

ANALYSIS OF 40 YEARS OF SNOWMOBILER FATALITIES – 1976-2016

Dr. Iain StewartPatterson<sup>1\*</sup>, Jeremy Hanke<sup>2</sup>

<sup>1</sup>Thompson Rivers University, Kamloops, BC, Canada

<sup>2</sup>Skadi Foundation, Revelstoke, BC, Canada

**ABSTRACT:** *There have been 127 snowmobile avalanche fatalities in Canada over last 40 years. With 19 snowmobiler avalanche fatalities in the 2008-2009 season, the Sparwood accident was a wake-up call for the snowmobile community. A year later the Turbo Hill accident on Boulder Mountain removed any doubt that change was necessary. It was apparent that decision behavior for many snowmobilers was not aligned with the reality created by riders who possessed limited avalanche knowledge and high performance sleds. Significant events often have the power to create change and stimulate the desire for learning. However as demonstrated by the twelve snowmobile fatalities in the 2015-2016 season, positive behavior changes that occurred after Boulder Mountain may have been lost.*

**KEYWORDS:** snowmobile, fatality, terrain management

## 1. INTRODUCTION

The 2009 Coroner's Death Review Panel following the 19 fatalities of the 2008-2009 season called for radical changes to improve mountain snowmobile safety (British Columbia Coroners Service, 2009). This was not the first time that the Coroner had commented. In 1993, following a snowmobiler fatality on the Bourne Glacier, the coroner stated that snowmobilers avalanche education needed to be improved. Sled technology has continually improved, allowing relatively inexperienced riders to penetrate further into the backcountry and reduced the skills needed to access avalanche start zones. The ATES scale was used to analyze the terrain of the fatal accidents. Although many of the accidents occurred in challenging and complex terrain, accidents also occurred in simple terrain. It is hard to estimate the total number of snowmobile user days in Western Canadian avalanche terrain, as relatively accurate records are only available for the managed snowmobile areas. However the relative risk (fatalities/user day) of managed areas may not be the same as unmanaged areas. Data from the Avalanche Canada Incident Report Database and Bulletin Archive were analyzed with regards to terrain use and hazard forecast (Avalanche Canada, 2016). The Hazard Forecast data for the 2011-2016 seasons were more com-

plete and allow a more in depth analysis for those years.

## 2. FATALITIES

Fatalities are only one way to assess the level of risk assumed by a user group. It is by no means a definitive method. Incidents and near misses are additional essential indicators. However the snowmobile community does not have a reporting process or access to a database to accumulate and assimilate the information and potential learning. The professional avalanche community has the InfoEx as a tool for extracting relative risk, however it is dependent on accurate and complete reporting. The InfoEx combined with the commercial operators requirement to report user days provides a way to assess relative risk. The snowmobile community only has user day statistics from managed areas and the annual body count.

From 2008 to 2016 there were 55 snowmobiler fatalities in Canada and all occurred in BC. They were all slab avalanches in the size 2 to size 4 range with an average of 2.7. From 2011-2016 more in-depth accident information was available. Most of the avalanches failed on persistent weak layers and the Hazard forecast was Considerable.

---

\* Corresponding author address:

Iain Stewart-Patterson, Thompson Rivers University, Kamloops, BC V2C 0C8;  
tel: 250-828-5184;  
email: spatterson@tru.ca

Strong-cvetich (2014) noted that snowmobilers had a preference to ride in areas that saw more traffic when the hazard was rated as Considerable and only down graded their terrain choices to Simple when the hazard moved to High. Moving to

higher traffic areas serves two purposes. Riders with less avalanche knowledge may have greater familiarity with that terrain and have the opportunity to observe the actions of other riders. In addition, previous heavy compaction may have reduced the significance of buried weak layers.

### 3. TECHNOLOGY

There has been a steady increase in capability of mountain snowmobiles. In a review of a fatal accident on the Bourne Glacier 1993, the BC Coroner stated "The features that are now being built into some of the machines enable the operators to access and travel in extreme avalanche terrain. Snowmobilers need to be better educated on the hazards of travelling in ... avalanche terrain, as well as on search and rescue equipment and techniques" (as cited in Jamieson & Geldsetzer, 1996, p. 122). The following year BRP introduced the new Ski Doo Summit. This was a revolutionary mountain snowmobile with a 580 cc engine, producing 108 bhp, and a track that was 136 inches long with a 0.912-inch lug height. This evolution of technology has continued as manufacturers design and produce machines that relatively novice riders are capable of taking high into avalanche start zones. In comparison to 1994, the 2015 Ski Doo Summit produces over 160 bhp, with a 174-inch track and a 3-inch lug height.

In many ways this is no different than the evolution of ski technology. The introduction of the Atomic "Fatboy" in 1992 opened up a whole new world to heli skiers. Current powder ski technology permits relatively weak skiers to survive and even thrive in steep and deep avalanche terrain. The technical skill set for both snowmobilers and skiers can regularly exceed their avalanche-related decision capacity.

### 4. ATES SCALE

This study used the ATES scale to analyze the terrain in which the accidents occurred. Although many of the accidents occurred in challenging and complex terrain, accidents also occurred in simple terrain.

Definitions - as per (Statham, McMahon, & Tomm, 2006)

Simple - Exposure to low angle or primarily forested terrain. Some forest openings may involve the runout zones of infrequent avalanches. Many options to reduce or eliminate exposure. No glacier travel.

Challenging - Exposure to well defined avalanche paths, starting zones or terrain traps; options exist

to reduce or eliminate exposure with careful routefinding. Glacier travel is straightforward but crevasse hazards may exist.

Just in the last three years, five fatalities occurred in Simple terrain or at the transition from Simple to Challenging. In three of the events the rider was traveling alone. All five events occurred at Treeline or below. The Hazard was rated as Considerable in all five cases. Three of the avalanches were size 2 and two were size 2.5; all were slabs that failed on persistent weak layers. This contrasts with the larger data set of all snowmobile fatalities since Harvey Pass 2008, in which the size range of fatal avalanches was 2-4 with an average of 2.7.

### 5. MANAGED AREAS VS. UNMANAGED AREAS

A comparative risk analysis that uses the number of fatalities per 100,000-snowmobile user days may not be a good indicator. Although it is hard to estimate the total number of snowmobile user days in Western Canadian avalanche terrain, relatively accurate records are available for the managed snowmobile areas. However the relative risk (fatalities/user day) of managed areas is likely less than that of unmanaged areas. There are two possible contributing factors: compaction and avalanche expertise. Heavily used areas such as Boulder and Frisby are likely to have different layering properties than more remote areas that see relatively little slope use. Terrain management expertise that is developed in heavily used areas will tend to build decision response patterns that do not adapt well to areas that experience little to no compaction due to previous slope use. However compaction makes a less of difference when dealing with surface conditions such as windslab, storm snow or warming.

### 6. LEARNING (AND FORGETTING) FROM BLACK SWAN EVENTS

Black Swan events have been defined as events that occur, which are beyond what is thought possible (Taleb, 2010). The Harvey Pass accident in December 2008 was such a wakeup call to the mountain snowmobile community. Eleven sledders from the town of Sparwood BC were caught in a series of three avalanches; only three survived. It was the beginning of the worst year on record for the number of snowmobiler fatalities (19) and fatal events (11). Although the events set waves of concern through the snowmobile community, the magnitude of the situation was a sufficiently large to initiate a public response. The BC Coroner

commissioned a Death Review Panel, bringing together avalanche and snowmobile experts from across the province. The report was completed in December 2009 and released shortly thereafter.

Recommendations included:

- Develop and distribute avalanche awareness programs for snowmobilers
- Develop a competency matrix to help AST students understand the limits of their training
- Implement an enhanced Public Avalanche Forecast System by decreasing the size of bulletin regions and increasing the coverage and frequency of forecasts issued by the Canadian Avalanche Centre
- Provide support for core avalanche awareness programs, which include avalanche forecasts and public warnings, development and distribution of avalanche safety educational materials and avalanche safety training
- ISMA engage in a dialogue with the Canadian Avalanche Centre and commit to provide support for core avalanche awareness programs
- Co-ordinate and undertake the development of avalanche terrain classification for popular snowmobiling areas.
- Engage in a collaborative effort to provide the public with access to Avalanche Terrain Exposure Scale (ATES) information for popular snowmobiling areas.
- Raise avalanche awareness and cultivating a culture of avalanche safety within the snowmobiling community.

The accident at Boulder Mountain in March 2010 could be considered a Black Swan event. The fact that there were only two fatalities can be attributed to good luck and the actions of the rescuers. Whether lessons were learned following the 19 fatalities during the 2008-2009 season and the Boulder Mountain accident is open to debate. There were 3.6 fatalities per year for the next five seasons. But then what happened? The 2015-16 season had 12 snowmobile fatalities.

The winter of 2009-2010 was a challenging one. Numerous persistent weak layers made avalanche forecasting difficult, and consequences for being wrong were potentially severe. Avalanche Canada issued a number of Special Avalanche Warnings in mid-February. A warning was issued for the

weekend of March 13<sup>th</sup>. This coincided with a planned snowmobile event at Boulder Mountain. The event included a hillclimb. Although many people chose not to go into the mountains that weekend, there were estimates that 350+ people accessed Boulder Mountain that day.

The accident at Turbo Hill on Boulder Mountain could be considered a Black Swan event. It could easily have been the worst avalanche accident in Canadian history with over 200 people involved and more than 60 full burials. Yet typical of Black Swan events it seems entirely predictable in hindsight. The fact that there were only two fatalities can be attributed to good luck and the actions of the rescuers.

Events of the magnitude of Harvey Pass and Turbo Hill have the potential to produce significant learning and behavior change. Whether lessons were learned following the 19 fatalities during the 2008-2009 season and the Boulder Mountain accident is open to debate. There were three fatalities per year during the five years prior to Sparwood. There were 3.6 fatalities per year for the five seasons after Boulder. But then what happened? The 2015-16 season had 12 fatalities.

## 7. SUMMARY

Snowmobilers access almost as much terrain and make as many decisions as heliski guides, yet their level of training is typically at the AST 1 level. Compared to Ski Guides who have completed over 55 days of training and certification the typical mountain snowmobiler is underprepared.

Snowmobile technology has accelerated the technical skill set of the average rider to the point that their decision-making skills have been unable to keep up. Changes in snowmobile specific avalanche education are needed. A change in the ATES scale is also warranted. Snowmobilers would benefit from an additional terrain classification that is simpler than Simple. When the hazard is Considerable to High with a persistent weak layer, a move to simpler terrain is warranted. Behaviour change is slow, but it begins with recognizing and accepting a need for further education.

## REFERENCES

- Avalanche Canada. (2016). Incident Report Database. Retrieved from <http://old.avalanche.ca/cac/library/incident-report-database/view>
- British Columbia Coroners Service. (2009).

*Findings and recommendations of a death review panel convened to examine winter 2008-2009 avalanche related deaths involving snowmobile operators: Report to the Chief Coroner of British Columbia.*

- Jamieson, B., & Geldsetzer, T. (1996). *Avalanche Accidents in Canada: Volume 4 1984-1996* (Vol. 4). Canadian Avalanche Association.
- Statham, G., McMahon, B., & Tomm, I. (2006). the Avalanche Terrain Exposure Scale. *Proceedings International Snow Science Workshop 2006*, 1–7.
- Strong-cvetich, L. R. (2014). Mountain Snowmobilers and Avalanches : An Examination of Precautionary Behaviour by, (586).
- Taleb, N. M. (2010). *The Black Swan: The impact of the highly improbable* (2nd ed.). New York, NY: Randon House.