

AVALANCHE FATALITIES IN CALIFORNIA'S SIERRA NEVADA, WINTERS 1987-2008

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ABSTRACT: This paper analyzes the 17 avalanche fatalities in the Sierra Nevada of California during 22 winters, 1987 through 2008. The avalanche deaths are evaluated with respect to slope angle, slope aspect, contributing weather, group size, activity, age, and sex. With some exceptions, trends in fatal accidents in the Sierra Nevada follow those of the rest of the western United States.

KEY WORDS: Avalanche fatality, avalanche death.

1. INTRODUCTION

Seventeen individuals lost their lives in 15 separate avalanche events in the Sierra Nevada of California during Winters 1987 through 2008. Two of these fatalities occurred in the Carson Range (above the north and east shores of Lake Tahoe) of western Nevada. Even though the Carson Range is considered a geologically distinct mountain range from the Sierra Nevada, a large part of the Carson Range is within the watershed of the Lake Tahoe basin, and its close proximity to the Sierra Nevada and the fertile winter recreation population of Lake Tahoe necessitates its inclusion in this analysis. The Carson Range is within the forecast area of the Sierra Avalanche Center based in Truckee, California. Conversely, the five avalanche deaths that occurred (since 1987) in the backcountry above the greater Los Angeles basin are not included in this analysis. The author is less familiar with the geography, climatology, and backcountry culture of this region. Consequently, this paper is not an analysis of avalanche fatalities with respect to the State boundary of California.

All the accidents described here occurred outside a ski area boundary and on snowfields not regularly controlled for public safety. The last in-bounds avalanche fatality in the Sierra Nevada occurred November 29, 1985.

While it is assumed that a significant percentage of non-fatal avalanche occurrences go unreported, it would be quite unusual for a fatal avalanche accident to go unreported. Hence, avalanche accident data is skewed heavily toward fatalities. Because of this, avalanche fatality data is not necessarily representative of how humans interact with avalanche terrain and/or avalanche prone snowfields. Nonetheless, these data are useful when investigating individual accidents and

for the comparison of similar data sets from other regions.

2. ANALYSIS

Of the 17 fatalities in the past 22 years (average less than 1 per year), 10 (59 percent) have occurred in the Sierra Nevada surrounding or adjacent to Lake Tahoe. The other 7 (41 percent) were spread from Carson Pass to Yosemite to Sequoia Kings Canyon National Park. This may reflect the high concentration of backcountry users in the Lake Tahoe area and that the Tahoe region has relatively easy and widespread backcountry winter access. No avalanche deaths occurred in the Sierra Nevada during nine of the 22 (41 percent) winters.

Date	Location
15 Mar 1990	Near Alpine Meadows
13 Feb 1992	Mt. Rose
30 Dec 1992	Mammoth Lakes
14 Jun 1995	Yosemite National Park
11 Feb 1998	Donner Summit
06 Feb 1999	Donner Summit
21 Feb 2001	Near Squaw Valley
09 Mar 2002	Donner Summit
15 Dec 2002	Near Mt. Rose
26 Apr 2003	Near Carson Pass
01 Jan 2004	Donner Summit
20 Feb 2005	Near Donner Summit
26 Mar 2005	Mt. Tom near Bishop
01 Feb 2006	Mt. Walt near Bridgeport
28 Jan 2008	Sequoia National Park

Table 1: Dates and locations of the 15 fatal avalanche incidents claiming 17 lives, Winters 1987 through 2008. The accidents of 21 Feb 2001 and 26 Mar 2005 each took two lives.

Group size (prior to avalanching) across the accident data ranged from 1 to 7 with the average

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being 3. 82 percent of the accident victims were male, 18 percent female. Women represented a combined 14 percent of the individuals in the backcountry groups. At least one female was part of the backcountry group in four of the instances, but women were always the minority with the greatest female/male ratio for any group at 0.75. Only four of the 15 (27 percent) backcountry groups were equipped with functioning avalanche transceivers.

Victim age ranged from the youngest at 17 to the oldest at 52. Average age was 32. When compared to the U.S. avalanche fatality data from 1950-2000, a higher percentage of Sierra Nevada victims are older (greater than 39 years), while a lower percentage of Sierra Nevada victims fall in the 25-29 age category.

Backcountry skiing was the dominant activity: 53 percent of the victims were skiers. The next largest category was snowboarders who comprised 17 percent of the deaths. Compared with the U.S. statistics, Sierra Nevada victims were more than twice as likely to be skiing and seven times less likely to be snowmobiling. Seven of the 15 accident locations are permanently closed to snowmobile use.

All the avalanches initiated on steep snow (minimum 30 degrees) with 47 percent starting on slope angles in the 35 to 39 degree range. As fits with both the geology/topography and snow deposition patterns of the Sierra Nevada, NE was the dominant avalanche aspect. N and E aspects (equally represented) were the next most likely aspects, while two of the avalanche accidents occurred on SE facing snow.

Stormy weather also dominated: during 12 of the 15 occurrences (80 percent), at least 20 cm new snow was recorded in the previous 24 hours. Wind speeds at or above the snow transport threshold were recorded during 13 of 14 events (93 percent). Sufficient wind data was not available for one occurrence.

3. CONCLUSIONS

With—on average—less than one avalanche fatality per winter in the Sierra Nevada, the range suffers far fewer fatal avalanches than other western mountain ranges. This detail is not necessarily supported by the fact that over 32 million people are within a day's travel from skiable terrain in the Sierra Nevada. Nor would the minimum, and inadequate, level of avalanche education upheld by the "average" Sierra Nevada winter backcountry user (anecdotal—if not numerous—field observations by the author)

account for the low fatality rate. The most likely explanation is the Sierra Nevada's deep, warm, and relatively fast-stabilizing snowpacks. That 80 percent of the accidents were coincident with new snowfall, and 93 percent coincident with snow-transporting winds, are, in fact, not coincidences.

The concentration of avalanche deaths around the Lake Tahoe basin is most likely a function of accessibility, and therefore winter recreationist density. South of Carson Pass (25 km south of Lake Tahoe), there is no winter automobile access to the remaining 350 km of the Sierra Nevada crest, much of which is dominated by designated Wilderness and National Park lands, all prohibiting snow machines.

The "average" avalanche fatality in the Sierra Nevada from the last 22 winters was a 32 year-old male, backcountry skiing 35 degree (or greater) NE facing snow on a stormy day with his two male companions somewhere near Lake Tahoe. No one in the ski group was wearing transceivers.

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