The Mountain Rescue Committee of Scotland

Survey of Scottish Avalanche Incidents (1980 – 2009)

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March 2010

Introduction

This report is based on the analysis of all Scottish mountaineering (avalanche) incidents that occurred in the 30 year period 1980 – 2009. The incidents examined are those serious enough to require use of the mountain rescue services. All were reported to and subsequently recorded by the Mountain Rescue Committee of Scotland (MRC of S). All the information used has been taken from the official reports produced by the MRC of S and published either in the Scottish Mountaineering Journal or on the MRC of S website. It is likely that many avalanche incidents take place across Scotland but go unrecorded. In these cases, people who are caught escape with no injury or with minor injuries that don't require mobilisation of the emergency services. Therefore, the incidents that are examined in this report probably underestimate the overall number that take place, but they reflect accurately those that are severe enough to require help from the mountain rescue service and other agencies.

Scope of the problem

Table 1 presents basic information about avalanche incidents over the 30 year period. As can

Table 1 – Avalanche incidents from 1980 - 2009

	Number	Percentage
Incidents	158	-
People involved	431	-
Fatalities	59	13.7
People injured	231	53.6
People not injured	141	32.7

be seen from the table there were 158 recorded incidents involving 431 people. Of these, almost 14% died and almost 54% suffered injury of some kind. Almost one third escaped any kind of injury. To put these figures into perspective it helps to look at the overall number of mountaineering incidents that took place over the same period. Table 2 presents this information.

Table 2 – Mountaineering incidents from 1980 - 2009

	Overall	Avalanche	Percentage
Incidents	7894	158	2.0
Fatalities	860	59	6.9
People injured	5139	231	4.5

As can be seen, avalanche incidents account for 2% of the total. However, the figures for fatal and injured persons exceed this value (6.9% and 4.5% respectively). This shows that the chances of being killed/injured in an avalanche incident are proportionately higher than in other kinds of incidents (e.g. slips). Of course, this is a logical finding. Table 3 adds more detail to the relative nature of avalanche incidents by looking at other 'causes' of mountaineering incidents. The data here are taken from the **sport**scotland (2007) study of 2446 Scottish Mountaineering Incidents over the period 1996 – 2005. The table lists the key factors associated with incidents and it can be seen that avalanches are reported very few times compared to others such as poor navigation and slips. It should be noted that the total figures are greater than 100% since in many cases, two or more factors are cited as reasons for an incident.

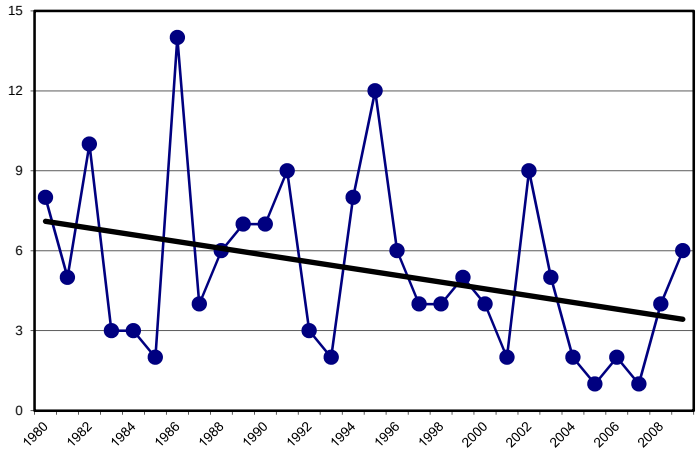
Table 3 – Key ‘causes’ of mountaineering Incidents

	Percentage
Overdue	29
Slips	27
Poor navigation	23
Lost/mislaid	21
Bad planning	18
Falls	16
Cragfast	14
Inadequate equipment	11
Medical problem	11
Poor timing	8
Group separation	7
Avalanche	2
River crossing	1

Trends over time

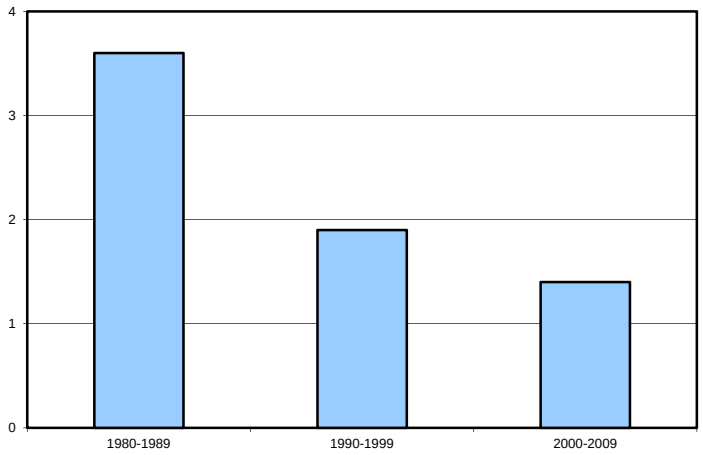
The above tables provide a broad brush picture, but they do not show how things may have changed over the 30 year period. Figure 1 shows the number of avalanche incidents for each year of the thirty year period. One thing that stands out clear is the extreme variability from one year to

Figure 1 – The number of avalanche incidents each year from 1980 - 2009



the next; the annual figures vary between 1 (2007) and 14 (1995). However, despite this variability there is a systematic trend across the period. A linear ’trend analysis’ (*see the straight line which overlays the annual figures*) suggests the number of incidents across the thirty-year period is declining. On average the number of incidents has fallen from just over seven each year in 1980 to just over three each year in 2009. Another way to look at the figures is to examine the number of incidents in each of the three decades. In the period 1980 – 1989 there were 62 incidents. In the period 1990 – 1999 there were 60 incidents and in the period 2000 – 2009 there were 36. Yet another way to look at the figures is to examine changes in the number of avalanche incidents as a proportion of all incidents. The overall figure is 2% as shown in Table 2, but this figure does alter over time. In the 10 year period from 1980 – 1989 the proportion was 3.6%, in the period 1990 – 1999 it was 1.9 % and in the last decade it was 1.4% (see Figure 2). Clearly, these figures show that, in relative terms, the proportion of avalanche incidents is declining.

Figure 2 – Avalanche incidents as a percentage of all incidents



Further evidence to support the decline is shown in Figures 3, 4 and 5 which reveal respectively the number of fatalities, injured casualties and number of people involved. In each case there is variability from one year to the next but there is also an overall decline across the period.

Figure 3 – The number of fatalities each year from 1980 - 2009

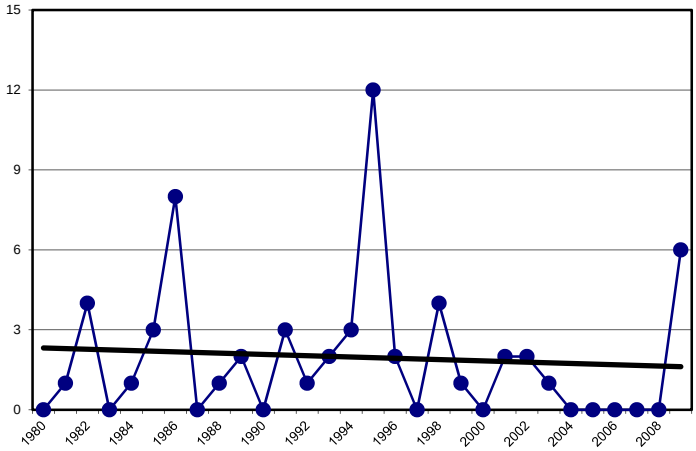


Figure 4 – The number of people injured each year from 1980 - 2009

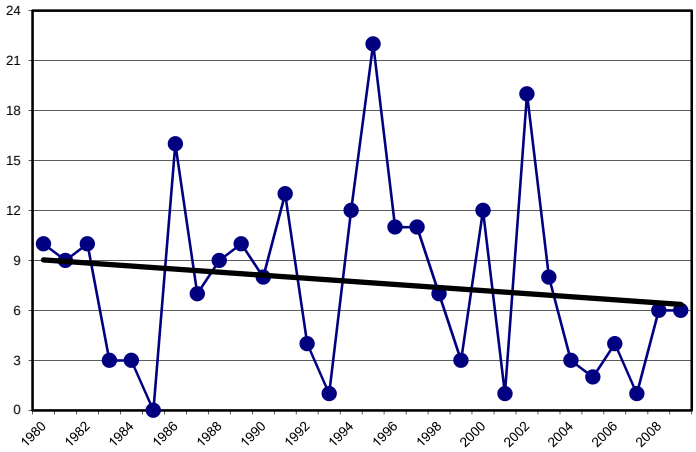
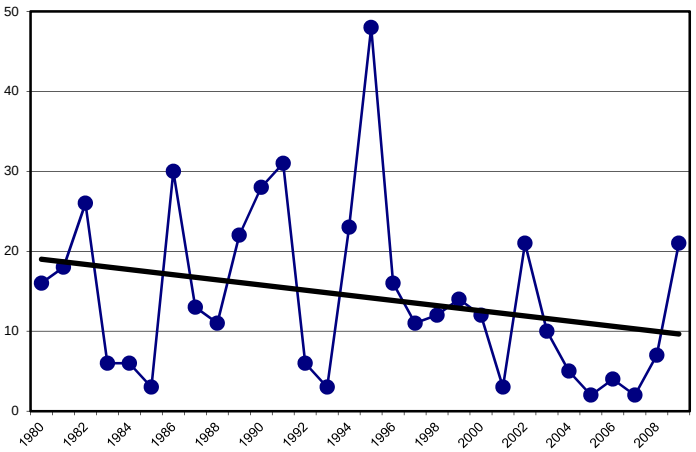


Figure 5 – The number of people involved each year from 1980 - 2009



In other words, the number of incidents, the number of people who die or injured and the number of people involved in avalanches each year are all declining. Taking these findings together, it seems relatively safe to conclude that there is an overall downward trend in avalanche incidents across the 30 year period.

The interesting question is to explain the downward trend. It's likely the answer in multi-faceted but two or three key factors stand out. Firstly, it is notable that the **sport**scotland Avalanche Information Service (SAIS) has been operational for a large part of this period. It is possible that in educating hillgoers more about avalanche hazards and provided them with forecasting information, the service has led to a generation of walkers and climbers who are more avalanche-savvy and better prepared to face winter hazards. So today, there may be a stronger safety culture towards winter mountaineering, which, in turn, has led to fewer incidents. Whilst it is impossible to attribute cause and effect and propose that the SAIS is responsible for the decline in incidents, the connection does seem to be strong.

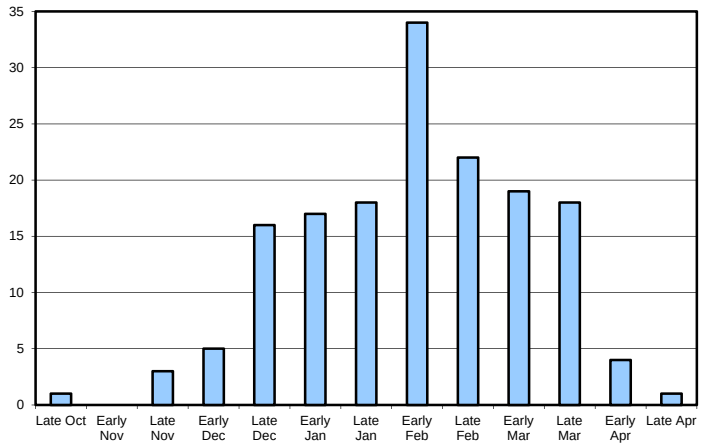
Another factor, which may have contributed to the fall in avalanche incidents, is the way in which mountaineers are now better prepared. It can be argued with some confidence that people who walk and climb in Scotland are much better equipped and informed than they were twenty or thirty years ago. As a result they are better prepared for dealing with a wide variety of mountain hazards both in summer and winter, including avalanche risk. This is reflected in changes in clothing, footwear, equipment, availability of information materials and courses and on-line access to weather and avalanche information. In broad terms, hillgoers are more knowledgeable than they once were. Of course, this alone does not make it less likely someone will be caught in an avalanche but it is indicative of a more informed and safer approach to winter travel. And this may be one reason for the overall decline in mountain incidents over the past 20 years. A third factor, which is perhaps rather tenuous, is the weather. It's well known that conditions for winter mountaineering (and snow sports for that matter) vary from year to year. Anecdotal evidence suggests winters are becoming less severe (global warming?) and many climbers and skiers report snow conditions are generally less favourable today than they once were. If this is the case then fewer people might be expected to tackle winter routes because of their inconsistent and patchy nature. Fewer 'participation days' each winter should therefore result in fewer incidents.

But, these suggestions are conjecture and there is no way of knowing with certainty why incidents rise and fall each year or why it seems the number of annual incidents is slowing down.

Monthly pattern

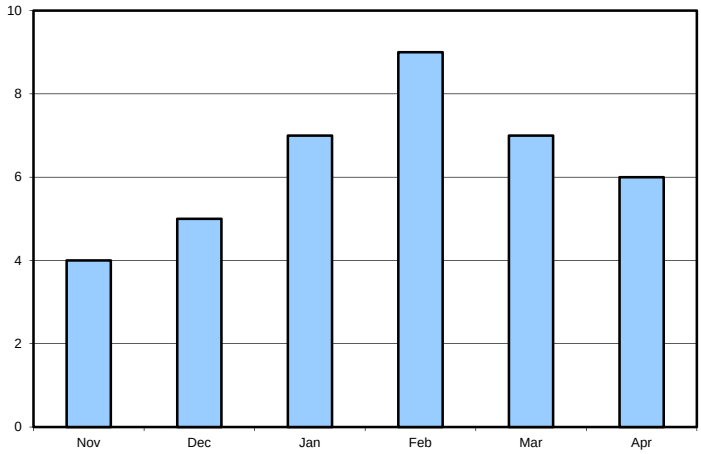
Avalanches are, of course, a winter phenomenon. However, the figures show they take place across a period of almost six months! Figure 6 shows the monthly pattern of incidents across the 30 year period. Each column in the figure represents a two week period. It is clear that the first

Figure 6 – Incidents across the months



half of February is the most hazardous (21% of all incidents) and February the most hazardous month with over one third of all incidents (35%). Sixty percent of all incidents take place from early February onwards. It is likely (but speculative) that this pattern mirrors participation levels, which in turn, mirrors good weather/climbing conditions. It is also interesting to note that this pattern is similar to the overall pattern of mountaineering incidents across this period (see Figure 7). This

Figure 7 – Mountaineering incidents (in % terms) from November to April

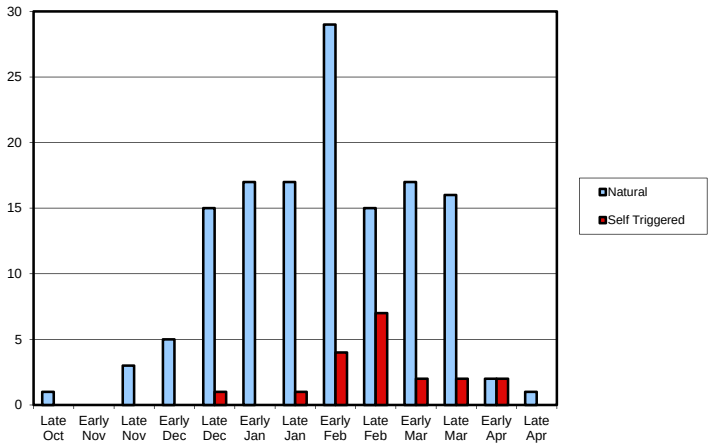


confirms that February is a particularly hazardous month not only for avalanche incidents but other incidents where different factors (e.g., slips, falls, lost, medical) are the focus.

The monthly pattern shown in Figure 6 does not change with respect to whether casualties were walking or climbing. Incident reports indicate whether the person/s was either climbing a named route or simply walking (on a ridge, on steep ground, in a corrie, etc.) at the time of the avalanche. One might expect the proportion of incidents in the early part of the season (say up to January) to involve walkers and those incidents in the latter part to involve climbers when routes are more likely to be in season. But this is not the case; the pattern shown in Figure 6 is the same whether the people involved are climbing or walking. In other words, the risks from month to month across the winter period are no different whether someone is climbing or walking. Similarly, the pattern is independent of whether an avalanche or a cornice collapse caused the incident.

However, there is an interesting finding in regard to how the avalanche is triggered. Overall, 12% of all avalanches/cornice collapses are reported as being triggered by casualties. Whilst the number of self triggered avalanches is small (n = 19) there is a tendency for these incidents to occur towards the latter part of the winter. This is seen in Figure 8 by noting the bars in red which

Figure 8 – Incidents across months in relation to avalanche initiation

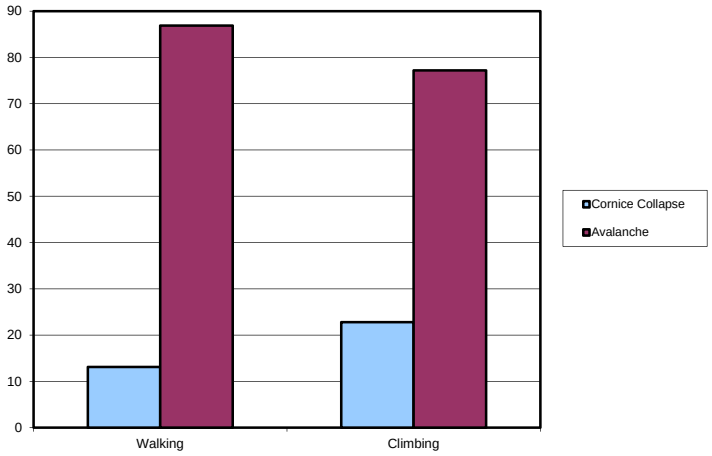


tend to the right hand side (later in the winter) of the chart.

Type of activity

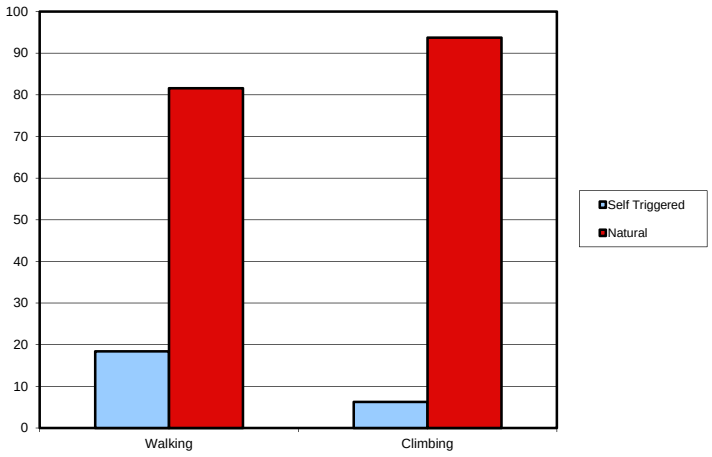
Overall, 51% of all incidents involve climbers on named routes whereas 49% involve walkers. Many of the latter are engaged in walking with no plan to climb a named route whilst some are climbers walking out having completed a route or walking in to begin a route. So, the split between those who are walking and those who are climbing is broadly 50/50, although there is no data to show how this relates to the numbers participating. If, for example, more people spend their time walking rather than climbing (named routes) over the winter period, then one could infer that climbers are more likely to be avalanched than walkers. But there is no evidence to support this conclusion. However, there is evidence to show how people are avalanched. Overall, 19% of all incidents result through a cornice collapse and 81% because of a direct avalanche. It turns out that these two types disproportionately affect climbers and walkers. Whilst the number of walking and climbing incidents are about equal, cornice collapses are relatively more common in climbing incidents (see Figure 9). This can be seen by comparing the relative heights of the bars in the figure. This would be expected since the risk of cornice collapse is less in the kind of terrain where walkers venture and greater where people climb (e.g. gullies). In other words, those who walk are less exposed to this type of hazard.

Figure 9 – Percentage of incidents as a function of activity and avalanche/cornice collapse



Another interesting finding shows that walkers are more likely to trigger an avalanche than climbers (compare the relative heights of the red and blue bars in Figure 10). An obvious

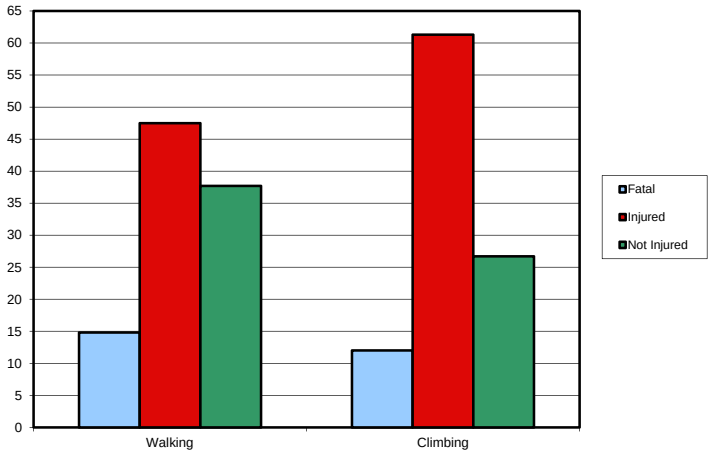
Figure 10 – Percentage of incidents as a function of activity and type of trigger



explanation is that walkers are less aware of the factors that predispose a slope to avalanche – including the possibility of self triggering - whereas climbers are more knowledgeable of the risk factors. If this is the case, it might be that walkers use the services of the SAIS less and/or do not apply the information gained.

It's also worth looking at the relative injury rate with regard to those who walk and climb. Figure 11 shows that the outcome of being caught in an avalanche is different for walkers and climbers. The figures show that walkers are more likely to escape injury (note the relative heights of the red and green bars). This might be explained by the fact that climbing incidents take place on steeper terrain where the risks of falling are more serious. However, it's not easy to see why walkers are at a slightly higher risk of dying in avalanches (see blue bars). But overall, a greater proportion of walkers escape injury altogether (see green bars) which makes sense.

Figure 11 – Percentage of incidents as a function of activity and injury



Location of avalanches

More avalanche incidents would be expected to occur in places that attract more walkers and climbers. Unfortunately there is little clear evidence on mountaineering participation in Scotland, but the reports show that incidents tend to concentrate in those areas traditionally considered popular for winter mountaineering and climbing. Table 4 shows that three areas (Ben Nevis, Glencoe and the Northern Cairngorms) account for 71% of all incidents. The areas listed in Table 4 are those adopted by the Scottish Mountaineering Club for their District Guides as well as the Mountain Rescue Committee of Scotland for categorising mountaineering incidents. It is notable

that the areas where most avalanche incidents occur are also those for which the SAIS provides reports. Although, there is one exception. Eleven percent of all incidents take place in the Northern Highlands and there is no current coverage for this very large area. An examination to see if any area has changed over time with regard to number of incidents reveals nothing obvious. The figures are too small to draw any clear conclusions about whether particular areas are becoming more or less 'hazardous'.

Table 4 – Geographical areas where avalanche incidents occur

	Number	Percentage
Ben Nevis (inc. Grey Corries and the Mamores)	45	29
N. Cairngorms (mainly northern corries)	35	22
Glencoe (inc. BEM and AE Ridge)	32	20
N. Highlands (inc. Torridon, Fannichs, Kintail, Skye)	19	12
Creag Meagaidh	12	8
S. Cairngorms (inc. Lochnagar and Angus glens)	9	6
S. Uplands/Highlands	6	3

Summary points

1. In the past 30 years there have been 158 recorded avalanche incidents in which 59 people (14%) have lost their lives and 231 injured (54%). One third of all those involved escape injury.

2. The chances of dying or being injured in an avalanche incident are greater than in incidents where other factors play a key part (e.g., poor planning, navigation error, illness).

3. Avalanche incidents represent 2% of all recorded mountaineering incidents.

4. The number of avalanche incidents is declining. This is reflected in falling number of incidents, number of people involved as well as numbers injured and dying. The number of incidents as a proportion of all mountaineering incidents is also falling.

5. More avalanche incidents take place in the month of February than any other month in the year (35%).

6. Avalanche incidents can take place at any time within a six months period in the year – late October to late April. The profile is broadly 'normal' in shape.

7. The monthly profile of avalanche incidents is no different for walkers or climbers.

8. The monthly profile of avalanche incidents is no different whether the incident is caused by an avalanche or cornice collapse.

9. Climbers rather than walkers are more likely to be involved in an incident started by a cornice collapse.

10. Avalanches account for 81% of all incidents and cornice collapses 19% of all incidents.

11. Self-triggered avalanches account for 12% of all incidents.

12. Self-triggered avalanches tend to take place towards the latter part of the winter period.

13. The proportion of self-triggered avalanches is greater with walkers than climbers.

14. 51% of all incidents involve climbers on named routes. 49% of all incidents involve those who are walking.

15. Walkers are more likely to escape injury than climbers.

16. Over 70% of all incidents take place in three areas – Ben Nevis, Glencoe and the Northern Cairngorms.

Conclusions

This is a complete survey based on all recorded incidents across a 30 year period. It stands as a unique and objective survey, which should be of interest to those involved in mountain rescue and mountain safety. There may be new items of information that could be used to help inform mountaineers about avalanche hazards. Two findings stand out clear. One is the relatively low number of avalanche incidents (already known) and the other is the overall decline in incidents across time. It is interesting to speculate whether the work of the SAIS has had an impact here. It is worth noting that whilst the large majority of incidents occur in those areas for which the SAIS presently provides a service, 12% take place in the Northern Highlands for which there is no service.

The survey would have been more comprehensive had there been information available about weather, personal details of those involved (e.g., age, experience, country of domicile) and avalanche forecasts at the time of each incident. Some of this information is available but would involve referring back to the original incident reports. This would be a very time consuming survey but possibly worthy of pursuing.

Reference

Sharp, R. H. (2007). Scottish mountaineering incidents (1996 – 2005).
www.mcofs.org.uk/research.asp