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Temporal change in the shyness of captive-born wisents (*Bos bonasus*) towards humans

A study on the escape behaviour of wisents in the 1st year after relocation to a reintroduction enclosure

Bachelorthesis

Von

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Zusammenfassung

Nachdem der Wisent (*Bos bonasus*) vor rund 1000 Jahren in der Schweiz ausgerottet wurde, gibt es nun Bestrebungen, ihn wieder im Schweizer Jura anzusiedeln. Wiederansiedlungsprojekte bergen jedoch Konfliktpotential, insbesondere wenn es sich um Tierarten handelt, welche von Menschen als gefährlich wahrgenommen werden. Bevor weitere Schritte für eine Wiederansiedlung in der Schweiz eingeleitet werden, wird deshalb zuerst die Tragbarkeit freilebender Wisente mithilfe einer eingezäunten Testherde überprüft. Eine Voraussetzung für die Wiederansiedlung ist eine ausreichende Scheuheit der Wisente, welche sich in einer Fluchtdistanz (FID) von ≥50 m äussert. Wir untersuchten die FID der Testherde gegenüber Menschen im ersten Jahr nach der Umsiedlung in das Auswilderungsgehege. Wir führten Störexperimente im Frühling und im Herbst durch, bei welchen sich jeweils eine Person der Herde annäherte und die FID mass. Wir verglichen die Fluchtbereitschaft im Frühling vs. Herbst und Wald vs. Wiese. Die Fluchtbereitschaft der Wisente erwies sich im 1. Jahr nach der Umsiedlung als sehr gering und die Tiere flohen nur in 1-17% der durchgeführten Störexperimente bei einer Distanz von ≥50 m. Die Fluchtbereitschaft war im Herbst nicht signifikant anders als im Frühling und wir konnten somit keine zeitliche Veränderung der FID feststellen. Ebenso wenig konnten wir einen signifikanten Unterschied zwischen der Fluchtrate im Wald und im offenen Grasland feststellen. Unsere Studie zeigt, dass Wisente ihre natürliche FID nicht unbedingt zurückerlangen, wenn sie in ein grosses Auswilderungsgehege gebracht werden. Unsere Ergebnisse stehen im Widerspruch zu einer vergleichbaren Studie, in der eine schnelle Verwilderung der Wisente beobachtet wurde. Gründe dafür könnten die Häufigkeit und Art der Interaktionen mit Menschen oder der Charakter der Individuen sein.

Abstract

After the European bison or wisent (*Bos bonasus*) was exterminated in Switzerland around 1000 years ago, efforts are now being made to reintroduce it to the Swiss Jura. However, reintroduction projects harbour potential for conflict, especially when it comes to animal species that are perceived as dangerous by humans. Therefore, the viability of free-ranging wisent is being tested with a fenced test herd before any further steps are taken towards reintroduction in Switzerland. A prerequisite for reintroduction is that the wisents are sufficiently shy, which is characterised by a flight initiation distance (FID) of ≥50 m. We investigated the FID of the test herd towards humans in the first year after relocation to the reintroduction enclosure. This was carried out with disturbance experiments in spring and autumn, in which a person approached the herd and measured the FID. We compared the willingness to flee in spring *vs*. autumn and forest *vs*. open grassland. The wisents' willingness to flee proved to be very low in the first year after relocation and the animals only fled in 1-17 % of the disturbance experiments conducted at a distance of ≥50 m. The willingness to flee was not significantly different in autumn than in spring and thus we could not detect a temporal change in FID. Nor did we find a significant difference between the escape rate in forest and open grassland. Our study shows that wisents do not necessarily regain their natural FID within a year when relocated to a large reintroduction enclosure. Our results contradict a comparable study in which a rapid feralisation of wisents was observed. Reasons for these differences could be the frequency of interactions with humans or the individual character of wisents.

KEYWORDS: European bison (*Bos bonasus*), fear, flight behaviour, flight initiation distance (FID), reintroduction

Introduction

The European bison or wisent *(Bos bonasus)* once colonised large parts of Europe. In the Holocene, its range extended from Spain to the south of Scandinavia and from the Black Sea to Moscow (Krasińska & Krasiński, 2013). Due to habitat destruction and anthropogenic hunting pressure, populations have declined since the arrival of humans around 10,000 years ago (Belousova et al., 2004). In Switzerland, the wisent was already wiped out around 1000 years ago (Kleinogel, 2008). After the last free-ranging wisent was shot in the Caucasus in 1927, only a few individuals survived in captivity, all of which descended from 12 ancestors (Krasińska & Krasiński, 2013). Since then, reintroduction projects have been launched in various European countries, including Germany, Poland, Lithuania, Ukraine and Russia (Krasińska & Krasiński, 2013; Samojlik et al., 2023; Schmitz et al., 2014).

There are also efforts being made to reintroduce wisents in Switzerland (Verein Wisent Thal, 2022). A research project has been running in the Swiss Jura since 2022 to investigate whether free-ranging wisents are bearable in Switzerland. Over a period of 10 years, a test herd will be used to try to answer this question. An important criterion is that the animals develop an appropriate level of shyness towards humans, as they come from a zoo and are used to contact with people. The study is being carried out by the Wisent im Thal association. If the research results confirm the viability of free-living bison in Switzerland, the association will campaign for the reintroduction of the herd into the wild (Verein Wisent Thal, 2022). Although this herd of bison would represent a subpopulation in the Swiss Jura, it would be part of the metapopulation thanks to the assisted transport of individuals (Krasińska & Krasiński, 2013). Isolated herds help to minimise risk, as only part of the population is affected in case of natural disasters and diseases (Schmitz et al., 2014). Because wisents have such low genetic diversity, each herd in the wild is valuable (Belousova et al., 2004).

However, reintroduction projects in areas used by humans harbour potential for conflict and are often met with resistance from the local population (Auster et al., 2021; Eriksen et al., 2022; Haidt et al., 2018; Watkins et al., 2021). A particularly strong factor here is the 'fear of the unknown' (Auster et al., 2021; Eriksen et al., 2022). In large mammals, there is an additional fear of attack, although such incidents are rare and usually due to human carelessness (Haidt et al., 2018). To avoid conflicts, it is necessary that animals are sufficiently shy and can be chased away when they are in a critical area like a human settlement or agricultural field where they cause damage.

Flight initiation distance (FID), i.e. the distance at which animals start fleeing as a reaction to an approaching stimulus, is usually used as a measure for shyness (Cooper & Blumstein, 2015). Individuals take flight when the cost of staying exceeds the cost of safety (Ydenberg & Dill, 1986). Another measure of animal shyness is the alert distance (AD). The exact definitions of alert behaviour vary in the literature and depend on the respective animal species (Cooper & Blumstein, 2015, S. 2007; Fernández-Juricic et al., 2001; Li et al., 2007; O'Neal Campbell, 2006; Weston et al., 2012). In this paper, we understand the term as the distance at which animals show alert behaviour which is expressed by looking at the approaching person.

In the wild, wisents usually flee when they see a human (Krasińska & Krasiński, 2013). Their natural FID is 65-100 m and it is usually not feasible to approach a herd of bison with a tailwind (Baskin & Danell, 2003). However, mammals may become used to contact with humans and respond by decreasing their shyness (Cabrera et al., 2017; Krasińska & Krasiński, 2013; Mbise et al., 2020; Stankowich, 2008). This can lead to captive-bred animals seeking contact with humans after release instead of avoiding it (Matipano, 2004). Other authors have shown that animals can relearn their shyness towards humans, and in some cases deterrence measures have been used to create negative experiences with humans (Reading et al., 2013; Ross et al., 2022). The wisents that have been reintroduced in Poland and Lithuania are partially hunted and have now regained their natural FID (Balciauskas, 1999; Haidt et al., 2018). A study by Schmitz et al. (2014) suggests that the natural FID of wisents returns to normal within a year, even without hunting or deterrents, if the animals are undisturbed by humans.

The escape behaviour of animals appears to be complex and depends on various factors. Since reintroduction projects are an important part of wisent conservation and at the same time harbour conflicts, it is essential to better understand the development of shyness in zoo animals after reintroduction. The aim of this study is therefore to investigate how the shyness of wisents towards humans develops during the first year after translocation. We investigated the willingness of wisents to flee in spring and autumn and compared the data. Our hypothesis (H1) was that wisents would escape more frequently in autumn (12 months after translocation) than in spring (6 months after translocation). We also investigated the difference in willingness to flee in the forest *vs.* in open grassland. Our hypothesis (H2) was that the wisents react more frequently to an approach by fleeing in the open grassland than in the forest. The Wisent Thal association has defined the desired FID of the wisents at 50 m at least. We chose this distance as the decisive value for escape or no escape when statistically analysing the data.

Materials and Methods

Study area

The study was carried out in Welschenrohr in the Solothurn part of the Jura Mountains (47° 16' 33'' N, 7° 32' 40'' E). The area lies at around 700 m a.s.l. and has a hilly topography (Figure 1). As part of a reintroduction project, a herd of 5 wisents was brought there in September 2022 to serve as a test herd for the experiments (Verein Wisent Thal, 2022). The animals are wisents of the low-land-Caucasus line. They come from zoos and were therefore used to humans. At the time of the experiments in spring 2023, the herd consisted of a bull (4 y.), 3 cows (4, 5 & 6 y.) and 1 calf (<1 y.). In autumn 2023, it also included 2 calves that had been born in summer. Since their reintroduction and hence during the experiments, the herd lived in a 50 ha enclosure (Figure 1). The enclosure was always accessible to visitors: in the period from September 2022 to August 2023, around 2400 events involving people were recorded on photo traps in and around the enclosure (Tschumi, 2023). There is no evidence of predators in the area that are relevant to wisents. Most of the enclosure consists of beech forest (37 ha), the rest is formed by open grassland (Figure 1).

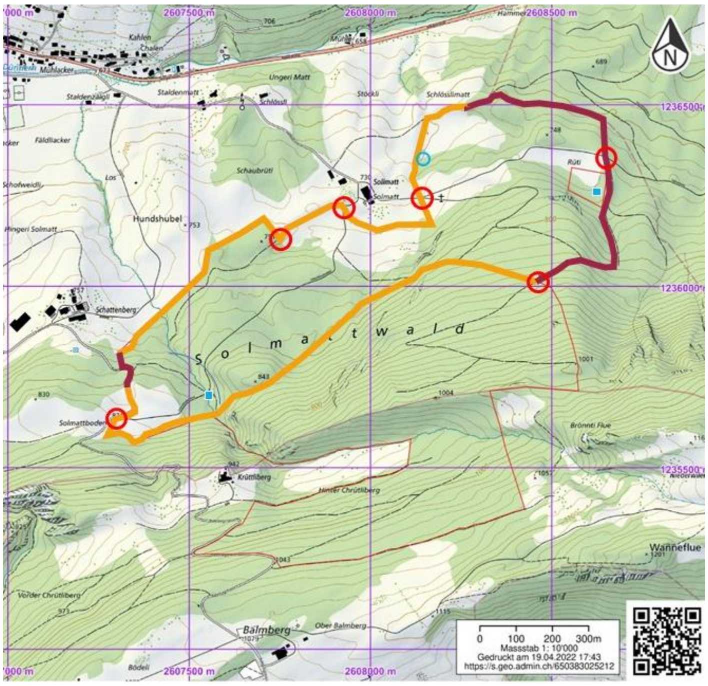

Figure 1: Map of the reintroduction enclosure. Red circles = gates, orange line = electric fence, red line = steel fence (Source: Verein Wisent Thal, 2022)

Data Collection

The experiments took place in spring and autumn 2023. In each season, disturbance experiments were conducted in a 4-week block on 2 days per week. The timing of the experiments was chosen to coincide with the period when the trees were in leaf.

The flight initiation distance (FID) of the wisents when encountering a human served as a measure of shyness. We measured the FID in disturbance experiments in which a single human approached the test herd. We conducted 2 to 3 experiments per day, with a break of at least 30 minutes between each experiment, and the next experiment was only started when the wisents showed calm behaviour. Calm behaviour was defined as ruminating, lying down, grazing or standing. Only the behaviour of the closest animal was recorded. We used radio telemetry to locate the wisents. We walked on paths until we were within sight distance before approaching them directly and leaving the path. No experiment was started in the following situations:

- If the herd was less than 50 m from the fence,
- if no animal was visible from the path,
- if the animals did not show calm behaviour or were sleeping.

The distance was measured using a laser distance meter (Swarovski Laser Guide 8x30) with an accuracy of 1 m. A marker was dropped at each measured distance so that it could be remeasured afterwards in the event of uncertainties.

We determined the FID at two times: firstly, the distance to the first animal F that fled (FID_F; Figure 2). Then the test person continued to approach the herd and the distance to the closest animal C was measured as soon as it fled (FID_C). We stopped the approach when the closest animal C fled. In addition to the FID, we measured the start distance (SD - distance between person and animal C before the human started direct approach) and the alert distance of the closest animal (AD - wisent stopped its activity and looked at the human without resuming its activity) (Figure 2). Only in case of a complete escape, where the entire herd moved away, we did measure the distance after the escape. In this case, the closest animal was decisive (DaF_C). We measured as soon as the whole herd showed calm behaviour again.

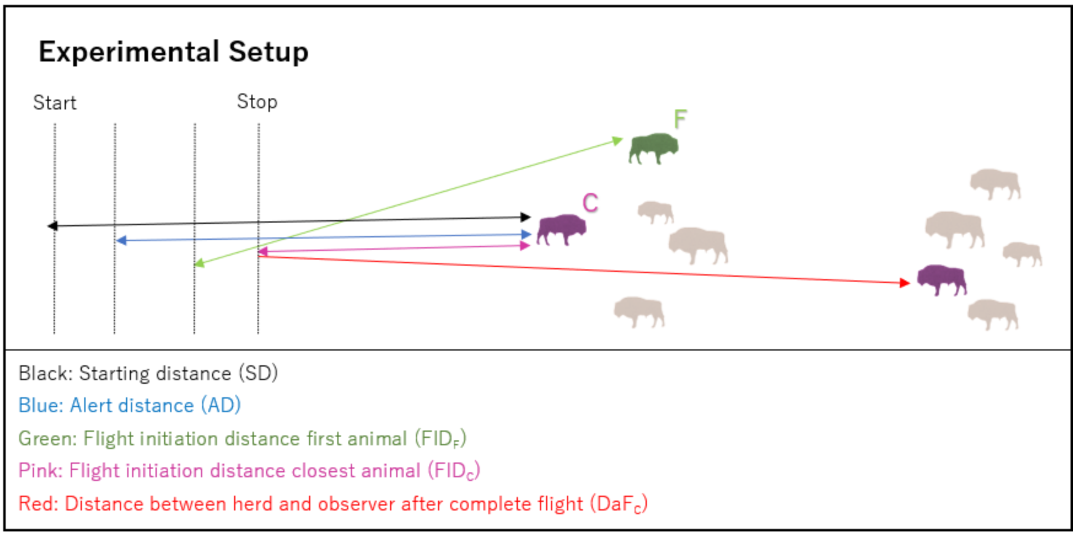

Figure 2: Visualisation of measured distances during experiments

Any movement of the wisents that increased the distance to the approaching human, which was at least one wisent length (3 m), was considered an escape. If no escape behaviour of the animals was registered at a safety distance, we stopped the experiment. In spring we maintained a safety distance of 20 m, in autumn it was 40 m, as the bull had behaved more aggressively than usual in the previous weeks. If we observed threatening behaviour during the approach, we wrote down the distance and the type of behaviour and stopped the experiment. Threatening behaviour included approaching, shaking the head, snarling and stomping (Krasińska & Krasiński, 2013).

In addition to the date and time, the following data was recorded: 1) habitat; 2) wind direction; 3) weather; 4) the angle at which the person approached (from above, below or horizontally); 5) specific behaviour (see Appendix). It was also recorded whether the animals were surprised by the person. Cases in which the animals showed alert behaviour as soon as they noticed the

person were counted as surprise.
Most of the experiments (75 %) were carried out by the same, well-instructed person A. Between the experiments, which took place on the same day, she changed her appearance by changing her clothes. To rule out falsification due to habituation to person A, the remaining 25% of the experiments were conducted by 4 other experimenters unknown to the wisents. Person A was connected to the experimenter by telephone to guide him and record the results.

Statistical Analysis

As no escape event occurred up to the safety distance in most experiments, we were unable to calculate a mean FID. Instead, we focused on the escape rate and categorised the data as FID ≥50 m (= escape) or FID <50 m (= no escape). This distance is relevant as it was defined as the minimum FID by the Wisent im Thal association.

To check whether a habituation effect occurs within a day, we investigated whether the number of experiments per day had an influence on the escape behaviour of the wisents. We checked this by using a chi-square test to compare the 1st, 2nd or 3rd experiment per day. The test was performed with a significance level of $\alpha=0.05$. Statistical tests were generally performed by using R (RStudio 2023.03.0+386 "Cherry Blossom").

To test for a difference in escape rates between spring and autumn, or forest and open grassland, a two-proportions Z-test (prop.test) with a confidence interval of 0.95 was used. We used the same test to check whether there was a difference in the escape rate depending on whether the experiment was carried out by person A or by another person.
Due to the overall low escape rate, only the FID of the Closest Animal was analysed. The R- code to generate the graphics was created with the assistance of ChatGPT, an AI model developed by OpenAI.

Results

In total, the wisents escaped in 7/50 experiments conducted, of which 3 escapes occurred before the target distance of 50 metres. (Figure 3). All escape events occurred in spring when the safety distance we maintained was 20 m. Figure 3 shows the distance up to which the wisents allowed a human to approach them. In 3 cases (2 in spring, 1 in autumn), the experiment was aborted before the safety distance was reached because an animal had shown threatening behaviour (Figure 3). These cases occurred at a distance of 25–52 m. In 2 cases the threatening behaviour manifested itself in an approach, in one case in a combination of stamping, head shaking, tail wagging, approaching and the bull puffing himself up.

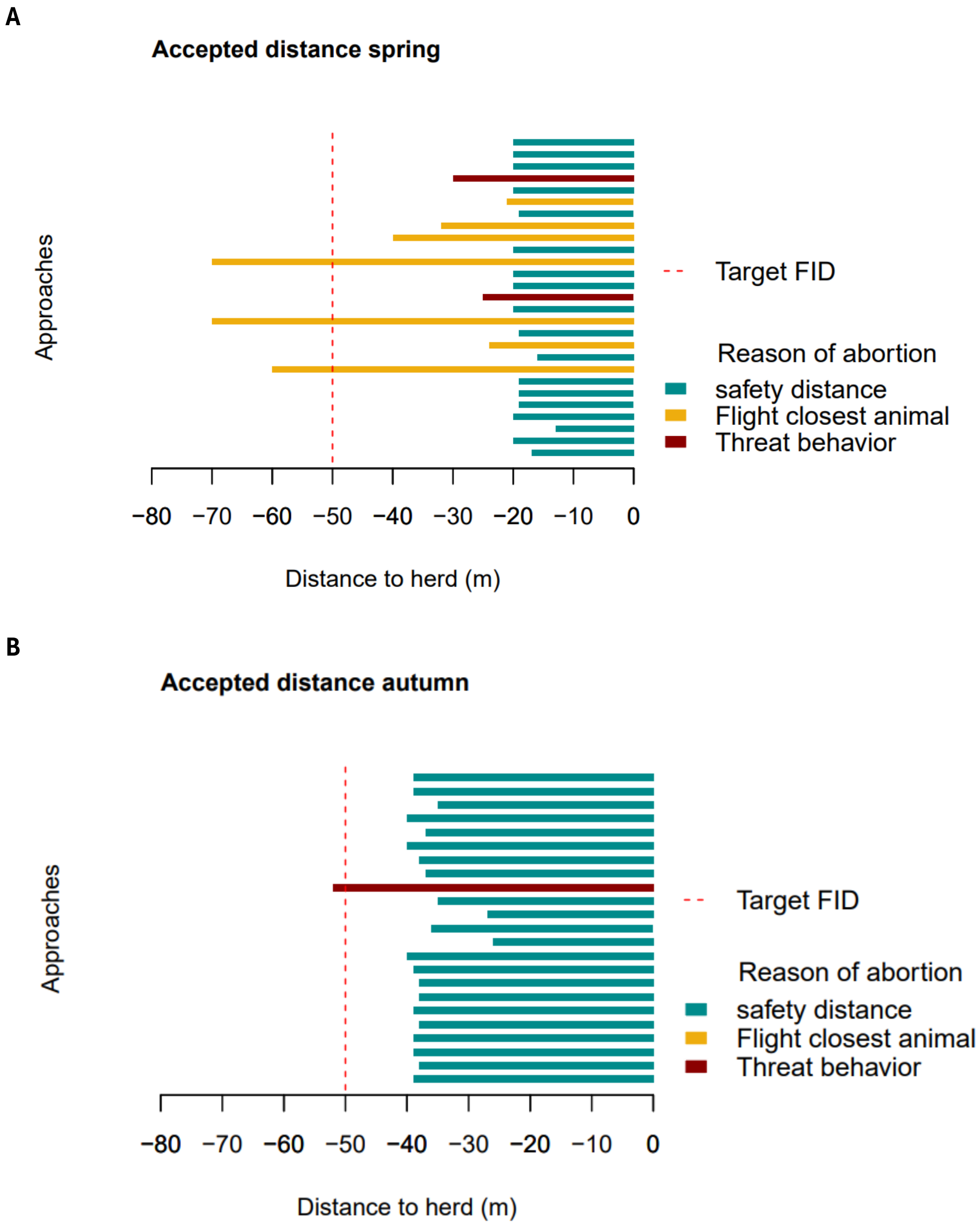

Figure 3: Distance to which we could approach in spring (A) and autumn (B). The colours visualise the reason of abortion of experiment.

At a target distance of ≥50 m, the wisents fled in 3 of a total of 50 experiments conducted (Figure 3, Figure 4). This corresponds to an escape rate of 6% of cases (95% CI: 0.01-0.17).

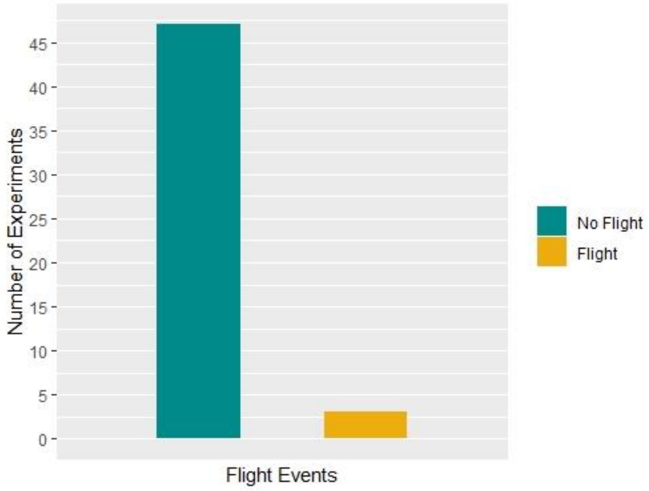

Figure 4: *Number of Flight Events of total conducted Experiments. Yellow = Flight of closest animal at ≥50 m. Green = no flight of closest animal up to 50 m.*

In autumn, the wisents fled in 3/27 cases, which corresponds to a frequency of 11% (Figure 5A, 95% CI: 0.02-0.29). In spring, they reacted with flight in 0/23 cases (95% CI: 0.00-0.15). The willingness to flee was thus not significantly different in spring than in autumn (χ^2 = 1.1055, p=0.293, two-sided). We also found no significant difference between the escape rate in the forest and in the open grassland (χ^2 < 0.001, p=1, two-sided). In the forest, the wisents escaped in 1/14 cases (7%), in the open grassland in 2/36 (6%) (Figure 5).

A **B**

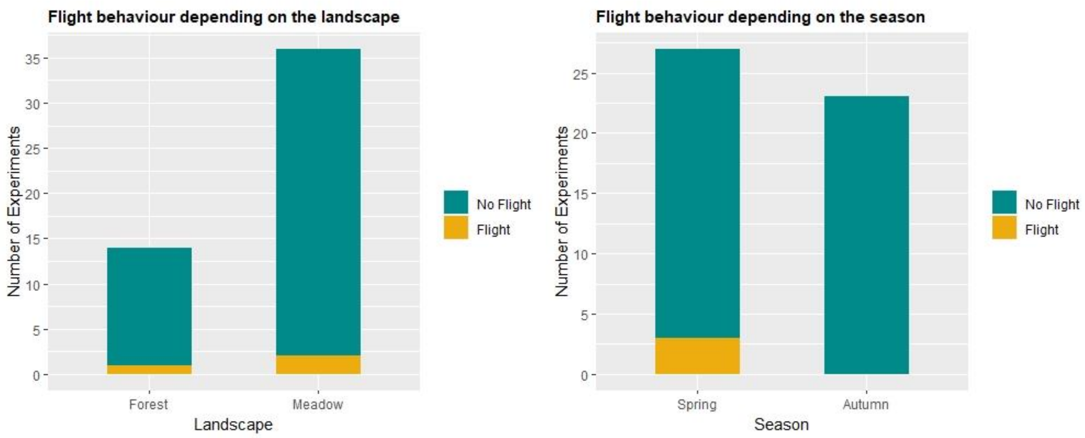

Figure 5: Number of Flight Events depending on season (A) and landscape (B). Yellow = Flight of closest animal at ≥50 m. Green = no flight of closest animal up to 50 m

The results of the chi-square test indicate that there is no statistically significant correlation between the experiment number (1st, 2nd or 3rd repetition per day) and the probability of wisents reacting by fleeing (χ^2=2.023, df=3, p=0.568). There is therefore no apparent habituation effect with the repetitions within one day. We also found no significant difference in the frequency of escape between the experiments conducted by person A compared to the experiments conducted by strangers (χ^2 = 0.145, p=0.704, two-sided).

Discussion

We found that the wisents' willingness to escape was very low in the first year after being transferred to the reintroduction enclosure. The FID of the animals was so low that it was mostly below the safety distance that we maintained. The FID is therefore far from the target FID of at least 50 m, which the Wisent im Thal association has defined as an important criterion for a possible release into the wild (Verein Wisent Thal, 2022).

Experience from reintroduction projects in Poland and Lithuania shows that the wisents' fear of humans returned over time (Balciauskas, 1999; Haidt et al., 2018). In both examples, however, the wisents are hunted, which promotes the animals' shyness towards humans (Reading et al., 2013). These results can therefore only be compared to a limited extent with our setting, in which the wisents are not subject to hunting or culling.

According to a study by Schmitz et al. (2014), the natural FID of wisents can return within a year even without being hunted. They investigated the FID of wisents in the Rothaargebirge (Germany), which also originated from zoo husbandry and were transferred to a reintroduction enclosure. According to their results, the FID of the wisents developed within one year to values that would be natural for animals in the wild and the wisents showed escape behaviour in most experiments (Schmitz et al., 2014). In this regard, the large discrepancy between our results and those of Schmitz et al. (2014) is remarkable:

Within the first year, we were unable to detect any change in shyness over time. Our H1 hypothesis, according to which the willingness to flee will be greater in autumn than in spring, was therefore not confirmed. One difference between the setting of Schmitz et al. (2014) and our setting was the frequency of human presence. In contrast to the setting of Schmitz et al (2014), where the wisents had hardly any contact with humans, the enclosure in the Swiss Jura was always accessible to visitors and frequently visited (Tschumi, 2023). When animals are frequently exposed to human encounters without negative experiences, they save energy by dampening their reactions (Borkowski et al., 2006; Herrero et al., 2005). A possible explanation for the different results of our study and that of Schmitz et al. (2014) could therefore lie in the frequency and type of encounters with people. If this is the case, a change could be observed in the following years. From September 2024, an expansion of the bison enclosure to 100 ha is planned, which will also include more impassable areas. Under these conditions, there will probably be less contact between wisents and humans and the habituation effect is likely to decrease while on the other hand shyness will increase. Brokowski et al. (2006) report temporal fluctuations in the reaction of bisons *(Bison bison)* to humans in Yellow Stone National Park, depending on visitor frequency. In winters with high visitation, the bisons reacted less strongly to humans than in winters with low visitation. This study also suggests that a change in FID within a year is possible in principle.

Another factor that influences the willingness of animals to flee is their individual character. Martínez-Abraín et al. (2022) emphasise the importance of considering among-individual differences in shyness and boldness in reintroduction projects. Shyness, or boldness, can not only be learnt but also inherited. Bolder individuals show less shyness towards humans (Martínez-Abraín et al., 2022). It could therefore be that the wisents in Switzerland are bolder in terms of their genetics than the wisents in the Rothaargebirge (DE).

The shyness and flight behaviour of wisents is a complex interplay of genetic, learned and environmental factors. The annual cycle of wisents can also influence their escape behaviour (Haidt et al., 2018; Krasińska & Krasiński, 2013; Schmitz et al., 2014). Krasińska & Krasiński

(2013) report bolder behaviour in wisent cows when calves are present, while Fortin & Andruskiw (2003) found a greater willingness to flee in bison when young are present in the herd (Fortin & Andruskiw, 2003). As our studies took place in autumn and spring, we cannot rule out the possibility that our results were influenced by the annual cycle of the wisents.

As described by Krasińska & Krasiński (2013), we also observed increased aggression from the bull during the mating season, which manifested itself in a mock attack on the known Wisentranger when he set up a fence 25 m away. This prompted us to increase the safety distance to 40 m in autumn for safety reasons. In the evaluation, we chose the FID of 50 m as the relevant escape distance, as this was defined as the minimal target FID (Verein Wisent Thal, 2022). Changes in the FID that occur below this 50 m are interesting, but not relevant for answering the question of whether wisents are sustainable in Switzerland, as all FID values below 50 m are too low. Determining AD as we defined it (wisent stops its activity and looks at people without resuming activity) proved to be difficult (cf. Guay et al., 2013) as it was sometimes not clear at first whether the wisent was alert or just attentive. In many cases, an animal raised its head and then continued to graze without showing any interest in the approaching person. For future experiments, it would be easier to define the AD as the distance at which the wisent lifts its head and looks at the human, as Haidt et al. (2018) did. Although it is then not clear whether the wisent is actually alert or just attentive, the measured values are more consistent.

Our H2, according to which the FID of wisents is lower in the forest than in open terrain, is supported by the literature (Haidt et al., 2018; Stankowich, 2008). However, we were unable to confirm this in our experiments; the wisents' willingness to flee was not significantly different in the forest than in the open grassland.

Since we stopped our experiments at the safety distance, there is a possibility that there is a difference in FID between forest-open grassland and spring-autumn that we could not measure. However, even if this were the case, the differences are so subtle that they are not relevant for conflict management between humans and wisents.

In 3 cases, we aborted the experiment because a wisent showed threatening behaviour. One of these cases occurred at a distance >50 m. However, this was an exception and to summarise, we can say that humans have nothing to fear as long as they keep a minimum distance of 50 m.

Conclusion

The target FID of at least 50 m was not reached within one year and there was no significant temporal change in shyness within the first year after release. We also found no difference between the willingness to flee in the forest and in the open grassland. The results differ from other results in comparable studies. The reasons for this could be the character of the wisents or the frequency and type of contact with humans. We were able to show that wisents do not necessarily regain their shyness within a year when placed in a large reintroduction enclosure. One driver of shyness appears to be the practice of hunting and deterrence measures, which has been used in other projects, but not in the project in Switzerland. It will be necessary to observe the further development of the FID of the test herd in the Swiss Jura in the coming years to document whether the shyness changes after more time or with the enlargement of the enclosure. If the wisents have not regained their shyness after several years, more detailed analyses of the differences between the conditions in this project and comparable projects where shyness has returned would greatly broaden our knowledge on the rewilding behaviour of wisents.

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Appendix

Saskia Maeder
Bachelorarbeit 2023

Feldprotokoll Störexperiment Wisente

Datum	Zeit	Nr.

Figurant:in ....

Wetter .... Temp ....

Zustand Wisente		Annäherung Mensch		Wind
☐ Wiese ☐ Wald ☐ Weg	☐ Liegen ☐ Stehen ☐ Wiederkäuen ☐ grasen	☐ Von oben ☐ Von unten ☐ waagrecht	☐ Überrascht	☐ rücken ☐ gegen ☐ seitlich ☐ windstill

	Distanz	Bemerkung
SD		
AD_C		
FID_F		
FID_C		
DaF_C		
Spezielles Verhalten		☐ knurren ☐ fixieren ☐ stampfen ☐ Kopf schwingen ☐ Schwanz wedeln ☐ Annähern ☐ ....