptions of crowding and nationality. At present the Cave tour treats all visitors as more or less homogenous. If the interpretive table (Table 6) accompanying the crowding was applied separately to nationality market groups some groups such as New Zealand and Europe other, should

be managed as ‘sacrificial’ markets whereas more tolerant markets such as Korea and Japan would require only moderate management attention.

TABLE 12. WAITOMO GLOWWORM CAVE—ANALYSIS OF VISITOR CROWDING.

ISSUE	VARIABLES	CONTRIBUTING FACTORS	INDICATORS	DESIRED CONDITION	PRIORITY
<b>Visitor density</b>	<ul style="list-style-type: none"> <li>• Perception of product (natural environment, wilderness, guided tour, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• Misleading marketing</li> <li>• Inappropriate zoning</li> </ul>	<ul style="list-style-type: none"> <li>• Dissatisfaction with visitor numbers (groups, individuals)</li> <li>• Dissatisfaction with elements of tour (queuing, traffic flows, noise, etc.)</li> <li>• Lack of tolerance for other visitors</li> </ul>	<ul style="list-style-type: none"> <li>• Expectations match product</li> <li>• Consistency across visitor spectrum</li> <li>• Marketing reflects product delivered</li> </ul>	<ul style="list-style-type: none"> <li>• High</li> </ul>
<b>Degree of interaction</b>	<ul style="list-style-type: none"> <li>• As above</li> <li>• Frequency of disruption</li> <li>• Level of disturbance</li> <li>• Individual/personal values and/or norms</li> </ul>	<ul style="list-style-type: none"> <li>• Poor traffic management</li> <li>• High visitor densities</li> <li>• Intergroup or interpersonal conflict</li> </ul>	<ul style="list-style-type: none"> <li>• Distraction from guided tour</li> <li>• Shuffling to accommodate movement of other groups</li> </ul>	<ul style="list-style-type: none"> <li>• High tolerance amongst all visitors</li> </ul>	<ul style="list-style-type: none"> <li>• High</li> </ul>
<b>Size of groups</b>	<ul style="list-style-type: none"> <li>• As above</li> <li>• Available space</li> <li>• Variations in group size</li> <li>• Group composition</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> <li>• Experience matches expectation</li> </ul>	<ul style="list-style-type: none"> <li>• Medium</li> </ul>
<b>Group behaviour</b>	<ul style="list-style-type: none"> <li>• Noise (exclamations, laughter, foreign languages)</li> <li>• Adherence to cave protocols (photography, touching formations etc.)</li> <li>• Movement (loose group formation, children running, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• Inappropriate behaviour of others (groups, individuals)</li> <li>• Diversity of cultural and ethnic group composition</li> <li>• Diversity of ages between and within groups</li> <li>• Flouting cave protocols</li> </ul>	<ul style="list-style-type: none"> <li>• Distraction from guided tour</li> <li>• High perception of crowding</li> <li>• Expressed dissatisfaction with product (verbal, survey, body language etc.)</li> <li>• Low return visitation</li> </ul>	<ul style="list-style-type: none"> <li>• Protocols are clearly defined, do not impair appreciation</li> <li>• Protocols are observed by all visitors</li> </ul>	<ul style="list-style-type: none"> <li>• Medium</li> </ul>
<b>Cultural composition of groups</b>	<ul style="list-style-type: none"> <li>• Groups of same cultural and/or ethnic origin</li> <li>• Groups of multiple cultural and/or ethnic origins</li> <li>• Personal/social values of individuals</li> </ul>	<ul style="list-style-type: none"> <li>• Arrival times (daily)</li> <li>• Seasonality (e.g., domestic holidays)</li> <li>• Prior visitation</li> <li>• Degree of prior knowledge</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• High tolerance of and acceptance between cultural and ethnic groups</li> </ul>	<ul style="list-style-type: none"> <li>• High</li> </ul>
<b>Visitor values</b>	<ul style="list-style-type: none"> <li>• Interpersonal</li> <li>• Social conflict</li> <li>• Values conflict</li> <li>• Expectations of product</li> <li>• Domestic and international visitation</li> <li>• Cultural/ethnic origin</li> </ul>	<ul style="list-style-type: none"> <li>• Socio-economic and cultural differentiation</li> <li>• Inconsistent visitor values between and within groups</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• As above</li> </ul>	<ul style="list-style-type: none"> <li>• High</li> </ul>
<b>Host values</b>	<ul style="list-style-type: none"> <li>• Ownership and management (state, private sector)</li> <li>• Conservation value</li> <li>• Commercial orientation</li> <li>• Cultural identification</li> <li>• Iconic status (role in cultural and social identity expression)</li> <li>• Tourism history (“traditional” usage of site)</li> </ul>	<ul style="list-style-type: none"> <li>• Conflicts of interest</li> <li>• Inconsistent values and orientations</li> <li>• “external” pressures to accommodate high volume visitation</li> </ul>	<ul style="list-style-type: none"> <li>• “inappropriate” use of physical and human resources</li> </ul>	<ul style="list-style-type: none"> <li>• unified developmental direction</li> <li>• mandate for proposed development from all interested parties</li> <li>• networked development</li> </ul>	<ul style="list-style-type: none"> <li>• high</li> </ul>

- If visitation levels continue to rise visitation characteristics may gravitate towards visitors with higher tolerances of crowding (e.g. Korean visitors). It should be noted that these markets are high-volume short-duration visitors to New Zealand and as such can be considered relatively unstable markets.
- A significant influence on the perception of crowding is the degree of interaction between individuals or groups (see Section 1.4). The preceding traffic management discussion may appropriately address many of these issues.
- Where cultural groups are readily identifiable and a degree of intolerance between cultural or ethnic groups exists, the degree of crowding may appear higher than when the same number of visitors are identified as of the same cultural or ethnic origin. The relative size of groups and their activity and behaviour also feature as variables not necessarily distinct from nationality (Section 1.4). These variables can independently and collectively generate conflict situations among visitor groups. A commonly cited example of conflict at the Glowworm Cave occurs between Japanese and Korean visitors.
- The use of nationality as a variable does not take into account the richness and complexity of cultures. It also overlooks certain other variables of identification, which transcend national boundaries such as social or income status, gender, religious identification, tourist role, personality, and lifestyle. Despite this, the most significant variation of perceptions of crowding in the survey data was by nationality.
- It should be recognised that the determination of appropriate levels of visitor crowding will be dependent on the cultural and contextual values of the hosts.

## 5. Managing the visitor experience

This section suggests recommendations based on the research data and analysis, provides a range of possible management options, outlines a generalised framework for management action, and suggests examples of readily implementable research and monitoring processes for the management of the visitor experience at the Waitomo Glowworm Cave.

### 5.1 GENERAL RECOMMENDATIONS

- Continued monitoring of the visitor experience be conducted to identify changes in perceptions over time.
- Goals and objectives for the management of the visitor experience be formulated based on analysis of ongoing monitoring data.
- Programme goals and objectives be formulated against which the visitor experience can be analysed and assessed.

- A computerised visitor booking system be introduced (e.g. database and/or spreadsheet) to provide basic background data for monitoring studies.
- Management objectives be carried out in consultation with ‘upstream’ and ‘downstream’ tourism providers to ensure a common commitment to quality objectives (see Section 3.1).

## 5.2 VISITOR EXPERIENCE MANAGEMENT — GENERAL CONCEPTS

Although the carrying capacity concept can be seen to be flawed in some respects (see Section 1.4) the rejection of the carrying capacity concept may be equally unhelpful in assisting decision-making on appropriate ‘levels’ and ‘types of use’. For this reason the measurement of perceived crowding should be used as a negative evaluation of visitor density levels and visitor experience analysis. This evaluative instrument in the form of a quantitative survey (such as the one used in this study) can contribute significantly to understanding the nature of the visitor experience and its relationship to crowding, in turn providing baseline data for the identification of a series of management objectives relating to the optimum visitor experience to be provided.

In establishing the management objectives the following factors should be observed:

- specific indicators should be employed to establish the conditions required over time to maintain the quality of the experience and reflect management objectives;
- indicators should be quantifiable and facilitate the monitoring and assessment of standards of quality.

Figure 12 outlines an objective-driven management process appropriate for the Glowworm Cave situation. The model is based on an amalgam of widely used management tools for natural environment and recreational settings featured in section 1.4.

## 5.3 A VISITOR EXPERIENCE MONITORING PROGRAMME FOR THE GLOWWORM CAVE

Ideally the visitor experience should be monitored and analysed as a continuous (i.e. ongoing) process and should include the following elements:

- satisfaction with elements of the tour, facilities and infrastructures;
- perceptions of crowding in relation to visitor markets, nationality groups and seasonality;
- demographic and tourist type characteristics of visitor markets;
- the changing tourism environment including ‘upstream’ and ‘downstream providers’.

The proposed Continuous Analysis of the Visitor Experience (CAVE) programme shown in Figure 13 identifies a process and structure for the ongoing management of the visitor experience at the Glowworm Cave. The model covers the range of tour elements featured in Section 3 as well as a range of monitoring instruments and approaches to be conducted and reported

regularly. The reporting process then feeds back into an objective-driven management process as detailed in Section 5.2.

FIGURE 12. OBJECTIVE DRIVEN MANAGEMENT PROCESS.

FIGURE 13. CONTINUOUS ANALYSIS OF THE VISITOR EXPERIENCE (CAVE) PROGRAMME.

## 5.4 MANAGEMENT APPROACHES AND RECOMMENDATIONS

The CAVE process is a comprehensive and integrated monitoring and management model and in this respect should be seen as an idealised structure to be worked towards. Given the practical constraints of implementing such an approach a number of steps can be implemented relatively simply to provide ongoing cost-effective monitoring of the visitor experience. An example of such an approach is given below:

- identify the issue (e.g. static gathering/queuing—see Table 11);
- develop a qualitative understanding of factors underlying the issue (e.g. where visitors are waiting such as the boat ramp, on the stairs, etc., how regularly queues form, whether groups are waiting in the dark, standing on steps, in high density situations etc.);
- identify indicators of the problem (complaints to tour guides, bus drivers or staff, body language, frustration indicated by expressed dissatisfaction to other visitors);
- develop techniques for further understanding the nature of the problem (timing groups waiting at particular places);
- develop instruments to quantitatively monitor changes in the scale of the problem over time (quantitative survey, guide debriefings, observations log book for guides);
- develop a measuring programme detailing sample sizes and frequency of implementation for the above approaches;
- develop a system for analysis and reporting data (how often results are to be analysed, in what form data are presented, and to whom).

The above process would provide a valuable complement to other research processes such as the replication of the quantitative survey conducted in this study. The following areas can be considered as easily implementable priority areas for ongoing visitor experience monitoring:

- Repeating the quantitative survey and methodology conducted in this study.
- Monitoring visitor waiting times throughout the cave tour (see above).
- Introducing reporting systems (e.g., log books) for qualitative feedback on key issues identified in Section 3.1 such as general complaints, traffic flows, visitors crossing the road, queuing at the toilets, evidence of congestion in the shop, visitors using cameras in the cave, duration of cave guide and/or tour guide spiel, visitors touching or damaging formations etc.

The above priority areas can be monitored and implemented relatively easily and cheaply using existing staffing and resources. Systems such as computerised booking arrangements would require more planning and investment with respect to resources.

Monitoring processes, such as, electronic monitoring devices and techniques, can be incorporated as a when resources allow. Regular literature reviews, qualitative interviewing, and participant observation could, for example, be conducted as a 3-5 yearly audit process. Methods adopted in this study can be used as a possible template for the implementation of the monitoring instruments identified in Figure 13.

## 5.5 OTHER POSSIBLE MANAGEMENT OPTIONS

The above recommendations identify a series of ‘best guess’ approaches to visitor experience management at the Glowworm Cave. There remain, however, a number of other management options for dealing with the issues raised in this study, which deserve some consideration. Table 13 details a range of possible management responses to the conditions featured in Section 4. The purpose of the table is to present and explore a range of hypothetical management options. As such, some of the options given may not necessarily be considered appropriate given the practical, cultural and social management environment of the Glowworm Cave. Nevertheless, the options outlined in Table 13 are presented to systematically examine a range of considerations and possible responses to the issues identified in this study.

# 6. Summary

The primary objective of this study was to analyse the nature of the visitor experience and the ways issues of crowding are perceived by the various nationality groups visiting the cave. The following general conclusions can be drawn:

- levels of visitor satisfaction with the cave tour overall are higher than levels of satisfaction with some characteristics of the tour (e.g. number of groups in the cave) and some of the facilities (e.g., toilets, shop);
- crowding at the Glowworm Cave is a problem condition during peak periods such as the summer months and peak times during the day; and requires management attention or intervention.
- crowding at the Glowworm Cave does not require management intervention during off peak seasons and periods;
- perceptions of crowding and tolerance of crowding at the Glowworm Cave are dependent on country of origin and mode of travel;
- the demands and constraints of upstream and downstream providers remains a significant influence on the demands and patterns of visitation;
- management of the visitor experience should be responsive to market diversity.

TABLE 13. WAITOMO GLOWWORM CAVE—POSSIBLE MANAGEMENT OPTIONS.

CATEGORY	OPTIONS	STRATEGIES	ADVANTAGES	DISADVANTAGES
<b>Maintain existing tour format</b>	<ul style="list-style-type: none"> <li>Do nothing</li> </ul>	<ul style="list-style-type: none"> <li>Do nothing</li> </ul>	<ul style="list-style-type: none"> <li>No additional cost</li> <li>Low disruption to current operation</li> <li>Maintain role as high volume hub for local region</li> </ul>	<ul style="list-style-type: none"> <li>Increasing congestion</li> <li>Erosion of product quality</li> <li>Alienation of less tolerant markets (e.g., domestic)</li> <li>Questionable long term commercial and environmental sustainability</li> </ul>
	<ul style="list-style-type: none"> <li>Impose access limits</li> </ul>	<ul style="list-style-type: none"> <li>Allow access at scheduled times only (with limited group numbers)</li> <li>Set visitor limit at that of the least tolerant indicator (e.g., CO2 levels, domestic visitor satisfaction)</li> <li>Liase with tour providers to increase punctuality</li> </ul>	<ul style="list-style-type: none"> <li>Low cost</li> <li>Easy implementation</li> <li>Reduced perceptions of crowding</li> <li>Limited environmental impact</li> </ul>	<ul style="list-style-type: none"> <li>Inability to identify overall crowding tolerance threshold</li> <li>Environmental and social indicators may not correspond</li> <li>Need to install monitoring devices</li> <li>Loss of markets</li> <li>Limited revenue</li> <li>Not responsive to market diversity</li> <li>Counter to market pressure</li> </ul>
	<ul style="list-style-type: none"> <li>Standardise tour elements</li> </ul>	<ul style="list-style-type: none"> <li>Standardise tour start frequencies (e.g., every half hour or quarter hour during peaks)</li> <li>Introduce computerised booking and monitoring system</li> <li>Standardise overall guide speil duration (cave guides, tour guides)</li> <li>Standardise guide speil duration per tour element (cave guides, tour guides)</li> </ul>	<ul style="list-style-type: none"> <li>Overcome short term peak traffic congestion</li> <li>Moderate cost</li> <li>Easy implementation</li> <li>Guides retain individuality of speil content</li> </ul>	<ul style="list-style-type: none"> <li>Associated cost of monitoring system</li> <li>Addresses symptoms not cause</li> <li>Does not address medium to long term congestion issues</li> <li>Treats highly segmented market as homogeneous</li> <li>Counter to market pressure</li> </ul>
<b>Modify existing product</b>	<ul style="list-style-type: none"> <li>Encourage off peak markets (daily)</li> </ul>	<ul style="list-style-type: none"> <li>Differential pricing</li> <li>Promote off peak attractions (e.g., organ loft)</li> <li>Add offpeak attractions</li> </ul>	<ul style="list-style-type: none"> <li>Increase revenue</li> <li>Low cost</li> <li>Raise profile of attraction</li> <li>Reduce environmental and social recovery period</li> </ul>	<ul style="list-style-type: none"> <li>Generally low success rate</li> <li>May intensify peak period congestion due to increased promotion of resource overall</li> </ul>
	<ul style="list-style-type: none"> <li>Encourage off season markets</li> </ul>	<ul style="list-style-type: none"> <li>Differential pricing</li> <li>Promote to schools, sports groups etc.</li> </ul>	<ul style="list-style-type: none"> <li>As above</li> </ul>	<ul style="list-style-type: none"> <li>As above</li> </ul>
	<ul style="list-style-type: none"> <li>Extend current peak period</li> </ul>	<ul style="list-style-type: none"> <li>Differential pricing</li> <li>Develop shoulder seasons</li> <li>Diversify markets</li> </ul>	<ul style="list-style-type: none"> <li>As above</li> </ul>	<ul style="list-style-type: none"> <li>As above</li> </ul>
	<ul style="list-style-type: none"> <li>Intensify current peak period</li> </ul>	<ul style="list-style-type: none"> <li>Promote to high volume high tolerance markets</li> </ul>	<ul style="list-style-type: none"> <li>As above</li> <li>Maintain or increase environmental and social recovery period</li> </ul>	<ul style="list-style-type: none"> <li>Intensify peak period congestion</li> <li>Increase perceptions of crowding</li> <li>Alienation of less tolerant markets (e.g., domestic)</li> </ul>
	<ul style="list-style-type: none"> <li>Modify facilities</li> </ul>	<ul style="list-style-type: none"> <li>Build new visitor centre: shop, toilets, information etc.</li> </ul>	<ul style="list-style-type: none"> <li>Provide interest for waiting visitors</li> <li>Increase revenue</li> <li>Increase capacity of facilities</li> <li>More controlled pedestrian traffic flows</li> <li>Improve visitor safety</li> </ul>	<ul style="list-style-type: none"> <li>High costs</li> <li>Disruption to outer cave environment</li> <li>Possible diminished “natural” appearance</li> </ul>
	<ul style="list-style-type: none"> <li>Increase capacity of structures within the cave</li> </ul>	<ul style="list-style-type: none"> <li>Widen stairs, paths</li> <li>Introduce alternative visitor movement devices (e.g., escalators)</li> </ul>	<ul style="list-style-type: none"> <li>Improve visitor traffic flows</li> <li>Facilitate higher visitor numbers and densities</li> <li>Increase revenue</li> </ul>	<ul style="list-style-type: none"> <li>Reduce “natural” atmosphere of cave</li> <li>Increase perceptions of crowding</li> <li>Alienation of less tolerant markets (e.g., domestic)</li> </ul>

CATEGORY	OPTIONS	STRATEGIES	ADVANTAGES	DISADVANTAGES
<b>Modify cave environment</b>	<ul style="list-style-type: none"> <li>Develop circular route</li> </ul>	<ul style="list-style-type: none"> <li>Construct boat passage from demonstration chamber to Glowworm Grotto</li> </ul>	<ul style="list-style-type: none"> <li>Remove two way passing of tourist traffic</li> <li>Reduce queuing at boat jetty</li> <li>Reduce perceptions of crowding</li> <li>Facilitate higher visitor numbers and densities</li> <li>Extend boat trip experience</li> </ul>	<ul style="list-style-type: none"> <li>Potentially "inappropriate" modification of resource (culturally, environmentally, legally)</li> <li>High cost</li> <li>Weakening of general cave structure</li> <li>Still unusable when river high</li> </ul>
	<ul style="list-style-type: none"> <li>As above</li> </ul>	<ul style="list-style-type: none"> <li>Construct walkway from Cathedral to Upper Entrance via Blanket Chamber (for use when river level closes usual exit)</li> </ul>	<ul style="list-style-type: none"> <li>Remove two way passing of tourist traffic</li> <li>Reduce perceptions of crowding</li> <li>Facilitate higher visitor numbers and densities</li> </ul>	<ul style="list-style-type: none"> <li>Potentially "inappropriate" modification of resource (culturally, environmentally, legally)</li> <li>High cost</li> <li>Weakening of general cave structure</li> </ul>
<b>Develop alternative products</b>	<ul style="list-style-type: none"> <li>Introduce new tour formats (complimentary or replacement)</li> </ul>	<ul style="list-style-type: none"> <li>Self-guided tours (e.g., tape and headset, interactive terminals etc.)</li> </ul>	<ul style="list-style-type: none"> <li>Moderate initial outlay but long term cost efficiency</li> <li>Easy to implement</li> <li>Talks can be tailored to all markets (language groups, time duration, educational groups, children etc.)</li> </ul>	<ul style="list-style-type: none"> <li>Difficulty in monitoring cave protocols</li> <li>Potential increased environmental impact</li> <li>Potential traffic management problems</li> <li>Difficulty in reconstructing tour groups</li> <li>Potential job losses</li> </ul>
	<ul style="list-style-type: none"> <li>Completely revise existing product</li> </ul>	<ul style="list-style-type: none"> <li>Develop low volume/high cost exclusive cave product (e.g., banquets, entertainment, concerts etc.)</li> </ul>	<ul style="list-style-type: none"> <li>Low impact</li> <li>Potential to maintain revenue levels</li> <li>Reduce seasonality</li> <li>Reduce congestion problems</li> </ul>	<ul style="list-style-type: none"> <li>Introduce instability</li> <li>Delays while fostering markets</li> <li>Limits access of some socio-economic groups (e.g., domestic market)</li> </ul>
	<ul style="list-style-type: none"> <li>Replicate and/or reproduce existing cave</li> </ul>	<ul style="list-style-type: none"> <li>Develop interactive multimedia products (CD Rom, virtual reality etc.)</li> <li>Build replica cave with glowworm colony</li> </ul>	<ul style="list-style-type: none"> <li>Reduce social and environmental impacts</li> <li>Allow development of interactive experience (e.g., touching, etc.)</li> <li>Enhance environmental and cultural integrity of the cave</li> </ul>	<ul style="list-style-type: none"> <li>Inauthentic experience</li> <li>Alienation of natural heritage market</li> <li>High cost</li> <li>Potential loss of some markets</li> </ul>

Issues of crowding and visitor satisfaction at the Waitomo Glowworm Cave are influenced by a range of variables additional to visitor numbers. For this reason this report suggests that assuming a direct relationship between the two variables may not be the most useful approach to resolving the issue of crowding. This report also suggests that the application of the carrying capacity concept to the management of the visitor experience is inappropriate in this situation although certain indicators and steps can be introduced to provide further understanding of the issues.

Short term 'best guess' approaches to congestion issues at the Glowworm Cave include:

- Replicating snap-shot quantitative surveys (such as the one used in this study)
- Introducing logging and reporting systems for guides and staff.
- Standardising traffic management practices.

Through the implementation of the above measures, the management of the visitor experience can be incorporated within management process driven by quantifiable objectives outlining the nature of the visitor experience to be provided. Ongoing monitoring and reporting systems outlined above can be

introduced using existing resources or with little additional cost. These indicators can then form the basis of a continuous visitor experience management process.

## 7. Acknowledgments

The author would like to thank the following people for their help and cooperation throughout the course of this project: Robert Tahi and the guides at the Waitomo Glowworm Cave, Elery Hamilton-Smith of Rethink Consulting, the Waitomo Caves Museum Society, Greg Martin and Gordon Cessford from the Department of Conservation, Corina Kemp of the National Institute of Water and Atmospheric Research, the staff at the THC Waitomo Caves Hotel, Professor Geoff Kearsley from Otago University, Professor Shun Inoue of Osaka University, the New Zealand Translation Centre, and the Internal Consulting Service of the Institute of Statistics and Operations Research at Victoria University of Wellington, and Steve Sutton of the Department of Conservation and Bev Abbott of the New Zealand Tourism Board for their comments on the initial draft.

## 8. References

- Arrel, R. 1984. Waitomo Caves—A Century of Tourism. Waitomo Caves Museum Society.
- Barskey, D. 1992. Customer Satisfaction in the Hotel Industry: Meaning and Measurement. *Hospitality Research Journal* 16(1): 51-73.
- Butler, R. 1980. The Concept of a Tourist Area Cycle of Evolution: Implications for the Management Of Resources. *The Canadian Geographer* 14(1): 5-12.
- Cessford, G. 1995. Canoeing and crowding on the Whanganui River. *Science & Research Series no.97*. Department of Conservation, Wellington.
- Coughlan D. and Kearsley, G., 1996. Does Participation Affect Perceptions of Crowding: The Case of the New Zealand Backcountry. Proceedings of the Tourism Downunder II Conference, Otago University, 3-6 December.
- DeFreitas, C. R., and Littlejohn, R. N. 1987. Cave Climate: Assessment of Heat and Moisture Exchange. *Journal of Climatology* 7: 553-569.
- Department of Conservation, 1990. Waitomo Glowworm Caves—Licence Agreement. Waikato Conservancy, Hamilton.
- DOC & NZTB 1993. New Zealand Conservation Estate and International Visitors. Department of Conservation and New Zealand Tourism Board, Wellington, July, 1993.
- Evans, M. 1988. Participant Observation: The Researcher as a Research Tool. In: Eyles, J. and Smith, D. (Eds.), *Qualitative methods in Human Geography*. Oxford, Polity Press.
- Graefe, A., Vaske, J. and Kuss, F. 1984. Social Carrying Capacity: An Integration and Synthesis of Twenty Years of Research. *Leisure Sciences* 6(4): 395-431.
- Graefe, A., Vaske, J. and Kuss, F. 1990. Visitor Impact Management: The Planning Framework. National Parks and Conservation Association, Washington DC.

- Graham, R. 1989. Visitor Management and Canada's National Parks, in Graham, R. & Lawrence, R. (Eds): Towards Serving Visitors and Managing our Resources. Tourism Research and Education Centre, University of Waterloo, Waterloo, Ontario, Canada.
- Haberlein, T. and Vaske, J. 1977. Crowding and Visitor Conflict on the Bois Brule River. (report WISC WRC 77-04), Madison, WI: University of Wisconsin Water Resources Centre.
- Hamilton-Smith, E. 1994. Carrying Capacity in Social Context. *Australasian Cave and Karst Management Association Journal*. 17(4): 10-12.
- Hamilton-Smith E. 1995. Maintaining Quality in Park Management. Discussion paper, Rethink Consulting, Melbourne.
- Higham J. and Kearsley, G. 1994. Wilderness Perception and its Implications for the Management of the Impacts of International Tourism on Natural Areas in New Zealand. Paper presented at the 'Tourism Down Under' Conference, Massey University, Palmerston North, New Zealand.
- Hof, M., Hammett, J., Rees, M., Belnap, J., Lime, D., and Manning R. 1994. Getting a Handle on Visitor Carrying Capacity—A Pilot Project at Arches National Park. *Park Science*, Winter 1994: 11-13.
- Kearsley, G. W. 1990. Tourism Development and Users' Perceptions of Wilderness in Southern New Zealand. *Australian Geographer* 21(2): 127-140.
- Kearsley, G; O'Neill, D. 1993. Some Perceptions of Crowding at Selected New Zealand Tourism Sites. Proceedings of the XVth New Zealand Geographical Society Conference, Wellington.
- Kliskey, A; Kearsley, G. 1994. Mapping Multiple Perceptions of Wilderness in North West Nelson, New Zealand. Otago University.
- Malcouronne, K. 1992. Carrying Capacity: Its Application to the New Zealand Tourism Industry. Dissertation, Centre for Tourism, Otago University.
- Manning, R. 1985. Crowding Norms in Backcountry Settings: A review and synthesis. *Journal of Leisure Research* 17(2): 75-89.
- Manning, R. 1986. Studies in Outdoor Recreation. Corvallis, Oregon State University Press.
- Manning, R., Lime, D., Freimund, W., Pitt, D. 1996. Crowding Norms at Frontcountry Sites: A Visual Approach to Setting Standards of Quality. *Leisure Sciences* 18: 39-59.
- NIWA, 1996. Daily Visitor Numbers—Waitomo Glowworm Cave. National Institute of Water and Atmospheric Research, Hamilton.
- NZTB 1994. New Zealand International Visitors Survey. New Zealand Tourism Board, Wellington.
- NZTB 1996. New Zealand International Visitors Survey. New Zealand Tourism Board, Wellington.
- Palmer, D. 1993. The Mount Cook Visitor Survey: A Marketing Strategy Background for Mt. Cook National Park. Dissertation, Centre for Tourism, Otago University.
- Plog, S., 1991. Leisure Travel: Making it a Growth Market ... Again! John Wiley and Sons, New York.
- Shelby, B. and Haberlein, T. 1986. Carrying Capacity in Recreation Settings. Corvallis, Oregon State University Press.
- Shelby, B. Vaske, J. and Haberlein, T. 1989. Comparative Analysis of Crowding in Multiple Locations: Results From Fifteen Years of Research. *Leisure Sciences* 11: 269-291.
- Stankey, G., Cole, D., Lucan, R., Petersen, M., and Frissel, S. 1985. The Limits of Acceptable Change (LAC) System for Wilderness Planning. USDA Forest Service, Intermountain Forest and Range Experiment Station, General Technical Report INT - 176.

- Twight, B., Smith, K., and Wassinger, G. 1981. Privacy and Camping: Closeness to the self vs. closeness to others. *Leisure Sciences 4(4)*: 427-441.
- Waitomo Caves Museum Society 1994. Unofficial Census of Waitomo Caves. Waitomo Caves Museum Society.
- Waitomo News, 1994. Your Holiday Guide to the Waitomo Tourist Region. Te Kuiti.
- Williams P. and Gill., 1994. Tourism Carrying Capacity Management Issues. In: Theobald, W. (Ed.) *Global Tourism: The Next Decade*. Butterworth-Heinemann, Oxford.

# Appendix 1

Isometric diagram of the Glowworm Cave (from De Freitas *et al.* 1982)

# Appendix 2

Waitomo Glowworm Cave Visitor Survey.

# Appendix 3

Test for statistical validity for summer/winter combined samples:

TEST STATISTIC	VALUE	DEGREES OF FREEDOM	ERROR PROBABILITY
PEARSON CHI-SQUARE	191.9378	27	0.0000
LIKELIHOOD RATIO CHI-SQUARE	191.9378	27	0.0000
COEFFICIENT	VALUE	ASYMPTOTIC STD ERROR	
PHI	0.3587		
CRAMER V	0.2071		
CONTINGENCY	0.3376		
GOODMAN-KRUSKAL GAMMA	-0.1421	0.0275	
KENDALL TAU-B	-0.1100	0.0213	
STUART TAU-C	-0.1127	0.0219	
SPEARMAN RHO	-0.1390	0.0259	
SOMERS D (COLUMN DEPENDENT)	-0.0986	0.0266	
LAMBDA (COLUMN DEPENDENT)	0.0632	0.0266	
UNCERTAINTY (COLUMN DEPENDENT)	0.0528	0.0072	