

Visitor perceptions of aircraft activity and crowding at Franz Josef and Fox Glaciers

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Abstract

Both Franz Josef and Fox Glaciers are popular tourist destinations on the West Coast of New Zealand, with total visitor numbers of 175 000 per annum, a figure that is anticipated to increase in line with current tourism trends. While people enjoy visiting the glacier viewing spots in the main glacier valleys and on the valley sides, many also make use of the scenic air flights. Scenic air flights have long been an integral part of the visitor experience, and this activity appears to be increasing significantly as well.

There are impacts that can arise from visitor activities, and this paper focuses on two of these: the social impacts of annoyance at aircraft activity (generally assumed to be the problem of noise), and the issue of crowding. Research methods have been developed to study crowding, but there is little existing methodology for measuring public reaction to the presence of aircraft. In order to address this anomaly, a questionnaire was designed to explore visitor perceptions at the glacier valleys, and 3 282 valid responses were gathered.

The results of analysis of the questionnaires indicate that crowding occurs only during the periods of highest visitation in the main valleys. Annoyance at aircraft activity also occurs to a significant degree only when the number of aircraft using the glacier valley reaches or exceeds 18 per hour. Visitors to the valley-sides, however, are much more sensitive to the numbers of other visitors and to air traffic, even though they may also be some of the people tolerant of much higher levels of activity in the main valleys.

The results support the continued use of self administered questionnaire methods of impact assessment using Likert scales. Visitor expectations appear to influence the extent to which social impacts become manifest. Management decisions need to be made as to which visitor experience will be used as the main focus for the area, and from this information, acceptable limits to visitor numbers or aircraft activity can then be set.

1. Introduction

Visitors to protected natural areas are generally seeking some form of experience, an experience that arises from the match between their expectations prior to their visit and the events that unfold during their visit. At popular tourist sites there is pressure to maximise the visitor opportunities, to cater for as many people as possible and to offer a range of visitor experiences. As a result of high levels of visitation, visitors may well be affected by the numbers of other people present, and the impacts of the various activities taking place; for example, noise from aircraft flights.

This research was undertaken at the popular neighbouring tourist destinations of Fox Glacier and Franz Josef Glacier, on the West Coast of New Zealand's

South Island. These glaciers arise in the snow fields on the western slopes of mountains directly to the north of Mt Cook (3 754m) the highest peak in New Zealand, and descend 7 km down towards the coast and the tourist towns that take the names of each of the glaciers. Currently, tourists are able to drive to within 1 km of the terminal face of either glacier and then walk the remaining distance along the riverbeds.

Other activities for people visiting the glaciers include the option of guided walks on the glaciers, bush walks on the valley sides offering attractive views, and scenic flights, by fixed wing aircraft or helicopter, which usually include a landing on the glacier névé at approximately 2 000 m. Aircraft have long been used for scenic flights in this area, but it is only in the last two decades that the level of activity has significantly increased. The aircraft and helicopters use flight paths that follow the valley sides from the townships to the snow fields in the mountains, in this way passing directly over the visitors walking to the terminal face of the glaciers.

The Department of Conservation manages Westland National Park where the glaciers are located. Managers had only anecdotal information about the impacts on the visiting public caused by the continued growth in the level of tourist related air traffic in the glacier area. There was no formal method of assessing whether an unacceptable level of air traffic had been or would be reached. There is pressure from scenic flight companies to allow increased numbers of aircraft landings on the glacier névés, but such approval is reluctantly given when there is limited understanding of the impacts of the aircraft flights on other users of the area.

Relevant research from the USA is reviewed in a 1994 publication Report to Congress: Report on Effects of Aircraft Overflights on the National Park System (National Parks Service, 1994). The report identified that aircraft activity, most particularly the intrusion of noise, was perceived to be a problem at many sites. Methods for recording the level of disturbance created by aircraft focused on those that sought visitor assessment of their experience, rather than measuring noise levels *per se*.

The National Parks Service (1994) report supports the use of targeted questions. "To understand visitor reactions to aircraft, visitors must be questioned specifically about aircraft." The report also notes that direct questions about the perceived effects of overflights have to be asked specifically and close to the time of the experience (National Parks Service, 1994: 6.2). What is achieved by the use of several satisfactions questions starting with the general and moving to the specific, is to provide a context for that impact, in terms of the visitors' general likes and dislikes (or the absence thereof).

Agreement was reached that some form of assessment should be undertaken at the Franz Josef and Fox Glacier area, in order to develop a method for ongoing monitoring of aircraft impacts. A scoping exercise in July-August 1994 identified several tasks that should be completed in order to explore this issue:

1. Establish if there exists (as is supposed), at times, a significant dissatisfaction with aircraft activity.
2. Develop methods for exploring social impacts without unnecessarily "leading the witness" to answer in a negative manner.

3. Explore the reaction of visitors to aircraft at different locations in the glacier valley, including valley sides and the main valley leading to the glacier face.
4. Tie the opinion expressed by visitors about aircraft to the actual level of aircraft activity at the time.

Several important variables relating to public visits to the glaciers were identified as requiring assessment. First, there is the actual aircraft activity occurring in the glacier valleys. Second, there is the level of visitor activity on the various walks associated with the glacier valleys. Finally, there are the visitors' reactions to the events they encountered on their visits.

2. Methods

Aircraft activity was recorded on site at the time that questionnaires were administered. For each aircraft flight heard and/or seen in the glacier valley, details were recorded for;

- the type of aircraft,
- the flight path,
- the approximate height, and
- the time.

Visitor numbers were recorded in the glacier valleys at the time the questionnaires were administered, by use of a counter device, which was read every twenty minutes. Numbers of visitors on the bush walks on the valley sides were recorded by asking visitors to record the number of other walkers encountered. While this latter figure is subjective, the use of visitor recall has been shown to underestimate actual numbers encountered on bush walks by only about five percent (Sutton, 1992).

The assessment of visitor perception of aircraft noise involved the use of a short self-administered questionnaire. This methodology was based on the previous research which supports this style of respondent self-assessment (Shelby *et al.*, 1989; Sutton, 1992). A Likert scale was used for questions about satisfaction, crowding and reaction to aircraft activity. A single question on satisfactions would not have been adequate by itself to explore visitors reactions to aircraft and to crowding, as both visitor expectations and ensuing levels of satisfaction have highly complex parameters (Ryan, 1995), and are likely to be poor indicators of specific management issues. The questionnaires were printed on A5 sheets, with general information questions on the front (previous visitation, demographics, satisfactions, dissatisfactions), and the more specific social impact questions on the reverse (Appendix 1). This method was used to test whether aircraft noise was an issue that arose without prompting (side one), and then more targeted questions led respondents to evaluate their experience.

A total of 3 282 questionnaires which were valid for analysis were completed during the summer of 1994-95, comprising 1 306 from Fox Glacier Valley, 1 536 from Franz Josef Glacier Valley, 298 from short bush walks on the valley sides (both valleys), and 142 from long bush walks on the valley sides (Franz Josef Glacier Valley only).

3. Results

3.1 AIRCRAFT ACTIVITY

Aircraft activity in the glacier valleys fluctuates during the day, with the highest activity in the morning, from 8.00 am to 11.00 am, and dropping during the day, but continuing until after 8.00 pm (Figures 1a and 1b). This also corresponds to the pattern of visitor activity (Figure 2). Such patterns are heavily influenced by the weather, as low cloud will prevent flights.

The average number of aircraft recorded in the main valleys is 6.3 per hour. However, this activity ranges from no aircraft to over 40 in an hour. For the tracks on the valley sides the average number of aircraft encountered per hour is 19.9. This higher average may be the result of additional aircraft flight-paths between glacier valleys (i.e., aircraft returning to their point of origin after completing a circuit of both glacier valleys), and may also have been influenced by the times chosen to sample in these areas.

FIGURE 1a. DAILY DISTRIBUTION OF AIRCRAFT OVER-FLIGHTS.

FIGURE 1b. COMPOSITE DAILY DISTRIBUTION OF AIRCRAFT OVER-FLIGHTS.

FIGURE 2. DAILY VISITOR ACTIVITY.

3.2 VISITOR ACTIVITY

Visitor activity in the glacier valleys has a daily peak between 10.00 am and 10.40 am, dropping during midday, and then increasing in the afternoon between 1.30 pm and 5.00 pm (Figure 2). The results show the average number of visitors recorded per 20 minute time period.

Relating aircraft activity to visitor numbers provides a “total person-exposure level”, or what is also known as Aircraft Exposure Units (AEU). Thus if 40 people are exposed to five aircraft, the total person-exposure level is 200. Applying AEU to data from Figure 3 accentuates the morning peak, but also shows the afternoon fluctuations (Figure 3). These peaks indicate the times that involve the greatest number of people coinciding with the greatest level of aircraft activity.

FIGURE 3. TOTAL PERSON-EXPOSURE TO AIRCRAFT.

3.3 QUESTIONNAIRE DESIGN

By offering the questionnaire on a clipboard, it was found that most respondents completed the questionnaire in the order they were presented, and virtually no people read both sides of the questionnaire before beginning their answers. It was thus assumed that responses to the open ended questions presented early in the questionnaire were not being influenced by the respondent's knowledge that aircraft noise was a topic to be considered later.

3.4 AIRCRAFT AS A GENERAL SOURCE OF DISSATISFACTION

In response to the question "What things did you not like about today's trip to the glacier":

1. Of main glacier valley walkers, 2.5% (51 people) noted that aircraft had annoyed them. Approximately 70% of these responses related specifically to helicopters, which may simply relate to the fact that helicopter flights make up approximately 75% of all aircraft activity as recorded during the study period;
2. For people engaged in bush walks, 10% (45 people) noted that aircraft had annoyed them. Again, helicopters were the main perceived problem, rather than fixed wing aircraft.

There is thus a measurable level of dissatisfaction with aircraft activity in the glacier area, and the level of dissatisfaction was considerably greater for visitors using the tracks on the valley sides compared with those on the main valley walks. These measurable levels of visitor response, recording the perception of impacts resulting from aircraft activity, are known as dose-response relationships in the National Park Service (1994) report.

The difference in the level of annoyance of users of the valley floor compared with people walking the valley sides is best explained as being due to the bush walkers' closer proximity to aircraft flight paths. It is also likely that the visitors to the bush tracks had different expectations for their experience compared with visitors in the main valley, although this issue was not explored in the questionnaire.

The level of negative responses relating to aircraft activity is less than the level of responses related to crowding or congestion. Approximately 60% more people responded with comments on crowding than did people commenting on aircraft activity.

The results support the premise that broad open-ended questions on satisfaction are effective in determining a baseline of public annoyance. It is also apparent from these results that aircraft do not appear to be annoying a significant number of visitors.

3.5 SATISFACTION OF EXPECTATIONS

In general there was a high level of satisfaction recorded by visitors. Of main valley visitors, 97.5% met or exceeded their expectations, and only 2.5% felt the visit was worse than expected.

Visitors to the tracks on the valley sides were only a little less satisfied, with 96% finding that the experience was as they expected or better, and 4% that felt it was worse than expected.

3.5.1 **Satisfactions and aircraft activity**

The level of satisfaction did not vary significantly in relation to the number of aircraft present at the time.

3.6 CROWDING

There is a clear relationship between the number of people encountered and the level of crowding recorded (Figure 4). Increasing encounter levels lead to higher overall feelings of crowding. This association may seem self-evident, but this positive result supports the use of the Likert scale as a method of social impact assessment with this sample population.

FIGURE 4. VISITOR NUMBERS AND PERCEIVED CROWDING: MAIN VALLEY WALKS.

3.6.1 **Unacceptable crowding**

The crowding indices suggested by Shelby et al. (1989) state that up to 50% response of any crowding (i.e., responses of 5 or more on the 9 point crowding scale) is not indicative of a problem, 50%-65% suggests management concerns should be raised, and more than 65% indicates some management action is required. It is probably time to review these "critical" thresholds in order to establish New Zealand standards. Even for popular areas, New Zealanders and overseas visitors are unlikely to accept the same levels of crowding as have been tolerated in the overseas studies.

Using the results from visitors to the main glacier valleys, the level of crowding increases with increasing encounter levels to approximately 60% crowding at the maximum visitor exposure level of 275–325 people in one hour, the average time visitors are exposed to other visitors during their visit to the glacier valley (Figure 4). There were no records of when visitor levels were higher than this.

The number of people encountered when the crowding level reached 50% on the main valley walks was approximately 150–200 people per visit. Using the results of the mean number of visitors per 20 minute period of the day, and the one hour exposure time, this equates to 50–67 people each 20 minute period. This level of activity represents the busier periods of visitation, but is, on average, usually exceeded at Franz Josef Glacier each day in the late mornings and mid afternoon (Figure 2).

The trends in Figure 4 suggest a result that will approach an asymptote of just less than 70% crowding as visitor numbers continue to increase to above 350 for any “visit” of one hour and forty minutes.

The implications of continued increases in international tourism mean that there will also be increasing periods of time when the level of crowding rises beyond an “acceptable limit” of 65%. Figure 2 indicates that there are patterns to visitor activity, and it is likely that the peak times of mid morning and mid afternoon will continue to receive the greatest share of visitors. An acceptance of crowded situations appears to accompany the development of crowding, once the higher levels of use have been reached. During the other periods of the day, which are currently receiving lower visitation levels and less crowding, increases in tourist arrivals will lead to more pronounced increases in crowding, in particular as numbers increase during the periods now receiving 50–150 visitors per 20 minute period.

3.6.2 Crowding levels; main valleys compared with bush walks

For visitors to the main valley walks, 45% recorded crowding to some degree, compared with only 25% for visitors using the walks on the valley sides. There was a significant difference between crowding recorded in the main valleys compared with the valley sides ($F = 9.535$, $p < 0.005$, $df = 1$). This result needs to be placed within context, recognising that there are far higher numbers of visitors using the main valley tracks compared with the tracks on the valley sides.

3.6.3 Crowding levels compared with actual encounter levels

Valley-side visitors showed significantly lower tolerance levels to encounters with others compared with visitors to the main valley tracks. This was particularly the case with those people on the longer walks. Encounter levels of greater than 18 people on a walk brought crowding responses to above 50%, which then increased to 100% crowding for the four people who reported meeting more than 20 people. This hyperbolic increase in crowding levels suggests quite a different encounter norm held by these visitors, compared with the seemingly more tolerant visitors in the main valleys. The expectation

that a bush walk will involve only a few encounters is expressed in this sharp increase in crowding after numbers of encounters reaches 17 (Figure 5).

FIGURE 5. VISITOR NUMBERS AND PERCEIVED CROWDING: BUSH WALKS.

People on the short bush walks did not meet large numbers of other people—a result of the shorter duration of the trip, and the smaller number of people using these facilities. As a result, the “crowding” for valley-side walks was registered by walkers on the long bush walks only.

3.7 ANNOYANCE AT AIRCRAFT

In analysing the impact of aircraft activity on visitors, the unit of aircraft activity is expressed as aircraft per hour. The responses from the survey relate to the actual time spent on the walks and the respondent’s reaction to the level of aircraft activity during that time. The time period of one hour chosen here allows an index of aircraft activity to be expressed in an easily understood unit. Alternative “assigned” exposure times would not change the visitor response levels reported in the study.

There is a positive relationship between increasing levels of aircraft activity and increasing levels of annoyance (Table 1; Figure 6).

An interesting result is the 6.4% of visitors registering annoyance for time periods when there were no aircraft recorded. This could be interpreted as representing those people who spent longer than one hour in the areas and hence may have encountered aircraft, when later it was assumed that they had not. Also, some people may say that they were annoyed at the presence of aircraft *per se*, even though they may not have encountered one. Both of these explanations are likely to lead to this result, the second more-so than the first.

3.7.1 The annoyance level of visitors to the main valley

An assessment of the level of annoyance at increasing aircraft encounters was made by grouping all responses that indicated a level of annoyance together (5–9 on the scale). Main valley walks show a gradual increase in the level of annoyance as aircraft frequency increases to six an hour, then a period of

relatively unchanging tolerance as aircraft frequency increased to 14 aircraft an hour (Figure 6). Between 15 and 18 aircraft an hour the result shows an erratic increase in overall annoyance. There is then a rapid increase in annoyance for

TABLE 1. TOTAL RESPONSES TO AIRCRAFT ANNOYANCE LIKERT SCALE FOR VISITORS TO MAIN VALLEYS.

		ANNOYANCE SCALE RATING										
		0	1	2	3	4	5	6	7	8	9	n=
AIRCRAFT NUMBERS	0	120	3	2	11	2	1	3	1	0	4	143
	1	157	6	5	51	18	9	4	4	3	4	255
	2	85	15	10	67	26	13	10	4	2	5	232
	3	28	17	11	58	50	11	9	3	0	4	190
	4	72	25	15	126	71	11	11	11	2	10	346
	5	24	21	23	112	69	19	17	6	4	6	296
	6	32	14	10	88	65	16	19	5	2	6	255
	7	16	7	14	57	38	8	8	6	0	0	161
	8	11	15	9	49	31	10	8	5	3	3	146
	9	18	8	10	64	55	17	12	3	0	9	196
	10	6	2	3	31	20	5	3	2	0	5	82
	11	3	6	7	35	23	3	5	3	2	1	96
	12	6	7	6	44	23	9	2	4	0	1	113
	13	3	4	4	36	15	6	0	5	0	0	86
	14	1	3	2	20	10	1	4	0	0	2	55
	15	2	2	2	6	5	2	1	0	2	2	35
	16	0	1	1	5	5	1	2	0	0	0	31
	17	1	3	1	15	11	3	1	1	0	2	53
	18	1	2	1	17	8	4	2	1	0	0	54
	19	0	0	0	3	7	9	1	1	0	1	40
	20	0	3	0	1	0	1	1	0	0	0	26
21+	0	0	1	4	3	2	3	2	3	6	15	

FIGURE 6. EXPOSURE TO AIRCRAFT AND ANNOYANCE REGISTERED: MAIN VALLEY WALKS.

people who experienced more aircraft than 18 per hour. A point appears to have been reached, after 14 aircraft encounters an hour, at which the percentage of visitors registering annoyance changes, and this change is most obvious with more than 18 aircraft encounters per hour. It should be noted

that the sample numbers exposed to higher levels of aircraft activity were low compared with the numbers experiencing up to 14 aircraft per hour.

The method of grouping all negative responses together masks the transition occurring from a generally neutral or positive reaction to one of increasing annoyance expressed by choices of higher and higher scores on the scale of 5-9 of the Likert scale (question 10). Table 1 holds the data for each number on the scale for respondents from the main valley walks of both glacier valleys. In order to make a composite picture of this information, different numeric weightings were given to each of the responses on the 0-9 annoyance scale. "Didn't notice" responses retained the scoring 0; 2 was scored for "noticed and felt it added to my enjoyment" (questionnaire scores 1 and 2); and 1 scored for "noticed but was not a problem" (questionnaire scores 3 and 4). For those responses showing annoyance in the questionnaire (5-9), new scores were assigned, decreasing from 1-5 at the "very annoying" end of the scale. In this way, for any one level of aircraft activity, an index of one number is produced for the total scores recorded on the scale of 0-9. In Figure 7 this index of annoyance is presented for each level of aircraft activity. This is different to the previous Figure 6 because the score weighting allows the shift to more negative assessments (resulting from greater numbers of aircraft) to be seen in the negative scores at the right of the figure. As with Figure 6, there appears to be no clear trend of increasing annoyance, until more than 18 aircraft are encountered during the visit period of one hour. At that point there develops a sufficient level of dissatisfaction to create the negative index, and suggests that a threshold for tolerance was reached.

FIGURE 7. INDEX OF PUBLIC REACTION TO AIR TRAFFIC: MAIN VALLEY WALKS.

3.7.2 Discussion regarding annoyance

The first conclusion that can be drawn from these results is that there is no common group agreement about the ways aircraft activity in the glacier valleys affect a visit. Rather, it would appear that there is a mixture of responses where there are air traffic encounters occurring. This result is not unexpected from the non-homogenous population of all visitors to the glacier valleys.

There are, however, obvious patterns that emerge. The proportion of people responding that they did not notice aircraft drops rapidly as the number of

possible encounters rises from one to five. There are a small percentage of visitors that think that the presence of aircraft added to the enjoyment of their visit, and this result continues even when the level of air traffic is at its higher levels. Another notable pattern is that, for up to 18 aircraft encounters, the overall visitor response is much the same, with responses spread across the options, and more people accepting or neutral about the presence of air traffic than annoyed with it. There is a very slow shift of responses towards the “annoyed” half of the scale, but this becomes a major change only when the level of air traffic climbs above 18 encounters per visitor trip.

3.7.3 The annoyance level of visitors on the bush walks

For the bush walks on the valley sides, the relationship between increasing aircraft activity and annoyance is erratic, but indicates growing dissatisfaction (Figure 8). By following a best line of fit, 50% annoyance is reached by exposure to 15 aircraft in an hour, although this level of annoyance was also reached by some people when exposed to only 3-4 aircraft.

FIGURE 8. EXPOSURE TO AIRCRAFT AND ANNOYANCE REGISTERED: BUSH WALKS.

3.7.4 Comparison of main valley users and bush walkers

When asked specifically about their reaction to aircraft activity, there was a significant difference between the annoyance recorded by the users of the main valley tracks to the terminal faces of the glaciers (16%) compared with visitors using the bush walks on the valley sides (42.5%) ($\chi^2 = 16.502$, $p < 0.005$, $df = 1$).

Visitors to the valley sides are also likely to visit the main valley during their stay in the area. Knowing this, and given the high response of dissatisfaction at aircraft activity for people engaged in the bush walks as well as the much more tolerant responses for the main valley visitors, it may be that individuals hold different tolerances for aircraft activity depending on the setting. This supposition could be explored further.

Managers deciding appropriate limits to aircraft activity may be faced with a dilemma of two different levels of visitor response from two main use areas adjacent to each other.

3.8 INTERPRETATION OF CROWDING AND ANNOYANCE RESULTS

The greater sensitivity of people engaged in bush walks on the valley sides, compared with visitors to the main glacier valley, to both crowding and aircraft, can be interpreted by assuming that many of the first group had been expecting a different experience from the one they encountered.

Preferred encounter levels revealed in wilderness management studies in the USA (Williams *et al.*, 1992) are comparable to the responses shown by the bush walkers, but not the main valley visitors. One of the main motivations for visiting more remote areas is because people visiting these areas believe they are unlikely to meet many others during their trip.

Responses of bush walkers to questions about what they liked most about their visit included up to 8% citing “peace”, “tranquillity” or “solitude”, while only 0.3 % of visitors to the main glacier valley gave these responses. In addition, people on the longer, more demanding walks may well feel that their experience is adversely changed and their achievement is belittled by the presence of aircraft, and thus respond with a higher annoyance rating.

The exposure to aircraft noise is considerably greater for a number of the walks on the valley sides than it is on the main valley floor where the bulk of visitors go. The higher the altitude reached, the closer the walker comes to the flight paths of aircraft, and the greater the likelihood that they will be exposed to more extreme types of aircraft noise such as “slap” and “thickness noise” from helicopter blades. These factors will also increase the level of annoyance registered by the people walking the tracks on the valley sides.

Research at popular back-country walking tracks at other locations in New Zealand has shown that aircraft activity is considered a significant impact. Cessford (1998) found that almost all visitors sampled on the Milford Track noticed the noise of overflying aircraft and 69% indicated that they were bothered by this.

3.9 RESULTS AND VISITOR CHARACTERISTICS

The visitor population is typical of other popular New Zealand outdoor recreation areas, with 70% being first time visitors (Cessford, 1987; Ward, 1993).

There was no significant difference in the responses of first-time versus repeat visitors to the questions on crowding and annoyance at aircraft; or between New Zealanders and overseas visitors; or between males or females. Age was not a factor influencing responses to these questions.

3.9.1 Mode of transport

The manner by which visitors reached the glacier valley from the nearby township appears to influence the visitors’ feeling of crowding and their

reaction to aircraft, both of which are more negative for people arriving by “non-motorised” means. The crowding response was 44% for motorised visitors compared with 53.5% for non-motorised visitors to the main valley, although this difference did not prove to be significant. There is a significant difference in the level of annoyance at aircraft registered by motorised visitors to the main valley (15%) compared with non-motorised visitors (40%) ($\chi^2 = 15.67$, $p < 0.005$, $df = 1$).

The results may relate to the experience walkers receive when travelling up the valley, and how this experience changes when reaching the main destination areas. People making their way by foot from the townships would have a greater period of time to be exposed to aircraft, which appears to decrease their level of tolerance. The trip would generally be undertaken in isolation from other walkers, and thus, when reaching the more congested areas, could lead to a greater sense of crowding.

3.9.2 Questionnaire introduction

Approximately half of the visitors were supplied with a questionnaire that began with a brief outline of the philosophy of the park—“This Park is managed in a way that not only provides access and recreational opportunities for visitors, but which also ensures that the wild character of the area is preserved forever”.

Visitors to the main valley who received the questionnaire with the qualifying introduction recorded a crowding level little different to respondents using the standard questionnaire (46% compared with 44% respectively). For the bush walks the results were 29% and 20% crowded respectively, which again does not prove significant.

When answering the questionnaire that included the message about the purpose of the Park, 18% of visitors to the main valley recorded annoyance at aircraft being present. This compares with 15% negative response for the ordinary questionnaire. For the bush walk, this difference was accentuated, with 52% recording annoyance at aircraft on questionnaires with the park management message included, but only 37% recorded annoyance at aircraft when using the questionnaire with the standard introduction. This last result is significant ($\chi^2 = 4.56$, $p < 0.05$, $df = 1$) and suggests that, by having an expectation of the “wild character” introduced in the questionnaire, visitors interpreted their experience in a way more discerning towards impacts such as the intrusion of aircraft.

4. Discussion

4.1 AIRCRAFT ACTIVITY

Historical records show that aircraft activity varies seasonally, peaking in February and March, and with a low period from June to August (Sutton, 1994).

The frequency of aircraft flights involved are, proportionately, 75% helicopters (mostly Squirrels and Jet Rangers), and 25% fixed wing aircraft. The fixed wing aircraft tend to fly up and down the valleys at higher altitudes than the

helicopters. Jet Ranger helicopters tend to fly low when descending the glacier valleys, compared with other aircraft (Oliver, 1995).

The noise created by aircraft is related to altitude, to speed, rate of ascent or descent, turning angle, and the position of the listener relative to the aircraft. The location of the listener is important, as are landscape features in the area, and any other sources of noise (USDA, 1992). Other over-flying aircraft (i.e. not flying in the glacier valleys) were noticed but were not particularly obvious from the main valley floor. It has been assumed in the past that these aircraft could contribute to the overall impact of air traffic, but this assumption would seem to be well overstated. Their altitude and flight-paths do not draw visitors' attention to anywhere near the same extent as air traffic associated with the glacier villages.

4.2 DECIDING WHAT LEVEL OF AIRCRAFT ACTIVITY IS "UNACCEPTABLE"

Oliver (1995) suggests an annoyance level of 25% as a "threshold of acceptability". This figure has been arbitrarily assigned, and can be compared with the crowding assessment thresholds proposed by Shelby *et al.* (1989), where 50% crowding indicates a level managers should be concerned about, and 65% suggesting "management problems" are at crisis level. These data appear to show a threshold has been reached at the point there occurs a non-linear increase in annoyance, once aircraft levels rose above 15-16 aircraft an hour. This threshold corresponds with when the percentage of respondents registering annoyance rises above 25% (Figure 6). This threshold must be understood and accepted by the aircraft industry if this questionnaire tool is going to be useful in monitoring aircraft impacts.

If the 25% annoyance threshold (as discussed above) is accepted for all visitors, then people using the bush walks will generally be annoyed to an extent that is unacceptable for most occasions that aircraft are flying, and conditions will be tolerable when only one or two aircraft are encountered during the average hour long visit.

4.3 INFLUENCES ON THE SAMPLE POPULATION — DEFINING THE EXPERIENCE

One interesting result is that, when presented with a message about the philosophy of the park, visitors respond in sympathy to that message. This association was significant only for the respondents using the valley-side bush walks. These were areas where the level of developed intrusion would probably be seen as more out of place than in the main valleys with their roads, carparks and extensive boardwalk access to the glacier face. Notwithstanding, this is very positive support for actions taken by managers of protected areas who seek to actively advocate the promotion of conservation values in their areas of responsibility.

4.4 IMPACTS OF AIRCRAFT IN PERSPECTIVE

The following statistics are used to place in context the issues of crowding and annoyance at aircraft activity.

Annual visitation in the glacier valleys is comprised of visitors to the main valleys (175 000), and people using the bush walks on the valley sides (63 800 short bush walks, 3 500 long bush walks)(Sutton, 1994). These totals are not necessarily mutually exclusive as many of those people using the bush walks will also visit one or other or both of the main valleys. Individuals' responses to crowding may well be different, however, depending upon the setting.

The percentage of visitors registering annoyance at aircraft varies depending on the location, and equates to totals of 28 700 for the main valleys, 20 560 for the short walks and 2 260 for the long walks. Again, these are not mutually exclusive. An added complication is that the same person may visit the main valley and not be annoyed at the aircraft, but on a visit to the bush walk, may consider the aircraft activity unacceptable (as witnessed by the higher level of negative impact). The total number of people negatively impacted by aircraft activity is thus not more than 51 000 or 21% of the total visitor population.

Some people responded that aircraft activity added to their enjoyment. This group equates to a total of 18 700 visitors to the main valleys, 4 470 from the short walks, and 100 from the long walks. This total is thus not more than 23 000 or nine percent of the total visitor population.

The total number of people undertaking scenic flights is calculated to be 40 000 clients making snow landing trips, 15 000 people involved in non-landing scenic flights, and 2 400 people involved in heli-hiking, heli-skiing and mountaineering (Sutton, 1994). It is possible that many of these people will also walk in the main valleys and it may be expected that, as a result of having flown in the area or intending to fly, they will not make unfavourable comments about aircraft activity. Thus the total number of people that can be said to be benefiting from air traffic is approximately (or possibly less than) 80 000, which represents 33% of the total visitor population.

It would appear that, of all visitors to the glacier area, approximately 33% are getting some form of positive outcome through the activity of aircraft (either seeing them and/or being in them), and 21% are having a negative outcome.

There remains now the challenge of using the results of this study to guide management decisions about appropriate levels of aircraft traffic. It may be best to accept that a certain level of aircraft activity will be considered a threshold beyond which the negative impacts are considered unacceptable. These results indicate that in the main glacier valleys, this threshold is 18 aircraft encounters per hour. Above this point there occurs a significant increase in the percentage of people recording negative responses to air traffic.

Due to the nature of air transport in the glacier valleys, there are peaks when this high level of activity occurs. During the survey period, which endeavoured to cover all levels of aircraft activity, only two percent of respondents were sampled at such a time. It would seem then that not a lot of people will encounter this level of use, unless the number of aircraft able to fly at any one time increases, and is accompanied by peaks in visitor demand for access to

flights. In terms of regulating the cause of these impacts, the companies involved should be encouraged or required to have, in total among them, no more than 18 aircraft in the air over any hour long period in either glacier valley.

4.5 FUTURE PROJECTIONS

4.5.1 Crowding

There is some debate about the extent to which international tourism will have increased in New Zealand by the year 2000. Total arrivals for the year ended December 1996 were 1 528 000 (NZTB 1997). What appears certain is that international tourism will continue to grow. Projections of two million visitors a year are likely to be reached by 2005, and the likely visitation level to the glacier area will be 222 000 annually, 73% from overseas (65% in 1995). This represents a 30% increase in total visitation from the 1995 level (170 000 visitors annually).

As the number of visitors increases, so will the number of visitor encounters with other visitors. With such increases, the total level of crowding can be assumed to increase.

4.5.2 Aircraft impacts

The current ratio of international visitors to New Zealanders taking scenic flights is 7:3 (as estimated by one major operator). An estimated increased patronage of the glacier area of 30% by international visitors should lead to a corresponding increase in scenic flights from the 1995 level of 14 000 (Sutton, 1994) to 17 000 per annum. As a result, the mean level of exposure to aircraft for visitors to the main valleys would rise from 6.3 aircraft to 8.2 aircraft per hour. However, the flow of aircraft varies markedly throughout the day, and during the survey period 27% of visitors encountered more than eight aircraft. What is of concern is the likely increase in incidence of aircraft activity that reaches and exceeds 18 aircraft per hour and the corresponding unacceptable levels of annoyance.

5. Summary

Aircraft activity at nature-oriented tourist destinations creates a dilemma for management. Some visitors are provided with a unique recreation opportunity to view the attraction from an aerial perspective or, to a much lesser extent, to gain access to the area by air. Others (or in some cases the same people) will be subjected to aircraft noise, and may find this detracts from their on-ground experience. Establishing acceptable limits to aircraft activity will be integral to achieving sustainable tourism at sites such as the glacier region of the South Island. In this situation, sustainable may be defined as the ability to retain a visitor experience that satisfies the majority of visitors, while the impacts resulting from aircraft activity are kept to within acceptable limits.

The total level of visitor activity is also impacting on visitor satisfaction. Crowding and annoyance at aircraft are impacts that manifest in similar ways. Both increase with increasing visitor activity, one as a result of people sharing the same site on the ground, the other by imposing on the visitor experience from the air.

Methodology was developed for identifying the types and extent of social impacts in the glacier region of the Southern Alps. A questionnaire was designed to seek first visitor opinion about general satisfactions, and to then focus on specific sources of possible annoyance. This method proved successful in identifying that annoyance at aircraft was an impact perceived by some visitors to the area. This impact was rather more severe for visitors using the bush tracks on the valley sides, compared with users accessing the glacier face via the main valleys.

The manifestation of social impacts was found to be influenced by visitors' awareness of the management philosophy of the area. Where visitors are informed of the management goals of a destination, for example the preservation of inherent and special characteristics such as naturalness or wilderness, then these visitors respond by being more critical of impacts that may detract from those values. Such a result may indicate that respondents are being led by the questionnaire to answer in a particular manner. However, another valid interpretation is that visitors are able to indicate the type of experience that they feel matches the management philosophy for the area, albeit that they may have only just been briefed about some of that philosophy.

By restricting the questionnaire to one sheet, presenting questions on either side of an A5 page on a clipboard, it was possible to have respondents provide responses to general questions first, thus revealing their "top of the mind" opinions about situational variables, and then to target specific issues. This method establishes if certain impacts are being overtly perceived (and hence recorded). Further assessment of the degree of perception of the impact can be undertaken using prompted questions using Likert scales.

Results showed that the level of crowding experienced by visitors increased with increasing encounter levels with other visitors. Relative to crowding studies conducted elsewhere (see Shelby *et al.*, 1989), crowding is occurring on the busier days. Crowding is registered by visitors on the bush walks at levels of use that are minimal compared with the level of activity in the main valley. Crowding is thus related to visitor expectation of encounter rate, and not simply the total number of other visitors encountered during a trip.

Negative responses to aircraft presence increased with increasing air traffic. Using the results from this study, it is possible to suggest a standard to represent when the level of annoyance has reached an unacceptable level. The percentage of people recording some level of annoyance relative to increasing aircraft activity indicates a threshold point of around 25%, after which there is a rapid increase in negative reaction. There is obviously a certain level of exposure to aircraft activity that is acceptable to most people, and beyond this point, a general shift in opinion happens, and high annoyance levels result. The level of annoyance of 25% was reached in the main valleys when the number of aircraft per hour exceeded 18. While aircraft activity seldom reaches this level, it does so during peak activity times.

The results from the bush walks show a trend of increasing annoyance with increasing air traffic, but the pattern appears quite erratic. The high overall level of annoyance suggests that these visitors are more sensitive to aircraft. There was considerably greater air traffic recorded in these areas, and visitors were exposed to much closer contact with the aircraft. These factors have influenced the resulting higher levels of annoyance. Different visitors tended to have different perceptions of crowding and levels of annoyance at aircraft activity, although these differences were not great.

6. Recommendations

6.1 Clarifying the visitor experience

While there are obvious conflicts arising between users of “scenic flights” and people engaged on “glacier valley walks”, resulting from very high levels of aircraft activity, it would appear that the level of air traffic is, for the most part, not unduly upsetting visitors to the main valleys. Visitors to the bush tracks on the valley sides are registering high levels of annoyance at aircraft activity, and this is occurring even at relatively low levels of aircraft activity.

A decision must be made as to the importance of the visitor satisfaction for people using the tracks on the valley sides. There would appear to be no compromise between maintaining the scenic air flights and retaining the opportunity for undisturbed walks on the valley sides. People wishing to experience a walk on the valley sides undisturbed by aircraft activity will need to make their visit when it is unlikely that there will be scenic flights operating, such as when there is low cloud, early in the morning or late in the evening.

It is recommended that the glacier valleys be accepted as destinations for people who wish to see the glacier by land and people who wish to see the glacier by air. People seeking a quiet experience while walking in the area should be provided with information that outlines how likely (or unlikely) it is that this will happen, so that false expectations can be avoided.

6.2 SETTING LIMITS ON AIRCRAFT ACTIVITY

There are levels of aircraft activity in the main valleys that breach a threshold of acceptability for visitors. In order to err on the side of caution, an upper limit for numbers of aircraft in either valley during any hourly period should be no more than 18.

It should be possible, through seeking the co-operation of the companies involved, to keep records of when aircraft activity reaches this level. Self regulation may be possible, if all operators can agree to fly no more than a set number of flights each per hour in any one valley.

Seek agreement from air transport operators that a combined total level of aircraft activity of 18 aircraft an hour in any one valley should be the upper limit.

The more important issue is whether the level of aircraft activity is going to continue to grow, leading to greater periods of time when this unacceptable level of aircraft activity is occurring. The future action is thus not so much one of regulation, but of monitoring aircraft activity at peak times.

Establish reporting procedures that can accurately show the total number of aircraft present in either of the main glacier valleys, to identify how often the total of 18 per hour is exceeded and for how many hours there are high aircraft numbers.

The use of the 0-9 Likert scale for measuring annoyance at aircraft activity was successful in establishing that there was general acceptance of air traffic by visitors to the main valleys, until the level of activity reached and exceeded 18 aircraft an hour.

Continue to use the short questionnaire developed for this study or some variation of it, on a periodic basis, in association with counts of aircraft, to determine the level of visitor acceptance of the higher levels of aircraft activity.

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Appendix 1: Questionnaire