THE ECONOMIC VALUE OF TOURISM IN THE AUSTRALIAN ALPS

By Trevor Mules, Pam Faulks, Natalie Stoeckl and Michele Cegielski

SUSTAINABLE TOURISM CRC

TECHNICAL REPORTS

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Contents

LIST OF TABLES

LIST OF FIGURES

Summary

This study reports on research to determine the economic value of tourism in the Australian Alps. The study's first objective was to measure the economic impact of tourists' expenditure in the Australian Alps, on the economies of the Australian Capital Territory, New South Wales and Victoria. The project involved measuring tourism expenditure in the Alps region and the associated multiplier effects of that expenditure. The economic impact is shown in terms of Gross State Product (GSP) and employment/jobs that are attributed to tourism to each of the states' Alps national parks.

A second objective of the study was to estimate a part of the environmental value of the Australian Alps; namely the recreation use value. This involved using the Travel Cost Method to estimate the economic welfare attributable to recreation in the Alps.

This project provides information on the value of tourism to the Australian Alps, both in terms of economic impacts of visitor expenditure, and in terms the environmental value of the Alps (or, more correctly, a part of the environmental value; namely the recreation use value). The project also provides managers of protected areas with useful data on the demographics and behaviour of visitors to the Australian Alps.

The results contained in this report are based on the responses to surveys distributed over a 12 month period, and provides comparison between the ACT Alps (Namadgi National Park), New South Wales Alps, and the Victorian Alps. Self-completion surveys were distributed throughout the ACT, NSW and Victorian Alps to people visiting the Australian Alps national parks. Questionnaire distribution began in March 2001 and continued for a 12 month period until the end of February 2002, so that both winter and summer visitation is included.

The number of questionnaires returned from each region over the 12 month period was:

ACT Alps	N= 195
NSW Alps	N=3,096
Victorian Alps	N=1,500
TOTAL	N=4,791

A reply-paid envelope was provided with each questionnaire and an incentive prize was offered (the chance to win $500 cash) to encourage visitors to the Australian Alps to return completed surveys. There were also drop boxes provided at visitor centres, retail centres, accommodation and transport centres, etc. The total of 4,791 returns indicate a response rate of approximately 11 per cent, which is fairly typical of self completion surveys of this type.

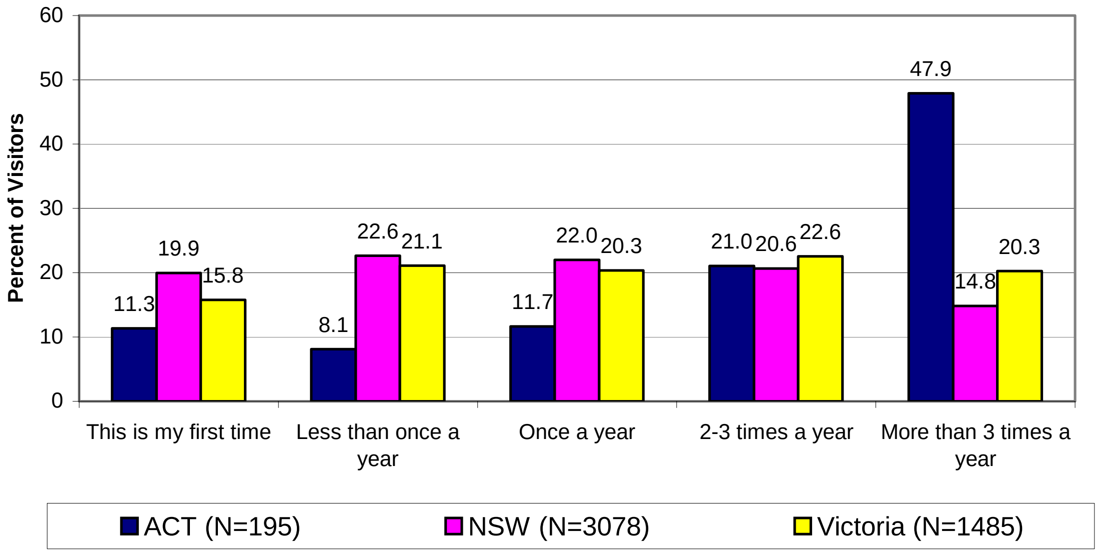
Domestic visitation to the regions appears to be largely dictated by proximity, with approximately 50 per cent of all visitors to each region coming from within the same state/territory.

Table 1. Origin of visitors to the Australian Alps

	ACT (N=188) %	**NSW (N=3,055) %**	**Victoria (N=1,491) %**
ACT	48.6	17.3	6.2
New South Wales	26.1	50.2	22.6
Victoria	16.5	17.4	57.1
Tasmania	.5	0.6	0.4
South Australia	1.6	2.1	4.6
Western Australia	.5	1.1	1.7
Queensland	1.1	5.2	4.1
Northern Territory	1.1	0.1	0.1
International	4.9	6.0	3.2

Figure 1 shows how frequently respondents visit the Australian Alps. Visitors to the ACT Alps are most likely to be regular visitors to the Australian Alps, with over two thirds of respondents (68.9%) indicating that they visit at least twice a year. On the other hand, visitors to the NSW and Victorian Alps are less likely to be frequent visitors to the Alps, with more than one third of respondents (42.5% and 36.9% respectively) indicating they were either visiting for the fist time or visit less than once a year. This compares to only 19.4 per cent of visitors to the ACT Alps.

Figure 1. Frequency of visits to the Australian Alps



A cross tabulation table was calculated to identify if a significant relationship exists between frequency of visit and a visitor's destination (NSW and Victorian Alps only). A significant relationship was found to exist, with those visiting the Victorian Alps more likely to visit more frequently (more than 2 times per year), compared to those visiting NSW Alps.

The economic impacts on each State/Territory are summarised in Table 2. The size of the impacts on GSP is a function of how many interstate visitors go to each of the Alps destinations, and since 2001 was a low snow year, these numbers may have been lower than they otherwise might have been. The economic numbers should therefore be regarded as being towards the lower bound of annual impacts.

Table 2. Economic impact of visitors to the Australian Alps, 2001

	GSP $m.	Employment FTE
Namadgi winter	na	na
Namadgi summer	na	na
Namadgi Total	29.64	456
NSW winter	97.64	1,502
NSW summer	52.57	809
NSW Total	150.21	2,311
Victoria winter	102.97	1,654
Victoria summer	42.06	675
Victoria Total	145.02	2,329

For Namadgi National Park there was insufficient data for a winter/summer breakdown and so annual results are presented. The ACT economy receives an annual boost to GSP of $29.64 million, of which $2 million represents increased tax revenue going to the ACT Treasury. For NSW the GSP boost is $150.21 million per year, of which $10.5 million is increased tax revenue to NSW Treasury on account of expenditure by visitors to the NSW Alps. For Victoria, the boost to GSP is $145.02 million annually, of which $10 million is extra State tax revenue.

The seasonality of economic impacts on NSW and Victoria has changed over the past decade, in line with the growth in summer tourism in each State's alpine areas. Studies in the early 1990s put the winter effect at 89 per cent of the total in NSW, and 83 per cent in Victoria. This study estimates the 2001 winter percentages at 65 per cent and 71 per cent respectively.

In addition to estimating economic impact, the present study also used the Travel Cost Method (TCM) to estimate the consumer surplus attributable to tourism in the Alps. Consumer surplus is a measure of the welfare gained by all domestic visitors to the Alps, regardless of their origin. The TCM is highly sensitive to measurement error and to researcher 'judgement'. Consequently, we choose to generate a range of 'plausible' estimates (rather than single figure estimates). The ranges of estimates are shown in Table 3.

Table 3. Estimates of per-person consumer surplus, annual consumer surplus and recreation use value

	Consumer Surplus ($ per visit)	**Aggregate Consumer Surplus ($ per annum)**	**Recreation Use Value**
ACT	$ 537 - 1,612	$ 86 - 388 million	$ 1 – 19 billion
NSW	$ 127 - 381	$ 102 - 458 million	$ 1 – 23 billion
Victoria	$ 317 - 952	$ 636 - 2,863 million	$ 7 – 146 billion
National Total	$ 342 - 1,028	$ 823 - 3,709 million	$ 9 – 190 billion

Per person consumer surplus estimates are higher in the ACT and Victoria than in NSW. Part of this is due to different travel patterns, and part is due to different expenditure patterns. The higher aggregate consumer surplus estimates in Victoria are due to this and to the fact that there were roughly 2 ½ times more visitors to the Victorian Alps than to the NSW Alps.

Finally, we note that our range of estimates is seemingly large - but in many circumstances a broad range of estimates will be better than no estimate at all. We can, for example, say that the aggregate recreation use value of the Australian Alps lies somewhere between $9 billion and $190 billion; most likely somewhere close to $40 billion. This figure does not include other use-values such as water, electricity or research, or non-use values such as option value and existence value. Therefore, we know that the environmental value of the Australian Alps is most likely well in excess of that.

The data on economic impacts and value of the Alps for tourism and recreation could be regarded as part of the benefits of tourism to the Alps. The Australian Alps Liaison Committee could compare these benefits with the costs of tourism, including environmental costs, in making decisions about the merits or otherwise of increased tourism.

Chapter 1

Introduction

This project was co-funded by the Sustainable Tourism Cooperative Research Centre (STCRC) and the Australian Alps Liaison Committee (AALC), and involved research being undertaken by the University of Canberra and La Trobe University to measure the economic impact of tourism to the Australian Alps national parks.

The study's primary objective was to measure the economic impact of tourists' expenditure in the Australian Alps, on the economies of the Australian Capital Territory, New South Wales and Victoria. The project involved measuring tourism expenditure in the Alps region and the associated multiplier effects of that expenditure. The economic impact is shown in terms of Gross State Product (GSP) and employment/jobs that are attributed to tourism to each of the states' Alps national parks.

A second objective of the study was to a part of the environmental value of the Australian Alps; namely the recreation use value. This involved using the Travel Cost Method to estimate the consumer surplus attributable to recreation in the Alps.

This project provides information of the value of tourism to the Australian Alps, both in terms of economic impacts of visitor expenditure, and in terms of the environmental value of the Alps (or, more correctly, a part of the environmental value; namely the recreation use value). The project also provides managers of protected areas with useful data on the demographics and behaviour of visitors to the Australian Alps.

Chapter 2

Sample Design

The results contained in this report are based on the responses to surveys distributed to visitors to alpine parks over a 12 month period, and provides comparison between the ACT Alps (Namadgi National Park), New South Wales Alps, and the Victorian Alps. It is important to note that these respondents may have visited other places on their trip and so the results relate to respondents' entire trip to the Australian Alps and may not be directly related to the region where the questionnaires were collected.

This Chapter outlines the process by which primary data was gathered from the visitors using sample survey methods. Self-completion surveys were distributed throughout the ACT, NSW and Victorian Alps to people visiting the Australian Alps national parks. Questionnaire distribution began in March 2001 and continued for a 12 month period until the end of February 2002, so that both winter and summer visitation is included.

Questionnaires were distributed at a variety of places throughout the Australian Alps, including visitor centres, campgrounds, visitor entrance stations and accommodation and local business establishments. Visitors to the Australian Alps were asked to complete the survey and return it to the University of Canberra via the attached reply paid envelope, or alternatively, deposit in the 'Drop Boxes' that were located at many distribution points.

In the ACT Alps, surveys were distributed at Namadgi National Park Visitor Centre and Namadgi National Park campgrounds. Face to face surveys were also conducted at the campgrounds several times throughout the 12 month period.

Due to the differences in size, surveys were distributed in a wider variety and number of points in NSW and Victorian Alps regions. In NSW Alps, distribution points included:

- Jindabyne Visitor Centre;
- Jindabyne Entrance Stations;
- Tumut Visitor Centre;
- Yarangobilly Caves;
- Thredbo Newsagency;
- Silvertop Snowy Mountains Retreat, Jindabyne;
- Adaminaby accommodation establishments;
- Khancoban Visitor Centre;
- Thredbo Ski Lift Ticket Office; and
- Perisher Blue Ski Tube.

Face to face surveys were also conducted at Jindabyne Visitor Centre several times throughout the 12 month period.

In Victorian Alps, distribution points included:

- Bright accommodation establishments;
- Mt Buffalo Chalet;
- Mt Buffalo Entrance Station;
- Bright Visitor Centre;
- Dinner Plain Central Reservations;
- Bairnsdale Tourist Information Centre;
- Orbost Tourist Information Centre;
- Omeo Tourist Information Centre;
- Falls Creek Resort Management/Visitor Entrance Station;
- Mt Hotham Resort Management Visitor Information Centre;
- Mansfield Tourist Information Centre;
- Parks Victoria Office, Bright; and
- Stoney's Horseriding, Mansfield.

Face to face surveys were also conducted at Bright Visitor Centre in November 2001.

The number of questionnaires returned from each region over the 12 month period was:

ACT Alps	N= 195
NSW Alps	N=3,096
Victorian Alps	N=1,500
TOTAL	N=4,791

A reply-paid envelope was provided with each questionnaire and an incentive prize was offered (the chance to win $500 cash) to encourage visitors to the Australian Alps to return completed surveys. There were also drop boxes provided at visitor centres, retail centres, accommodation and transport centres, etc. The total of 4,791 returns indicate a response rate of approximately 11 per cent, which is fairly typical of self completion surveys of this type.

Note that the number of useable questionnaires from visitors to NSW was higher than might have been expected. This was due to the distribution of questionnaires at the Jindabyne entrance stations which captured a large proportion of visitors to the NSW Alps. The same concentration of visitors does not occur in the ACT and Victoria and so mass distribution of questionnaires is more costly in those areas.

The accuracy with which a sample of this kind can be used to estimate characteristics of the target population of all visitors to the Australian Alps is affected by two major issues of sampling theory:

1. Bias – the more representative the sample is of the underlying population, the less will be the bias. In order to achieve representativeness it is desirable to have a truly random sample where each element of the population has an equal chance of being selected in the sample.
2. Efficiency – the smaller is the variability of the distribution of sample means, the greater will be the statistical efficiency of the sample[1]. In practice this means that the greater the sample size, the greater the chance that the sample mean is close to the population mean.

In this project it was impractical to aim for bias-free sampling because it was virtually impossible to use random sampling, given the large geographical area being sampled, the diversity of visitor types, the seasonality of the attraction, and the range of entry points to the Australian Alps National Parks. Instead we opted for statistical efficiency and aimed to have as many questionnaires completed as possible from as many locations as possible, given the budget.

Accordingly, a broad approach to sampling was adopted where it was attempted to ensure that the major tourism locations and types were covered with effort put into questionnaire distribution, with the incentive prize being the vehicle for achieving the response rate. The resultant sample is not necessarily free from bias, but it does have the characteristic that the large sample size gives a good chance that the estimated means of the various attributes of visitors are close to the true values of those attributes for all visitors.

[1] The standard error of estimate of the mean is $\delta/\sqrt{n}$, where δ is the standard deviation of the underlying population, and n is the sample size. Thus the larger is n, the smaller the standard error of estimate of the mean.

Chapter 3

Survey Characteristics

This Chapter summarises the main characteristics of the sample of visitors, according to whether they were visiting the Alps in NSW, ACT and/or Victoria. Details are given for demographics, length of stay, activities undertaken, and expenditure. All data relate to the survey itself, with subsequent chapters using these results to make inferences about all visitors to the Alps.

Demographics

Group Size

Group size characteristics are consistent across all regions in the Australian Alps.

Table 4 shows the average group size of visitors travelling to the Australian Alps. Although visitors travelling to NSW tend to be travelling, on average, in slightly larger groups (3.88) than those travelling to the Victorian Alps (3.68) or ACT Alps (3.61), the median group size for both NSW and Victorian Alps was three people, decreasing to two people in the ACT Alps.

Table 4. Group size of visitors to the Australian Alps

	ACT (N=193)	NSW Alps (N=3069)	Victorian Alps (N=1487)
Average group size	3.61	3.88	3.68
Median group size	2	3	3

Table 5 provides greater detail regarding the size of groups visiting the Australian Alps, and illustrates that the majority of visitors travel with one other person, regardless of the region visited. The next popular group size is four people.

It is interesting to note that groups of four or less people make up over three quarters of visitors (79%) in each region, while visitors to the ACT are most likely to travel by themselves (10.36%) and visitors to the Victorian Alps, least likely (5.92%).

Table 5. Frequency of group sizes of visitors to the Australian Alps

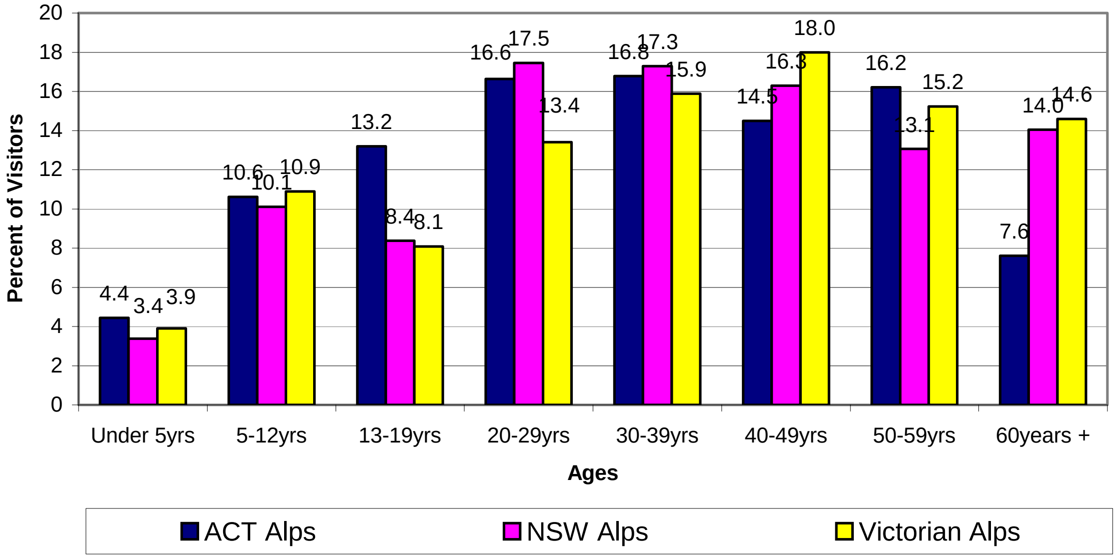
No. of people in group	ACT (N=193) %	NSW (N=3,069) %	Victoria (N=1,487) %
1	10.36	7.20	5.92
2	**41.97**	**41.67**	**41.76**
3	11.91	11.80	13.32
4	**15.03**	**18.28**	**18.16**
5	5.18	7.85	8.54
6	4.15	3.23	3.63
7	1.55	2.09	2.22
8	2.59	1.66	1.28
9	3.11	1.08	1.21
10	0.00	0.72	0.74
11 to 20	3.63	3.16	2.49
20+	0.52	1.27	0.81

Age and Gender

A comparison of the age of visitors to each of the Australian Alps regions is provided in Figure 2, while Figures 3 to 5 give a more detailed breakdown of the age and gender of visitors to each region. This not only includes the age of respondents, but also the age of their travelling companions.

Figure 2 highlights several variations between the ages of visitors to each region, with the greatest variations appearing in visitors to the ACT Alps in the 13–19 years and 60 years and over groups, compared to visitors to the NSW and Victorian Alps in these age groups.

Figure 2. Age of visitors to the Australian Alps



Overall, gender distribution of visitors to the Australian Alps was fairly even, with each region having only a slightly higher percentage of males to females:

- ACT Alps – 53% males;
- NSW Alps – 51% males; and
- Victorian Alps – 52% males.

Figure 3 illustrates the age and gender of visitors to ACT Alps (N=697). The most strongly represented age groups are the 30-39 years group (16.8%), closely followed by 20-29 years (16.6%) and 50-59 years (16.2%). In fact, approximately one third of visitors to the ACT Alps (33.4%) are between 20 and 39 years of age, and almost two thirds (64.1%) are between 20 years and 59 years of age. Interestingly, however, only 7.6 per cent of visitors to this region are 60 years or over, compared to 14.0 per cent of visitor to NSW Alps, and 14.6 per cent of visitors to Victorian Alps.

Figure 3. Age and gender of visitors to ACT Alps

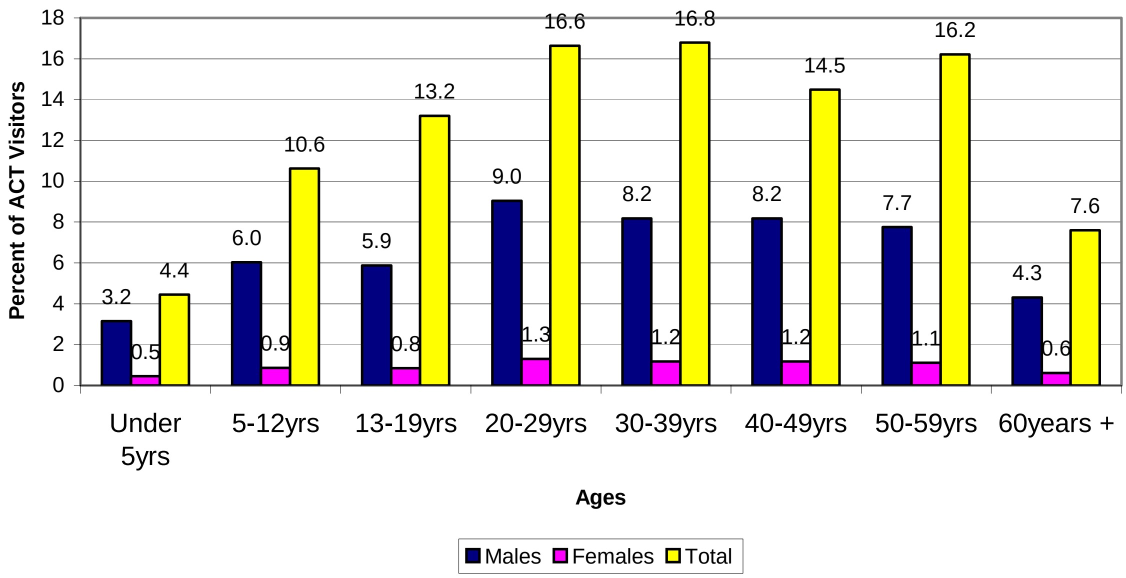


Figure 4 provides data on the age and gender of visitors to the NSW Alps (N=11,781). The most common age group in this region is 20-29 years of age (17.5%), closely followed by those 30-39 years (17.3%), and 40-49 years of age (16.3%). These three groups combined make up just over half (51.0%) of all visitors to the NSW Alps, representing a slightly younger cohort of visitors than those that visit the ACT and Victorian Alps.

Figure 4. Age and gender of visitors to NSW Alps

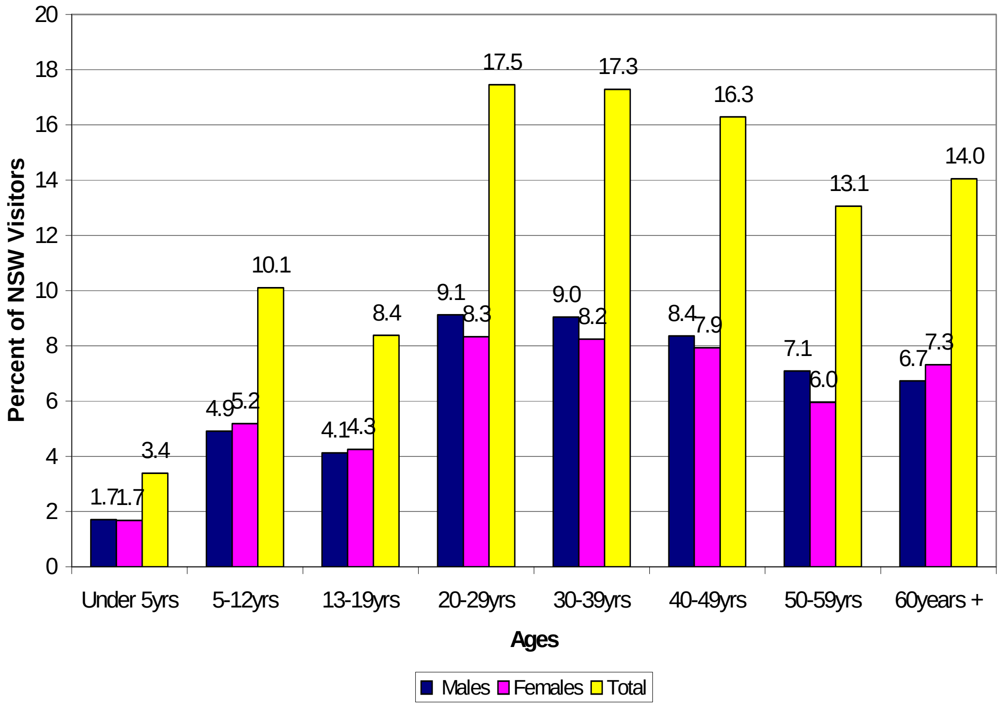
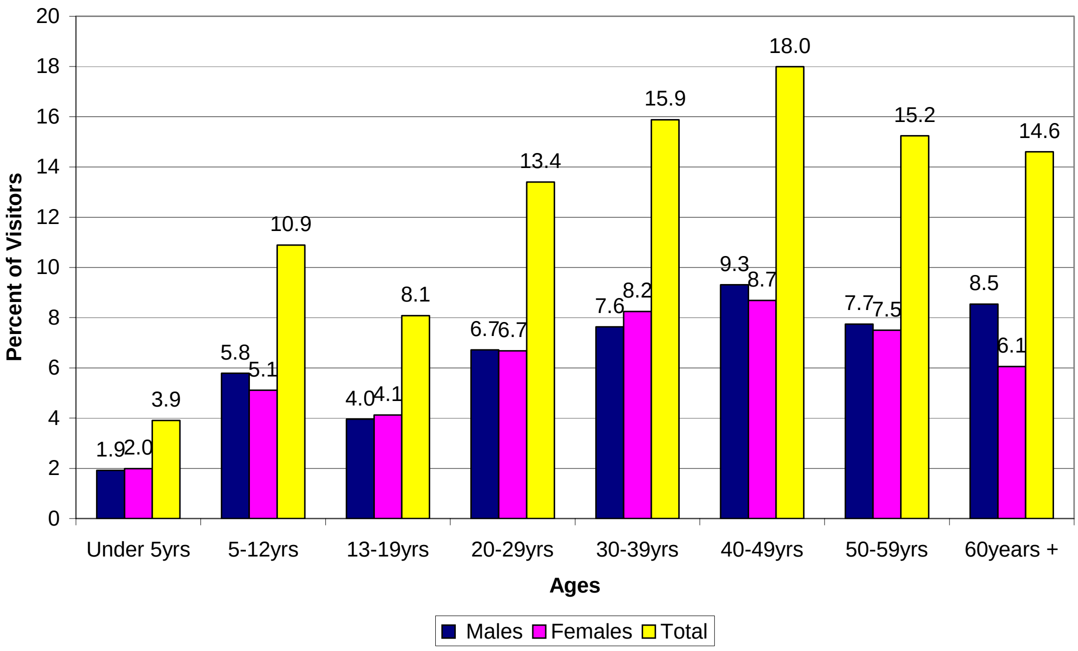


Figure 5 illustrates the age and gender of visitors to Victorian Alps (N=5,479). The most frequently represented age group in this region is 40-49 years (18.0%), followed by the 30-39 years (15.9%) and 50-59 years (15.2%) age groups. Like visitors to the ACT Alps, these three groups combined make up approximately half (49.1%) of all visitors to the region.

Of the three regions, Victorian Alps has the oldest predominant age group: 40-49 years, compared to 30-39 years in the ACT Alps and 20-29 years in NSW Alps. It also has the greatest representation of those 60 years and over (14.6%).

Figure 5. Age and gender of visitors to Victorian Alps



Origin

Tables 6 and 7 show the origin of visitors to each of the Australian Alps regions. Table 6 shows that respondents were primarily domestic visitors, with between 94 and 97 per cent of visitors residing within Australia. Domestic visitation to the regions appears to be largely dictated by proximity, with approximately 50 per cent of all visitors to each region coming from the surrounding region.

Table 6. Origin of visitors to the Australian Alps

	ACT (N=188) %	NSW (N=3,055) %	Victoria (N=1,491) %
ACT	48.6	17.3	6.2
New South Wales	26.1	50.2	22.6
Victoria	16.5	17.4	57.1
Tasmania	.5	0.6	0.4
South Australia	1.6	2.1	4.6
Western Australia	.5	1.1	1.7
Queensland	1.1	5.2	4.1
Northern Territory	1.1	0.1	0.1
International	4.9	6.0	3.2

Table 7 provides more detailed information about the origins of international visitors. It is important to remember that international visitors make up only a small proportion of visitors to the Australian Alps, and so figures in Table 7 are based on a smaller sample group, particularly in relation to the ACT Alps. Despite this limitation, it is interesting to note the predominance of visitors from Europe and the United Kingdom. Also interesting is that visitors from New Zealand, who are Australia's largest source of visitors (BTR 2000), make up less than 10 per cent of all international visitor to the NSW and Victorian Alps.

Table 7. Origin of international visitors to the Australian Alps

	ACT (N=7) %	NSW (N=182) %	Victoria (N=48) %
Asia	0.0	2.7	16.7
Africa	0.0	1.6	4.2
Canada	28.6	7.7	4.2
Europe	28.6	**38.5**	**31.3**
Middle East	0.0	0.5	2.1
New Zealand	14.3	6.0	8.3
Northern Ireland	0.0	0.5	0.0
South America	0.0	0.5	0.0
UK	14.3	**28.0**	**27.1**
USA	14.3	13.7	6.3

Occupation

Data concerning the occupation of visitors to the Australian Alps is consistent across the three regions, apart from a higher percentage of students visiting the ACT Alps (14.9%), compared to the NSW Alps (5.9%) and Victorian Alps (6.3%). The most frequently represented occupation category in all regions is 'professional', with at least one third of visitors to each of the regions categorising themselves this way (between 36.5% and 40.7%). This is followed by managers/administrators (between 13.8% and 17.2%) and, in NSW and Victoria, retirees (13.1% and 13.5%, respectively).

The percentages of retirees in each region is consistent with data presented in Figures 2 - 4 , showing age distribution of visitors to each region, with those 60 years and over making up between 8 to 15 per cent of all visitors.

Table 8. Occupation of visitors to Australian Alps

Occupation	ACT (N=195) %	NSW (N=3084) %	Victoria (N=1493) %
Manager/administrator	**15.9**	**17.2**	**13.8**
Professional	**40.5**	**36.5**	**40.7**
Para-professional	2.6	3.5	3.3
Tradesperson	1.5	5.7	4.7
Machine operator/driver	1.5	1.2	1.5
Labourer & related	0.5	1.0	0.7
Sales and personal services	1.0	3.9	3.3
Clerk	3.1	3.6	2.1
Home duties	2.1	3.7	4.2
Retired	9.7	**13.1**	**13.5**
Student	**14.9**	5.9	6.3
Unemployed	1.0	0.6	0.5
Other	5.6	4.3	5.6

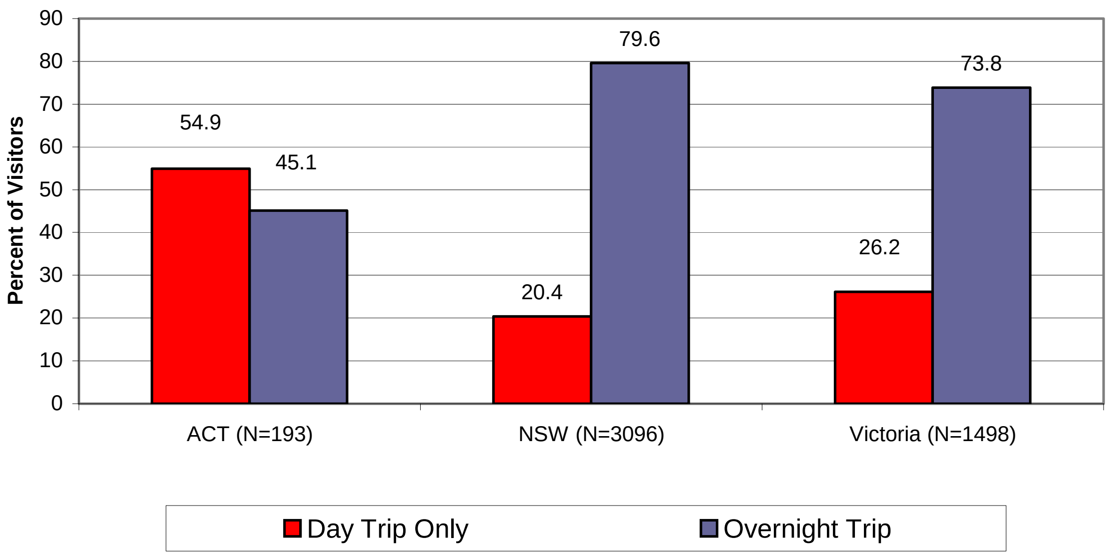
Behaviour

Length of Stay

Figure 6 indicates whether or not visitors stayed overnight in the Australian Alps. There is a significant difference between visitors to NSW and Victorian Alps, and visitors to the ACT Alps. Visitors to ACT Alps have a greater likelihood of being on a day trip (54.9%), compared with visitors to the NSW (20.4%) and Victorian (26.2%) Alps. Important to note when analysing these figures is that only limited accommodation options are available in Namadgi National park.

It is possible that the difference between day trips to NSW Alps (20.4%) and Victorian Alps (26.2%) may be related to Melbourne's proximity to the Victorian Alps, compared to Sydney's proximity to the NSW Alps.

Figure 6. Day trips and overnight trips to Australian Alps



The average length of stay for all visitors to the Australian Alps, as well as overnight visitors only, is represented in Table 9, and shows details for both all visitors to that region, as well as for those visitors who reside outside that specific state. As seen in Table 6, approximately half of the visitors to each region reside within that state, which is an important factor when estimating the economic value of tourism to the Australian Alps to each state/territory.

Figures provided in Table 9 illustrate that, while non resident visitors to ACT and Victorian Alps (including day trippers and overnight visitors combined, as well as overnight visitors only), stay longer than residents of those states/territories, for visitors to the NSW Alps, the reverse is true. Excluding day trippers, non resident visitors to the Victorian Alps have the greatest average length of stay (4.50 nights), and it appears that Victorian residents stay longer is the Victorian Alps than the residents of NSW and the ACT stay in their respective alpine areas. As mentioned above, accommodation options are very limited in the ACT Alps, which is reflected in the low number of nights for both all visitors (1.48 nights) and non-ACT residents (1.75 nights).

When only those visitors that stay overnight are considered, the average length of stay naturally increases, as day trippers are excluded from the calculations. Non resident visitors to the Victorian Alps have the longest average length of stay (4.50 nights), followed by all visitors to the Victorian Alps (4.34 nights). Overnight visitors to the ACT Alps (including both residents and non residents), have the shortest average length of stay (2.80 nights), followed by non resident visitors to the NSW Alps.

Table 9. Average length of stay in the Australian Alps

	ACT Alps		NSW Alps		Victorian Alps	
	All Visitors N=221	**Non ACT Residents N=124**	**All Visitors N=2,651**	**Non NSW Residents N=1,356**	**All Visitors N=1,410**	**Non Victorian Residents N=656**
Average no. of nights – day trips and overnight trips combined	1.48	1.75	3.58	3.34	3.50	3.65
	All Visitors N=94	**Non ACT Residents N=54**	**All Visitors N=2,190**	**Non NSW Residents N=1,086**	**All Visitors N=1,102**	**Non Victorian Residents N=516**
Average no. of nights – overnight trips only	2.80	3.37	4.23	4.05	4.34	4.50

Figures 7 (all visitors) and 8 (visitors form outside each state/territory) indicate that for those visitors staying overnight, they are most likely to stay between three and five nights for visitors to NSW or Victoria. ACT visitors tend to be mainly day trippers. The next most frequent length of stay in NSW and Victorian Alps is a day trip, applying to at least one fifth of all visitors and non resident visitors to these regions.

As mentioned above, visitors to the ACT Alps are most likely to be undertaking a day trip (67.3% - all visitors; 60.8% - non resident visitors). If visitors to ACT Alps do stay overnight (Namadgi National Park only), they are most likely to stay between one and five nights.

Figure 7. Length of stay of visitors to the Australian Alps

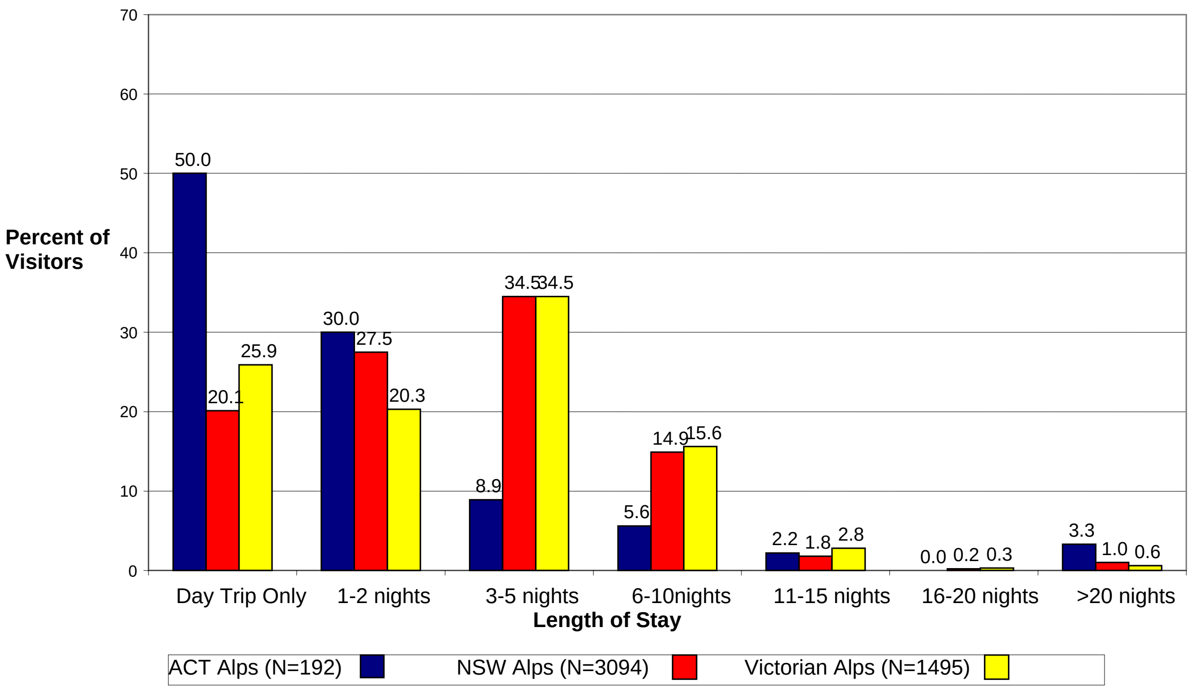
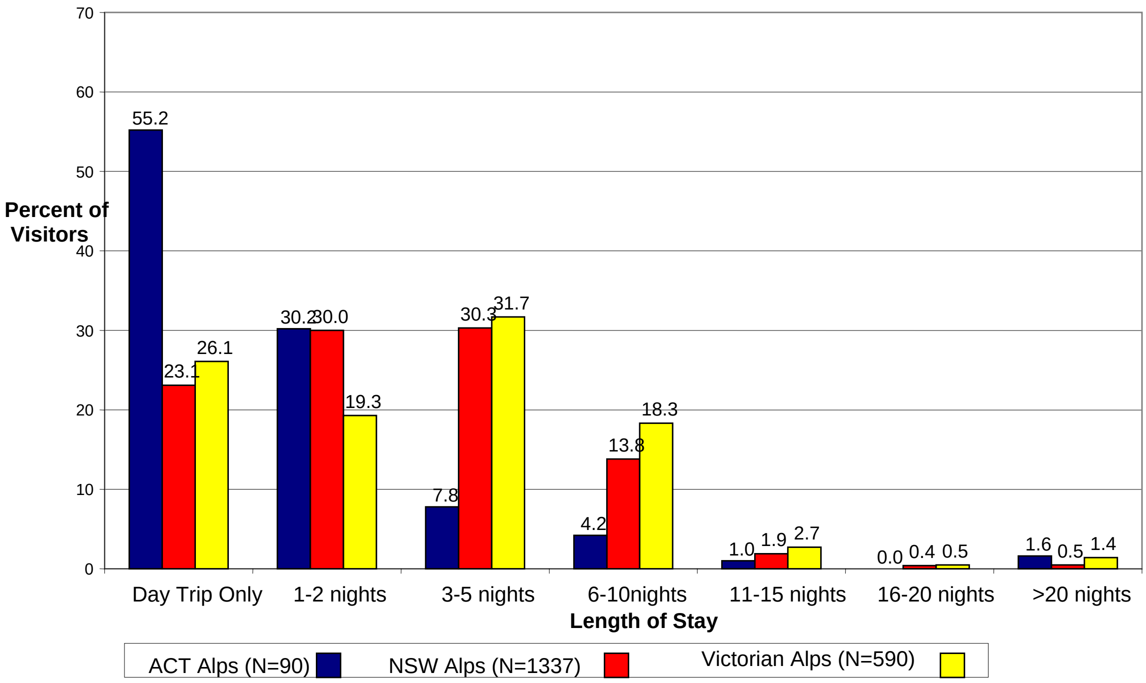


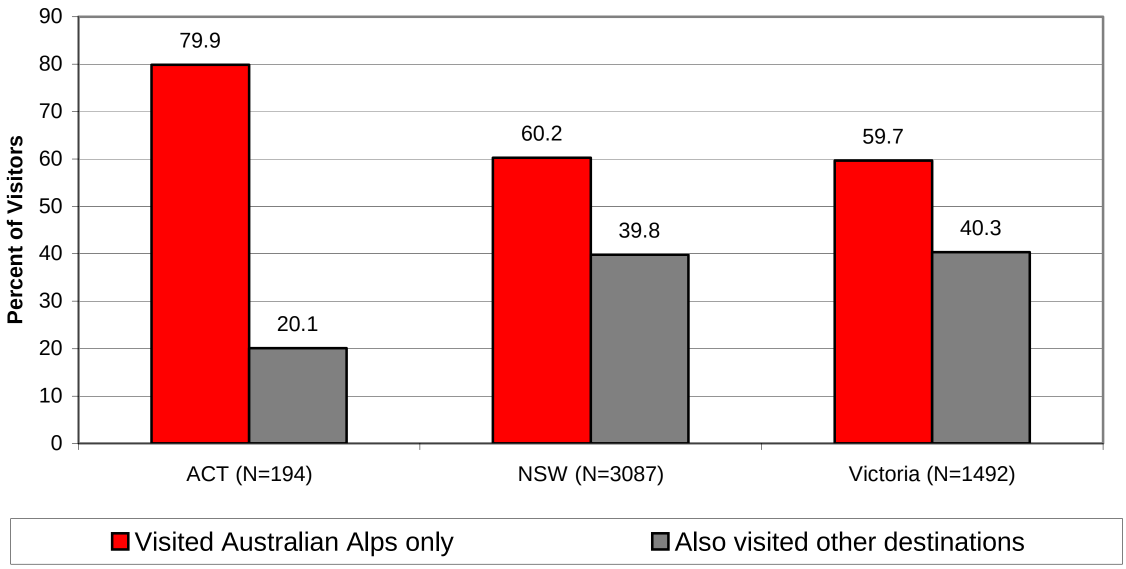
Figure 8. Length of stay in the Australian Alps – non residents



Nature of Trip

People on a trip to the Australian Alps may just be visiting places in the Australian Alps, or they may be visiting other places as part of their trip. For example, they may be car touring across Victoria and a visit to Mt Buffalo National Park may just be one part of that trip. Figure 9 shows whether or not respondents were just visiting the Australian Alps, and illustrates that the majority of visitors to all three regions were only visiting the Australian Alps. Visitors to the ACT Alps are most likely to be visiting only the Australian Alps, with only about one fifth of visitors also including other destinations in their trip. Figures for NSW and Victorian Alps are almost identical, with approximately two fifths of visitors including other destinations in their trips, and two fifths only visiting the Australian Alps.

Figure 9. Nature of trip to the Australian Alps



Activities Undertaken in the Australian Alps

Figures 10-12 illustrate the activities undertaken by visitors to each of the three regions. When looking at the information provided in these graphs it is important to remember that the information provided by respondents undertaken at the place where the survey was distributed. Respondents could also nominate as many activities as applicable, and so percentages do not equal 100.

Activity data for NSW and Victoria are shown for 'summer' (October to March) and 'winter' (April to September). However, for the ACT the sample size was too small to enable this.

Figure 10 illustrates that visitors to the ACT Alps are most likely to participate in bushwalking/hiking (88.2%), followed by nature appreciation (55.9%), car touring/sightseeing (37.4%) and camping (37.4%).

Figure 10. Activities undertaken by visitors to the ACT Alps

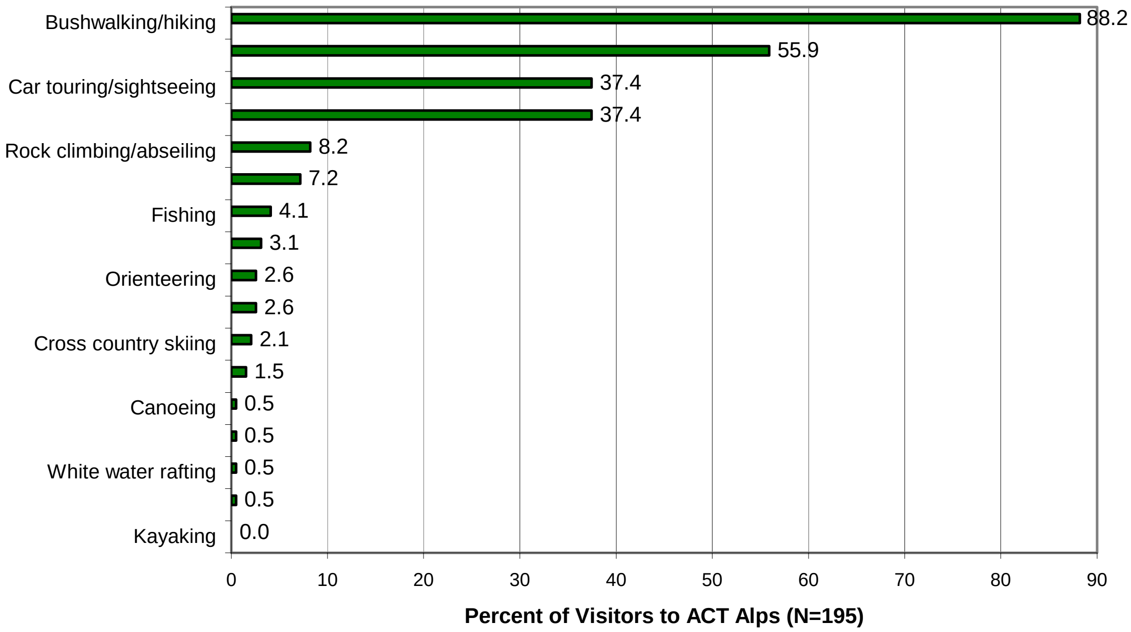
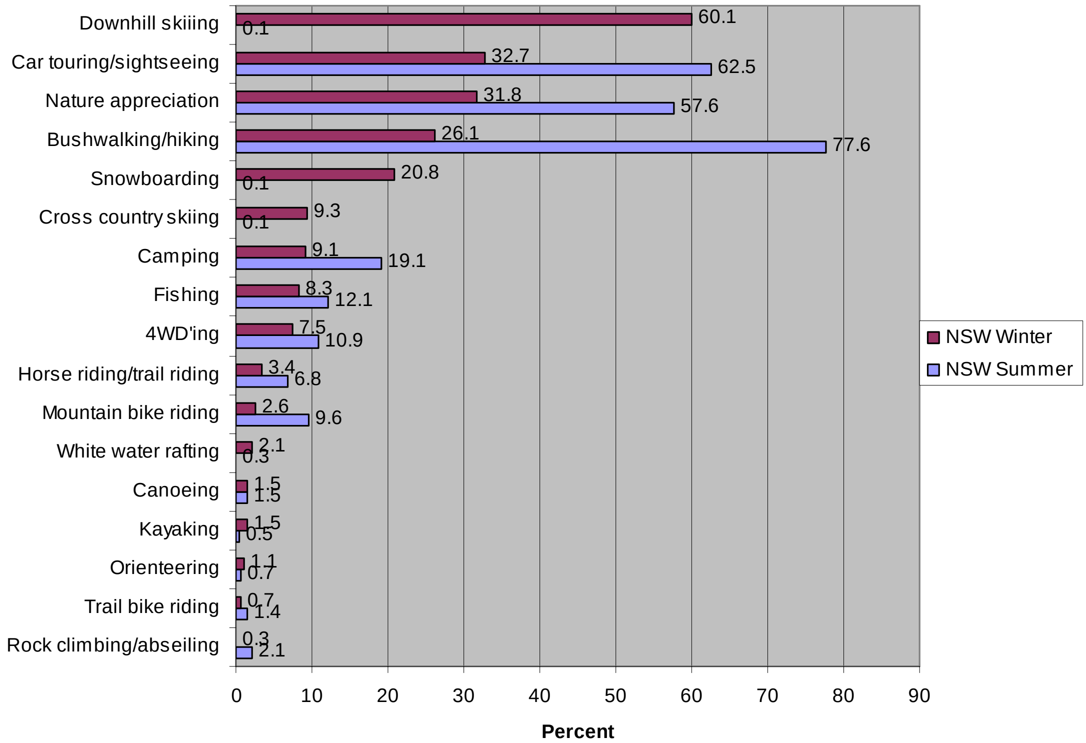


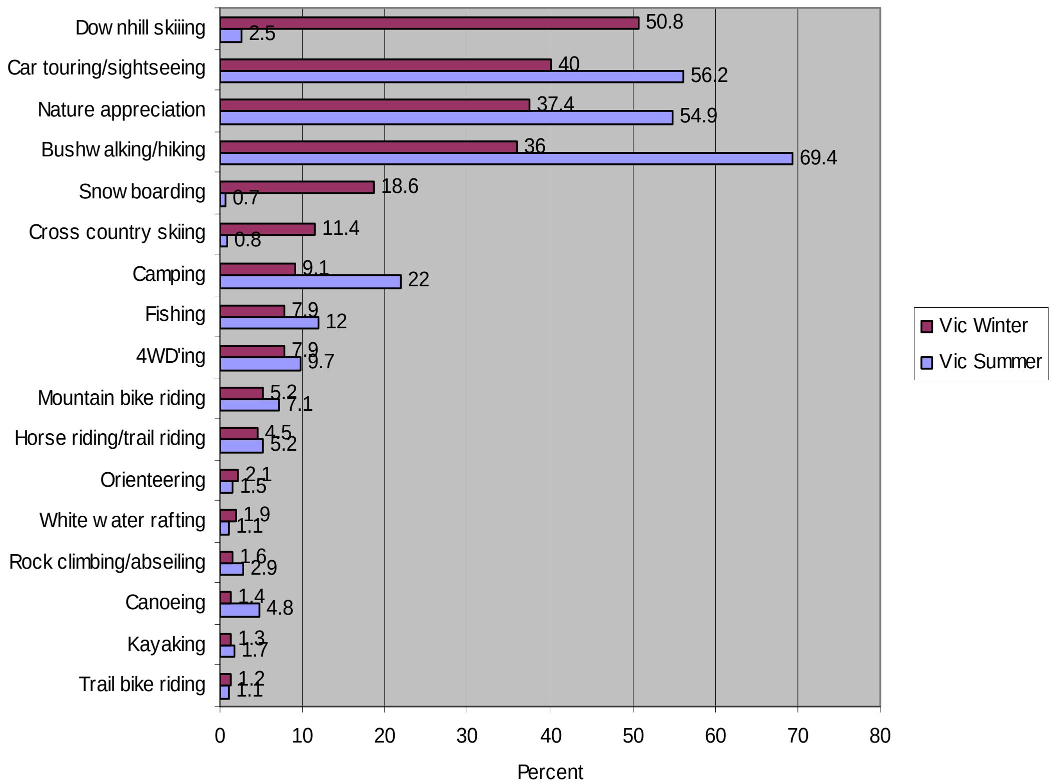
Figure 11 illustrates activities undertaken by visitors to the NSW Alps and shows, as would be expected, that downhill skiing is most popular in winter (60.1%), and bushwalking is most popular in summer (77.6%). It is worth noting the popularity of sightseeing, nature appreciation, and bushwalking (all over 25%) in winter as well as in summer. Also of note is the popularity of mountain bike riding in summer (9.6%).

Figure 11. Activities undertaken by visitors to NSW Alps



Visitors to the Victorian Alps are most likely to participate in bushwalking/hiking (69.4%), car touring/sightseeing (56.2%) and nature appreciation (54.9%) in summer. As would be expected, winter is dominated by downhill skiing (50.8%). Again, note the popularity of car touring (40%), nature appreciation (37.4%), and bushwalking (36%) in winter, which would be regarded by some people as the off-season for these pursuits

Figure 12. Activities undertaken by visitors to Victorian Alps



Respondents were also given the option to nominate other activities they participated in during their visit to the Australian Alps that were not among the activities listed in the survey. Similar activities were grouped together and appear in Table 10.

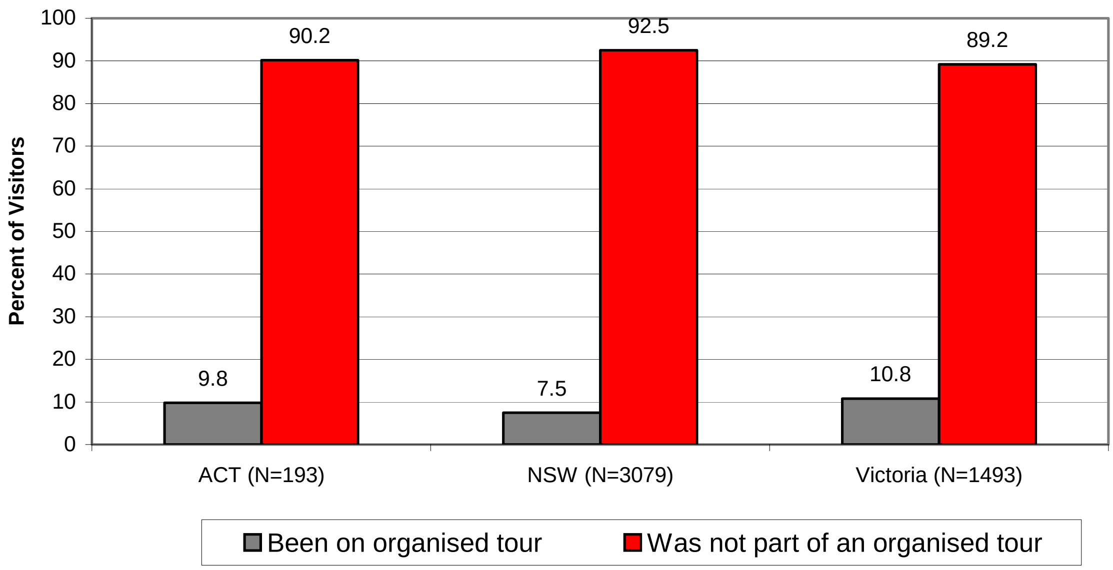
Table 10. Other activities undertaken by visitors to the Australian Alps

	ACT Alps (N=161) %	NSW Alps (N=3,096) %	Victorian Alps (N=1,500) %
Music Festival	0.0	1.6	0.2
Rest and Relaxation	1.2	1.5	2.5
Golf	0.0	1.3	0.2
Caving	0.0	1.2	0.5
Photography	4.4	1.2	2.1
Swimming	0.6	1.2	0.1
Tobogganing	0.0	1.0	0.1
Other Sports	2.5	0.8	0.9
BBQ/Picnic	3.1	0.4	0.6
Bird Watching/Feeding	0.6	0.4	0.8
See Aboriginal rock art/painting or Sacred Sites	3.1	0.0	0.0
Running	1.2	0.1	0.3

Organised Tours

The overwhelming majority of visitors to each of the regions of the Australian Alps do not go on an organised tour. This is illustrated in Figure 13.

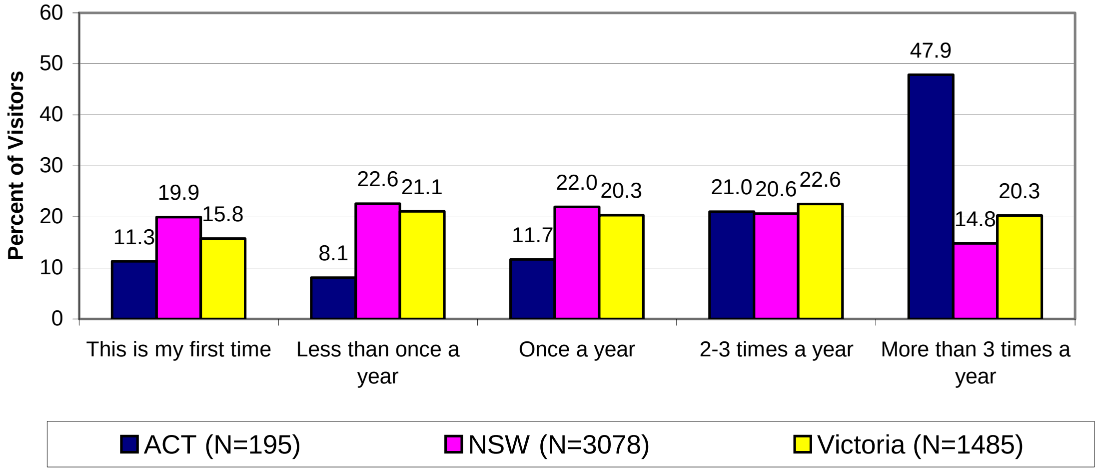
Figure 13. Participation in organised tours



Frequency of Visits to the Australian Alps

Figure 14 shows how frequently respondents visit the Australian Alps. Visitors to the ACT Alps are most likely to be regular visitors to the Australian Alps, with over two thirds of respondents (68.9%) indicating that they visit at least twice a year. On the other hand, visitors to the NSW and Victorian Alps are less likely to be frequent visitors to the Alps, with more than one third or respondents (42.5% and 36.9% respectively) indicating they were either visiting for the fist time or visit less than once a year. This compares to only 19.4 per cent of visitors to the ACT Alps.

Figure 14. Frequency of visits to the Australian Alps



A cross tabulation table was calculated to identify if a significant relationship exists between frequency of visit and a visitor's destination (NSW and Victorian Alps only). A statistically significant relationship was found to exist, with those visiting the Victorian Alps likely to visit more frequently (more than 2 times per year), compared to those visiting NSW Alps.

Trip Expenditure

Table 11 shows the proportion of visitors to each of the Alps regions that reside within or outside the state/territory. The proportion of visitors from outside the state will affect the economic impact of tourism to the Alps in each state. In other words, the larger the ratio of non residents to residents, the greater the economic impact. Figures represented in Table 11 represent number of respondents visiting each state/territory, and as some respondents visited more than one state, figures do not match the number of respondents.

Table 11. Ratio of resident to non resident visitors

Visitor Source	ACT Alps (N=187) %	NSW Alps (N=3,059) %	Victorian Alps (N=1,500) %
Residents	50.80	48.55	53.18
Non Residents	49.20	51.45	46.82

Tables 12-14 show the average expenditure per visitor for each Alps region. For the purpose of analysing expenditure visitors have been grouped into three categories: day tripper, overnight visitor and package tourist. The tables also compare average expenditure for all visitors to the average expenditure of visitors who have travelled from outside the state. This group of visitor expenditure will be used to calculate the economic value of tourism to the Alps of each state/territory. It is important to note that the data presented in the following tables is average expenditure per person. However, for ease of interpretation the tables also show a line of per person per night expenditure.

Table 12. Average expenditure in ACT Alps per visitor

	Day Trippers		Overnight Visitors		Package Tourists	
Expense Category	**All Visitors N=127 $**	**Non ACT residents N=70 $**	**All Visitors N=93 $**	**Non ACT residents N=54 $**	**All Visitors N=8 $**	**Non ACT residents N=6 $**
Package costs	n/a	n/a	n/a	n/a	105.84	134.93
Accommodation	n/a	n/a	16.04	13.70	40.50	33.75
Food and drink	4.84	5.78	20.95	24.28	20.54	24.86
Transport (petrol, taxis, buses, car hire etc.)	5.35	6.85	16.26	20.03	14.28	16.90
Park entry fees	2.93	2.55	6.93	8.09	1.86	1.24
Lift tickets, fishing licences, camping permits etc	3.13	3.21	6.63	7.11	0.15	0.03
Shopping, Ski hire, Equipment hire	4.78	5.36	11.65	11.04	37.17	18.59
Entertainment (clubs, gambling, cinema etc.)	1.79	1.82	5.36	6.12	16.67	9.98
Other (medical, hair etc.)	2.09	2.02	12.98	13.00	1.52	0.13
Total average expenditure per person	**24.91**	**27.59**	**96.80**	**103.38**	**238.52**	**240.39**
Total average expenditure per person per night	**24.91**	**27.59**	**34.57**	**30.68**	**238.52**	**240.39**

Note that because the tables show averages, package tourists are shown as having accommodation costs. This is because some packages include accommodation, some do not, and so the average package tourist will show some accommodation expenditure.

Expenditure figures for the ACT may be artificially low because of a lack of accommodation in Namadgi – it may have been that overnight visitors may have stayed elsewhere in the ACT but may have not shown this in their survey. It is also important that it is stated that this potentially artificially low expenditure figure may have flow on effects for other calculations on the total economic benefit for the ACT.

Table 13. Average expenditure in NSW Alps per visitor

	Day Trippers		Overnight Visitors		Package Tourists	
Expense Category	**All Visitors N=450 $**	**Non NSW Residents N=279 $**	**All Visitors N=2,178 $**	**Non NSW Residents N=1,076 $**	**All Visitors N=431 $**	**Non NSW Residents N=219 $**
Package Costs	n/a	n/a	n/a	n/a	395.63	353.21
Accommodation	n/a	n/a	147.59	139.68	119.05	125.21
Food and Drink	18.64	14.96	71.67	64.26	77.06	74.29
Transport (petrol, taxis, buses, car hire etc.)	19.34	18.87	43.50	42.05	48.89	55.35
Park entry fees	6.78	6.35	16.26	14.45	16.32	15.33
Lift tickets, fishing licences, camping permits etc.	34.12	28.71	91.15	91.47	107.61	96.59
Shopping, ski hire, Equipment hire	24.50	20.38	59.30	55.46	64.64	60.07
Entertainment (Clubs, gambling, cinema etc).	9.07	5.50	37.44	29.91	40.60	36.74
Other (medical, hair etc)	11.04	10.14	26.01	21.22	28.42	25.35
Total average expenditure per person	**123.49**	**104.91**	**493.83**	**458.50**	**898.21**	**842.16**
Total average expenditure per person per night	**123.49**	**104.91**	**116.74**	**113.21**	**219.08**	**246.96**

Table 14. Average expenditure in Victorian Alps per visitor

	Day Trippers		Overnight Visitors		Package Tourists	
Expense Category	**All Visitors N=304 $**	**Non Victorian Residents N=138 $**	**All Visitors N=1,092 $**	**Non Victorian Residents N=512 $**	**All Visitors N=174 $**	**Non Victorian Residents N=85 $**
Package Costs	n/a	n/a	n/a	n/a	320.13	351.07
Accommodation	n/a	n/a	122.59	113.75	90.22	87.83
Food and Drink	11.66	13.03	64.10	69.94	48.87	63.64
Transport (petrol, taxis, buses, car hire etc.)	9.61	11.87	40.49	49.07	37.78	47.04
Park entry fees	2.04	2.35	9.29	9.63	5.75	6.41
Lift tickets, fishing licences, camping permits etc.	12.48	9.41	71.72	77.79	17.70	13.77
Shopping, ski hire, Equipment hire	14.93	22.36	43.40	39.93	33.33	38.65
Entertainment (Clubs, gambling, cinema etc).	6.32	6.31	25.88	26.60	20.98	20.14
Other (medical, hair etc)	4.68	7.13	19.99	23.44	17.60	14.80
Total average expenditure per person	**61.72**	**72.46**	**397.46**	**410.16**	**592.37**	**643.36**
Total average expenditure per person per night	**61.72**	**72.46**	**91.58**	**91.15**	**167.34**	**167.98**

In the next section, the expenditure by non-resident visitors to each Alps National Park area is used to estimate the economic impact of visitors to the Parks on the State/Territory economy. Expenditure by visitors to NSW in general exceeds that by visitors to Victoria and the ACT.

Chapter Summary

In general, visitors to the Alps tend to be professionals between the ages of 20 and 50, travelling in groups of 2-4 and staying 3-4 nights in the Alps. They tend to visit the Alps in their own State, and undertake a wide range of activities, including snow based sports for winter visitation, and bushwalking in summer.

Visitors to the NSW Alps tend to spend more than visitors to Victoria, and visitors to the ACT spend the least. The largest item of expenditure is accommodation, followed by food, and transport which is typical pattern for tourism in general.

Chapter 4

Economic Impact

This Chapter uses the expenditure data from the previous Chapter and models the impacts of that expenditure on the Gross State Product and employment of each State and Territory.

Background

Methodology and Previous Studies

There have been economic impact studies conducted on visitation to Kosciuszko National Park (KPMG Management Consulting 1994), the Victorian Alps (Centre for South Australian Economic Studies 1993) and the Victorian ski resorts (KPMG Consulting 2001). These have all used the same general principle as the present study:

- Comprehensive surveying of visitors has been conducted in order to estimate average expenditure;
- Average expenditure is factored up to total visitor expenditure by using some estimates of total visitor numbers; and
- Economic impact is then estimated by using the total visitor expenditure with multipliers from an economic model. In this project and those cited above the input output model has been used.

For the present study, input output[2] models were developed for each of the ACT, NSW, and Victorian State economies by the Centre for Tourism Research at the University of Canberra, and provided free of charge to this project. The models provide detailed sector multipliers for Gross State Product (GSP), which is the state equivalent of Gross Domestic Product (GDP), and for employment measured in full time equivalents (FTEs).

In conducting tourism economic impact studies it is important to define the economy of interest or viewpoint. Thus, if the viewpoint is a city, then expenditure by other residents of the same State can be included in impact calculations. However, if the viewpoint is the State economy, then only expenditure by non residents of the State should be counted. This is because expenditure by residents of the same State is seen as shifting expenditure around the State, rather than being an additional demand on the production of goods and services within the State.

In this study we have adopted the State as the viewpoint because the Australian Alps National Parks management agreement is between the States Governments of Victoria and New South Wales, the ACT territorial government, and the Federal government. Through the State and Territory Parks services and State and Territory tourism agencies, there is a high level of State Government involvement in the visitor use of the Alps.

This approach has led us to treat only the expenditure by visitors to the State as having an economic impact on the State economy. In previous studies cited above, there has been an attempt to include the expenditure by residents who, in the absence of an alpine area in their home State, would have visited another State or country for their trip. We have taken a conservative view that if within-State travellers were not holidaying in the Alps they would be holidaying elsewhere in the State, and so their holiday expenditure is transferred from one part of the State to another.

Survey respondents are asked hypothetical questions such as ‘where would you have gone for your holiday if Kosciuszko National Park did not exist?’ These studies have then included as part of the economic impact measurement, that expenditure which is by residents who said that in the absence of their own mountains, they would have visited mountains elsewhere. This approach was not used in the present study because of the dubious reliability of the respondents’ answers, and because the budget for the present study precluded gathering the necessary information.

Comment should be made here about the difference between economic impact, as used in this study, and economic benefit as would be used in a cost benefit study. This is not a cost benefit study of the Australian Alps. The measurement of economic benefits as would be used in a cost benefit study requires an allowance for the opportunity cost of resources used up in the production of goods and services consumed by tourists. As shown by Burgan and Mules (2001), economic benefit is only the same as economic impact if the economy in question has substantial unused capacity, which means that the opportunity cost of resources is zero.

[2] For more details about input output models see Miller and Blair (1985)

Estimation of Total Visitor Numbers

As stated in the previous section, the economic impact of alpine tourism depends upon the aggregate expenditure by visitors, which in turn depends upon average expenditure per person, and the total number of visitors. The survey that we have conducted has yielded detailed estimates of average per person visitor expenditure.

Estimating the number of visitors for any period to the Australian Alps National Parks is a difficult exercise because entry is not ticketed, and there is no official agency that collects visitation data on a comprehensive basis. Entry to some parts of the Alps is ticketed by the Parks Services at some times of the year in some places, at some times of the day in some places, and not at all in other places.

The Australian Bureau of Statistics (ABS) has a survey of tourism accommodation which is unsuitable for present purposes because it excludes people staying in their own or friends' accommodation, and it excludes commercial establishments with fewer than 15 beds. The latter excludes many accommodation establishments in the Australian Alps.

The Bureau of Tourism Research's National Visitor Survey (NVS) provides detailed visitor numbers for the Snowy Mountains region of NSW, and the High Country region of Victoria. These regions approximate the Australian Alps National Parks in each State, but they also include areas adjacent to the parks which may attract visitors for near-mountain activities.

Nevertheless, it was decided to use these NVS numbers for NSW and Victoria rather than attempt to cobble together an estimate from other sources[3]. The inclusion of people who may not have actually gone into the Park protected area can be justified in a tourism sense because the tourism destination owes its attraction potential to the existence of the Alps adjoining the destination.

For Namadgi National Park in the ACT, there was no available data from the NVS. Instead we were given access to some car count data from the Namadgi Visitor Centre and we assumed 3.6 people per car, a figure based on our survey.

Table 15 below shows the estimates for each jurisdiction, broken down according to whether day trip visitors or overnight visitors. For Namadgi, this breakdown was based on the sample, while for Victoria and NSW, the NVS provided the breakdown. This is an important distinction, because the expenditure by day trippers does not include accommodation.

Table 15. Estimated visitor numbers to Australian Alps, 2001

	All Visitors		
	Day trippers	**Overnight**	**TOTAL**
Namadgi	110,075	90,425	200,500
NSW	274,500	727,500	1,001,500
Victoria	1,257,000	1,249,000	2,506,000
	Interstate Visitors Only		
	Day trippers	**Overnight**	**TOTAL**
Namadgi	56,600	46,500	103,100
NSW	155,000	180,500	335,500
Victoria	73,000	232,000	305,000

Sources: Bureau of Tourism Research, Namadgi Visitor Centre, University of Canberra Alps survey.

Given the lack of facilities, the number of overnight visitors to Namadgi National Park is perhaps surprising. It is possible that some respondents were actually staying in Canberra rather than in the Park itself. However, from the viewpoint of economic impact on the ACT economy, their expenditure still represents demand for ACT produced goods and services.

It is of interest that the proximity of Melbourne to the Victorian Alps leads to a very high number of visitors overall, especially in the form of day trippers. However, the numbers drop right away when Victorian residents are netted out (interstate visitors only).

How do these numbers compare with previous studies? There is no earlier figure for Namadgi, but the 1994 KPMG study for NSW used a total of 2,860,512 visitor nights (estimated by the Parks Service at the time). If we use a 3 night average length of stay[4], and the 1994 estimate of interstate visitor proportion (41%), we get 391,000 interstate visitors, compared with 335,000 in Table 15. The difference could be due to the fact that 2001 was one of the worst snow seasons for many years, for it is well known that visitor numbers change dramatically from year to year in response to the amount of snowfall.

For Victoria, the 2001 KPMG study was restricted to the ski resorts, and so is not comparable to this current project. However, the 1993 study in Victoria by the Centre for South Australian Economic Studies implied total

[3] Such sources include car counts, gate counts, ABS.

[4] This was the estimate from the current survey, as well as from the 1994 survey.

interstate visitor numbers of 134,240. This is referring to 1991 which was not a good year for snow, and it is significantly fewer that the estimate in Table 15 of 305,000. It is possible that the Victorian Alps have seen greater development (albeit from a smaller starting point) over the decade than NSW and this has resulted in higher growth in numbers.

Aggregate Expenditure of Visitors

While it has been argued above that the economic impact on each State/Territory economy depends only upon the expenditure of visitors to the Alps who are not residents of the respective States/Territory, there may also be an interest in the aggregate amount of all expenditure by visitors to the Alps. This aggregate includes the expenditure in each State/Territory of residents who are visiting the Alps in their own State, and therefore likely to be transferring expenditure from one part of the State to another.

Table 16 shows the aggregate expenditure for each jurisdiction for both interstate visitors and all visitors (including residents).

Table 16. Aggregate expenditure by visitors, 2001, $m.

	ACT		NSW		Victoria	
	Interstate Visitors	**All Visitors**	**Interstate Visitors**	**All Visitors**	**Interstate Visitors**	**All Visitors**
Accommodation	0.84	1.75	28.05	118.18	28.74	164.51
Food and Drink	1.61	2.59	15.73	64.82	18.94	100.97
Transport (petrol, taxis, buses, car hire etc.)	1.43	2.17	11.91	41.80	13.57	67.78
Park entry fees	0.54	0.97	3.96	15.26	2.57	14.84
Lift tickets, fishing licences, camping permits etc.	0.52	0.95	23.26	86.45	18.81	105.91
Shopping, ski hire, Equipment hire	1.01	1.85	14.61	56.23	11.98	77.25
Entertainment (Clubs, gambling, cinema etc).	0.49	0.80	7.16	33.72	7.17	43.01
Other (medical, hair etc)	0.74	1.42	6.03	24.75	6.33	33.20
TOTAL	7.17	12.51	110.73	441.21	108.14	607.47

It is clear from Table 16 that expenditure by within-state visitors dominates the aggregate expenditure, especially in Victoria, where only $108.14 million out of a total of $607.47 million is attributable to interstate visitors. Clearly, businesses which provide visitors with goods and services in the Victorian Alps do well out of the visitors, but much of their turnover is at the expense of businesses elsewhere in the State.

Impacts on GSP and employment

As has been indicated above, it is expenditure by non resident visitors which drives the economic impact of Alps visitors in the State and Territory economies. In deriving estimates of total expenditure, it was first necessary to combine expenditure by package tourists with expenditure by other overnight visitors. The amount spent on the package itself was allocated across expenditure categories (accommodation, food, transport, etc) in proportion to the expenditure by non package overnight visitors.

Next, a weighted average of expenditure per person by package tourists, and by overnight visitors was derived by using weights in each category from the sample. We now had expenditure per person for overnight visitors (including package tourists), and expenditure per person for day trippers separately. Aggregate expenditure was found by multiplying the average expenditure by the total number of visitors in each category. The results are shown in Tables 17, 18 and 19.

Table 17. Average and total expenditure by visitors, ACT

Expenditure category	Expenditure per person $		Total expenditure $m
	Day Trippers	O'night + package	
Accommodation		18.16	0.84
Food and Drink	5.78	27.50	1.61
Transport (petrol, taxis, buses, car hire etc.)	6.85	22.33	1.43
Park entry fees	2.55	8.52	0.54
Lift tickets, fishing licences, camping permits etc.	3.21	7.34	0.52
Shopping, ski hire, Equipment hire	5.36	15.09	1.01
Entertainment (Clubs, gambling, cinema etc).	1.82	8.30	0.49
Other (medical, hair etc)	2.02	13.47	0.74
TOTAL	**27.59**	**120.74**	**7.17**

As would be expected, expenditure in the ACT is lower than for NSW and Victoria, both because of lower visitor numbers, and lower expenditure per person. The latter is due to the lack of commercial accommodation in Namadgi National Park, and the lack of ski fields in Namadgi. Expenditure figures for the ACT may be artificially low because of a lack of accommodation in Namadgi – it may have been that overnight visitors may have stayed elsewhere in the ACT but may have not shown this in their survey. It is also important that it is stated that this potentially artificially low expenditure figure may have flow on effects for other calculations on the total economic benefit for the ACT.

Table 18. Average and total expenditure by visitors, NSW

Expenditure category	Expenditure per person $		Total expenditure $m
	Day Trippers	O'night + package	
Accommodation		155.43	28.05
Food and Drink	14.96	74.33	15.73
Transport (petrol, taxis, buses, car hire etc.)	18.87	49.78	11.91
Park entry fees	6.35	16.48	3.96
Lift tickets, fishing licences, camping permits etc.	28.71	104.25	23.26
Shopping, ski hire, Equipment hire	20.38	63.46	14.61
Entertainment (Clubs, gambling, cinema etc).	5.5	34.96	7.16
Other (medical, hair etc)	10.14	24.68	6.03
TOTAL	**104.91**	**523.38**	**110.73**

Aggregate expenditure for NSW and Victoria are similar, despite NSW having larger expenditure per person estimates. Victoria has a higher number of interstate overnight visitors, particularly from NSW (NVS data). This brings total expenditure by visitors to the Victorian Alps up to almost the same level as for NSW. Visitors to NSW appear to spend more on ski lift tickets but less on shopping than visitors to Victoria.

Table 19. Average and total expenditure by visitors, Victoria

Expenditure category	Expenditure per person $		Total expenditure $m
	Day Trippers	O'night + package	
Accommodation		123.92	28.74
Food and Drink	13.03	77.57	18.94
Transport (petrol, taxis, buses, car hire etc.)	11.87	54.76	13.57
Park entry fees	2.35	10.35	2.57
Lift tickets, fishing licences, camping permits etc.	9.41	78.16	18.81
Shopping, ski hire, Equipment hire	22.36	44.61	11.98
Entertainment (Clubs, gambling, cinema etc).	6.31	28.92	7.17
Other (medical, hair etc)	7.13	25.07	6.33
TOTAL	**72.46**	**443.35**	**108.14**

Note that for Victoria and NSW we were able to disaggregate the expenditure data according to season (winter versus summer). This was not able to be done for the ACT because of lack of data on visitor numbers, and small sample size. However, since the ACT does not have a ski season this separation is not particularly important.

The economic impacts of Alps visitor expenditure in each of the respective economies are shown in Tables 20, 21, and 22. Note that the employment impacts are estimated in the input output models by assuming that labour is proportional to output. This may not always be the case, and where businesses have excess capacity they may be able to expand without the need for extra employees. The employment estimates presented here should therefore be regarded as upper bounds.

Table 20. Economic impacts on the ACT economy

Sector	GSP $m	Employ FTE
Agriculture	0.01	0
Mining	0.00	0
Manufacturing	0.27	6
Elec, gas, water	0.31	1
Construction	0.02	0
Wholesale	0.13	2
Retail	0.88	29
Accomm, cafes, etc	1.07	20
Transport, storage	0.85	9
Communication	0.24	2
Finance, insurance	0.35	3
Property, bus services	1.88	21
Government	0.35	4
Education	0.14	3
Health	0.19	3
Cultural & recreational	0.53	8
Personal services	0.95	15
TOTAL	**8.16**	**126**

For the ACT, most of the economic impacts are felt in the Retail sector and in the Hospitality sector (Accommodation, cafes etc). There are also substantial impacts in the Property and Business Services sector and the Personal Services sector. On the basis that Government (State and Territory) taxes and charges account for some 7 per cent of GSP, the ACT Government is estimated to receive some $0.57 million in extra revenue due to visitors to Namadgi National Park.

The NSW economic impacts are noticeably larger than the ACT's, mainly because of larger visitor numbers and higher expenditures, but also because the NSW economy is larger and produces more of its requirements for goods and services, which have to be brought in (imported) to the ACT economy. Hence, the multipliers in the NSW input output model are larger than for the ACT (the Victorian ones are also larger than the ACT's for the same reason).

As Table 21 shows, the total annual effect of tourism in the NSW Alps on the NSW economy is $150.21 million of GSP, of which $97.64 million (65%) is attributable to winter tourism. Much of this would be attributable to the ski season, and it must be remembered that this is possibly a lower than average figure because 2001 was a poor year for snow. However, using the $150.21 million figure for GSP, it is estimated that tourism to the NSW Alps generates an extra $10.5 million in State revenue (taxes, fees, and charges).

Table 21. Economic impacts on the NSW economy

Sector	GSP $m			Employ FTE		
	Winter	Summer	Total	Winter	Summer	Total
Agriculture	1.40	0.75	2.15	29	16	45
Mining	0.47	0.25	0.72	2	1	3
Manufacturing	9.68	5.21	14.89	118	64	182
Elec, gas, water	2.90	1.56	4.46	14	7	21
Construction	0.25	0.13	0.39	5	3	8
Wholesale	3.48	1.87	5.35	49	27	76
Retail	9.64	5.19	14.84	311	168	479
Accomm, cafes, etc	14.56	7.84	22.39	273	147	421
Transport, storage	5.61	3.02	8.63	85	46	131
Communication	3.42	1.84	5.26	29	16	44
Finance, insurance	7.31	3.94	11.24	56	30	87
Property, bus services	25.35	13.65	39.00	280	151	431
Government	0.38	0.21	0.59	6	3	9
Education	1.40	0.76	2.16	28	15	44
Health	1.99	1.07	3.06	39	21	60
Cultural & recreational	5.78	3.11	8.90	75	41	116
Personal services	4.02	2.17	6.19	101	54	155
Total	**97.64**	**52.57**	**150.21**	**1502**	**809**	**2311**

The main sectors affected by economic impact of Alps tourism in NSW are Retail, Accommodation/Cafes/Restaurants, and Property/Business Services. This is a similar distribution to that for the ACT. The impacts on the Retail sector are worth remarking, as it is often not well appreciated the extent to which the Retail sector is engaged as part of the tourism industry.

It is worth noting that the comparable figure from the 1994 KPMG study to the total NSW GSP of $150.21 was $137.3 million, of which 89 per cent was attributable to winter tourism. Clearly there has been modest growth in the overall economic impact of tourism in the NSW Alps, (1.3% per year compounding). However, of note is the change in the winter proportion from 89 per cent in 1994 to 65 per cent in 2001.

This change in the mix of tourism has had the effect of evening out the seasonal flow of income to tourism businesses in the Alps, but it also has the effect of reducing the mean yield, because summer visitors do not spend as much as winter tourists. For example, our survey showed that summer visitors spent an average of $77 per person on accommodation, while winter visitors spent an average of $235 per person.

The economic impacts on the Victorian economy are shown in Table 22. The total impact on Victorian GSP is $145.02 million, of which 71 per cent is attributable to winter, noticeably higher than NSW’s winter share. It is interesting that despite the GSP effects being slightly less in Victoria than NSW, the employment effects are about the same. This is mainly due to a higher effect on the Manufacturing sector in Victoria than NSW. Apart from this, the main sectors affected in Victoria are Retail, Accommodation/Cafes, and Property/Business Services, as was the case in NSW.

Table 22. Economic impacts on the Victorian economy

Sector	GSP $m			Employ FTE		
	Winter	Summer	Total	Winter	Summer	Total
Agriculture	2.51	1.03	3.54	39	16	55
Mining	0.72	0.29	1.01	2	1	3
Manufacturing	12.90	5.27	18.17	183	75	258
Elec, gas, water	4.26	1.74	6.00	13	6	19
Construction	0.24	0.10	0.34	5	2	7
Wholesale	4.27	1.75	6.02	50	21	71
Retail	9.77	3.99	13.76	315	129	443
Accomm, cafes, etc	13.12	5.36	18.48	310	127	437
Transport, storage	7.04	2.87	9.91	95	39	134
Communication	4.07	1.66	5.73	37	15	51
Finance, insurance	6.69	2.73	9.42	52	21	73
Property, bus services	22.44	9.17	31.61	275	112	387
Government	0.33	0.14	0.47	7	3	10
Education	1.69	0.69	2.38	31	13	44
Health	2.26	0.92	3.19	43	18	61
Cultural & recreational	4.89	2.00	6.88	85	35	120
Personal services	5.77	2.36	8.13	112	46	157
TOTAL	**102.97**	**42.06**	**145.02**	**1654**	**675**	**2329**

The Victorian Treasury gains an estimated $10 million in extra revenue because of the expenditure of interstate tourists in the Victorian alpine regions.

The 1991 study by the Centre for South Australian Economic Studies showed total GSP generated to be $122 million (a compound growth rate of 1.7% per year), of which 83 per cent was attributable to winter tourism. In the present study, the winter proportion is 71 per cent, illustrating a similar growth in the importance of summer tourism to that highlighted above for NSW.

Chapter 5

Recreation Use – Value of the Alps

This Chapter explains how the survey data was used to estimate a ‘demand relation’ for travel to the Alps by all visitors, regardless of place of residence. It uses a method known as ‘travel cost’ wherein the cost of travel to the Alps is treated as a proxy for the price that consumers were willing to pay for consuming the Alps experience. The recreational use value of the Alps is then measured by calculating the consumers’ surplus. This is the difference between what a consumer is prepared to pay for the experience, and what they actually had to pay, where the latter is either nothing or the entry fee depending upon whether an entry fee was applicable or not.

Introduction

One of the main contributions that economists make to the environmental policy debate is to focus thought upon costs and benefits. This creates a need for relevant information, and much of the research undertaken by environmental economists looks at ways to measure the benefits attributable to wilderness conservation. The fact that the environment is typically unpriced, or underpriced, makes the problem of estimating such benefits a difficult one, yet numerous techniques are available. The travel cost methodology (TCM) is one of the most popular.

The TCM, suggested in a letter by Hotelling in 1949, was first given form by Clawson and Knetsch in 1966. While there are many different versions of the TCM, the simplest (hereafter referred to as the zonal TCM), is theoretically capable of generating an estimate of the - uncompensated - consumer surplus (CS) attributable to recreation at a particular area[5]. This is, necessarily, a subset of the total economic value of an area, since benefits from wilderness areas derive from two main sources: use and non-use values [6].

By 1989 the TCM had been used in over 200 studies world wide (Smith 1989) – all, considerably more complex than that described above. Notable Australian examples include: Knapman and Stanley's study of Kakadu National Park (1991); the Resource Assessment Commission's Forest and Timber inquiry (1992); and Carter, Vanclay and Hundloe's valuation of recreation on the Great Barrier Reef (1987). Notable NZ examples include: Woodfield and Cowie (1977) who used the technique to examine the recreation use value of the Milford Track; Kerr, Sharp and Gough (1986) who included a travel cost analysis within their study of Mt Cook National Park; and Clough and Meister (1991) who applied the technique to Whakapa Skifield.

This report uses the TCM to generate an estimate of the recreation use value of the Australian Alpine areas, and is divided into several sections. The next section introduces the TCM, where the implementation process of a simple - zonal – TCM is described. More sophisticated travel cost studies are briefly reviewed in an Appendix, and an array of different implementation issues are discussed. The Appendix also briefly reviews (pertinent) survey data – focusing on variables of interest to the travel cost component of the study.

General Approach

The TCM is a two stage process which begins by noting that although recreational areas may be used free of charge, the fact that individuals must travel to and back from an area in order to use it means that a price is actually paid. The cost of travel can be used as a proxy for price. The first stage of the TCM involves identifying the number and origin of visitors to a recreational site, and estimating their costs in travelling from that origin to the site and back again. This information is then used to estimate the functional relationship between visitation rates and travel costs. Stage two of the process makes the assumption that individuals react to changes in travel costs in the same way as they react to changes in price, and uses the function estimated in stage

[5] More complex versions are capable of generating estimates of compensating variation. However, it is not altogether clear that the extra effort involved in estimated CV - as opposed to CS - generates compensatory returns. Kling (1988) used monte carlo simulations to investigate a number of issues relating to the TCM. Amongst other important results, she notes that ‘..the use of a Hicksian measure of compensating variation in these simulations does not appear to improve the accuracy of the welfare estimate’ (p 900). This seems to accord with Willig (1976), who noted that the proportional difference between consumer surplus (CS) and compensating variation (CV) will be a function of the income elasticity of the good in question, divided by ‘base income’. If the TCM is used to produces estimates of the national recreational use-value of a particular area, then the relevant base income in Willig's formula will be national income. On most occasions, CS will be small relative to this figure, indicating that it may provide a reasonable approximation to CV.

[6] Use-values are those benefits derived from direct use of the area. Examples include such things as those benefits derived from recreation, from the value of any goods produced within the area, and from scientific research. Non-use benefits (often termed preservation values) include such things as option and existence values (although option value is occasionally classified within the broader category of use-values, and bequest value is often listed as a category of its own).

one to simulate visitation responses to hypothetical changes in price. A demand curve for the recreational area is thereby derived and used to estimate consumer surplus.

To illustrate, assume that travel costs, alone, influence visitation, that the current entry fee into a national park is set at zero, and that the following data are available:

Table 23. Example of observed travel costs and visits

Zone	Observed Travel Cost	Observed Number of Visits
A	10	20
B	20	10
C	30	0
		Total=30

Stage one of the implementation process involves using statistical methods to determine the relationship between the number of visits and the cost of travel. From this, one can infer that within any zone, every increase in travel cost of 10 units results in a decrease in the number of visits of 10. Stage two of the implementation process occurs when one uses that information to predict the number of visits (from each zone) which would obtain at higher entry fees such as in Table 24.

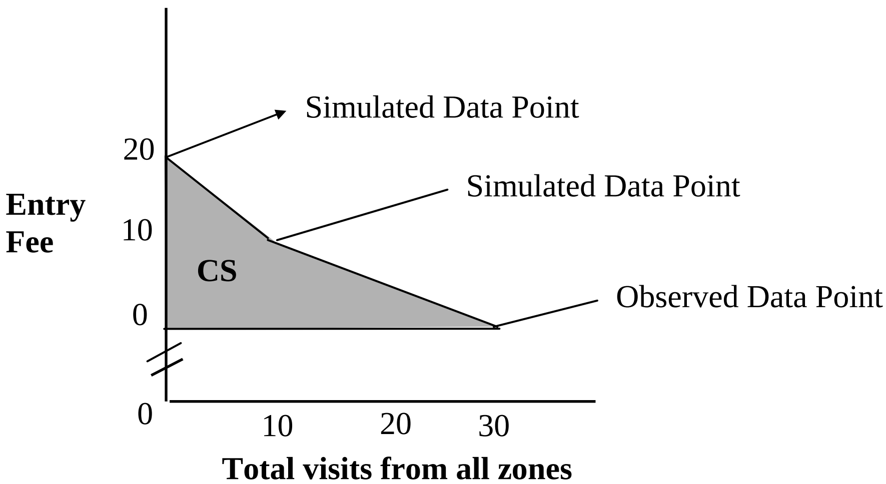
Table 24. Example of predicted travel costs and visits

Zone	Cost Level 1 Entry fee = 0	Number of Visits	Cost Level 2 Entry fee = 10	Predicted Number of Visits	Cost Level 3 Entry fee = 20	Predicted Number of Visits
A	10	20	20	10	30	0
B	20	10	30	0	40	0
C	30	0	40	0	50	0
		Total=30		**Total=10**		**Total=0**

Reading across the line for zone A in Table 24 it can be seen that when the 'price' (given by entry fee + travel cost) is 10, the number of visits is 20; when the price rises to 20, the number of visits is predicted to fall to 10; when the price rises to 30, the number of visits is predicted to fall to zero.

This information is used to simulate a demand curve for the national park, as shown in Figure 15. The consumer surplus is the shaded area under the demand curve above the current entry fee which represents the excess amount in dollars that each level of visitors is prepared to pay over and above the national park entry fee. It is the measure of welfare that is used by economists to indicate the value to consumers of the consumption experience, in this case the experience of the national park.

Figure 15. Simulated points on the demand curve



Empirical travel cost studies are considerably more complex than this; the functional relation between visits and travel costs, for example, is rarely linear and almost always includes other variables. Numerous problems are also encountered when attempting to collect relevant data, and measurement difficulties abound. Nevertheless, this stylised version helps to illustrate the process underlying the TCM.

Consumer Surplus Estimates for the Visitor Sample

The Data

As mentioned previously, 4,908 survey questionnaires were returned, providing information on 18,480 individuals. A total of 4,614 questionnaires were completed by Australian residents, all of who were asked to identify the postcode of their 'home'. This allowed us to allocate 16,528 Australian residents into 2,293 different postal 'zones'. We then divided that data into seven different sub-sets; according to which region (within the Australian Alps) the individuals were visiting when they completed the questionnaire.

Table 25 (below) shows the number of different postal 'zones' and the number of visitors surveyed at each of the seven different Alpine regions. In Table 25 town names are used to identify a broad geographical region around the town. This was an arbitrary division of the Alps into regions for ease of surveying visitors' destinations.

Table 25. Regions used in the travel cost study

State	Region	Central Town/Location (for calculating Distances)	Number of Different Zones	Number of Visitors
NSW	1	Yarrangobilly	204	1,006
	2	Jindabyne	887	9,303
ACT	3	Tharwa	113	664
	4	Tidbinbilla	58	351
VIC	5	Mt Buffalo	515	2,678
	6	Falls Creek	230	1,236
	7	Bright	286	1,290

Reading across the first line of Table 25, it can be seen that 1,006 people visited the northern area of the NSW Alps (labelled as 'Yarrangobilly') from 204 different postal zones.

The Visitation Equations

For each region, visitation equations (demand relations) were estimated using 5 different functional forms (A, B, C, D and E as detailed in the Appendix). Each form is a different way of specifying the relationship between visitation and cost. Other influences on visitation were also included in the model, such as household income and educational status, data on which was obtained for each region from the ABS Population Census. Many researchers estimate a variety of different visitation equations, selecting that which has superior statistical and economic properties. For all regions within the Australian Alps, model D (the double-log) was selected as the best representation of all visitation equations.

Consumer Surplus Attributable to Surveyed Visitors

Coefficients from the visitation equations were used in the formulas listed in appendix A to generate the following estimates of CS attributable to our sample of visitors assuming an arbitrary travel cost of 50 cents per km, an assumption which is varied further below. Estimates for all functional forms are provided in Appendix C.

Table 26. Consumer surplus estimates

Region	Aggregate Estimates of CS (using only the sample of visitors, and TC = 50 cents per km)	Per-Person Estimates of CS (using only the sample of visitors, and TC = 50 cents per km)
1	$1,295,620	$1,324
2	$5,245,460	$1,088
3	$1,783,470	$1,334
4	$557,418	$2,254
5	$2,910,170	$1,047
6	$2,755,510	$5,220
7	$2,593,900	$2,066
	Total: $17,141,548	**Mean: $1,037**

These data were further refined by the development of a range of 'plausible' travel costs, as a check on how sensitive the aggregate CS is to different values of travel cost per kilometre. We examined the NRMA's 'what it costs to run your car', taking an 'average' figure of 15 cents per km. To this we added the cost of time, because time spent travelling has a cost to the person involved, perhaps in the form of lost income. Transport economists frequently approximate this 'opportunity cost' of time by valuing it at the average wage. We assumed a speed of 100kph in order to convert income per hour to income per kilometre, and we used a maximum and minimum value of household income drawn from ABS data. This gave us a rounded 'plausible' range as between 10 and 30 cents per km. When travelling to and from a destination, individuals must pay for things like fuel - the further an individual travels, the more fuel used and the higher the overall cost. Those travelling very long distances, may also need to stop for food and rest. The further they travel, the more food and rest/accommodation stops they must take and the higher their overall cost. Like fuel, these costs are also related to distance.

There is considerable controversy about which items should, and should not be included in the 'true' cost of travel. In this report, we do not take sides. Instead, we provide a range of different estimates, letting the reader decide which seems most appropriate.

Those who believe that petrol costs are the only 'true' travel cost of should consider CS estimates that are associated with the low per-km price of distance (say, the 10 cents per kilometre). Those who believe that other travelling expenses - such as food and accommodation - are also 'true' costs should consider CS estimates that are associated with the higher per-km costs (say, the 30 cents per kilometre estimates). This is discussed more formally in Appendix A.

Table 27 presents consumer surplus estimates across that range of 'plausible' Travel Costs.

Table 27. 'Plausible' consumer surplus estimates from the visitor sample

Region	CS at 10 cents per km	CS at 30 cents per km	Per Person CS at 10 cents per km	Per Person CS at 30 cents per km
1	$259,124	$777,372	$258	$773
2	$1,049,092	$3,147,276	$113	$338
3	$356,694	$1,070,082	$537	$1,612
4	$111,484	$334,451	$318	$953
5	$582,034	$1,746,102	$217	$652
6	$551,102	$1,653,306	$446	$1,338
7	$518,780	$1,556,340	$402	$1,206
	$3,428,310.00	$10,284,929.00	$286.38	$859.00

In words, these figures indicate that average consumer surplus attributable to recreation in the Australian Alps is between $280 and $860 per visitor, per annum. The aggregate consumer surplus attributable to the recreational activities of respondents to our survey is at least $3.5 m and possibly as high as $10.3 m.

Total Consumer Surplus and Recreation Use Value

The figures from the preceding section only apply to our sample of visitors and our aim is to estimate the recreation use value of all visitors. Consequently, we must scale the estimates upwards to arrive at an annual consumer surplus estimate attributable to all visitors. If the distribution across postal zones of all visitors identically matches the distribution across zones of our sample, then one need simply scale the surveyed visitor estimates upwards to arrive at an 'all visitor' estimate. However, identical matching is unlikely, so that a direct scaling is probably inappropriate; the true population range may be larger or smaller than the scaled estimates. Consequently, we present a 120 per cent range (where the minimum is 20% lower and the maximum is 20% larger than the simple range). Further to that, our data relating to total visitor numbers during 2001 is highly aggregated: rather than providing information on the total number of visitors to each of the seven sub-regions featured thus far, it gives information on the total number of visitors within each state (see Table 28).

Table 28. Visitor numbers: sampled and total

Region		Visitors	
		Sampled	Total
3:	Namadgi	664	200,500
1 & 2:	NSW	10309	1,001,500
5, 6 & 7:	Vic	5204	2,506,000

More specifically, to calculate the minimum 'plausible' CS estimate attributable to all visitors, we calculated the average per-person consumer surplus attributable each sub-region (Table 29). Our averages are weighted ones: the weights corresponding to the number of sampled visitors[7]. We have also excluded Tidbinbilla from this segment, since it is not, strictly speaking, a part of the Australian Alps.

Table 29. Average regional per-person consumer surplus

State	Region	CS a 10 cents per km	CS at 30 cents per km	Per Person CS (at 10 cents per km)	Average Regional Per-Person CS (at 10 cents per km)	Per Person CS (at 30 cents per km)	Average Regional Per-Person CS (at 30 cents per km)
NSW	1	$259,124	$777,372	$258	$127	$773	$381
	2	$1,049,092	$3,147,276	$113		$338	
Namadgi	3	$356,694	$1,070,082	$537	$537	$1,612	$1,612
VIC	5	$582,034	$1,746,102	$217	$317	$652	952
	6	$551,102	$1,653,306	$446		$1,338	
	7	$518,780	$1,556,340	$402		$1,206	

We then multiplied the 10 cent per km per-person consumer surplus estimates by the total number of visitors to the each region, and multiplied that figure by 0.8 to generate lower-bound estimate. For the upper-bound estimates, we multiplied the 30 cent per km per-person consumer surplus estimates by the total number of visitors to each region, and then scaled those numbers upwards by a factor of 1.2. We also supply a 'middle of the road' estimate; calculated using an implied price of distance equal to 20 cents, and using total visitor numbers (without scaling). A selection of these estimates are presented in Table 30.

Table 30. 'Plausible' range of consumer surplus estimates for all visitors

State	Region	Visitors	'Plausible' minimum CS if P = 10 cents	'Plausible' minimum CS if P = 20 cents	'Plausible' maximum CS if P = 30 cents
NSW	1 & 2	1,001,500	$101,752,400	$279,819,100	$457,885,800
Namadgi	3	200,500	$86,134,800	$236,991,000	$387,847,200
VIC	5, 6 & 7	2,506,000	$635,521,600	$1,749,188,000	$2,862,854,400
TOTALS		**3,708,000**	**$823,408,810.00**	**$2,265,998,120.00**	**$3,708,587,430.00**

Note, P = travel cost in cents per kilometre.

In words, this indicates that the consumer surplus attributable to recreation in the Australian Alps is at least $820 million, and possibly as much as $3.7 billion.

If one wishes to obtain an estimate of the recreation use value of an environmental area, consumer surplus estimates must be extrapolated into the future and discounted back to present values. Generally, it is assumed that current values of consumer surplus will continue in perpetuity, and the present value of such a continuous flow of annual value can be found by discounting the flow to present value using an appropriate social discount rate.

To handle the problem of choosing the appropriate social discount rate, practitioners generally produce several different estimates across a range of different discount rates; that range hopefully including the 'true' but unknowable rate at which society in general discounts the future. In this study, for a minimum we have used the minimum estimate from Table 31 and a discount rate of 10 per cent, the 'middle' estimate was calculated from the 'middle' consumer surplus estimate (with a discount rate of 6%) and the maximum used the highest estimate with a 2 per cent discount rate.

Table 31. 'Plausible' estimates of recreation use value

State	Region	'Plausible' minimum RUV if P = 10 cents and δ = 10%	'Plausible' maximum RUV if P = 20 cents and δ = 6%	'Plausible' maximum RUV if P = 30 cents and δ = 2%
NSW	1 & 2	$1,119,276,400	$4,943,470,766	$23,352,175,800
Namadgi	3	$947,482,800	$4,186,841,000	$19,780,207,200
VIC	5, 6 & 7	$6,990,737,600	$30,902,321,333	$146,005,574,400
TOTALS		**$9,057,496,810.10**	**$40,032,633,119.06**	**$189,137,957,430.02**

[7] Eg. the average per-person CS for NSW using ten cents per km as the price of distance was calculated as ($258* 1006 + 113*9303)/ (1006 + 9303)

Conclusions

As has been demonstrated here, it is possible to use the TCM to generate a range of ‘plausible’ CS estimates across a range of ‘plausible’ Travel Costs and a range of ‘plausible’ functional forms. Admittedly, that range is large - but in many circumstances a broad range of estimates will be better than no estimate at all. We can, for example, say with some certainty, that the aggregate recreation use value of the Australian Alps lies somewhere between $9 billion and $190 billion; most likely somewhere close to $40 billion.

Chapter Summary

This Chapter has demonstrated the use of the Travel Cost Method to estimate the present value of future streams of consumer surplus from recreation use of the Alps. This value is only part of the total value of the Alps, and is subject to some uncertainty regarding key parameters such as the full travel cost in cents per kilometre from each origin of visitors, and the appropriate social discount rate. Taking all things into account the most reasonable value is of the order of $40 billion.

APPENDIX A - METHODOLOGICAL ISSUES

Model Choice: Individual or Zonal?

Despite the very large number of empirical applications of the TCM, several theoretical and practical problems have been identified. One criticism of the zonal TCM is that the process of aggregating individual observations into zones is inconsistent with the concept of utility maximisation[8]. Another criticism is that the summary statistics associated with a zonal TCM will show less unexplained variation than a disaggregated model. This is not because the model is better able to explain individual behaviour, but because it uses zonal averages[9] rather than individual observations and, therefore, has less variation to explain (Walsh 1986, p 225). Still another problem with the zonal TCM is that if the data are divided into zones of unequal population, then the variances will not be equal and heteroscedasticity may be present. Finally, the zonal TCM is not always capable of generating information that can be used to assess the effect of changes in site quality.

Perhaps in an attempt to overcome at least some of these problems, many different variations/extensions of the zonal TCM have been developed – most pertinent here are those based on individual observations[10]. Popular in the United States, and to a lesser extent in the United Kingdom, the individual TCM (ITCM) has been in use since the early 1970s. It follows the same general procedure as the zonal approach (i.e. estimating a relation between visits and travel costs and then using that relation to simulate responses to increased prices), but uses individual data to do so. Hence, rather than working with the number of visits from each zone of origin, one works with the number of visits per individual.

The ITCM is not always a feasible option - particularly in situations where the area under study is relatively remote. In such cases, it is likely that most individuals will only visit the area under study once within a given year (and often, only once in a lifetime). In the extreme, all observed values of the dependent variable may take on a single value - one. Hence OLS will not be able to develop a functional relation between visits and travel costs.

In cases where there is considerable variation in visits per person, the ITCM has considerable appeal - not only does it avoid the aggregation problems discussed above, but it requires less data and may, therefore, be cheaper to implement than the zonal TCM. Despite these advantages, OLS regression is not normally suitable to the ITCM; researchers will frequently need to use more sophisticated estimation techniques[11]. A good discussion of some of these approaches is given in Hellerstein (1991) – the most important point here, being that:

> ‘ ... truncated models may be more biased than aggregated models....In other words, aggregate models permit non visitors to influence estimation, so that the resulting parameters are a reduced form incorporating information on both visitors and non visitors. For many purposes, such as calculating the consumer surplus for an entire population, such parameters may be superior to those produced by truncated models. In short, aggregate analysis is not necessarily dominated by site-based samples estimated with econometric techniques that recognise truncation.’ Hellerstein (1991, p 866)

Our aim is to calculate consumer surplus for an entire population, but we have do not have access to data from that entire population. Instead, we must work with a sample of visitors. We have, therefore, chosen to use the zonal TCM. Not because it is ‘perfect’, but because it is, arguably, less imperfect than other models in these circumstances.

[8] See Deaton and Muelbauer (1980) for a thorough discussion of the conditions under which it is theoretically legitimate to use aggregate data

[9] In this context, there is another related problem with the zonal TCM. OLS relies on variation in the independent variable to arrive at estimates of the relation between the dependent and independent variable. Because aggregation reduces variance, many independent variables may appear to be statistically insignificant.

[10] Since this study is primarily interested in the total recreation use value of the Australian Alps – rather than changes in site quality - the later group of methodologies are not discussed in detail here.

[11] As discussed in Fletcher, Adamowicz & Graham-Tomasi (1990, p 130), when data are collected only from those who visit the site, observed values of the dependent variable are always positive, and the model is *truncated.* If OLS regression is used, this can result in biased parameter estimates (Hellerstein 1992, p 200). The problem is exacerbated when an on-site survey includes only a sample of visitors. In this case, those who visit the site frequently will have a higher probability of being included within the sample than those who visit only rarely - hence *endogenous stratification,* which leads to biased parameter estimates. Even when both visitors and non-visitors are sampled, problems of this type occur. For instance, if the value of the dependent variable is restricted to some subset of numbers (as in the case where the dependent variable must be a non-negative integer), then the data are *censored*. This will tend to bias the OLS estimator towards zero. That these problems exist means that researchers using the ITCM need to adopt econometric techniques which prevent such biases from occurring.

Defining Zones

A fundamental assumption of the TCM is that visits will decrease as travel costs increase. Since travel costs generally increase with distance, the central aim of dividing visitors into origin zones is to separate those visitors according to distance and hence travel costs. Yet there are many other determinants of recreation[12] which one needs to measure - if only because a failure to do so may bias final estimates. This means that studies which use numerous small zones (differentiated by distance and by other factors) may perform better statistically than those that use fewer, larger zones (only differentiated by distance). Nevertheless, because it is costly to collect data, zones are often chosen for practical reasons[13]. In Australia, for example, it is common to choose zones according to the statistical divisions of the Australian Bureau of Statistics.

In this study, zones have been chosen to coincide with Australian Postcodes – primarily because socio-economic statistics are readily available from the ABS at the post-code level, and because individuals are often happy to provide researchers with post-code information. Of the 4,908 questionnaires returned, we were able to allocate visitors to 2,293 different postal 'zones'[14].

Defining/Measuring The Dependent Variable: Visits

To estimate the visitation equation, one must first define and measure the dependent variable - 'recreational visits'. Yet it is often difficulty to qualify - let alone quantify - recreation. For instance, some individuals may decide to visit an area for a week for the purpose of camping and bushwalking. Others may visit for only a day and choose to simply sit and watch the birds. The problem facing researchers, is to determine what constitutes a visit. Difficulties arise because visitors engage in different activities, stay for different lengths of time, and are of different ages.

Strictly speaking, when visitors engage in different activities, &/or are staying for different lengths of time, they are 'consuming' different types of recreation. The theoretically correct way of dealing with this is to estimate a separate demand curve for each type of activity (Ulph & Reynolds 1981, p 199)[15] and/or for trips of different duration (eg Brown & Mendelsohn 1984). Evidently, one could carry this argument to its logical extreme - reasoning that one should estimate a separate demand curve for each individual. Clearly, this is not a practical option; at some point applied researchers must resort to aggregation. In this study, we aggregate all visitors into one; irrespective of activity. We argue that this is appropriate because our aim o is to estimate <u>total</u> recreation use-value (not the recreation use-value attributable to specific activities). Our dependent variable, therefore measures the number of visits from each zone, irrespective of the age of the visitor[16], the activity or the length of visit.

Finally, it worth noting that many zonal TC studies define the dependent variable in terms of visitation rates[17] rather than in terms of the total number of visits. It seems that much of this is to do with convention - i.e. following the lead of Clawson and Knetsch. In their case, the justification for use of a visitation rate was that 'it takes account of differences in the population … and is analogous to data on such things as per capita consumption of various food items'. However, as pointed out by Common (1973, p 402), it is possible to take account of population by including it as an independent variable. Use of a visitation rate, he argues, imposes an (unnecessary) constraint upon the model.

To illustrate, assume that visits (V) are determined solely by travel costs (TC) and population (Pop), and that the following data are available:

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[12] Discussed in section 0

[13] Variations in choice of zones will impact upon final estimates of recreation use value. In a series of Monte Carlo experiments, Common and McKenney (1994) found that small errors in assessments of population numbers generated large errors in benefit estimates, and that the errors tend to interact with other error sources.

[14]In some cases, the data set will contain several zero-visit zones – and no definitive guide on how to deal with them exists. 'Much informal folklore (has) developed on treating origin zones with zero visit rates .... Often no use would be recorded for some states closer to the site than others. Three approximations were used. Some investigators simply ended the sample when visit rates became sparse. Others aggregated all other more distant states records into a single composite zone, using an average distance measure. Finally, others included zones with zero visit rates, but added a small constant when the estimating equation was in semilog or double-log form. All approaches were ad hoc.' (Smith, 1989, p 286). We have taken one of the 'ad hoc' approaches, namely to exclude zero visit zones.

[15]In some cases, data deficiencies may preclude this as an option, while in others, the segregation of users may not contribute to the explanatory power of the model (Woodfield & Cowie 1977)

[16] Some studies only include the number of adult visits. Yet we are attempting to generate estimates of value which can be meaningfully compared to other estimates of value. Hence defining the dependent variable in terms of 'visits per zone' - regardless of whether the visitor is an adult or not would appear to generate data most consistent with other valuations,

[17] Eg. the number of visits per head of population, or per 1,000 of population.

Table 32. Travel costs, visits and population

Visits	Travel Costs	Population	Visits per Population
10	1	10	1.00
9	2	10	0.90
8	3	10	0.80
7	4	10	0.70
6	5	10	0.60
5	6	10	0.50
10	7	20	0.50
9	8	20	0.45
8	9	20	0.40
7	10	20	0.35

Defining Visits per head of population as the dependent variable, implies that researchers will estimate:

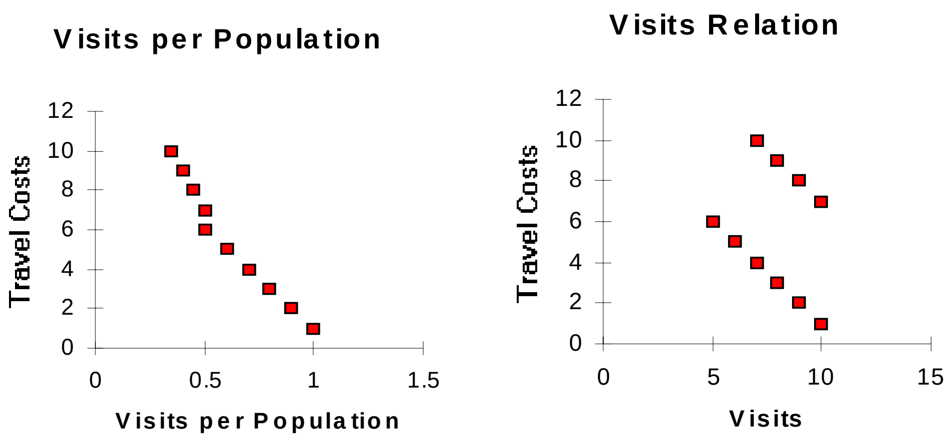
Equation 1: $V/Pop = \alpha + \beta TC$

Defining 'visits' as the dependent variable and including population as a regressor, implies that researchers will estimate

Equation 2: $V = \lambda + \delta TC + \eta Pop$

These different models can be depicted diagrammatically:

Figure 16. Travel costs, visits and population



The first diagram is a representation of Equation 1, whereas the second represents Equation 2. If OLS regression is used to estimate the models, the former will identify a single line of best fit, whereas the latter will, in essence, estimate two different demand curves. Here, Equation 2 is clearly preferable to Equation 1 in so much as it does not confuse the population and travel cost effects. Hence, this study uses the total number of visits from each zone as the dependent variable (rather than visitation rates), including population as a regressor in the visitation equation.

Definitional issues aside, applied travel cost researchers are confronted with the additional problem that measurement error on the dependent variable can bias CS estimates - even if it does not bias slope estimates[18]. To illustrate, assume that the aim of a TC study is to estimate the consumer surplus attributable to recreation at a particular area over a particular period of time (say, one year). Assume also, that the researcher is only able to collect information from a sample of visitors (say, 10% of the total visitor population). One way for the researcher to estimate consumer surplus is to multiply the dependent variable by ten before estimating the visitation equation, and then calculate CS using those coefficients. Another way for the researcher to proceed is to estimate the consumer surplus associated with the sample of visitors and then multiply that number by ten to

[18]Greene (1993, p 281).

arrive an estimate for all visitors[19]. The problem here is that either approach assumes that the distribution (across zones) of sampled visitors exactly coincides with that of all visitors. If this is not the case, final estimates of consumer surplus may be biased.

This was demonstrated by Common and McKenney (1994), who used Monte Carlo simulations to investigate the impact upon aggregate consumer surplus estimates in a hedonic Travel Cost Model. Consumer surplus was over (under) estimated when each zone's visits were over (under) estimated. Further to that, they found that the distribution of visitors across zones was important. If the total number of visits from some zones was over-estimated and the total from other zones was under-estimated, it was not possible to determine - *a priori* - whether aggregate consumer surplus would be over or under estimated.

In the light of research such as this, we chose to estimate the visitation equation and associated consumer surplus from the (known) sample of visitors. We report the results obtaining to the particular sample of visitors, and then scale that estimate upwards, noting the assumptions behind that scaling.

Defining/Measuring Travel Costs

Subjective or Researcher-Defined Travel Costs?

A significant problem attending applied travel cost researchers is that one cannot be sure whether it is subjective or objective (researcher defined) costs which determine recreational behaviour (eg. Randall 1994). Some economists seem to interpret this as indicating that 'respondent-revealed' prices are the 'correct' prices to use in Travel Cost studies. Yet self-reported costs do not necessarily reflect true costs (hence the complexity of surveys used by many psychologists who seek to compare the perceptions of respondents with the perceptions of 'objective observers').

Consequently, applied travel cost researchers who believe that it is subjective, rather than researcher-defined travel costs which determine recreational behaviour, cannot simply ask respondents 'how much did it cost you to travel here?' and expect coherent answers (Common, Bull & Stoeckl 1989). Rather, some type of 'plausibility' test must be applied.

It is, however, worth noting that if the relationship between subjective and researcher-defined costs is random, and if it is subjective costs which determine recreational behaviour, then one would not expect to find evidence of a statistically significant relationship between researcher assigned costs and visits. Yet hundreds of travel cost studies have used researcher defined costs (almost always increasing with distance) - and most have found the relationship between these costs and visits to be statistically significant. It would, therefore, appear, that either (a) researcher defined costs (expressed as a function of distance) determine behaviour, or (b) subjective costs determine behaviour, but there is a 'well-behaved' relationship between researcher defined costs (expressed as a function of distance) and subjective costs.

These hypotheses may not be empirically distinguishable, and we do not attempt to settle the problem here. Instead, we acknowledge that researchers cannot 'know' the correct price of travel, but point out, that they can almost certainly identify a range of 'plausible' travel costs – and that these researcher-defined travel costs are likely to be statistically related to 'true' costs (be they subjective or otherwise). We therefore proceed, detailing our methodology, and the reasoning behind it, in the following sub-sections.

Researcher-Defined Travel Costs

Although precise methodologies vary from study to study, researchers often attempt to measure travel costs themselves - calculating them in a relatively complicated manner. Knapman and Stanley (1993) provide a typical example. In their study, they calculated per-person travel costs in two different ways - one excluding the opportunity cost of time, and the other including it:

[19] If the sample of visitors is a true representation of the total visitor population, it does not matter which approach is taken. To illustrate, assume that the sampled number of visits were used to estimate $V_S = \alpha - \beta TC$. Hence, the consumer surplus attributable to the sample of visitors from each zone is $CS_{Si} = (V_{s0i})^2/-2\beta$. Alternatively, if the total number of visits (across the entire year) were used, the visitation equation would be: $V_T = \delta - \eta TC$. If the distribution of sampled visitors is identical to that of the total visitor population => the total number of visits from each zone (V_{Ti}) is equal to V_{Si} multiplied by some weighting factor (w). Hence, $V_T = w(\alpha - \beta TC) = w\alpha - w\beta TC$. => the consumer surplus attributable to the total number of visitors from each zone (CS_{ti}) is $CS_{ti} = wCS_{si}$

Equation 3 (a): $\pi_i = 1/N_i\{K_i/T_i[0.1733D_i + C_f + 60D_i/700 + A_f] + E_i\}$

and

Equation 3 (b): $\pi_i = 1/N_i\{K_i/T_i[0.1733D_i + C_f + 60D_i/700 + A_f] + E_i\} + Wi$

where:

π_i = travel cost per person by zone
N_i = average household size in zone i
K_i = average number of nights spent in Kakadu by visitors from zone i
T_i = average number of nights spent in Kakadu and at other Northern Territory attractions
D_i = return distance to Kakadu from zone in kilometres (0.1733 being vehicle costs per km in dollars)
C_f = cost of return crossing on Bass Strait ferry for a vehicle of 2,850 cc ($238)
$60D_i/700$ = food and accommodation costs calculated at $60 per day for a trip of $D_i/700$ days, where 700 is the assumed number of km travelled per day
A_f = cost of return crossing on Bass Strait ferry for a household of 2.5 persons ($460)
E_i = average in-park expenditure per household from zone i inclusive of $10 entry fees.
$W_i = (K_i/T_i)(D_i/87.5)(4.07)$ = an estimate of the opportunity cost of time, where 87.5 is the assumed average driving speed, and 4.07 is 25% of the average male and female weekly earnings divided by average weekly hours worked.

This example serves to highlight the complexity of the measurement problem - clearly, if researchers wish to estimate the full price of travel, they must be able to identify (and measure) a range of different prices and quantities.

The Price of (Non-time) 'Inputs'

Interestingly, it is possible to demonstrate that arguments about whether particular inputs should - or should not - be counted as part of the full price of travel, are conceptually equivalent to arguments about the price of distance. To illustrate, note that it is possible to re-write Knapman and Stanley's travel cost equation (Equation 3(a)) as:

Equation 4: $\pi_i = \rho_i(P_{1i}D_i + P_{2i}f(D_i)) + P_{3i}X_{3i}$

where:

$\rho_i = K_i/T_i$
$P_{1i} = 1/N_i\ [0.1733 + 60/700]$
$P_{2i}\ f(D_i) = 1/N_i\ [C_f + A_f] = 0$ for mainland residents.
$P_{3i}X_{3i} = E_i/N_i$

If Knapman and Stanley had not included an allowance for food and lodging, P_{1i} would have been lower. Similarly, allocating a different price to that food and lodging would have altered the numerical value of P_{1i}. Those who argue about which inputs should - or should not - be included as part of the full price of travel (and at what price) are, therefore, arguing about the price of distance. This is further outlined in 'The Range of 'Plausible' Travel Costs Approach' section.

The Opportunity Cost of Time

Attaching a value to the opportunity cost of time is another significant problem facing applied researchers - arguably, it has received more attention than any other within the travel cost literature. That many studies have chosen to exclude time from the analysis (acknowledging that any estimates so generated must be biased) is fair indication of the difficulties encountered in this area.

The most common approach is to assign a value to the opportunity cost of time which is some fraction of average wages; normally between 25 and 50%[20] (Walsh, Gillman & Loomis 1981; Willis 1990). Yet there are problems with this approach - mainly because the opportunity cost of time is likely to vary across activities (McConnell 1985; Ulph & Reynolds 1981) and across individuals (Bockstael, Strand & Hanemann 1987b). Indeed some individuals may find travel enjoyable, indicating that travel time should not be counted as a cost.

[20]In early days, these values were often derived from studies on commuting research: for example, in 1979 the US Water Resources council generated estimates of commuter travel time at 25% of the wage (for adults). In 1987, the Department of Transport in the United Kingdom estimated the cost of non-working travel time at 43% of earnings.

The Range of 'Plausible' Travel Costs Approach

Most relevant here is the fact that arguments about whether one should use subjective or objective costs and/or about how to measure the opportunity cost of time are conceptually equivalent to arguments about how to measure the price of distance. To illustrate, note that it is possible to re-write Knapman and Stanley's travel cost equation (Equation 3(b)) as:

Equation 5: $\pi_i = \rho_i(P_{1i}D_i + P_{2i}f(D_i)) + P_{3i}X_{3i}$

where:
$\rho_i = K_i/T_i$
P_{1i} as $1/N_i\ [0.1733 + 60/700] + 4.07/87.5$
$P_{2i}\ f(D_i) = 1/N_i\ [C_f + A_f] = 0$ for mainland residents
$P_{3i}X_{3i} = E_i/N_i$

This is algebraically identical to Equation 4; only the value of P_{1i} differs. In other words, changes to either the price or the quantity of a recreational input will have the effect of changing the price of distance: seemingly different estimation problems are - on occasion - conceptually similar.

Hence, while it is difficult to do other than agree with Randall's observation that one cannot but measure the 'true' price of travel with error, one is not required to relegate the TCM to a shelf entitled *Theoretical Interest Only*. Applied researchers conducting Cost/Benefit analyses have long acknowledged that they do not 'know' the correct social discount rate. Yet they do not discard the methodology. Instead they use a range of 'plausible' discount rates to generate a range of 'plausible' cost/benefit estimates. A similar approach is taken here.

More specifically, we generate a range of different consumer surplus estimates for a range of 'plausible' travel costs. We do this by estimating the visitation equation using distance[21] as a regressor. Since visitors must travel both to and from the site, this is equivalent to assuming that distance-sensitive travel costs are equal to $0.50 cents per km. Clearly, the travel costs may be higher or lower than that. Consequently we scale estimates of consumer surplus (generated from visitation equations which use an implied price of distance = 0.50) upwards and downwards across a range of 'plausible' travel costs, producing not a single estimate of the recreation use value of regions within the Australian Alps, but a range of 'plausible' values.

Multiple-site Visitors

Applied travel cost researchers frequently work with data sets containing information on both single and multiple-site visitors. The problem here is that the theoretically correct way of dealing with multiple-site visitors (i.e. modelling the demand for all goods within the region simultaneously – See Haspel & Johnson 1982) is rarely practicable. If this is not done, an '*ad hoc* method for the allocation of costs must be employed' (Kerr & Sharp 1985, p 129)[22]. Several different methods have been suggested.

Smith (1971) proposed the use of marginal - as opposed to total - costs. However, if a site which yields considerable benefit to individuals is only a short distance from an earlier stop-over, this approach may under-value the benefits of that site (Ulph & Reynolds 1981, p 203). Another method - introduced by Trice and Wood (1968) and refined by Beardsley (1971) - is to apportion travel costs according to the ratio of time spent at the site under study relative to total trip time (net of travel time). While this is perhaps the most common means of dealing with multiple-site visitors, it requires the assumption that visitors allocate their time in proportion to the benefits received at each site[23]. Others (for example, Knapman & Stanley 1993), have included survey questions

[21] We do not attempt to identify the precise road distance travelled by visitors to the Australian Alps. The main justification for doing so, is that many visitors may voluntarily choose to take circuitous routes because they enjoy travel. We therefore use the minimum distance between each respondent's home and a central town at the site under survey, calculated using the 'great circle distance' formula (Auslig 2002):

D = 1.852 * 60 * ARCOS (SIN(L1) * SIN(L2) + COS(L1) * COS(L2) * COS(DG))

Where L1=latitude of the survey site (degrees)
L2 = latitude of the respondents postcode (degrees)
G1 = longitude of the survey site (degrees)
G2 = longitude of the respondents postcode (degrees)
DG = L2-L1 (degrees)
D = computed distance (km)

[22] That the method must, to some extent, be *ad hoc* reflects the fact that an 'appropriate' means of allocating costs will differ from site to site, and from individual to individual.

[23] As noted by Kerr and Sharp (1985, p129) 'It has not been shown that travellers do behave in this manner, and there is some evidence to the contrary'. For example, 'It might be expected .. that a brief period at a spectacular site would be valued more highly than a tedious visit to a less spectacular site' Clough and Meister (1991, p 116).

which elicit information on the 'importance' of other destinations visited whilst away from home. Total costs are only allocated between the sites so listed - the justification for this being that these were the sites yielding benefits.

While there is evidence that 'valuation estimates are highly sensitive to the assumptions regarding the proportion of travel costs to be assigned to the (site)[24]', it is not clear which - if any - of the above approaches is best. Here, we deal with the problem by using dummy variables to differentiate between multiple and single-site visitors. By using an intercept, and an interactive term (dummy variable * distance), we allow the model to estimate the proportion of distance-related travel costs to be allocated to the site in question for multiple-site visitors.

Defining/Measuring Other Independent Variables

There are many factors - other than just travel costs - which influence recreational behaviour, and to omit them from the visitation equation is to run the risk that OLS estimates will be biased[25]. This is not to say that the way to avoid the problem of omitted variable bias is to include almost anything one can think of within a regression equation - on the off chance that it *might* help and certainly can't hinder. Not only does such a tactic consume valuable degrees of freedom, but it inflates the standard errors of the estimates and may introduce the problem of multicollinearity[26]. Applied researchers must, therefore, tread a rather thin line between that of excluding important variables, and that of including essentially irrelevant information. The first problem is to determine which variables should be included within the visitation equation; the second, is to determine how to measure them. There has been considerable research in this area and the following discussion highlights only a small part of that work.

'Tastes'

Most TC studies attempt to allow for the way in which 'tastes' influence recreational behaviour by collecting data on indirect measures of such - for example: age, education, occupation and sex. Generally, this information is collected from survey respondents and the zonal averages are used as independent variables. Yet coefficients on variables such as average income, education and occupation are often statistically insignificant. This is despite evidence that the average socio-economic status of visitors to recreational areas is usually greater than that of the population from which they originate (eg. Knapman & Stoeckl 1995; Leuschner et al. 1987; Carter, Vanclay & Hundloe 1988).

Part of the reason for this is because aggregation reduces variance. Another, perhaps more interesting, explanation is provided by Ulph and Reynolds (1981, pp 204-5). They note that if the income elasticity of demand for recreation is positive, then (*ceteris paribus)* zones with high average incomes will have higher visitation rates. Using visitor incomes (rather than zonal incomes) may lead one to the erroneous conclusion that income does not affect visitation, and - importantly - may leave differences in visitation rates unexplained.

To illustrate assume that travel costs and income are the only variables which influence visitation, and that the zonal populations comprise the following individuals with the following characteristics.

Zone A

	Income ($ pa)	**Travel Cost**
Individual A	30 000	10
Individual B	30 000	10

Zone B

	Income ($ pa)	**Travel Cost**
Individual C	30 000	10
Individual D	5 000	10

If the choke price for individuals earning at least $30,000 per annum is $11, and the choke price for individuals earning less than $30,000 per annum is $5.00, then one would expect individuals A, B and C to visit the recreational area. If one only measures the income of individuals who visit the site, then both independent variables will be identical for both zones, and the difference in visitation rates will remain unexplained. If, however, one considers the income of all individuals within each zone, then it is possible to explain the differing

[24]Woodfield and Cowie (1977) p 108-109

[25]Slope estimates will be biased unless there is zero correlation between the included and excluded variables. However, even if there is zero correlation between the included and excluded variables, the intercept estimate will still be biased and inconsistent (McKean & Revier 1990, p 431).

[26] While multicollinearity will not bias any estimates, it will lead to large standard errors and can produce unstable regression results (Maddala 1992, chapter 7).

visitation rates - via the differences in income. This study therefore uses postcode data from the Australian Bureau of Statistics' 1996 Census.

Some studies also attempt to measure tastes directly. Visitors are asked questions on things such as *the importance of spiritual inspiration in wilderness, primary recreation activities in the wilderness, importance of family activity in wilderness, membership of environmental organisation, etc* (Walsh et al. 1981; Knapman & Stanley 1991). Typically, the responses are recorded on a Likert scale - the zonal averages included as regressors in the visitation equation. As discussed above, however, it is evident that this information should come from the population as a whole. The benefits of having this information (in terms of model improvement) may not warrant the - possibly substantial - cost of obtaining it, and has not been done in this study.

Substitute Sites

Inclusion of a measure of substitute sites is also considered important - not only to avoid omitted variable bias (which affects slope estimates), but also to ensure that consumer surplus is estimated correctly. That is, to estimate CS, one must simulate reactions to price increases, and these simulations may be imprecise if one does not allow for the price (and availability) of other sites[27].

Importantly, if the price of a substitutable (and/or complementary) good is constant, then it may be valid to exclude it from the visitation equation[28]. This is because a (constant) omitted price cannot be correlated with the included variables - hence slope estimates will not be biased (Kling 1989). It should be noted however, that the intercept and error estimates may be biased (Smith 1993, p 122). This may bias estimates of CS. Hence, if a researcher wishes to estimate CS, he/she must determine how to measure substitute sites.

Smith (1993) alludes to a particularly difficult problem confronting applied travel cost researchers; that of determining what does - and does not - constitute a substitute. Somewhat surprisingly, little attention has been given to this in the literature. Most often, it is assumed that areas which exhibit similar recreational opportunities represent substitutes, yet this may not be so in all cases (Caulkins, Bishop & Bouwes 1985). As pointed out by Walsh (1986, p176) 'work by social psychologists ... shows that researcher-defined substitutes are not statistically related to recreation user-defined substitutes.' Clearly, it is very difficult for researchers to determine what does, or does not constitute a substitute or complement. Perhaps more disturbing, however, is the fact that if researchers decide to exclude measures of other sites they may not be able to anticipate either the magnitude or the direction of the resultant omitted variable bias (McKean & Revier 1990, p435). This will occur if researchers do not know whether the excluded site is a complement or a substitute - since they will not be able to determine the sign of its correlation with the own-price variable.

Evidently, researchers should allow recreationers to determine an appropriate set of substitute sites, and as noted in previous discussions, this should be determined by the population as a whole, rather than simply by those sampled at the site. This was an impractical option for this study, leaving us to choose between two second-best models: one with a badly measured proxy of substitute sites; or one without any measure at all. Since literature provides little guidance[29] we chose to exclude the measure altogether – acknowledging that our final estimates are most certainly biased (in an unknown direction).

Estimating the Visitation Equation: Which Functional Form?

The fact that choice of functional form can have significant influence upon estimates of recreation use value is well documented in the literature. In their meta-analysis, Smith and Kaoru (1990) found the coefficient on functional form to be highly significant, and some researchers have found that choice of functional form contributes more substantially to variations in estimates of recreation use value than do many other factors. For example Willis and Garrod (1991) found that (using OLS), consumer surplus estimates ranged from close to three pounds per person to over 124 pounds per person, depending upon whether the function was in linear, log-linear or double log form. The major problem here is that 'theory does not provide guidance to choose one

[27] For example, assume that prices rise at site A. If sites A and B are substitutes, this will invoke an increase in demand for recreation at site B. If this generates an increase in the price of B, that increase will cause an increase in demand at site A. Hence, to determine the consumer surplus associated with recreation at site A, one needs to allow for such changes. This is essentially the idea behind *general equilibrium adjustment schedules (* Harberger 1971).

[28]If one is attempting to measure the general equilibrium effects of the change being imposed, then one must also assume that there are no distortions in markets which are indirectly affected OR that there are no changes in demand for these goods. Smith (1993) cites work of Thurman and Wohlgenaut (1989) who note that their analysis 'coupled with the practical findings of residual demand analyses suggest that we may not have to seek these extreme conditions (ie zero correlation between the variable whose estimated coefficient is desired and the omitted variables) to approximate general equilibrium measures.'

[29] While the first approach will subject the estimates to omitted variable bias, the latter will produce measurement error bias. As discussed in Greene (1993, p 286), McCallum (1972) and Wickens (1972) show that bias is worse if a badly measured variable is excluded, yet Aigner (1974) concludes that 'it could go either way'.

(functional) form over the others and selection of functional form is usually made on statistical grounds' (Kerr & Sharp 1985, p 130)[30].

Many travel cost studies choose functional form on the basis of F-statistics. Often, several different visitation equations are estimated, each with a different functional form, and the model with the highest F-statistic is selected (see, for example, Knapman & Stanley 1993). In this study, we therefore estimate five different visitation equations for each region (detailed below). We use coefficients from these visitation equations to generate estimates of consumer surplus for each of those forms – highlighting our preferred form(s), and the important variations across different estimates.

Functional Form A *(linear)*: $V_i = \alpha + \beta_e (P_e D_i) + \varepsilon_i$

$$\partial V / \partial P_e = \beta_e$$

$$CS_e = \sum \frac{V_i^2}{-2\beta_e}$$

Functional Form B *(log-linear)*: $\ln V_i = \alpha_e + \beta_e (P_e D_i) + \varepsilon_i$

$$\partial V \; / \; \partial P_e \; = \; \beta_e e^{(\alpha_e + \beta_e \overline{TC})}$$

$$CS_e = \sum \frac{V_i}{-\beta_e}$$

Functional Form C *(semi-log)*: $V_i = \alpha_e + \beta_e \ln(P_e D_i) + \varepsilon_i$

$$\partial V \; / \; \partial P_e \; = \; \beta_e \; / \; P_e \overline{D}$$

$$CS_e \; = \; \sum \left(- P_e D_i V_i \; + \; \beta_e (P_e D_i \; - \; e^{(-\alpha_e / \beta_e)}) \right)$$

Functional Form D *(double-log)*: $\ln V_i = \alpha + \beta_e \ln(P_e D_i) + \varepsilon_i$

$$\partial V \; / \; \partial P_e \; = \; \beta_e e^{\alpha_e} P_e \overline{D}^{\,\beta_e - 1}$$

If $\beta_e < -1$

$$\mathrm{CS}_e = \sum (- P_e D_i V_i) \; / \; (\beta_e + 1)$$

If $\beta_e > -1$

$$\mathrm{CS}_e = \sum (MaxPMinQ - P_e D_i V_i) \; / \; (\beta_e + 1)$$

where:

$$Min\ Q \; = \; 1$$

$$Max\ P \; = \; (1 \, / \, e^{\alpha_e})^{1/\beta_e}$$

[30] Sandrey and Simmons (as reported in Kerr & Sharp 1985, p 130) suggest that the logged functional form is more appealing than the linear form 'because it is more consistent with observed behaviour of hard-core site users'. Presumably this means that Sandrey and Simmons believe that recreational demand curves are convex to the origin. Yet, it is possible for the aggregate demand curve to be convex even if the visitation equation is linear. Clearly it is not necessary to choose a logarithmic visitation function *for this reason*; some other criteria for making a choice between functional forms must be sought.

Functional Form E*(Inverse)*: $V_i = \alpha + \beta_e/(P_e D_i) + \varepsilon_i$

$$\partial V / \partial P_r = -\beta_r / \overline{TC}^2$$
$$CS_r = \sum \alpha_r (\overline{P} - TC_i) + \beta_r Ln(\overline{P} / TC_i)$$
$$where:$$
$$IF \ \alpha_r < 0$$
$$\overline{P} = \beta_r / -\alpha_r$$
$$Else \ if \ \alpha_r < 1$$
$$\overline{P} = \beta_r / 1 - \alpha_r$$
$$Else$$
$$\overline{P} = TC_{20}$$

Estimating Consumer Surplus

There are two different ways of using information from the visitation equation to calculate consumer surplus: one can 'simulate' an aggregate demand curve and integrate it to find the area beneath it; or one can calculate the consumer surplus attributable to each zone[31], and add those amounts. They yield identical results. When undertaking applied research, however, a problem arises. This is because the number of visits (at current travel costs) which are observed (V_o), will frequently differ from the number of visits (at current travel costs) which are predicted by the model (V_p). Researchers must, therefore, decide whether to use V_o or V_p as the 'base' of the demand curve.

Bockstael and Strand (1987) discuss this issue in some detail, arguing that when the dependent variable is measured with error, the best guess of the actual number of trips at current prices is given when the predicted values of V are used. They also argue that observed values of V should be used when a variable has been omitted from the visitation equation. It is unclear whether predicted or observed values should be used if both problems exist. In this study, we know there are missing variables (a measure of substitute sites to name the most obvious). We hope – although cannot be certain – that the dependent variable is not measured with error. Consequently, we use observed visits when calculating consumer surplus for each functional form:

Estimating Recreation Use Value

Researchers occasionally use the TCM to generate estimates of recreation use value. An Australian example of this is given in Stanley and Knapman (1991). In this study, they estimated that the annual consumer surplus attributable to recreation at Kakadu National park was approximately $35 million. Assuming that that value approximated the CS obtainable in each and every year into perpetuity, and using an eight percent real discount rate (δ), they calculated total recreation use value (RUV) as:

Equation 6: $RUV = CS_e \times (1 + 1/\delta)$

The general methodology serves to illustrate an important point: these estimates of RUV are only valid if the demand for recreation is stable over time. If, for example, population or income were to change, then the demand curve would probably shift - altering future values of consumer surplus. Similarly, it is possible that the parameters (or the functional form) of visitation equations change over time - and this will alter future values of consumer surplus.

It must be said that this problem is not unique to the TCM. Any cost-benefit analysis which uses future estimates is subject to similar criticisms. This merely serves to highlight the importance of conducting sensitivity analyses - and of attaching as much significance to variations so discovered as to any absolute numbers reported. In this study, we generate several different estimates of RUV – each derived from a different discount rate (if only to highlight the sensitivity of final estimates to changes in assumptions regarding the future).

[31] The integral of each zone's demand curve.

Methodological Summary

We generate a range of estimates of the Recreation use value of each of seven different regions within the Australian Alps. Rather than attempting to determine travel costs from each zone, we use the 'great circle' distance between each zone of origin and the location from which the survey was collected as a measure of travel costs (assuming a price of distance = $ 0.50 per km since distance is one-way). Distance, the population of each zone, and other socioeconomic measures (taken from the ABS's 1996 census) are used as regressors within the visitation equation and the dependent variable is defined as the number of sampled visitors from each zone. We allow for multiple-site visitors problem by using dummy variables to identify multiple-site visitors, and estimate five different visitation equations (using five different functional forms) for each region. Parameters from the visitation equations are used to generate 5 different estimates of Consumer surplus (using the observed number of visits to do so). Those estimates are scaled upwards and downwards for a range of 'Plausible' P, and several different discount rates are used to generate a range of 'plausible' estimates of the RUV of the Australian Alps.

APPENDIX B: VISITATION EQUATIONS FOR ALL FUNCTIONAL FORMS

Table 33. Visitation equations for region 1[32]

Region	N	Model	AdjR	F-Ratio	Variable	Coefficient
1	203	A	0.0012	1.0343	Constant	4.6321
					EOS	-0.0003
					D	-0.0012
					M*D	-0.0007
					M	-0.0278
					Pop	0.0063
					Education	-0.0117
					Income	0.0019
		B	0.0177	1.5213	Constant	* 10.3331
					EOS	-0.0003
					D	* -1.0773
					M*D	-0.3171
					M	1.2074
					Pop	0.0091
					Education	-0.0078
					Income	0.0017
		C	0.0276	1.8192	Constant	* 0.9619
					EOS	* -0.0001
					D	* -0.0002
					M*D	-0.0001
					M	0.0293
					Pop	0.0040
					Education	-0.0056
					Income	0.0008
		D	0.0593	2.8198	Constant	* 2.0421
					EOS	-0.0001
					D	* -0.2026
					M*D	-0.0655
					M	0.3016
					Pop	0.0046
					Education	-0.0048
					Income	0.0008
		E	0.0083	1.2422	Constant	2.7668
					EOS	-0.0003
					D	* 226.6996
					M*D	-21.7051
					M	-0.5980
					Pop	0.0092
					Education	-0.0072
					Income	0.0024

[32] * indicates that the variable is significant at the 10% level

Table 34. Visitation equations for region 2[33]

Region	N	Model	AdjR	F-Ratio	Variable	Coefficient
2	879	A	0.1503	23.1829	Constant	4.2277
					EOS	* -0.002
					D	* -0.0055
					M*D	0.0025
					M	* -8.9747
					Pop	* 0.2977
					Education	* 0.4532
					Income	0.0012
		B	0.1876	29.9566	Constant	* 41.3462
					EOS	* -0.0018
					D	* -6.8658
					M*D	2.3191
					M	* -22.4203
					Pop	* 0.3143
					Education	* 0.4389
					Income	0.004
		C	0.2358	39.6964	Constant	* 1.1916
					EOS	* -0.0002
					D	* -0.0005
					M*D	0.0002
					M	* -0.7239
					Pop	* 0.0224
					Education	* 0.0326
					Income	0.0004
		D	0.2744	48.4412	Constant	* 3.8905
					EOS	* -0.0002
					D	* -0.5054
					M*D	0.1116
					M	* -1.3693
					Pop	* 0.0236
					Education	* 0.032
					Income	0.0006
		E	0.2024	32.8336	Constant	* -11.0400
					EOS	* -0.0022
					D	* 3252.1271
					M*D	*-2431.1868
					M	-1.8682
					Pop	* 0.3264
					Education	* 0.4556
					Income	0.0066

[33] * indicates that the variable is significant at the 10% level

Table 35. Visitation equations for region 3[34]

Region	N	Model	AdjR	F-Ratio	Variable	Coefficient
3	112	A	0.0692	2.1797	Constant	-9.9842
					EOS	-0.0016
					D	0.0041
					M*D	-0.008
					M	* 6.4184
					Pop	0.1122
					Education	0.1146
					Income	0.012
		B	0.2161	5.3714	Constant	-12.9675
					EOS	-0.0013
					D	1.0066
					M*D	* -6.0562
					M	* 37.232
					Pop	0.0833
					Education	0.0921
					Income	0.0115
		C	0.1282	3.3315	Constant	-0.8672
					EOS	* -0.0003
					D	0.0005
					M*D	-0.0008
					M	* 0.7314
					Pop	0.0045
					Education	0.0058
					Income	0.0023
		D	0.256	6.4557	Constant	-1.5898
					EOS	* -0.0003
					D	0.179
					M*D	* -0.643
					M	* 3.9783
					Pop	0.0023
					Education	0.0036
					Income	* 0.0023
		E	0.2455	6.1589	Constant	-4.7901
					EOS	-0.00117
					D	-107.183
					M*D	* 906.1518
					M	-1.34041
					Pop	0.079214
					Education	0.083749
					Income	0.008663

[34] * indicates that the variable is significant at the 10% level

Table 36. Visitation equations for region 4[35]

Region	N	Model	AdjR	F-Ratio	Variable	Coefficient
4	58	A	0.0808	1.7154	Constant	-4.3519
					EOS	-0.0029
					D	-0.0002
					M*D	-0.0039
					M	2.703
					Pop	0.0975
					Education	0.1465
					Income	0.0078
		B	0.3021	4.5241	Constant	5.1877
					EOS	-0.0022
					D	-0.3968
					M*D	* -3.7799
					M	* 21.989
					Pop	0.0204
					Education	0.1252
					Income	-0.0011
		C	0.1142	2.0498	Constant	0.0617
					EOS	-0.0001
					D	-0.0004
					M*D	-0.0003
					M	0.3415
					Pop	0.0072
					Education	0.0022
					Income	0.0018
		D	0.3843	6.0831	Constant	2.267
					EOS	0.0001
					D	-0.2267
					M*D	* -0.3854
					M	* 2.3821
					Pop	-0.0038
					Education	-0.0003
					Income	0.0003
		E	0.3075	4.6156	Constant	2.153352
					EOS	-0.00272
					D	5.795154
					M*D	* 498.2534
					M	-2.3112
					Pop	0.039076
					Education	0.152124
					Income	-0.00084

[35] * indicates that the variable is significant at the 10% level

Table 37. Visitation equations for region 5[36]

Region	N	Model	AdjR	F-Ratio	Variable	Coefficient
5	509	A	0.1195	10.8508	Constant	* 4.1721
					EOS	-0.0004
					D	-0.0008
					M*D	* -0.0019
					M	* 3.0361
					Pop	* 0.0829
					Education	* 0.0789
					Income	-0.0037
		B	0.1718	16.0564	Constant	* 7.1413
					EOS	-0.0004
					D	* -0.7381
					M*D	* -1.7008
					M	* 11.7383
					Pop	* 0.0954
					Education	* 0.0826
					Income	-0.0026
		C	0.1385	12.6682	Constant	* 1.2524
					EOS	* -0.0001
					D	* -0.0002
					M*D	-0.0001
					M	* 0.3598
					Pop	* 0.0127
					Education	* 0.0117
					Income	-0.0005
		D	0.1829	17.2466	Constant	* 2.0298
					EOS	* -0.0001
					D	* -0.171
					M*D	* -0.1192
					M	* 0.9555
					Pop	* 0.0143
					Education	* 0.012
					Income	-0.0004
		E	0.1274	11.5909	Constant	1.966804
					EOS	* -0.00049
					D	99.51812
					M*D	* 118.8103
					M	1.661443
					Pop	* 0.087517
					Education	* 0.082833
					Income	-0.00171

[36] * indicates that the variable is significant at the 10% level

Table 38. Visitation equations for region 6[37]

Region	N	Model	AdjR	F-Ratio	Variable	Coefficient
6	229	A	0.0356	2.2014	Constant	2.4293
					EOS	* -0.0014
					D	-0.0001
					M*D	-0.0009
					M	0.4225
					Pop	* 0.0916
					Education	0.0421
					Income	0.0021
		B	0.0344	2.161	Constant	1.7185
					EOS	* -0.0014
					D	0.0939
					M*D	-0.5106
					M	3.0095
					Pop	* 0.0929
					Education	0.0417
					Income	0.0023
		C	0.041	2.3929	Constant	* 0.9231
					EOS	* -0.0002
					D	0.0001
					M*D	-0.0002
					M	0.1482
					Pop	* 0.0120
					Education	0.0073
					Income	0.0002
		D	0.0429	2.4591	Constant	0.3783
					EOS	* -0.0002
					D	0.1053
					M*D	-0.1588
					M	0.963
					Pop	* 0.0120
					Education	0.0071
					Income	0.0002
		E	0.0318	2.0695	Constant	2.584406
					EOS	* -0.00141
					D	1.471963
					M*D	-6.3422
					M	0.093087
					Pop	* 0.089699
					Education	0.044766
					Income	0.001763

[37] * indicates that the variable is significant at the 10% level

Table 39. Visitation equations for region 7[38]

Region	N	Model	AdjR	F-Ratio	Variable	Coefficient
7	286	A	0.027	2.1312	Constant	* 5.8711
					EOS	* -0.0013
					D	-0.0006
					M*D	-0.0009
					M	0.1892
					Pop	*0.0482
					Education	0.0721
					Income	-0.0038
		B	0.042	2.7832	Constant	5.5724
					EOS	* -0.0013
					D	-0.1619
					M*D	* -1.2401
					M	6.8435
					Pop	* 0.0534
					Education	0.0691
					Income	-0.0023
		C	0.0561	3.4215	Constant	* 1.4708
					EOS	* -0.0002
					D	-0.0001
					M*D	-0.0001
					M	0.1265
					Pop	* 0.0092
					Education	* 0.0103
					Income	-0.0008
		D	0.071	4.113	Constant	* 1.3345
					EOS	* -0.0002
					D	-0.0069
					M*D	* -0.1952
					M	* 1.1815
					Pop	* 0.0099
					Education	0.0098
					Income	-0.0006
		E	0.0348	2.4685	Constant	* 4.400814
					EOS	* -0.00132
					D	-17.0111
					M*D	165.5033
					M	-0.94498
					Pop	* 0.047284
					Education	0.065622
					Income	-0.00163

[38] * indicates that the variable is significant at the 10% level

APPENDIX C: CONSUMER SURPLUS ESTIMATES FOR ALL FUNCTIONAL FORMS

Table 40. Consumer surplus estimates (from the sample of visitors, with TC = 50 cents per km)

	Model					Mean (across models)
Region	**A**	**B**	**C**	**D**	**E**	
1	$3,647,370	$885	$385,164	$1,295,620	$6,036	$1,067,015
2	$31,198,000	$1,462	$4,054,840	$5,245,460	$2,368,354	$8,573,623
3	$1,596,122	$47	$164,213	$1,783,470	$21,620	$713,094
4	$2,536,341	$262	$71,248	$557,418	$9,000	$634,854
5	$7,356,773	$1,887	$947,426	$2,910,170	$8,385	$2,244,928
6	$22,524,500	-$1,040	$528,722	$2,755,510	$7,627	$5,163,064
7	$7,549,500	$3,701	$513,388	$2,593,900	$3,195	$2,132,737
Sum	**$76,408,606**	**$7,204**	**$6,665,001**	**$17,141,548**	**$2,424,217**	**$20,529,315**

Table 41. Per-person estimates of consumer surplus (with TC = 50 cents per km)

	Model					Mean
Region	**A**	**B**	**C**	**D**	**E**	
1	$3,626	$1	$383	$1,324	$6	**$890**
2	$3,354	$0	$436	$1,088	$255	**$814**
3	$2,404	$0	$247	$1,334	$33	**$665**
4	$7,226	$1	$203	$2,254	$26	**$1,615**
5	$2,747	$1	$354	$1,047	$3	**$693**
6			$428	$5,220	$6	**$1,884**
7	$5,852	$3	$398	$2,066	$2	**$1,388**
Mean (across Regions)	**$4,623**	**$0**	**$403**	**$1,037**	**$147**	**$1,035**

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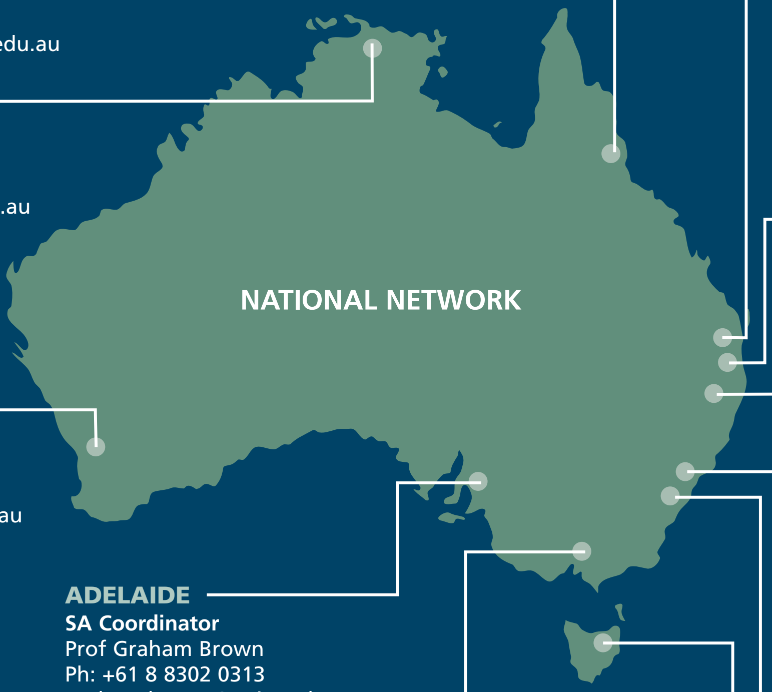

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