



Tourists visiting Þórsmörk lack knowledge and awareness of Katla and jökulhlaup hazard



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Introduction

Historically, jökulhlaup emanating from a Katla eruption have typically flowed from the Kötlujökull and Sólheimajökull catchments. None have emanated from the Entujökull catchment. However, recent research identified at least ten volcanically induced jökulhlaup which have flooded this western region of Mýrdalsjökull (Fig. 1) prior to settlement (Smith, 2003; Larsen *et al.*, 2005; Smith and Haraldsson, 2005). In addition to this new evidence, an increase in seismic activity in Goðabunga – the western region of the Katla caldera – highlighted the need for a regional hazard assessment (Guðmundsson *et al.*, 2005). If the next catastrophic jökulhlaup were to emanate from Entujökull the first region to be affected would be the popular tourist destination of Þórsmörk. Consequently, a multidisciplinary investigation was conducted and the results predict that a catastrophic jökulhlaup on the Markarfljót River would produce a flood height in excess of 20 m reaching Þórsmörk in approximately 2 hours after the initiation of a Katla eruption (Guðmundsson *et al.*, 2005). Subsequently, Almannavarnir (the Icelandic Civil Protection) developed an evacuation plan and hazard education strategies for tourists in the Þórsmörk region. In conjunction with the Air Ground Rescue Team in Hella, the police commissioner in Hvolsvöllur, Almannavarnir will erect hazard information signs in prominent positions along hiking trails and inside mountain huts in Þórsmörk prior to the tourist season in 2008. Furthermore, information brochures entitled ‘Eruption Emergency Guidelines’ will be available in five different languages (see www.almannavarnir.is).



Figure 1. The volcanogenic hazard zone surrounding Mýrdalsjökull with the three main catchment regions Kötlujökull, Sólheimajökull and Entujökull (www.almannavarnir.is).

There are major concerns for tourists that frequent the Þórsmörk each year due their close proximity to Katla. During 2006 more than 20,000 overnight stays were recorded by tourists in this region. The majority of tourists visit Þórsmörk during the summer months

with most International tourists in the region during July. Icelanders stay in the region all year round.

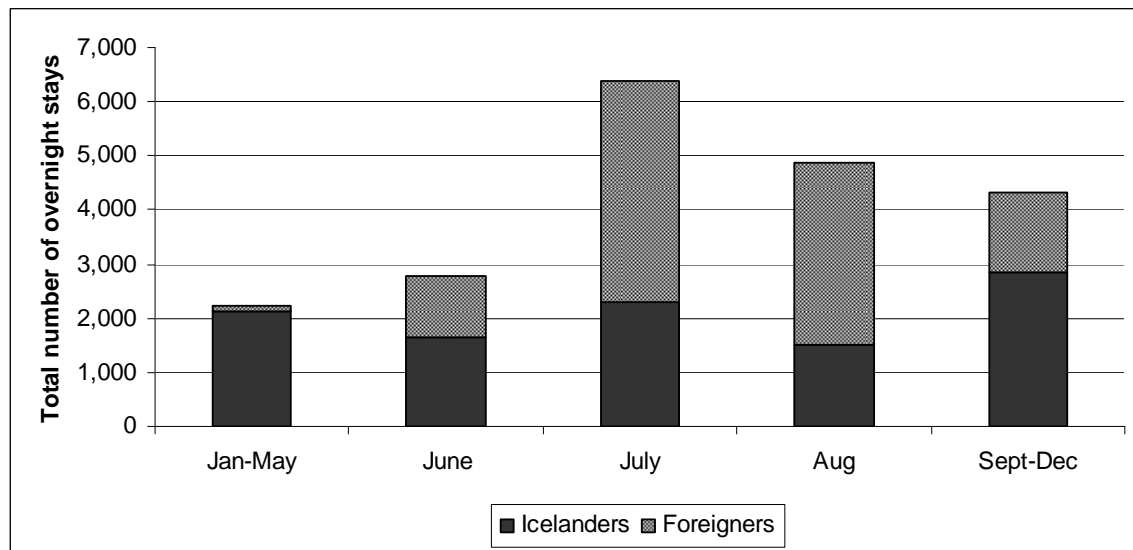


Figure 2. The total number of overnight stays in Þórsmörk during 2006 (information supplied by Statistics Iceland).

Methods

In order to gain an insight into the public's knowledge and awareness of Katla and jökulhlaup hazard 116 face-to-face questionnaire survey interviews were conducted with tourists in the Þórsmörk region during the 2007 summer season. The questionnaire survey instrument is a popular tool to gain social data in relation to natural hazards (Gregg *et al.*, 2007; McIvor and Paton, 2007; Paton, 2007; Bird and Dominey-Howes, 2008). The tourist questionnaire consisted of 52 questions which collected classification data and information about the participants knowledge, awareness and perception of Katla and jökulhlaup hazards and if any personal preparedness measures had been taken. The design of this questionnaire was pre-tested with tourists in Þórsmörk during the 2006 tourist summer season. The interviews were conducted in English and Icelandic and all participants were 18 years or older. Participants were recruited for the survey by direct approach and the contents of the questionnaire were revealed to them prior to the interview.

Results and Discussion

Table 1 highlights some key characteristics of our participants. The age distribution was fairly even for each of the age classes. Nearly a quarter of our participants were Icelandic and more than half had University degrees or higher. This result reflects a well educated group of participants.

Table 1. Participants' key characteristics

Distribution of participants by age	18<30 yrs 36	31<50 yrs 36	51+ yrs 28
% of Icelandic and international tourists	Icelandic 23		International 77
% of participants that have achieved the following level of education:			
Educated from 6-20 yrs 9.5	Special Education 13.8	Under-graduate 11.2	University degree 38.8
			Postgraduate Qualification 25.9
			Other (Un-completed higher education) 0.9

Nearly all participants were staying at least one night in the region (Table 2). The main reason for most international tourists coming to Þórsmörk was hiking whilst Icelandic tourists visited the region for multiple reasons such as hiking, for the nature and sightseeing, and spending time with family and relaxing.

Table 2. Participant responses to various behavioural questions in the survey

How long will you be spending in the region? ○ Icelandic tourist ○ International tourist	1 day 15 6	2+ days 85 94
What is your main purpose for visiting the region? ○ Icelandic tourist ○ International tourist	Hiking 37 62	Other 63 38
Are you travelling with a guide? ○ Icelandic tourist ○ International tourist	Yes 7 9	No 93 91
Do you have your GSM with you whilst in this region? ○ Icelandic tourist ○ International tourist	Yes 89 65	No 11 35
Do you carry a satellite phone with you when travelling in this region? ○ Icelandic tourist ○ International tourist	Yes 22 10	No 78 90

A surprising number of participants who were not travelling with a guide admitted that they were not carrying a mobile phone or any other form of emergency communication device. Without any mode of communicating with these people it is difficult for Almannavarnir to issue a warning of an unexpected Katla eruption. To further exacerbate this situation many parts around Þórsmörk are not covered by the national GSM network. Those people travelling without a guide and only a mobile phone may be in an area where they cannot contact emergency information services during a volcanic crisis.

All participants knew that Iceland is volcanically active but only half the international tourists had heard of Katla. For those participants that stated that they had heard of Katla we asked them to describe what they know about Katla and we determined them to be correct if they could tell us the approximate frequency of eruptions and when the last confirmed eruption occurred. The results from this indicated that both Icelandic and international tourists lack general knowledge about the Katla volcano and an overwhelming majority of international participants are unaware of jökulhlaup hazard. Many of the international tourists that stated that they did know about jökulhlaup said

that they had heard about the hazard whilst visiting the information centre in Skaftafell. These participants were very positive and interested in the information provided about the 1996 jökulhlaup from Vatnajökull.

Furthermore, nearly all participants stated that they are not aware of the emergency procedures if a jökulhlaup warning is issued. This result is not surprising however since the evacuation plan had not formally been communicated within the Þórsmörk region. The majority of participants stated that they would rely on the hut wardens to provide this information to them. This transfer of responsibility was also evident in other international hazard studies (Mulilis and Duval, 1995; Lindell and Whitney, 2000; Gregg *et al.*, 2004a). When the local population assumes that community preparedness is predominantly the responsibility of civil authorities these individuals may be less likely to heed hazard information, they may be less likely to follow hazard evacuation plans and also less likely adopt self protective behaviour as apposed to those participants who perceive responsibility upon themselves.

The results of this research highlight the need for hazard education for tourists in the Þórsmörk region. Furthermore, the importance of educating and training hut wardens in evacuation procedures is emphasised by the participants' stating that they would rely on them during an emergency situation. The integration of this social data, which includes the public's knowledge and awareness of Katla and jökulhlaup hazard, will add further scope to risk mitigation strategies and thereby aid the development of a thorough and comprehensive risk mitigation plan. It has been argued that appropriate hazard education and risk communication strategies can be developed based on the community's beliefs, needs and expectations rather than just providing hazard information that reflects only the knowledge and expectations of the scientific community (Dominey-Howes and Minos-Minopoulos, 2004; Hampel, 2006; Alexander, 2007; McIvor and Paton, 2007; Paton, 2007). Through the erection of hazard information signs and the distribution of hazard information brochures the tourist's knowledge and awareness of Katla and jökulhlaup hazard will hopefully improve.

This issue of communication between scientists, civil authorities, hut wardens and the public can make the difference between a successful response to a threat and an unsuccessful one (Chester *et al.*, 2002). Many of the interviewed tourists supported the need for hazard information and they did not feel that it would have a negative impact on the region. They stated that they would prefer to have this information prior to arriving in Þórsmörk so they could better prepare themselves for extreme events and many said that it would be beneficial to provide this information upon arrival at the airport. This result suggests that it may be beneficial for Almannavarnir to provide the "Eruption Emergency Guidelines" brochures at the airport and also to link this information to tourist websites such as the Icelandic Tourist Board. Additionally, Almannavarnir in conjunction with the rescue teams and the local police will conduct training and education campaigns with hut wardens working in and around Þórsmörk. Many of the tourists believed that the evacuation plan should be practiced with the hut wardens and tour operators each year.

The proposed hazard education campaigns to be launched by Almannavarnir prior to the 2008 tourist season should greatly improve tourist's knowledge of Katla, jökulhlaup hazard and the evacuation plan. Additionally, these campaigns will include education and training of hut wardens working in and around Þórsmörk. However, by providing hazard information it must not be assumed that the public will accept and absorb it (Rohrman, 2000; Paton, 2003). Therefore it is important to conduct follow-up surveys in order to determine how effective the signs and information brochures have been in increasing knowledge and awareness. To achieve this we will conduct questionnaire survey interviews again during the 2008 tourist season. Through this reassessment, we hope to establish whether or not this information is helping tourists adopt self protective behaviour for an emergency situation.

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