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# Recreational noise issues and examples for protected areas in New Zealand

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The New Zealand Department of Conservation manages a wide variety of recreation activities in an extensive system of protected areas. A diverse range of recreation noise issues provides challenges to management of these areas. Some basic recreational noise definitions and issues are described, and a classification of noise-generation sources is outlined. Examples of recreation noise issues are presented from an extensive survey of visitors to popular New Zealand walking tracks, where some recreation noise impacts were found to occur at very high levels. Visitors demonstrated a varied range of tolerance for noise effects in the different examples assessed, but highlighted particular noise issues related to aircraft sightseeing flights, recreational motorboating, and social noise in huts. A need for more active research and management of noise effects in New Zealand recreation settings is proposed. © 1999 Institute of Noise Control Engineering. [S0736-2501(99)00703-1]

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## 1. INTRODUCTION

New Zealand has an extensive system of national parks and other protected areas covering almost 30% of its land area. The Department of Conservation (DOC) manages these diverse areas primarily for protection of their intrinsic natural and historic resources. Subject to this primary conservation goal, the Department is also required to foster the use of these lands for public enjoyment and appreciation. In fulfilling these integrated conservation and recreation management responsibilities, the management challenge to the DOC is becoming more complex. There is wide-ranging diversity in the recreation opportunities that the DOC may allow. Consequently, there is similar diversity in the impacts these activities may have on different physical and social values. As noted internationally, trends in New Zealand outdoor recreation are characterized by growth in the diversity of visitors and the activities they engage in, rather than by simple growth in use-levels.<sup>1,2</sup> Such growth in the diversity of recreation demand brings with it growth in the diversity of situations where impacts may arise from recreational noise effects, and consequently in the complexity of managing these impacts.

To enable more effective understanding of the diversity of management issues raised by recreational noise, some basic distinctions are helpful. First, it is important to distinguish noise effects from noise impacts. Noise effects are simply the sounds being generated, while noise impacts can be considered the specifically negative outcomes resulting from certain noise effects. For practical management purposes, it is also useful to distinguish the major types of noise impacts that can occur and the different sources of noise effects. Such distinctions help answer the basic noise management questions: What is the problem? Who is generating it? What can we do about it? To further address these questions, two sets of useful distinctions are described below. The first distinguishes the physical and social impacts of noise effects in protected areas, and the

second provides a pragmatic classification of the sources that generate different noise effects.

## 2. DISTINGUISHING ENVIRONMENTAL AND SOCIAL NOISE IMPACTS

### A. Environmental impacts of noise in protected areas

The predominant environmental impact of noise in protected areas is the disturbance it creates among different wildlife species. The environmental consequences of noise will depend on the response characteristics of the impacted species and the degree to which noise variables such as type, volume, periodicity, and duration may alter the severity of the effects.<sup>3,4</sup> In general terms, biological research into noise impacts can focus simply on how the noise affects the behaviour, viability, and sustainability of the different wildlife species. Of little environmental significance are contextual factors such as what the noise is, how it is being generated, and who are the primary agents generating it. These factors become more important after impact issues are identified and decisions about management actions are required. Yet these types of contextual factors are fundamental to understanding the social consequences of recreational noise.

### B. Social impacts of noise in protected areas

The social impacts of noise do not relate simply to the occurrence of noise events. They are affected much more by the meanings and associations attributed to those noises by the people perceiving the impacts. These subjectively defined social impacts go beyond simple expressions of annoyance. They are commonly related to perceptions of natural quiet, visitor enjoyment, and safety concerns.<sup>3</sup>

#### 1. Natural quiet

Natural quiet is managed as an important component of recreation experiences in the protected areas of New Zealand<sup>5</sup> and elsewhere.<sup>3</sup> Natural quiet does not necessarily mean silence. It can be defined as the natural ambient conditions or the sounds of nature, and can range from com-

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plete silence to a thunderstorm.<sup>5</sup> Such values are considered increasingly significant in providing a counter to the cacophony of everyday life. Extensive U.S. research from the National Park Service found that over 90% of surveyed visitors considered natural quiet an important part of their reason for visiting a national park.<sup>3</sup>

The U.S. National Park Service notes that while parks offer many tangible features such as animals, plants, waters, geological features, historic buildings, and archeological sites, they also contain many intangible qualities such as solitude, space, scenery, clear skies, sounds of nature, and natural quiet.<sup>3</sup> The DOC also views natural quiet as a tangible social and environmental value. It is committed in its Strategic Business Plan to identifying those areas where restrictions may be required to maintain natural quiet to ensure visitor enjoyment, minimize visitor conflict, and protect wildlife.<sup>6</sup> In this management context, natural quiet could be considered a specific environmental condition, disturbance of which would represent an environmental rather than a social impact.

## 2. Visitor enjoyment

Visitor enjoyment is a more generic concept, relating to the sense of satisfaction or fulfillment from having achieved the recreation experiences being sought. After protecting nature, providing visitor enjoyment is usually the major objective of most public land management agencies. Noise effects that represent intrusions into the desired recreation experiences of visitors can have a negative impact on the degree to which visitor enjoyment is achieved. People may still consider they have had an enjoyable recreation experience overall, but the quality of their visit may have been compromised.

However, the management task is not simple, as people's reactions to different noise types, levels, and contexts are highly variable. Kariel compared the evaluations of mountaineers and roadside campers for different natural, human, and technological noises.<sup>7</sup> Both groups provided consistent preference rankings of different noise sources, but the values associated with these noises were expressed at different levels. Mountaineers were found to be more positively and negatively sensitive to sounds. They rated the nature-related sounds as more pleasant than did the campers, and the human and technology-related sounds as particularly more annoying. While the noise types and levels were the same, the meanings associated with them were not. As a consequence, the relative social impacts arising from these noises would also be different.

In some cases, the actions of some visitors may generate the noise effects that impact on the recreation experiences of others. The most common examples from recreation conflict research highlight differences between motorised and nonmotorised recreation activities. In these cases, motor-noise does more than just disturb natural quiet. The sound of a snowmobile, jet ski, motorbike, or helicopter can sometimes be interpreted as a strong indicator of differences in the motivations, goals, environmental values, and behaviours of different recreation participants. For example, consistent differences have been identified between the motivations and goals of snowmobilers and cross-country skiers.<sup>8-10</sup> Perceptions of group dissimilarity are

often associated with recreation conflict issues in this manner. People pursuing different goals in shared settings may have different personal and activity behaviours that may not be compatible with all participants achieving their preferred recreation experience outcomes. These are not simply cases of one activity versus another, but of how different people value and define their recreation experiences; how they act to achieve these experiences; and how they differ in their perceptions of acceptable conditions associated with these experiences. In this context, the noise effects that contribute most to negative social impacts are generally those related to people seeking different recreation goals<sup>11,12</sup> or people engaged in obtrusive behaviours.<sup>13-15</sup>

## 3. Safety concerns

One particular association made with noise relates to the degree to which it is associated with perceptions of potential hazard. To a nonmotorised user, the sound of a motorised vehicle can raise a sense of apprehension about possible collisions. Such apprehension can interfere with achievement of recreation experiences. Conversely, sounds indicating the presence of other people and ready access to vehicles can create a sense of reassurance in natural settings which, for some visitors, may feel like an alien and threatening environment. Yet the lack of sound from mountain bikes is often perceived as a hazard, due to the silent approaches and surprise meetings that occur. Many walkers concerned about mountain bike hazards on tracks suggest that riders carry bells so that the surprise factor from silent approaches is reduced in track encounters. However, to others, such noise might be considered intrusive and could fuel recreation conflict. A similar mixture of attitudes can relate to the presence of cell phones in remote settings, giving reassurance to some visitors and causing disturbance to others.

## 3. DISTINGUISHING SOURCES OF NOISE

While the social impact issues related to noise are complex and are embedded in wider issues of recreation conflict generation, clearly establishing the sources of any noise effects remains a particularly important task for managers. If a noise impact issue is identified, the ability to make effective management decisions depends on clearly identifying the source of the noise, determining the degree of jurisdiction that can be exercised, and identifying the relevant stakeholders for consultation and negotiation. In general, the variety of noise effects that can generate environmental and social impacts in protected areas can be summarised in four interrelated categories, as described below.

### A. External, nonrecreational noise intrusions

External intrusions can be generated by nonrecreation sources outside of the conservation manager's control. Perhaps the most intrusive examples worldwide are military aircraft engaging in low-altitude training flights. Commercial aircraft use flight paths that rarely allow for land-use

conditions in underlying protected areas, and the high-altitude jets sometimes exacerbate their noise impacts by leaving the additional intrusion of distinctive contrail markings in the sky. Other examples include noise from road, rail, and shipping movements, machinery use, industrial processes, and general urban noise.

### B. External, recreational noise intrusions

External intrusions can also be generated by recreation sources generally outside of the conservation manager's control. Most examples refer to sightseeing overflights by planes and helicopters. Other examples include noise from the use of recreational motorcraft or other machinery on areas of land and water adjacent to the managed lands but not under the same conditions of management control (e.g., motorbikes, jet skis, rock concerts, water-skiing). Recreational activities such as large picnic groups or music events may also generate high levels of different noise types. These types of external noise intrusions could be termed "edge effects" or "boundary effects."

### C. Interactivity noise intrusions

People engaged in different types of recreation activities in the same recreation settings can generate interactivity noise intrusions. In this situation, the different activities share a recreational setting but have effects on each other as a result of different use characteristics associated with participation. Different use characteristics commonly relate to the different types of participants, their behaviours, and their use of equipment. The most commonly cited examples emphasize differences between motorised and nonmotorised activities (e.g., cross-country skiing versus snowmobiling; canoeing, sailing, and swimming versus motorboats, jet skis and water-skiing; skiing versus heli-skiing; walking and cycling versus motorbiking and off-road driving). Numerous other variations can also occur when noise from other nonmotorised activities contributes to perceptions of intrusion (e.g., rafting and canoeing versus fishing; walking and running versus mountain biking; walking versus running; stock-use versus walking). Noise has been one of the key distinguishing factors between many of these different activities. It can contribute to perception of recreation conflict in two main ways: by creating a direct sound intrusion that is considered inappropriate by some (e.g., loud music, cell phone use) or by acting as an indicator that an activity or behaviour considered inappropriate is taking place (e.g., chainsaw, motorbike). While these two aspects clearly overlap, it does emphasize that there is a distinction between the audibility of a noise and the different things that noise can mean to people.

### D. Intra-activity noise intrusions

People engaged in different types of behaviour while participating in the same activity can generate intra-activity noise intrusions. In principle, the same impact processes apply as with interactivity noise, but the characteristics are often more subtle. In this situation, people differ in how they participate in the activity and in the meanings they attach to different activity-related behaviours. The social behaviour of some people along trails, at huts and camp-

sites, at picnic areas, or at other attractions may not fit with what is considered appropriate by those being impacted. Characteristics of noise timing, level and type can play a major role in defining perceptions of appropriate behaviours. Often these perceptions are accompanied by judgements about the recreation values, motivations, and worthiness of other people in that setting. For example, rowdy behaviour in a hut may be viewed very differently if it is expressed in a different language or accent.

## 4. RECREATIONAL NOISE EXAMPLES FROM NEW ZEALAND

Through managing a diverse array of land areas and activity types, the DOC is faced with many situations where recreational noise has an actual or potential social impact. A selection of results from an extensive visitor survey program illustrates the diversity of noise issues that can arise. The survey program sampled almost 5000 visitors in 11 surveys from several of the most popular multiday walking tracks in New Zealand, a multiday river-canoeing trip, and a multiday sea-kayaking trip.<sup>16</sup> These trips typically take between 3 to 5 days in unmodified natural environments of wilderness quality. Visitors spend the nights in accommodation huts or campsites that are provided by the Department along the well-defined routes, but must carry all their own clothing, food, and equipment. Generally, visitor expectations for their experiences on these trips emphasize natural conditions with minimal intrusion by human effects.

Among the questions visitors were asked was the degree to which they experienced a variety of physical and social impacts from various types of human effects, including some related directly to recreational noise. These were:

- (i) hearing aircraft fly overhead/aircraft landing;
- (ii) some people being loud in the huts during the evenings;
- (iii) some people being loud at campsites in the evenings;
- (iv) motorboat disturbance at huts and campsites;
- (v) motorboat disturbance at beaches/on the water.

Using an awareness/annoyance response scale (Fig. 1), visitors were asked to indicate the degree to which they perceived each of these recreational noise effects as impacts on their visit enjoyment. In each case, a proportion of visitors indicated they noticed the noise effect (e.g., scores 2-4), and some of these indicated that this bothered them (e.g., scores 3+4).

This approach generated evaluations of 38 individual noise-effect cases, including 11 related to aircraft, 8 related to motorboats, 11 related to social noise in huts, and 9

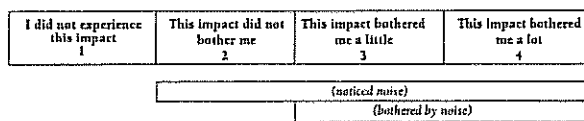


Fig. 1 - Awareness/annoyance response scale for social and physical impacts.

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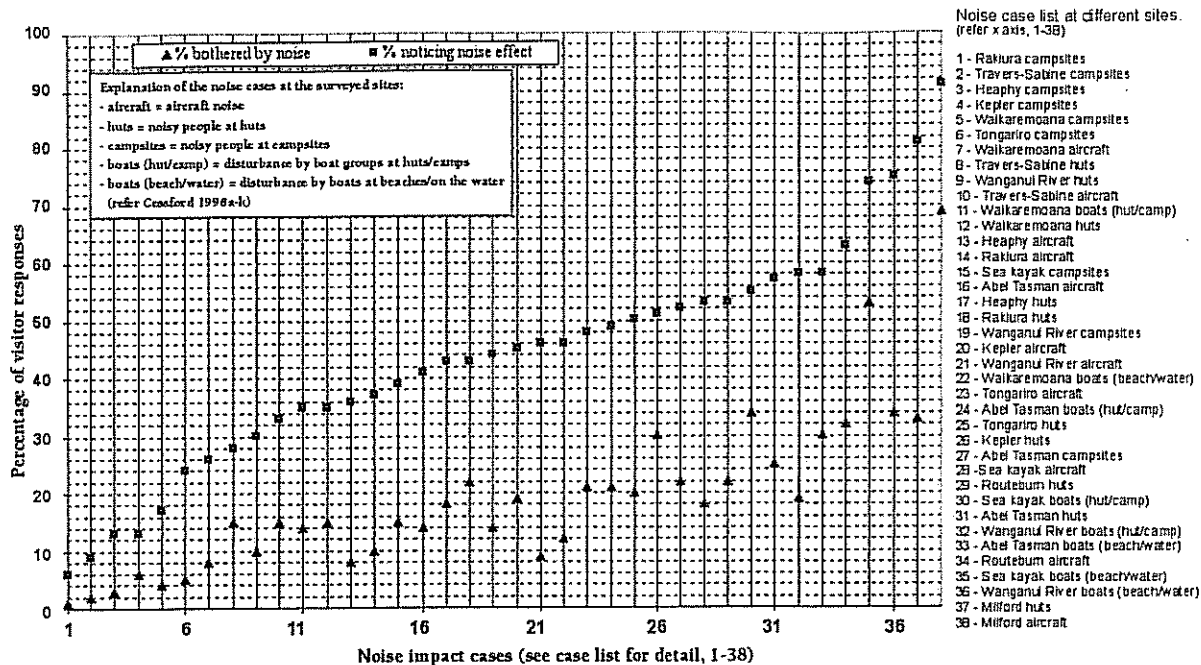


Fig. 2 – Perception of different noise effects at different New Zealand sites.

related to social noise at campsites. These results are summarised in Figs. 2 and 3. The overall patterns of visitor response to the different noise effects are summarised, followed by discussion of case-specific results and the options for noise management.

**A. Overall patterns of noise perception**

In Fig. 2, the different cases are ranked according to increasing awareness of the noise effect among the visitors. This ranking does not directly represent cases of increasing noise levels (e.g., volume, duration, event frequency), but shows increasing visitor perception of the noise effects. In some cases, this may simply reflect higher noise levels. But in others, it may represent greater visitor sensitivity to noise in that visit experience context. Some basic conclusions can be drawn from the results in Fig. 2.

- (1) Visitor perceptions of noise effects will vary in different situations. This is clear from the different levels of noise effects noticed for the 38 cases reported. These cases represent a diverse range of use types, use-levels, setting characteristics, and visitor experience expectations.
- (2) There are differences between noticing a noise-effect and being bothered by it. These differences represent the degree of impact tolerance held by visitors.
- (3) Impact tolerance is not consistent for different noise-effect cases. In cases where the awareness of the noise-effects is similar, the proportions of visitors actually bothered can vary considerably. This suggests case-specific degrees of noise tolerance.

Figure 3 presents the same data as a plot of noise awareness versus annoyance. This clearly shows that the level of annoyance felt by visitors increases as their awareness of noise increases. The regression curve fitted to these data

also suggests that with higher levels of noise awareness (i.e., where more visitors are noticing noise effects), the levels of annoyance have increased at a proportionately higher rate. Thus, when 30% of visitors noticed noise (Fig. 1), about one-third (10%) were also bothered by it. When 80% of visitors noticed noise, around half (40%) were also bothered by it. This suggests the relative tolerance of noise effects declines at an increasing rate as these effects become more commonly noticed.

These perceptual variations across the different noise-effect cases add complexity to the manager's task of identifying which noise issues are priorities for management. While other research gives some indication that higher noise levels or duration are simply associated with greater perceptions of noise impacts,<sup>3,17</sup> these are not necessarily the primary determining variables in generating recreational noise management issues. In most cases, the activity, setting, and recreation experience context in which noise effects occur, as well as the different variables affecting the visitor's individual evaluation of those noise effects, may be more important.

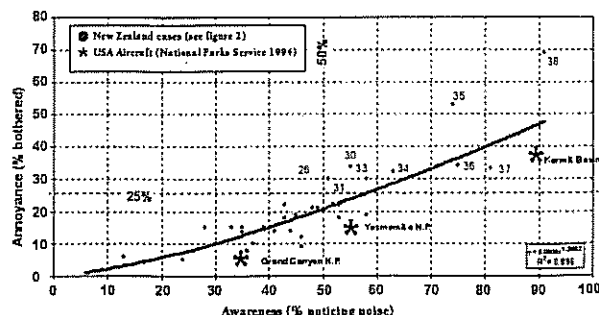


Fig. 3 – Awareness/annoyance for various noise impacts.

## B. Case-specific noise issues

The noise impact results summarised in Figs. 2 and 3 range from low levels of awareness and annoyance for noisy behaviour at campsites (e.g., cases 1–6) to very high levels for aircraft noise on the Milford track (case 38). Between these extremes are a variety of noise impact examples representing different noise levels, characteristics, settings and evaluations. Apart from this variety of response, one of the most notable findings was that the levels of noise awareness and annoyance were very high. Visitor awareness of the different noise effects exceeded 50% of respondents in 14 of the 38 cases reported (Fig. 3); this compared with only 5 of 39 aircraft noise cases reported in a major U.S. review.<sup>3</sup> In addition, visitor awareness of aircraft noise on the Milford Track (91%) greatly exceeded levels noticed in some major U.S. National Parks (Yosemite, 55%; Grand Canyon, 34%) that have widely cited aircraft noise problems.<sup>3</sup> Only the most highly impacted site measured in the Grand Canyon National Park sample (Hermit Basin, 90%) matched the noise awareness levels reported on the Milford Track. Moreover, while the noise awareness was similar in both these examples, the level of visitor annoyance was relatively much higher on the Milford Track (e.g., Fig. 3, 38% vs 69%). These comparisons suggest that significant noise issues do exist in New Zealand's protected areas, and that noise impacts may require more specific management attention.

The approach currently being developed by the DOC to identify major noise impact issues is based on developing a systematic assessment process for managers to identify problem noise situations, and measuring visitor expressions of disturbance. In this context, development of a trial aircraft noise monitor has been taking place, based on the application of visitor survey techniques that query aircraft noise awareness and annoyance.<sup>18</sup> This approach has also been adapted for assessing jet-boat noise.<sup>19</sup> One pragmatic management approach for interpreting the results of such work has been proposed by Sutton.<sup>17,20</sup> This has involved specification of an arbitrary 25% threshold for levels of

visitor annoyance with noise effects. Cases with annoyance above this level could be considered priorities for noise management attention. When this threshold is applied to the 38 cases reported here, nine specific noise impact cases are highlighted (Table 1).

In summary, priorities for managing noise impacts in New Zealand should be initially focused on addressing the very site-specific noise effects of scenic aircraft flights, recreational motorboats, and congestion in busy huts. The Milford Track is a particular focus, given the very high levels of aircraft noise impact that are apparent and the high status of this track as a recreation experience for both walkers and airborne sightseers. The high levels of hut noise noticed on the Milford Track are also particularly notable, given that walker numbers are restricted to minimize social impacts from hut overcrowding. Despite such regulation, these results suggest that Milford Track visitors are subject to greater social impact than they expected for this more controlled experience. Other results highlight prominent effects from motorboats on the recreation experiences of other waterway users and park users.

Overall, the distinction between the disturbance by noise effects and the wider underlying recreation conflict issues requires more investigation. If noise is not the main contributing factor to such conflict issues, it is clearly one of the more prominent indicators. In this respect, noise will be a key component of many social conflict issues. Clearly, initiatives that generally promote reduction of noise effects should have high priority in any social impact management programmes that are undertaken.

## C. Management options for noise impact issues

The DOC has most control over noise in the management of formally designated wilderness areas, where no motorised access or use of motorised equipment is allowed; no tracks, huts, or any other facilities are permitted; and the rugged nature of the terrain limits visitor numbers. Under these conditions, recreation noise issues are extremely rare.

TABLE 1 – New Zealand recreation noise impact cases exceeding 25% annoyance levels.

Case	Site	Issue
38	Milford Track (Cessford 1998H)	Aircraft scenic flights bothered 69% of track walkers (91% noticed). Fiordland National Park.
35	Abel Tasman coast (Cessford 1998e)	Recreation boats on the water or at beaches bothered 53% of sea-kayakers (74% noticed). Abel Tasman National Park.
36	Wanganui River (Cessford 1998i)	Recreation boats on the river bothered 34% of canoeists (75% noticed). Wanganui National Park.
30	Abel Tasman coast (Cessford 1998e)	Recreation boats near huts and campsites bothered 33% of sea-kayakers (55% noticed). Abel Tasman National Park.
37	Milford Track (Cessford 1998h)	Other people in huts bothered 33% of walkers (81% noticed). Fiordland National Park.
34	Routeburn Track (Cessford 1998k)	Aircraft scenic flights bothered 32% of walkers (63% noticed). Mount Aspiring and Fiordland National Parks.
33	Abel Tasman Track (Cessford 1998d)	Recreation boats on the water or at beaches bothered 30% of walkers (58% noticed). Abel Tasman National Park.
26	Kepler Track (Cessford 1998b)	Other people in huts bothered 30% of walkers (51% noticed). Fiordland National Park.
31	Abel Tasman Track (Cessford 1998d)	Other people in huts bothered 25% of walkers (57% noticed). Abel Tasman National Park.

Conditions of natural quiet are maintained for most of the time, and largely noise-free recreation experiences are achieved. However, in all other areas managed by the DOC, more complex processes of activity allocation and compromise are required. For example, the use of motorised vehicles in national parks is limited to official formed roads; aircraft have minimum height and landing limitations; and use of motorised machinery is prohibited. In other areas, a greater variety of activities and behaviours may be allowed, raising greater potential for noise impact issues.

Once the need for some management action is determined, the first problem confronting managers is the extent of their management jurisdiction. As discussed previously, many of the noise generating activities come from external sources, outside of direct management control. This is an important characteristic of most of the prominent noise examples listed in Table 1. Aircraft overflights above 500 m are subject primarily to Civil Aviation Authority regulations, while motorboat activities on navigable waterways and coastlines beyond mean high water are subject primarily to Ministry of Transport regulations. There are limited options for any direct management control of these aircraft and boat activities. For any direct controls to be applied in this context, the Department must engage in consultation processes and management partnerships with the appropriate controlling authorities. Subject to these jurisdictional limits, any protected area management agency has three broad and interrelated types of noise-management strategies available to them when management action is required.

- (1) **Managed separation:** Management actions can reduce direct contact between noise generation and reception. These would primarily include actions that involved separation of noise-conflicting visitor activities and behaviours in time or in space (e.g., spatial zoning, use-seasons, time of day).
- (2) **Reduced noise effect:** Management actions change the emission and reception characteristics of the noise. These would primarily include direct actions that reduced noise emission levels (e.g., mufflers, lower operating levels, developing other options for the task), and indirect actions that reduced the final audibility of the noise effects (e.g., insulation, baffles, shielding, masking). Making visitors aware of likely noise conditions prior to their visit can also make them less sensitive to the same level of noise.
- (3) **Improved visitor expectations:** Management actions that improve the accuracy of visitor expectations can reduce the relative impact of noise. These actions would primarily include providing information on the prevailing characteristics of activities and noise at different sites and times. This would allow visitors to make more informed choices and expectation compromises. Visitors would be less likely to put themselves in situations where noise would compromise the recreation experiences they are seeking. If they choose to visit a site with known noise conditions, their recreation experience expectations would include compromises to allow for those noise impacts.

When considering the management options available within each of these overall strategies, managers may draw on a range of approaches for addressing noise issues. In summary, these approaches include:

- (1) **Voluntary agreements:** Participating stakeholders agree on codes of practice and standards for activity timing, duration, location, equipment use, operating conditions, and behaviours.
- (2) **Concession conditions:** Management agencies allow commercial recreation activity subject to conditions that specify requirements for activity timing, duration, location, equipment use, operating conditions, and behaviours.
- (3) **Management regulations:** Management agencies allow recreation activity subject to regulations that specify requirements for activity timing, duration, location, equipment use, operating conditions, and behaviours.
- (4) **Education and advocacy:** Management agencies and other stakeholders collaborate to give visitors accurate information about on-site conditions to enable informed activity and site choices, and to promote appropriate codes of behaviour and noise-sensitive practices.
- (5) **Incentives for quiet choices:** Management agencies set conditions that favor visitors and commercial providers making quiet-sensitive choices in their equipment types, operating practices, activity timing and location, and behaviour.
- (6) **Design for quiet:** Management agencies and other stakeholders promote noise-reducing technologies in the design and operation of the equipment used in recreation areas, and noise-reducing designs for the layouts, materials, and locations of recreation facilities (e.g., huts, camps, jetties, airstrips, tracks, roads).

In each case of noise-management need, some integrated combination of these approaches will be required to achieve the best results for the majority of recreation stakeholders. As recreation activity and diversity continue to increase in protected areas, the potential noise impact issues will also increase. Managers will have to consider resource allocation for different activities. But given the finite extent of available lands, any initiative that can allow sustainable use by a variety of activities will be particularly valuable. Subject to wider physical and social impact criteria, ongoing application of a broad range of noise management strategies, as suggested here, can maximize the extent to which activities with different noise signatures can share resources.

## 5. CONCLUDING COMMENTS

Application of the range of noise management options summarised here should be considered for the more prominent New Zealand noise-impact issues. There is a clear need to establish more active relationships with air and marine management agencies, and to determine what activity conditions and behaviours lead to the social noise problems arising in some huts. These recreational noise impacts appear to be quite severe, and in some cases may compromise the degree to which visitors can achieve quality recreation



experiences. However, while noise issues are prominent in many cases, in some instances they may be no more than indicators of wider recreation conflict issues. The diversity in visitor tolerance for noise effects in the different cases reported here suggests that many other intervening factors are affecting noise impact perceptions. In either situation, the management challenge is still to determine how these noise effects and underlying conflict issues can be managed and reduced without also seriously compromising the viability of the activities that generate them. This requires that the whole suite of available social and technical management approaches be applied together. To some extent, this will mediate existing issues in the short term, but in the main, it should be aimed at preventing similar issues arising in the future.

Investigation of noise impacts should also expand to cover more of the low-use protected areas. In these areas, visitor expectations of remoteness and wilderness may contribute to higher noise annoyance at much lower levels of noise generation. In general, any future noise impact research should include consideration of visitor awareness and annoyance, visitor expectations of the experience in that area, and some consistent measure of noise-level variables.

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