

## Direction of escape in reindeer

L. M. Baskin<sup>1</sup> & T. Skogland<sup>2\*</sup>

<sup>1</sup>Institute of Ecology and Evolution, Russian Academy of Sciences, 33 Leninsky Pr., Moscow, 117071 Russia.

<sup>2</sup>Norwegian Institute for Nature Research, Tungasletta 2, N-7005 Trondheim, Norway. (Deceased)

*Abstract:* We tested the hypothesis that reindeer prefer to run uphill and upwind when escaping from man. Groups of wild and feral reindeer in Norway, Svalbard and on Wrangel Island were approached and their behaviour and direction of escape were recorded. Two stages of interaction with man were studied: first flight and final withdrawal. First flights proved to be away from man, upwind and uphill. Most final withdrawals were in the direction reindeer were moving when first observed.

**Key words:** behaviour, *Rangifer tarandus*.

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### Introduction

To our knowledge, no authors have undertaken analysis of patterns of flight direction by reindeer. However, experienced herdsman and native hunters often predict in fine degree the direction they expect reindeer to move when they are approached (Washburn & Lancaster, 1968; Baskin, 1970; Spiess, 1979). Understanding reindeer escape behaviour is potentially important for management and for understanding anti-predator behaviour. A herder usually approaches reindeer in a way that will elicit a predictable escape response, and the essential part of herding is being able to predict the direction of movement. Direction and rate of travel of reindeer are influenced by environmental factors (e.g. wind, terrain, relief), the quality of pasture, migratory motivation, position of neighbours, and if disturbed, where they were prior to disturbance.

If reindeer consistently use escape routes with certain characteristics we could consider that behaviour as adaptive.

Naumov (1933) described a hunting method used by Nenets people which takes advantage of the tendency for reindeer in small bands, to move downwind of man. If a hunter moves around a herd, the herd in turn tries to move around the man. During whirling, the hunter and the reindeer, gradually come closer until the hunter is within shooting range. Herdsman report that frightened reindeer usually run upwind and uphill (Baskin, 1974; 1991).

### Study areas

Disturbance trials were conducted on two wild (Dovre fjell and Svalbard) and two feral (Forehogna and Wrangel Island) reindeer populations in

1990–1994. The Dovrefjell wild reindeer population in Norway comprises several interacting subpopulations including those we observed in the Snøhetta and Rondane areas. Both subpopulations consist of about 2000 individuals, and are hunted annually at a sustainable rate of about 25% of the winter population size.

On the high arctic island of West-Spitsbergen, Svalbard, we studied a subpopulation of about 1000 animals in the Reindalen area. There are no large terrestrial predators on Svalbard and no indigenous people have ever occupied the area.

The Forelhogna population, east of Dovrefjell in Norway, consists of about 1700 animals. They became feral in the mid-1950s and since 1968 have been hunted annually at a sustainable cropping of 40% of the winter population size (Skogland, 1989).

The reindeer population on Wrangel Island in the Bering Sea has been feral since 1974 when domestic herding was abandoned. In spring 1991, when our experiments were conducted, there were about 3000 animals. To control population size in recent years, reindeer have been herded annually by snowmobiles into a corral and slaughtered. However, more than two-thirds of these individuals usually escape before reaching the corral. These survivors have become fearful of humans.

## Methods

All populations except the Wrangel population were examined in March–early May, a month or more before calving. Wrangel reindeer were studied in June, a month after calving.

After locating a herd in an open area, we approached it upwind in order to present only a visual stimulus. For our trials it was important to consider whether reindeer first detected man by scent or by sight. The response to human scent evokes a stronger reaction because all the animals in herd often become frightened simultaneously. However, whether all the animals are aware of the smell depends on herd size, dispersal of animals in the herd, and wind direction. In contrast, after visual detection, reindeer often try to identify the intruder through other means. The intensity of the stimulus and the activity of reindeer prior to disturbance may also affect the response and the direction of movement. Here, only strong stimuli were used, specifically, walking purposefully toward the reindeer.

In general, we had no knowledge of factors influencing pre-disturbance behaviour. We sketched each

scene, depicting the direction of approach, wind direction, terrain aspect and relief and tracks in the snow. We analyzed two main stages of response: first flight (the acute initial response), and final withdrawal, when reindeer became calmer.

We classified movement direction into six 60° sectors. A herd was considered to have moved upwind if the direction traveled was within 30° of the wind direction (i.e., within a sector of 60°). Runs towards the observer were excluded and treated separately, so only five sectors (totaling 300°) were considered. Therefore, in each trial, reindeer had a 20% probability of running away from man by chance alone. Significance levels were determined using G-tests (Sokal & Rohlf, 1981).

## Results

Only in the Svalbard population was the principal flight of reindeer away from man (Table 1). However, away from man directions predominated with combined data for all of populations (Table 1). Sometimes just after the observer had been detected reindeer rushed towards man (Table 2). This was observed most often in the Forelhogna area. In other populations, such approaches were more common after first flight when animals had become more calm.

Moving upwind was typical for first flights of wild reindeer, but not of feral populations (Table 1). Wind direction did not influence the direction of final withdrawal in any of the populations.

In most cases reindeer moved uphill during both first flight and final withdrawal. The direction of reindeer movement prior to disturbance influenced direction of first flight and final withdrawal (Table 1).

## Discussion

The hypothesis that reindeer generally fly by running away from man direction was not confirmed. However, experiments differed from situations usually encountered by herdsman or during predator attacks because the investigator remained in place after reindeer had been alarmed.

The unexpected movements toward man were observed in both wild and feral populations. Reindeer usually moved around a man to a downwind position probably trying to recognize him better. Lent (1966) referred to such behaviour as “investigative behaviour”. Juveniles and two-years-

Table 1. Routes of first flight and final withdrawal of reindeer after human disturbance.

Direction <sup>a</sup>	Dovrefjell		Svalbard		Wrangel		Forelhogna		All populations	
	%	<i>n</i>	%	<i>n</i>	<i>n</i>	%	<i>n</i>	%	<i>n</i>	
	First flight									
Away from man	27.7	36	38.7*	31	33.3	18	21.4	14	31.3**	99
Upwind	50.0*	34	50.0*	30	23.5	17	38.5	13	43.6**	94
Uphill	62.1**	29	27.6	29	37.5	8	55.5**	9	45.3**	75
Along prior course	23.8	21	50.0*	8	40.0	10	66.7**	6	37.8**	45
	Final withdrawal									
Upwind	20.8	24	24.0	25	23.5	17	33.3	12	24.3	78
Uphill	58.8**	17	—	—	75.0**	8	60.0**	10	62.8**	35
Along prior course	37.5*	16	83.3**	12	40.0	10	62.5**	8	54.3**	46

<sup>a</sup> Expected frequency of flight away from man was 20%. The upwind, uphill and along prior courses were 16.7%.

\*  $P < 0.05$ . \*\*  $P < 0.01$ .

old showed the greatest tendency to approach man. Adult females were more wary, preferring to stay in the most distant part of the herd and frequently led the herd away after approaching to within some critical distance. Approaches to man are probably evoked by predominance of curiosity over wariness. Young reindeer are inquisitive while adult females are cautious. Bull groups sometimes approached man but they usually moved downwind and then moved away.

Scenting and observing from an elevated position might be useful for detecting and escaping from predators. However, it is unclear whether it is most advantageous to move upwind or downwind. By running upwind, reindeer may avoid ambush, but by running downwind they can stay in contact with the alarming stimulus. By scenting a man, reindeer could more accurately monitor his movements. As we observed in five experiments, they became frightened if man moved  $>30^\circ$  from an upwind position. The previously mentioned hunting "on circle" is based on this behaviour.

Why do reindeer try to continue moving in the same direction after encountering a man? Probably, it reflects an overall movement tendency that is only temporarily suppressed by alarm. Migratory motivation for a specific direction, such as movement toward the sea or to the north in early summer, is often strong. In Norway, where winter pastures are on mountain plateaux, reindeer follow very old routes (Skogland, 1986). In the Rondane and Forelhogna areas, they make regular circles within

Table 2. Initial reaction of reindeer to human disturbance.

% approaching man			
Feral reindeer		Wild reindeer	
Forelhogna	Wrangel	Svalbard	Dovrefjell
56.2	33.3	27.2	8.8

pastures every 5–6 days. We propose that disturbed reindeer tended to move in these directions.

We confirmed the tendency of reindeer to flee from man upwind and uphill immediately after disturbance and the tendency to resume travel in the original direction during final withdrawal. Ultimately, taking into account all four factors discussed in this paper, it may be possible to predict the flight direction of reindeer when disturbed by man.

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