

## The effect of communicative and on-site measures on the behaviour of winter sports participants within protected mountain areas – results of a field experiment

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**Keywords:** steering instruments, interventions, management, outdoor recreation, conflicts of use, winter sports, wildlife, social science, survey, theory of planned behaviour

### Abstract

Recreational activities have increased remarkably and may negatively affect native wildlife populations. A nationwide campaign in Switzerland (*Respektiere deine Grenzen*) tries to manage the behaviour of winter-sports participants through awareness raising and by using on-site intervention instruments. Following an experimental survey design, the campaign was evaluated among people engaged in ski-touring or snow-shoeing in the winter of 2011/12 ( $n = 548$ ). The results reveal that the campaign is successful in raising awareness and has a positive impact on stated responsible behaviour towards nature. In contrast, the results of the treatment-control comparisons show that on-site-intervention instruments do not significantly influence stated behaviour. We can conclude that steering instruments should preferably be applied during the planning phase of the tour or, at the latest, at its starting point, whereas measures trying to influence the behaviour on tour seem to have no additional effect.

### Introduction

Outdoor recreation activities have increased significantly all over the world (Manning & Anderson 2012) and also in Switzerland (Hunziker et al. 2011). This development has led to positive and negative effects. On the one hand, outdoor recreation has a positive impact on health, recreation, integration and family solidarity (Hartig et al. 1996; Kaplan & Talbot 1983; Manning 2011; Martens & Bauer 2008). On the other hand, conflicts between recreationists and conservationists, especially within protected mountain areas, are very common (Arnberger et al. 2011; Bennett et al. 2011; Hendee et al. 1990; Liddle 1997; Marzano & Dandy 2012; Taylor & Knight 2003). In Switzerland it has been shown that the main conflict arises between winter sports participants and native wildlife populations in subalpine areas, where protected species like the capercaillie (*Tetrao urogallus*) can be affected (Arlettaz et al. 2007; Ingold 2005; Thiel et al. 2011). Therefore, to reduce the negative impacts on nature and wildlife populations, it is important to manage outdoor recreation, especially the activities of winter sports participants, while preserving high levels of recreation value. The nationwide campaign *Respektiere deine Grenzen* tries to accomplish this by steering the behaviour of people who engage in ski-touring and snow-shoeing in order to diminish the negative impact on native wildlife populations, especially in protected mountain areas. Two strategies have been implemented: the first is raising awareness (e.g. through flyers, media, information panels), with a focus on promoting four main rules (Table 1). The second strategy is supporting the Swiss cantons in steering winter sports participants through on-site intervention instruments (e.g. barrier tapes and prohibition signs, Figure 1).

However, it is not yet well known whether such steering instruments actually influence behaviour in a positive way. Therefore this study aims to evaluate



Figure 1 – Example of on-site intervention instruments in Brunnli, Alpthal (Switzerland): protection zone, marked by prohibition signs and barrier tapes. © S. Burki 2010

the effectiveness of the campaign in Switzerland. Furthermore, the evaluation allows gathering knowledge on how to develop steering instruments for managing outdoor recreation in general.

### State of research

Several studies have considered steering instruments in outdoor recreation. In North America investigations have been conducted to obtain knowledge on how to manage people, especially in national parks, in order to reduce the negative impact that outdoor recreation can have on natural resources (e.g. Duncan

Table 1 – The four main rules promoted in the nationwide campaign *Respektiere deine Grenzen*.

<b>Rule 1</b>	Respect protected mountain areas. Wildlife populations hide within these areas.
<b>Rule 2</b>	Stay on marked routes and paths within forests. This allows wildlife to get accustomed to humans.
<b>Rule 3</b>	Avoid forest edges and snow-free areas. These are the places most favoured by wildlife.
<b>Rule 4</b>	Put your dog on a leash, especially within forests. Wildlife must be able to escape from dogs.

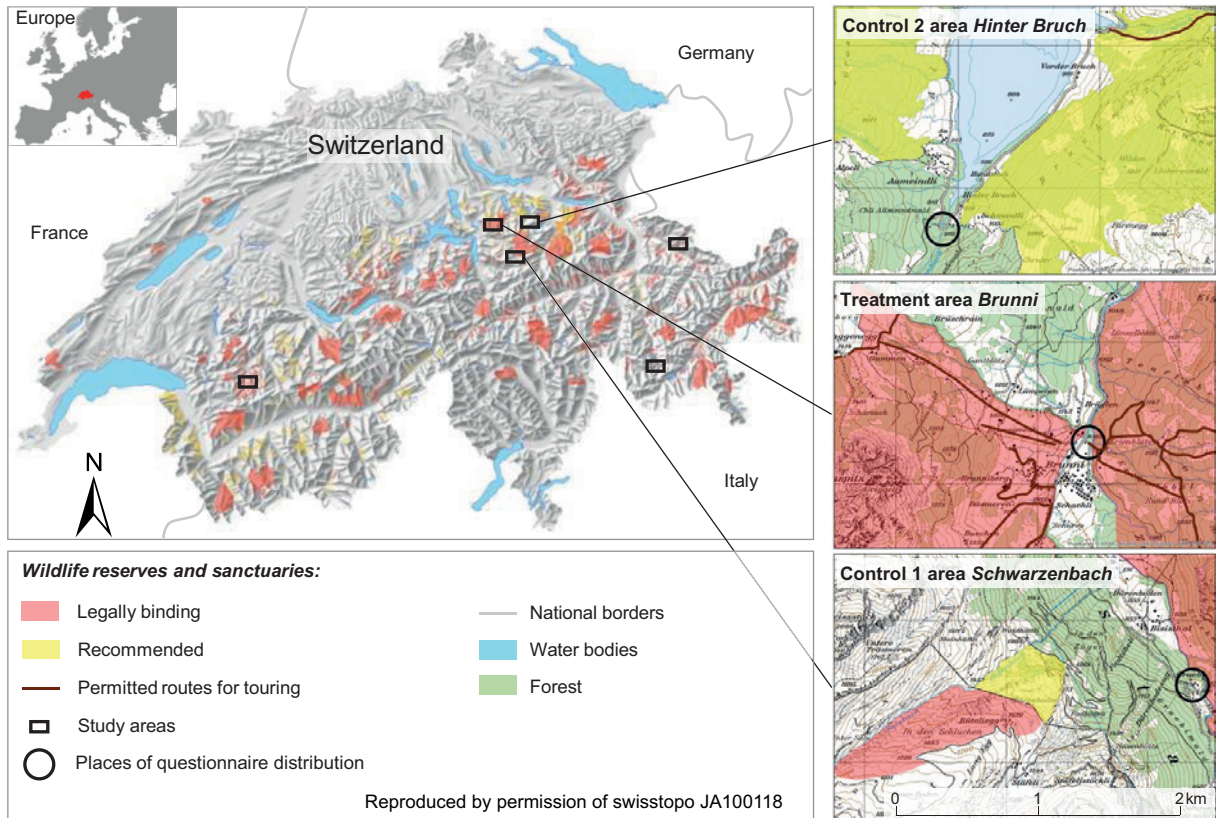


Figure 2 – Overview map showing the distribution of the wildlife reserves in Switzerland as well as the locations of the investigated areas. Three detailed maps of treatment and control areas exemplify the different appearance of protected zones in these areas.

Table 2 – Overview of the treatment and control areas with the related six starting points of touring, where questionnaires were distributed (maps to exemplify see Figure 2).

Designation	Description	Locations
Treatment	High density of protection zones and high level of existing on-site intervention instruments (in particular presence of barrier tapes and prohibition signs on the mountains and slopes)	Brunni, Alpthal, SZ [47°05' N, 8°71' E]
Control 1	High density of protection zones, but low level of existing on-site intervention instruments (only presence of some perimeter signs at the starting points for touring).	Schwarzenbach, Bisisthal, SZ [46°94' N, 8°84' E] St. Antonien, GR [46°97' N, 9°82' E] Grimmialp, Diemtigtal, BE [46°57' N, 7°48' E]
Control 2	Very low density of protected zones (only recommended ones), without any presence of on-site intervention instruments.	Hinter Bruch, Wägital, SZ [47°06' N, 8°91' E] Bivio, GR [46°47' N, 9°65' E]

& Martin 2002; Manning 2011; Manning & Anderson 2012; Vorkinn 1998; Widner Ward & Roggenbuck 2003). In Europe managing recreation within (urban) forests has been discussed by several authors (e.g. Bell et al. 2009; Elands & van Marwijk 2012; Freuler & Hunziker 2007; Liechti et al. 2009; Pröbstl et al. 2010; Vorkinn 1998; Zeidenitz et al. 2007). Some enquiries have been conducted into managing outdoor recreation in general (Mönnecke et al. 2005), regarding social conflicts (De Vries & Goossen 2002) or conflicts between recreationists and conservationists (Hennig & Riedl 2012). However, with regard to winter sports, there is hardly any systematic evaluation of the implemented steering instruments. Some research has been conducted to understand where winter sports participants leave trails (Coppes & Braunisch 2013), whether they are aware of recreation impacts on wildlife (Sterl et al. 2008), and on the factors that influ-

ence the attitude of ski-tourers towards management measures (Sterl et al. 2010). Some experimental studies have examined how steering instruments, such as flyers or information signs, may influence the behaviour of people who engage in free-riding, snow-shoeing, or ski-touring (Freuler & Hunziker 2007; Liechti et al. 2009; Zeidenitz et al. 2007). These studies, including some generalized findings of the one presented here, are summarized and synthesized in Immoos & Hunziker (2014).

### Research gaps and questions

The literature review shows that additional knowledge is needed about the factors that influence the behaviour of winter sports participants, especially about the effectiveness of the implemented steering instruments on the behaviour. The evaluation of *Respektiere*

Table 3 – Predictors of nature-responsible behaviour of winter sports participants with sample operationalization, i.e., questions and response scales used in the survey. Predictors in bold: predictors according to the theory of planned behaviour (Ajzen & Madden 1986), predictors in italics: campaign-related predictors.

Predictors	Description referring to literature, where necessary/possible, and application in this study	Examples of the operationalization for the questionnaire
<b>Perceived behavioural control</b>	Refers to the perceived ease or difficulty of behaving in the desired fashion (Ajzen 1991). Here: the perceived ease or difficulty of behaving according to the four (three) rules of the campaign.	First component of the principal component analysis (PCA) on the behaviour-control items regarding rules 1–3. Sample item: Do you think it is difficult to behave according to rule 1? Answer options (after Fishbein & Ajzen 2010): Yes 1 2 3 4 5 6 No
<b>Subjective norm</b>	Refers to the perceived social pressure to behave in a certain way (Ajzen 1991), here: the social pressure within the group of people who engage in ski-touring and snow-shoeing.	First component of the PCA on the subjective-norms items regarding rules 1–3. Sample item: Do you think that your friends or family would respect protected mountain areas? Answer options: Yes 1 2 3 4 5 6 No
<b>Attitudes towards behaviour</b>	Refers to the degree to which a person has a favourable or unfavourable view of the behaviour in question (Ajzen 1991). To find out about the attitude towards wildlife-protection in general, we asked about the attitude towards the four rules promoted in the campaign.	First component of the PCA on the attitudes-to-behaviour items regarding rules 1–3. Sample item: What do you think about the four rules (1 question for all together)? They are..... restricting /important for nature /easy to obey /too severe. Answer options: "I fully agree", "I rather agree", "neither nor", "I rather don't agree", "I don't agree at all"
<i>Knowing of the campaign</i>	Refers to the knowledge about the campaign <i>Respektiere deine Grenzen</i> .	Single question: Do you know the campaign <i>Respektiere deine Grenzen</i> ? Answer options: "I know the campaign very well", "I've heard about the campaign" and "I don't know the campaign".
<i>Solution knowledge</i>	Means knowledge about how to achieve nature-protective behaviour.	First component of the PCA on the solution-knowledge items regarding rules 1–3 Sample item: Do you know how to respect protected mountain areas? Answer options (after Fishbein & Ajzen 2010): Yes 1 2 3 4 5 6 No

*deine Grenzen* tries to bridge this gap by answering the following research questions:

1. What are the significant influencing factors on the desired behaviour of people who engage in ski-touring and snow-shoeing?
2. What role does the *Respektiere deine Grenzen* campaign as a whole, with its general awareness-raising purpose and with all its communicative measures, play in influencing the behaviour of winter sports participants?
3. What effect do on-site intervention instruments (barrier tapes and prohibition signs to mark protection zones) have on the behaviour of winter sports participants?
4. Are there differences in behaviour and in the influencing factors between the two target groups, people who pursue ski-touring and those who engage in snow-shoeing?

**Methods**

**Data collection**

To answer the research questions, a survey with a standardized, pre-tested questionnaire (to be returned by post, free of charge) was distributed during March 2012 at the starting points for ski-touring and snow-shoeing in six study areas within the Swiss Alps (only weekend days with sufficient frequency of ski-touring and snow-shoeing people). The questionnaires were handed out to the respondents directly when they returned from their tour or left under the windscreen wipers of their cars.

Given the period of data collection, there were fewer snow-shoers around than ski-tourers. Additional data were collected by an online survey for snow-shoers (addressed by the Facebook site of the Swiss Alpine Club and by a mailing of the Swiss organization of hiking guides, ASAM).

**Field-study areas representing treatment and control areas**

To answer research question 3, i.e. to find out the effectiveness of the on-site intervention instruments (marking protection zones with barrier tapes and prohibitive signs), we compared study areas with different intensities of use of these instruments. The six field-study areas were selected according to a treatment-control design with treatment areas presenting a high density of on-site intervention instruments and control areas with fewer or no such instruments (see detailed description in Table 2, Figure 2). This allowed comparing the nature-responsible behaviour of the winter sports participants in the treatment with those in the control areas and interpreting it as a result of protection-zone density and level of barrier/sign presence.

**Conceptual model**

To find out about the influence of the different factors on the nature-responsible behaviour of winter sports participants – measured by the stated behaviour regarding the four (later reduced to the first three) rules of *Respektiere deine Grenzen* (Table 1) –, we developed a model with potential behaviour predictors,

Table 4 – Output of the principal-component analysis (1-component solution, unrotated).

Stated behaviour refers to rule:	PC1	PC2	PC3
Rule 1: Respect protected mountain areas.	<b>0.795</b>	-0.374	0.478
Rule 2: Stay on marked routes and ways within forests.	<b>0.830</b>	-0.206	-0.519
Rule 3: Avoid forests edges and snow-free areas.	0.576	<b>0.813</b>	0.088
Eigen value	<b>1.652</b>	0.843	0.505
Share of variance	<b>55.078</b>	28.088	16.834
Cronbach's alpha	0.582	--	--

Same question on all rules: Do you behave according this rule?

Answer scale was always a 6-point scale with 1 = no and 6 = yes

based on theories, in particular the theory of planned behaviour (Ajzen 1991), research findings described above, and the *Respektiere deine Grenzen* campaign. Figure 3 shows the conceptual model with Ajzen factors and campaign-related rules. It is assumed that all these predictors have direct and linear impacts on behaviour.

### Questionnaire

As the theory of planned behaviour (Ajzen & Madden 1986) is an important part of our conceptual model, its developed methodology (Fishbein & Ajzen 2010) was used as a guide for the questionnaire. The behaviour of the winter sports participants was also measured using this method, with respect to the four (three) rules of the campaign. Accordingly, we analysed stated behaviour and not observed behaviour. Descriptions referring to literature, as well as sample questions for all predictors of the behaviour that later turned out to be significant, are listed in Table 3.

### Data analysis

The data were analysed statistically using SPSS 22. Exploratory factor analyses were conducted in order to reduce the number of predictor variables. As for the depending variable *stated nature-responsible behaviour*, we also performed an exploratory factor analysis including the stated behaviour regarding the first three of the four rules (Table 1), resulting in a first principal component that covers the behaviour regarding rules 1–3 very well (Table 4). Stated behaviour regarding rule 4 was excluded because it is of minor importance for people engaging in snow-shoeing and ski-touring (most of them do not take a dog on the tour) and it would have reduced scale reliability significantly.

Cronbach's alpha was calculated for the three resulting items with a value of 0.58. Scale reliability could be increased to 0.65 by removing stated behaviour regarding rule 3, as the second part of the rule, *avoiding snow-free areas*, is not part of winter sports behaviour. The first part of the rule, *avoid forest edges*, however, is relevant for winter sports behaviour. Therefore we kept this item despite the negative effect on scale reliability. Tests with only the first two rules revealed the same non-significant differences between treatment and control areas, thus backing up this decision.

The model with assumed predictors for behaviour was finally examined using multiple regression models, with the above-mentioned stated nature-responsible behaviour regarding rules 1–3 as the independent variable.

We used ANOVA to check whether there are significant differences between treatment and control areas, i.e. to ascertain whether the on-site instruments produce significant effects. The same technique was applied to evaluate the differences between the two target groups, ski-tourers and snow-shoers.

## Results

### Description of the sample

Of the questionnaires distributed at the starting points of the six study areas a total of 398 were returned completed (response rate: 46.5%). Of those, 61 came from the treatment area, 220 came from the three control-1 areas, and 117 came from the two control-2 areas. Another 150 questionnaires were completed online by snow-shoers (here, no response rate can be measured). In total, 548 questionnaires were

Table 5 – Significant predictors for nature-responsible behaviour (i.e. the first principal component of the stated behaviour regarding rules 1–3, see Table 1 & 4) of *ski-tourers and snow-shoers* (conceptual model tested by multiple regressions).

	Ski-touring & snow-shoeing		Ski-touring		Snow-shoeing	
	beta	sig.	beta	sig.	beta	sig.
Attitude towards behaviour	0.455	0.000	0.457	0.000	0.495	0.000
Subjective norm	0.196	0.000	0.192	0.000	0.205	0.001
Perceived behavioural control	0.160	0.000	0.119	0.000	0.181	0.003
Solution knowledge	0.185	0.000	0.284	0.000	0.073	0.204
Knowing of the campaign	0.097	0.002	0.096	0.010	0.161	0.005
	Adj. R <sup>2</sup> = 0.56; N = 539		Adj. R <sup>2</sup> = 0.60; N = 379		Adj. R <sup>2</sup> = 0.67; N = 169	

Table 6 – Outcome of the ANOVA for stated nature-responsible behaviour (Table 5) of the whole group, with treatment areas (high density of protection zones and high level of on-site steering efforts), control 1 (high density of protection zones, low level of on-site steering efforts) and control 2 areas (low density of protection zones and no on-site steering efforts) as compared subgroups.

	Treatment area		Control-1 area		Control-2 area		F	sig.
	N	mean	N	mean	N	mean		
Stated behaviour	58	0.139	212	-0.085	111	-0.053	1.074	0.343

analysed. The average age of the respondents was 47.9 years. 79 respondents engaged in ski-touring and 169 in snow-shoeing. While the distribution between the sexes for the snow-shoers was balanced (50% each), more men participated in ski-touring (67.8% men; 32.2% women). The education level of the participants was high, with 46.7% of the respondents holding a university degree. A total of 43.1% of the respondents were members of an environmental association and 52% were members of the Swiss Alpine Club (SAC).

**Behaviour and knowledge of the four rules, and solution knowledge**

For the descriptive analysis, we calculated the mean values for the variables stated current behaviour, intended future behaviour, solution knowledge and knowledge about the rules, and each mean according to the four campaign-mediated rules. Figure 4 shows that the means of knowledge about the rules and solution knowledge are rather high, except for knowledge about the third rule, *avoid forest edges and snow-free areas*. For the stated current and intended future behaviour, the distributions are similar: the lesser-known third rule is the one that people are less likely to follow.

**Predictors for nature-responsible behaviour of winter sports participants**

The results of the regression analyses (Table 5) indicate that the campaign has had significant positive impacts on behaviour. People who know the campaign state more often that they behave in accordance with the first three rules (rule 4 excluded from analyses, see method section) than people who do not know about the campaign. Solution knowledge, which is also promoted by the campaign, also has positive impacts on the stated behaviour, except for the snow-shoers. Moreover, the regression analyses reveal that the three factors of the theory of planned behaviour, attitude towards behaviour, subjective norm and perceived behavioural control (each of them represented by the first principal component of the items regarding the first three rules), influence behaviour. The main influencing factors on behaviour are attitude towards behaviour, subjective norm and solution knowledge. Based on these findings, the original conceptual model (Figure 3) can be revised, i. e. reduced to the significant predictors.

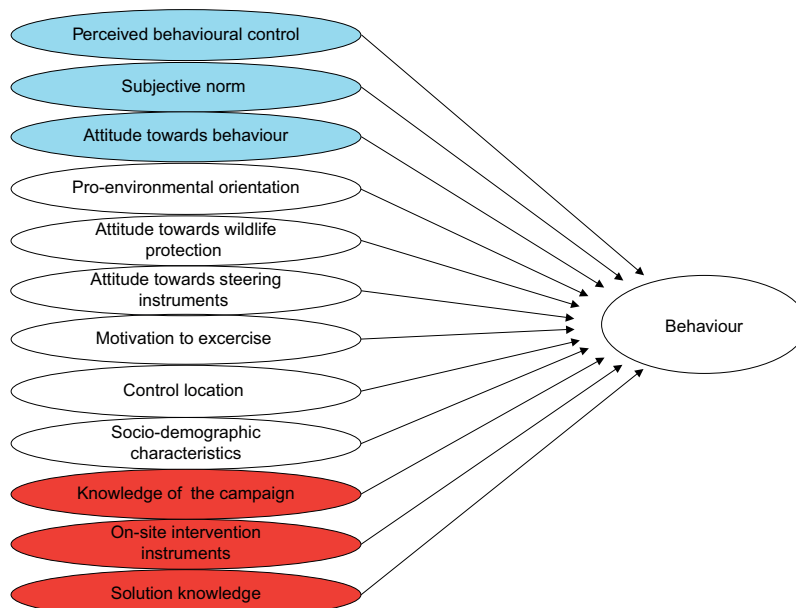


Figure 3 – Conceptual model with potential predictors of behaviour of winter sports participants. Blue filled circles: predictors according to the theory of planned behaviour (Ajzen & Madden 1986), red filled circles: campaign-related predictors.

Table 7 – Outcome of the mean comparison (*t*-test for independent samples) for the significant influencing factors on nature-responsible behaviour, with snow-shoers and ski-tourers as compared subgroups (significant factors in italics).

	Snow-shoers		Ski-tourers		<i>t</i>	Sig.
	N	mean	N	mean rank		
Attitude towards behaviour	165	0.120	317	-0.056	-1.260	0.084
Subjective norm	167	-0.072	348	0.046	1.587	0.208
Perceived behavioural control	167	-0.012	353	0.007	-0.204	0.838
Solution knowledge	53	-0.091	348	0.026	-0.806	0.420
<i>Knowing the campaign</i>	166	0.303	366	-0.140	4.827	0.000
<i>Stated nature-responsible behaviour</i>	169	0.142	368	-0.069	2.276	0.023

### Effect of on-site intervention instruments

The effectiveness of the on-site intervention instruments was evaluated using ANOVA to compare the treatment, control-1 and control-2 areas (see Table 2 and Figure 2) on differences in the stated behaviour. The analysis revealed that the stated nature-responsible behaviour did not significantly vary between treatment and control areas (Table 6). If the analysis was performed for ski-tourers only, the difference was again not significant ( $p = 0.830$ ), which means that the on-site instruments do not exert any additional influence on ski-tourers. It remains unclear whether this is also true for the snow-shoers, because the sample size of the snow-shoers in the field study was too small to

allow for reliable tests. Attempts with non-parametric tests (Kruskal-Wallis), however, returned no significant differences ( $p = 0.358$ ).

### Differences between ski-touring and snow-shoeing participants

In terms of differentiating between ski-touring and snow-shoeing participants, the analysis suggests that, except for solution knowledge, the predictors for behaviour are the same for both target groups (Table 5), i.e. attitude towards behaviour, subjective norm, perceived behavioural control and knowledge of the campaign. For these predictors, as well as stated behaviour, a *t*-test was conducted to compare the means of

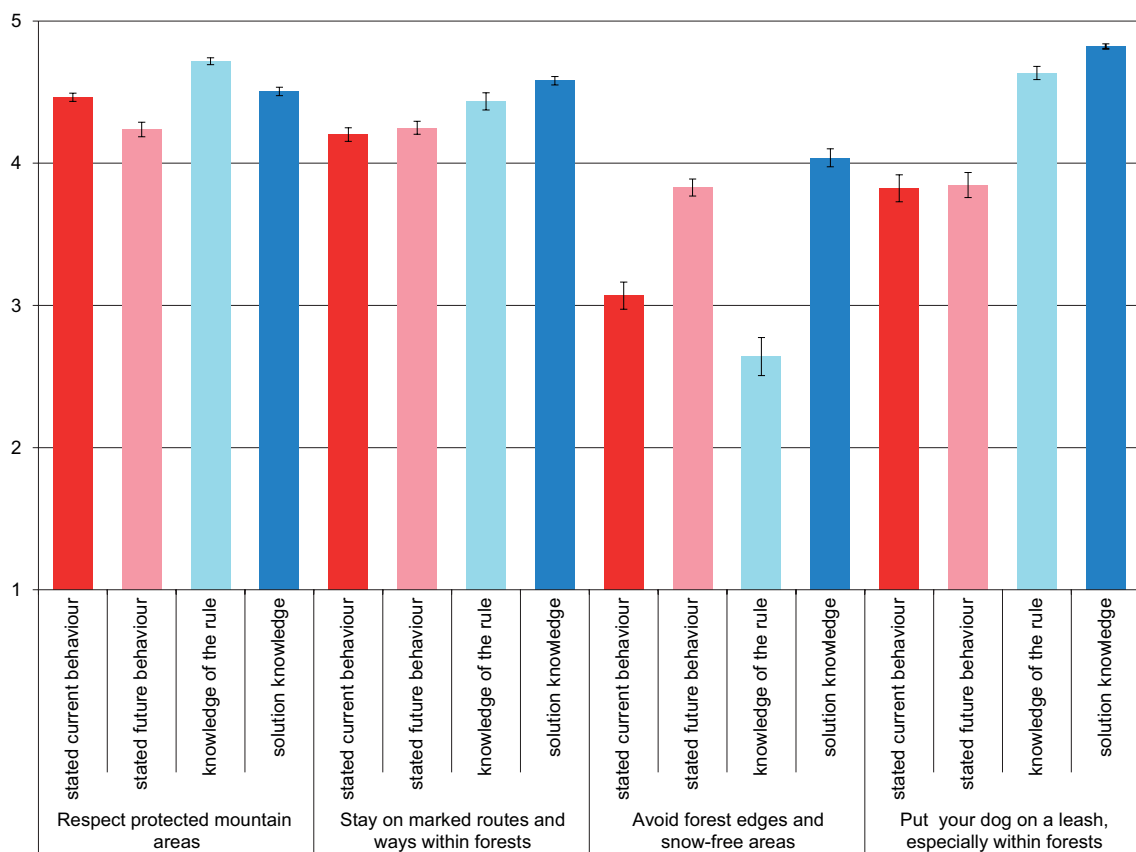


Figure 4 – Mean values (with standard errors) of the variables stated current behaviour (red), stated future behaviour (light red), solution knowledge (blue) and knowledge about the rule (light blue). Scale 1–5, from 1 = I (won't) don't behave according to this rule to 5 = I (will) behave according to this rule; and from 1 = I don't know the campaign / how to behave according to this rule to 5 = I know the campaign / how to behave according to this rule.

these predictors between snow-shoers and ski-tourers (Table 7). It revealed that snow-shoers know the campaign significantly better than ski-tourers do and have slightly (but not significantly) more positive attitudes towards the requested behaviour. Overall the snow-shoers' (stated) behaviour is significantly more nature-responsible.

## Discussion

The results indicate that the four (i.e. the relevant first three) rules are well known and that they correspond with the winter sports participants' willingness to behave in accordance with these rules. This finding corresponds with those of many other authors who found that raising awareness positively influences recreationists' behaviour towards nature and wildlife (e.g. Cornelisse & Duane 2013; Freuler & Hunziker 2007; Sterl et al. 2010; Vorkinn 1998). However, this effect can primarily be expected if the recreationists' attitudes towards wildlife protection are positive in principle (Petty & Caccioppo 1986), which was already known for the snow-shoers (e.g. Freuler & Hunziker 2007) and assumed for the ski-touring participants (e.g. Sterl et al. 2010). Although information seems to be effective for both groups, snow-shoers know the campaign better, have a more positive attitude towards the desired behaviour, and are more likely to behave in a wildlife-friendly manner than the ski-tourers. This may be explained by the fact that for ski-tourers adventure as a motivation to exercise is more important (Ingold 2005), which was already suggested by Sterl et al. (2010) and Zeidenitz et al. (2007).

The finding of the positive awareness-raising effect of the *Respektiere Deine Grenzen* campaign was further corroborated by the results of the regression analysis that aimed at testing the conceptual model, which postulated knowledge of the campaign to be a significant predictor of nature-responsible behaviour. However, other factors also turned out to be highly significant in influencing behaviour. First of all, attitude towards behaviour is the strongest influencing factor on behaviour, which has already been stated in other studies (e.g. Zeidenitz et al. 2007). This finding corresponds with the theoretical background, which notes that behaviour can often best and most sustainably be changed by influencing attitudes (Mosler & Tobias 2007). Subjective norm and perceived behavioural control are further significant predictors of behaviour also indicated by other studies (Marzano & Dandy 2012; Zeidenitz et al. 2007) and postulated by the theory of planned behaviour (Ajzen & Madden 1986). Other predictors, such as socio-demographic variables, environmental values or attitudes towards wildlife, did not significantly influence the stated nature-responsible behaviour. This means that (stated) nature-responsible behaviour only depends on behaviour- and campaign-related factors, whereas more general factors do not influence it. Similar results are often reported when

such specific behaviour-related investigations are conducted (e.g. Freuler & Hunziker 2007; Zeidenitz et al. 2007). It implies that general environmental education does little to change behaviour, which needs to be influenced by tailor-made campaigns.

Whereas the persuasive awareness-raising measure seems to be successful, the on-site intervention instruments (prohibition signs and barrier tapes) seem not to add any impact on behaviour. These findings correspond with previous studies regarding steering instruments in winter sports. Freuler & Hunziker (2007), who have evaluated different on-site intervention instruments for snow-shoers, as well as Liechti et al. (2009), who have evaluated a pilot version of the *Respektiere deine Grenzen* campaign for snow-shoers and people who engage in ski-touring, concluded that ecological information at starting points of the tours had a positive influence on behaviour, whereas steering instruments without information along the tour added nothing to influence behaviour. This might be explained by some intuitive resistance caused by the experience of constraints on the tour. Sterl et al. (2010), for example, observed experienced constraints as a negative predictor for the acceptance of management measures. If, however, on-site steering instruments are rigid enough, they might be successful as was observed by Vorkinn (1998) for camping behaviour. Such rigid measures, however, need corresponding controlling, which is rarely feasible in the mountains. Persuasion and information seem to remain the best choices.

Finally, the comparison of ski-tourers and snow-shoers revealed that essentially they share similar attitudes and nature-responsible behaviour. The better campaign knowledge and the slightly more positive attitude towards the requested behaviour on the part of the snow-shoers can be explained by the fact that the campaign aimed at snow-shoers started some years earlier than that aimed at ski-tourers. Consequently, the snow-shoers seem to behave more nature-responsibly than the ski-tourers because they have been influenced for longer by the campaign (Freuler & Hunziker 2007; Liechti et al. 2009). It can further be assumed from the above findings that solution knowledge is a significant predictor for nature-responsible behaviour of the ski-tourers, as some of them already have this knowledge and others do not, whereas the solution knowledge is already widespread among the snow-shoers. In addition, solution knowledge is more important for ski-tourers as they plan their tour mostly by themselves, whereas snow-shoers often follow pre-defined routes and trails.

## Conclusions

As attitude towards behaviour turned out to be the strongest influencing factor on behaviour, steering instruments should, generally, try to influence these attitudes by informing, educating and persuading the target groups. Solution knowledge as well as subjective

norms are two other variables that serve as starting points for persuasion. Solution knowledge, however, seems to be more relevant for those people, such as the ski-tourers, who are competent enough to plan their tour themselves and, therefore, need knowledge about correct behaviour. The subjective-norm approach might be especially promising for target groups such as the free-riders, whose attitudes cannot be influenced easily. The presentation of role models that show the desired behaviour might convince their peers and fans.

The result that on-site intervention instruments (barrier tapes and prohibition signs) seem not to have an additional effect on behaviour suggests that winter sports participants are more readily influenced during the planning phase of touring or at least at its starting point, but not once they have decided where to go. However, it remains unclear whether this is also true for the free-riders.

More research is needed, e.g. through qualitative analyses, to unearth detailed information about the mechanisms of influencing behaviour and about the role steering instruments play. Such analyses might explain why on-site intervention instruments seem not to exert additional influence on behaviour. Furthermore, we suggest integrating the social context, e.g. communication through role models for target groups whose attitudes and behaviour are difficult to influence directly. The effectiveness of such strategies needs to be evaluated. And finally, the influence of on-site instruments on the behaviour of the free-riders needs further investigation. Generally it seems necessary to focus future research more on this target group, as there is as yet scant knowledge about the free-riders and the possibilities of persuading them to adopt nature-responsible behaviour.

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