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Behaviour of Alpine ibex (*Capra ibex ibex*) under the influence of paragliders and other air traffic

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Abstract

In summer 1992 we investigated the influence of paragliders and other air vehicles on the behaviour of male ibexes (*Capra ibex ibex*) in a population of the Swiss prealps. Within a range of 1 200 m ibexes fled more frequently from paragliders than from motorplanes, helicopters, sailplanes, and jetfighters. Neither group size, previous activity nor the relative flight altitude of the aircraft (above or beneath the observed group) was found to have any influence on the reaction. Distance fled after encounters between paragliders and ibex ranged from 30–1 200 m (median 650 m) and the changes in altitude while fleeing from 20–500 m (median 200 m). These two parameters were much smaller when reacting to the other air-based vehicles. The daily walking distances were longer on days with paraglider activity compared with days without paraglider activity. Many escape flights went out of the home range normally used by the observed male ibexes. These strong reactions to paragliders were as yet unknown for ibexes. The conservation implications would be regulation of paragliding in some regions to protect these animals.

Key words: *Capra ibex*, Air traffic, paragliders, behaviour

Introduction

The Alps are increasingly becoming a resort for tourism and modern leisure activities. Especially hang- and paragliding have been booming since the eighties in all regions of the Alps, with an increase in Switzerland from 2 800 active pilots in 1980 to nearly 20 000 in 1991. Paragliders are able to fly and soar at low speed and low ground clearance and pilots can take off from almost any slope limited only by meteorological and topographical conditions. With their light and easy to carry equipment, the pilots are able to fly into new and untouched areas.

Studies in North America show that air traffic may affect free-ranging ungulates. Especially low-flying aircraft can cause particularly intense reactions (Calef et al. 1976; Miller and Gunn 1980; Krausman et. al 1986; Harrington and Veitch 1991). Furthermore changing of home range areas and reduced foraging efficiency were found in bighorn sheep (*Ovis canadensis*; Bleich et al. 1990; Stockwell et al. 1991). Alpine chamois (*Rupicapra rupicapra*) show intense flight reactions to paragliders and often seek shelter in the woods (Schnidrig-Petrig 1994).

The Alpine ibex (*Capra ibex ibex*) is probably the most famous Alpine mammal and in some parts of the Alps well known to tolerate human activities like hikers at close distances. However, little is known about its reaction to air traffic. The reintroduction of this once extinct species represents a true success story for conservation (Stüwe and Niever-

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GELT 1991) and the fate of ibex in Switzerland is therefore of concern to nature conservation. Ibexes live above the timber line (NIEVERGELT and ZINGG 1986) and are therefore considered to be particularly confronted with paragliders and other air traffic. If they would react strongly on air traffic and especially paragliding as a new leisure activity, this should be of importance for nature conservation.

The aim of our study was to investigate the behaviour of male ibex towards paragliders, compared to other types of aircrafts like helicopters, motorplanes, sailplanes, and jet-fighters.

Material and methods

Study area and animals

The study area lies within the national game reserve Augstmatthorn (Bernese Oberland, Switzerland). The Augstmatthorn region (top at 2 137 m a. s. l.) is characterized by steep slopes interspersed with rocky cliffs. The vegetation on the lower parts is dominated by subalpine coniferous forest. Due to the historic lowering of the timber line, large species-rich alpine pastures have been opened in the higher parts. The ibexes of the study area spend the summer above the tree line. In summer sexual segregation is distinct and males form groups of irregular composition with a size of up to 50 animals. They usually stay at the highest levels of the mountain and tolerate humans within distances of around 15–20 m. The Augstmatthorn ibexes belong to one of the first reintroduced colonies in Switzerland after their extinction in the last century (estimated size of the present population: about 120 animals).

Within 20 km of the study area there are two air force bases where helicopters, jets, and motorplanes take off and land and within 50 km there are two small civil airports. Paragliders usually soar along the mountain slopes into the study area, but they also take off within the study area itself. Since 1989, when we saw the first paragliders in the area, there was a continuous increase in summer (1992 on nearly 20% of days).

Data collection

Data were collected from July to October 1992. Our observation distance to the animals was about 50 m to avoid possible influence. We focused on the first animals that we found in the morning and noted size and position of the group every 30 min from 7:00 h until 20:00 h. One observer searched the sky for approaching air-based vehicles. The topography of the area allowed a good allaround view; approaching aircraft could be detected at great distance. Aircraft that seemed to come closer than 1 200 m to the animals were followed with a telemeter (Sokkisha 3SD3, length 25 cm). The type of aircraft, its closest approach distance to the animals and its flight altitude (above or beneath the observed group) were noted. The second observer noted the behaviour of the animals (feeding, standing, lying). Then he noted, if the animals fled or not. The flight path was marked on a map (scale 1 : 5 000). A flight was decided to be finished when the animals stopped moving for more than 5 minutes. If the animals went out of sight (e. g. if they disappeared into forests or behind rocks), we measured the distance to the point of the last sight contact. Daily walking distances and changes in altitude (not distinguished between walking up or downhill) of any group were calculated by connecting their half hourly position.

Statistical analysis

Statistical analysis of the data was done with a stepwise logistic regression (The Logistic Procedure) on SAS/STAT (SAS Institute Inc. 1989). The response variable was fleeing or not fleeing after an encounter with an air-based vehicle. The following variables were included (variables with an asterisk are indicator variables to which differences in the response variable refer): The different types of flying objects (paragliders*, motorplanes, jet-fighters, helicopters, sailplanes), the approaching distance (< 500 m*, 500–1 200 m), flight altitude (above* and underneath the observed group), group size (1, 2–6*, > 6 animals), and activity (feeding, lying*, standing). For days with several encounters with air-based vehicles only the first encounter was considered in the analysis.

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Results

In encounters with sailplanes, helicopters, jet fighters, and motorplanes the ibexes took flight only occasionally. In contrast, they fled in all encounters with paragliders (Fig. 1). Within the range up to 1 200 m, the difference in the frequency of escape flights from paragliders and other aircraft is highly significant, independent of the distance between air-based vehicles and animals. Neither the flight altitude of the aircraft, nor the activity of the group members before the encounter, nor the group size showed any significant influence (Tab. 1). When cases of escape flights occurred, the reaction was strongest to paragliders with a median of the distance fled (DF) of 650 m (30–1 200 m; n = 13) and a covered difference of altitude (AD) of 200 m (20–500 m). These two parameters were much smaller in the reactions to the other air-based vehicles (sailplanes: DF: 200 m, AD: 50 m, n = 3; helicopters: DF: 20 m, AD: 0 m, n = 5; jet fighters: DF: 20 m, AD: 0 m, n = 1; motorplanes: DF: 20 m, AD: 0 m, n = 3). On days with encounters with paragliders groups of ibex walked significantly further (median 1 600 m) and covered more altitude (475 m) than on days without paragliders (800 m/110 m; Fig. 2). Many escape flights went out of the home range normally used by the observed male ibexes (Fig. 3).

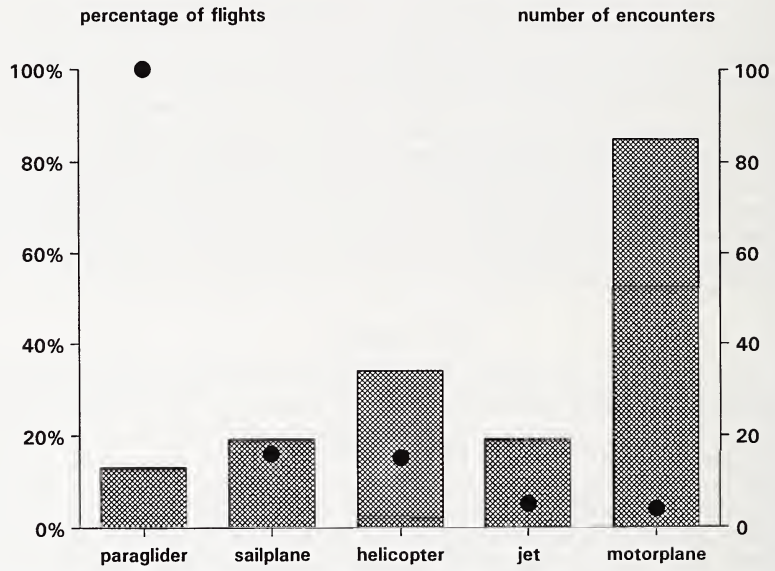

Fig. 1. Percentages of the flights (dots) of male ibexes in encounters with different types of air-based vehicles (columns) within a distance of max. 1 200 m.

Table 1. Results of the SAS Procedure-Logistic (n = 186, Two Response Levels: flight or no flight). Left: p-values of the remaining variables after the Backward-Elimination-Procedure. Right: the order of elimination of other variables with their corresponding p-values. All p-values refer to the corresponding indicator variables (see statistical analysis, *). For the different types of aircraft the indicator variable is paragliders.

Variable	p-value	Variable	p-value
Motorplanes	0.0001	group size: > 6 animals	0.609
Helicopters	0.0006	flight underneath	0.531
Jetfighters	0.0006	activity standing	0.505
Sailplanes	0.0127	activity feeding	0.436
distance (500–1 200 m)	0.019	single animal	0.208

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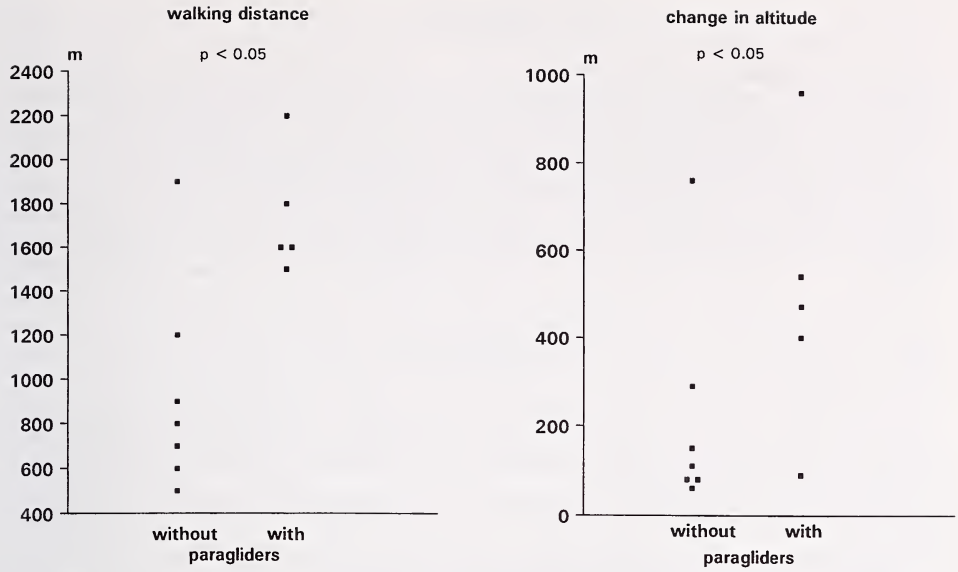

Fig. 2. Daily walking distances and changes in altitude during walking of groups of male ibexes on days with and without paragliders (Mann-Whitney U-Test, $p < 0{,}05$, two-tailed).

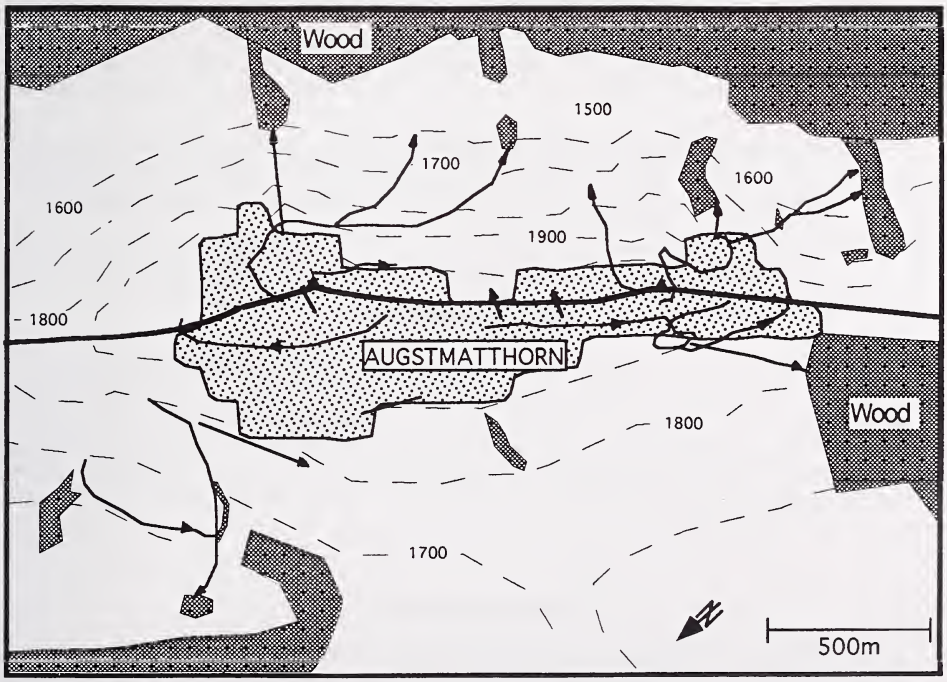

Fig. 3. Home range of male ibexes (dotted) and paths fled when paragliders appeared from July to September 1992 on the Augstmatthorn. Thick line: mountain ridge.

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Discussion

Paragliders have the greatest influence on the behaviour of male ibex compared with other aircraft. The intense and long flights in this steep terrain which covered altitude differences up to 500 m downhill have never been observed before. It seems that the animals try to escape from the range of the paragliders by seeking refuge in the forest or by changing to the other side of the mountain ridge. Such flights and the increased daily walking distances with the respective changes in altitude result in increased energy expenditure. Hüppop (1995) estimated for a mammal like the ibex (50–100 kg) that one flight could cost up to 2.5% of the daily energy costs (field metabolic rate, distance fled 500 m, altitude difference 100 m). It is likely that the animals are still able to compensate for the energy loss, if these flights occur at low frequency as was observed to date. However, if paragliding should increase and the animals would still flee in the same way, this could have severe consequences on the animals' condition and therefore on their survival in winter.

In the Augstmatthorn region male ibexes show no fear of hikers (flight distances of 15 to 20 m). Furthermore, they have no enemies from the air. It is therefore surprising that they react so strongly to paragliders, but several features make paragliders something special. They fly very slowly and cause almost no flight noise; they can not be heard like engine-powered aircraft when approaching. Their appearance is spatially very variable and the animals have not had much experience with this activity compared to all other aircraft. To date we have no indication that ibexes habituate to paragliders, but on the long run the possibility of habituation is not excluded (for habituation of ungulates to aircrafts: Krausman et al. 1986). Alternatively, it may be that these animals change their normally used habitat, staying close to woods (where they can seek shelter) and avoid exposed sites. If this would happen, it could be a serious problem because the animals would lose the open pastures as feeding sites, an important part of their habitat. Moreover, females with their kids are affected as well. A few observations (females could not be observed as well as males) showed that they react to paragliders as sensitively as males. Long flights and shifts into suboptimal habitats could be critical for kid survival and therefore for the whole ibex population.

In summary, our data show that paragliders are the only air-based vehicles that seem to be a problem for ibexes in our study area. Reports from gamekeepers showed that ibexes in other parts of the Swiss Alps also react strongly to paragliders. It should be worth discussing some regulation of paragliding.

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Zusammenfassung

Zum Verhalten von männlichen Alpensteinböcken (Capra ibex ibex) unter dem Einfluß von Gleitschirmen und anderen Luftfahrzeugen

Im Sommer 1992 untersuchten wir im Gebiet Augstmatthorn (Schweizer Voralpen), wie Gleitschirme und andere Luftfahrzeuge das Verhalten von männlichen Alpensteinböcken (*Capra ibex ibex*) beein-

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flussen. Unabhängig von der Distanz zu den Tieren lösten Gleitschirme innerhalb eines Bereichs von 1 200 m häufiger Flucht aus als Segelflugzeuge, Propellermaschinen, Helikopter und Düsenjets. Weder Gruppengröße, vorherige Aktivität der Tiere noch Flugroute (ober- oder unterhalb der beobachteten Gruppe) hatten einen Einfluß auf die Reaktion der Tiere. Die nach Begegnungen mit Gleitschirmen zurückgelegte Fluchtstrecke betrug 30–1 200 m (Median 650 m), die Höhendifferenz 20–500 m (Median 200 m). Viele Fluchten führten weit über das normale Aufenthaltsgebiet hinaus, oftmals bis hinunter zum Wald. Auf andere Luftfahrzeuge reagierten die Steinböcke wesentlich schwächer. An Tagen mit Gleitschirmvorkommen legten sie erheblich längere Wege zurück, die zudem über eine größere Höhendifferenz führten, als an Tagen ohne. Insgesamt reagierten die Steinböcke auf Gleitschirme mit einer kaum erwarteten Heftigkeit. Zum Schutz der Tiere drängt sich in gewissen Gebieten eine Regelung des Gleitschirmfliegens auf.

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