VISION ZERO: COLLABORATIVE PROJECT TO REDUCE AVALANCHE ACCIDENTS IN LYNGEN, NORTHERN NORWAY

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ABSTRACT: Avalanche accidents are an increasing problem in Troms, Norway, particularly on the Lyngen peninsula. Every year, the tourism industry sees a growing number of ski-touring tourists coming to the region, which is the main reason for the increasing number of avalanche accidents. The "Vision Zero" project is an extensive cluster collaboration with the mission of reducing avalanche accidents in the county of Troms and aims for zero fatal accidents. While zero fatalities might be unrealistic, it is the vision. The project started season 2023/2024 and will run for one more season. The first season launched several measures including a new mobile app for safer ski tours, daily online guide meetings, distribution of important avalanche information and enhanced avalanche forecasting. This paper reviews the different measures discussed and tried out, along with ideas and plans for the next season. Preliminary results from the 2023/24 season are promising, with positive feedback from different user groups. Notably, there were no fatalities among foreign tourists this season, which is very promising. However, it's important to emphasize that it was a calm and easy winter season with rather stable snowpack, which is unusual for the Troms region.

KEYWORDS: Avalanche warning, tourism, avalanche mitigation, app, guide meetings

1. INTRODUCTION

Adventure tourism is often promoted as a solution to sustainable development in Arctic communities with limited economic opportunities (Sisneros-Kidd et al., 2019) and has been explicitly identified as a means to achieve social and economic progress in Northern Norway (Stokke et al., 2023). It is estimated that approximately 30,000 guest nights per year are accounted for by ski tourists in the Lyngen, Kåfjord, and Skjervøy municipalities alone (Arctic 365, 2019). This suggests that ski tourism plays a crucial role in the economic development of the region. However, engaging in recreational activities in avalanche-prone areas comes with significant risks. Since 2008, 98 people have lost their lives in avalanche-related outdoor activities in Norway.

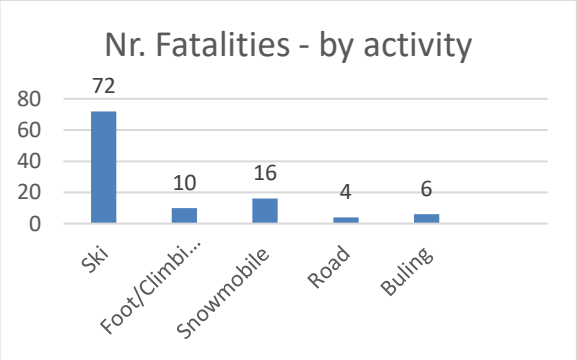

Figure 1**:** Since 2008, 108 people have died in avalanche accidents in Norway, with 98 of them involved in outdoor activities. Ref. varsom.no

Ski avalanche accidents in the backcountry of Troms are the most represented group in this statistic, with two-thirds of the victims being foreign tourists. During the 2021/22 and 2022/23 seasons, all eight ski avalanche fatalities in Troms involved foreign tourists, posing a considerable challenge for local authorities and communities, particularly on the Lyngen peninsula, which is experiencing a steady increase in ski-touring tourism.

In about 90% of all fatal avalanche accidents, the avalanche was triggered by someone in the victim's group (McClung and Schaerer, 2006; Schweizer and Lütschg, 2001). In other words, skiers make decisions that put them at risk. The

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underlying causes can vary: limited understanding of avalanche forecasts (e.g Engeset et al., 2018; Terum et al., 2023) personality traits, risk preferences, emotional drives (Mannberg et al., 2017, 2021), inherent aleatory risk, and epistemic risk, among others (Landrø et al., 2020, 2022). Additionally, many of the host communities are small municipalities with limited capacity. Due to the small size of these municipalities and the scarcity of other economic opportunities, a large portion of the population is directly or indirectly affected by the increasing avalanche risk.

Local stakeholders and national politicians have repeatedly called for action. A recent response to these calls is the Vision Zero project, a collaboration between Arctic 365, a cluster of tourism companies, the Norwegian Police, the Norwegian Avalanche Warning Service, and the Center for Avalanche Research and Education (CARE). With a total budget of 2.1 million NOK, the project will be conducted over two years, covering all activities and administrative costs. Funding is a collaborative effort involving public grants, contributions from a private bank foundation, and investments from project participants.

The project aims to develop and test several concrete strategies to reduce avalanche accidents in Northern Norway, with a particular focus on the Lyngen peninsula. This paper outlines the established initiatives and presents preliminary feedback and reflections from the ongoing project.

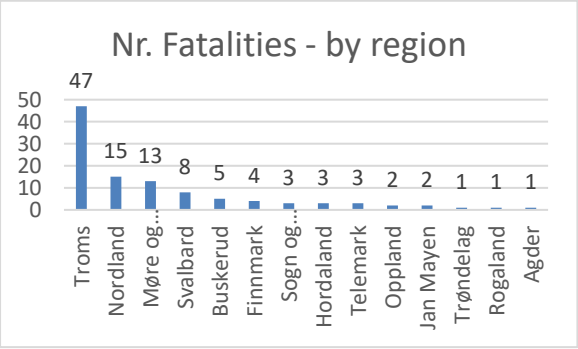

FIG 2: Avalanche accidents are a growing concern in Troms, Northern Norway. Half of all avalanche accidents in Norway occur in this region. Ref. Varsom.no

The project members first convened in June 2022. Our initial ideas for reducing avalanche accidents included the following:

1.1 Improving General Information

It is essential to ensure that every tourist is aware of the avalanche forecast available at Varsom.no, which also provides other critical safety information. The weather and conditions in Northern Norway can change rapidly, with long distances and limited access to rescue services. Therefore, tourists must be informed about the importance of carrying the necessary equipment for self-rescue, how to contact rescue services, and how to accurately provide their location in an emergency.

1.2 Enhancing Information on Snow Conditions

Due to the climatic and geographic differences between Northern Norway and other popular ski destinations, tourists may not fully understand the complexities of the snowpack. In the Arctic coastal climate, old or newly formed weak layers can persist late into the season, at low altitudes, and on all aspects. Statistics show that most accidents occur on quickly formed weak layers on southern aspects in the spring. Unfortunately, the current avalanche forecast does not have enough frequent observations to effectively track and detect these weak layers. The forecast heavily relies on observations from local observers and voluntary skiers through the open platform Varsom Regobs. Increasing the number of observations could significantly enhance the quality of the forecast.

1.3 Helping People Choose Safer Ski Tours

Informal discussions with tourists and tourism operators suggest that most people do not wish to expose themselves to high risk; they simply want an enjoyable ski trip. If offered a safer alternative with a great view but less risk, more people might choose safer terrain. Even if skiers do not change their plans, the project aims to make skiers more aware of critical points on well-known routes, such as areas with large cornices and terrain traps.

2. METHOD

2.1 Project Scope

The project operates over two seasons, from 2023 through 2025. Measures were implemented based on accident statistics, which indicate that most accidents occur in March and April during ski tours involving foreign tourists. These tourists come from various countries, with the majority originating from the European Alps. Most accidents involve skilled and experienced skiers, including mountain guides, and typically occur when there is a weak layer of facets, often newly formed. Many accidents happen at low altitudes and on southern aspects.

2.2 Measures Implemented

2.2.1. Daily Online Guide Meetings: On March 1st, we launched what is likely the world's first open and free daily online guide meetings, continuing every evening until the end of April. These daily Zoom meetings, hosted by a local IFMGA mountain guide, lasted about 30 minutes and included information and discussions about weather, snow conditions, avalanche forecasts, potential uncertainties, and strategic planning for the next day's activities. Participants shared their experiences and observations of avalanches and danger signs.

Summaries of the snow conditions discussed in the meetings were published on Varsom Regobs to inform the wider public. These summaries aimed to enhance public understanding of current conditions and precautions during challenging weather and snow conditions, particularly focusing on awareness of new weak layers and the severity of different weak layers. The summaries also provided valuable input for the Norwegian Avalanche Forecast.

The meetings were well-received, fostering an open and educational discussion among guides. Attendance ranged from 3 to 17 guides, with higher participation during more challenging avalanche conditions. The summaries posted on Varsom Regobs became popular among skiers and forecasters.

2.2.2. SkiGuide App: We designed and developed a new mobile app, SkiGuide.app, aimed at helping tourists choose terrain according to current conditions and informing users of critical sections on popular routes.

Known ski tours and tracks were collected through a Strava application. Based on these GPS tracks, 200 trips, mainly from the Lyngen and Tromsø areas, were described using a purpose-built map tool. The trips were then quality-checked and assessed by local guides. Some routes were modified to enhance safety, and all tours were classified according to avalanche terrain using the ATES 2.0 scale. New routes were also added, and the trips were imported into the app. Simultaneously, the commercial app Skida was launched, and data from the project was also implemented in this app. The trips are openly available to other parties under the NLOD license and can be downloaded here: (https://osf.io/2hxkq/) For more details on the Skida app, please contact the providers.

While the current setup of SkiGuide.app does not allow us to track the number of individual users, by the end of the season, more than 10,000 individual trips had been downloaded. Future plans include adding daily ratings of tours based on avalanche forecasts and incorporating information about parking and other logistical details.

2.2.3. Enhanced Avalanche Forecasting: We increased the number of professional field observations to improve the quality of regional avalanche forecasts, from three observations per week to five. Additionally, the summaries from the guide meetings on Varsom Regobs provided valuable information, resulting in more detailed forecasts for the Lyngen area. The English version of the forecasts was also expanded.

2.2.4. Information Dissemination: Efforts were made to inform tourists about the new measures and other important information. For instance, downloading the 113-help app was recommended to make it easier to be found in case of an accident in the mountains. Flyers and posters with this information were distributed at airports, ferry terminals, ferries, hotels, lodges, restaurants, and on the Northern Norway destination webpage, as well as the Varsom.no page, which was updated with new information. We also redistributed videos created in spring 2022 about the challenging conditions in the North, aimed at tourists. Information was sent out via email and social media to reach both the tourism industry and tourists. To reach IFMGA guides, we collaborated with Nortind, which sent out messages via WhatsApp to all their members.

No fatal accidents involving foreign tourists occurred during the season, although the easy conditions this season likely contributed to this outcome. It was beneficial to have a calm season, allowing for adjustments along the way. To understand how visiting tourists experienced the different measures we conducted a serie with random interviews at parking lots and lodges during the season.

3. DISCUSSION

3.1 Guide Meetings

The goal of the guide meetings was to create a platform for professionals to discuss current conditions and then extract and publish key information for non-professional users via Varsom Regobs. The initiative was well-received by the participating guides, and several expressed interest in establishing similar meetings in their respective countries. To ensure a professional dialogue and maintain a manageable group size, participation was limited to IFMGA guides. In hindsight, including participants from Norway's ski guide educational program, which is equivalent to the IFMGA's section for ski and avalanche, would have been beneficial. In addition to IFMGA

guides, we also included avalanche forecasters and local avalanche observers.

Due to business considerations, many guides are reluctant to disclose the exact locations of their observations. To address this, we focused on general observations rather than specific locations. This approach did not negatively impact the quality of the discussions; in fact, it encouraged guides to share their observations more freely and safely. The meetings were kept relatively brief, seldom exceeding 30 minutes, which proved beneficial as it allowed guides to fit the meetings into their schedules. Leveraging strategic mindsets is crucial, and next season, we plan to promote the meetings more effectively and consider extending the meeting season to include mid-February and early May, depending on conditions.

3.2 SkiGuide App

The SkiGuide app has shown promise as a useful tool. We included a feature that allows trips to be ranked from least to most risky based on current conditions. The idea was that the guide meetings could suggest a ranking for trips, which could then be published in the app to help non-professionals make safer terrain choices. Although we did not utilize this feature this year, we plan to test it in the upcoming season. All data for the 200 trips are openly available for other providers, and we will continue to describe more trips to offer a wider selection next season. Adding features like parking information and closer collaboration with the tourism industry could further enhance the app's utility. While the app received favorable ratings, we realize that increased marketing is necessary. Our random interviews revealed that few tourists were aware of the app.

3.3 Information Dissemination

Throughout the project, we created and distributed flyers at key locations. However, we are uncertain about the effectiveness of this approach. Future efforts may need to focus on more targeted and impactful methods of information dissemination.

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