Is the maternal condition important for domesticated reindeer calf survival?

Är vajans kondition viktig för kalvens överlevnad?

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(Photo: Bromée, 2014)

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ABSTRACT

There are many challenges within reindeer husbandry in Sweden. There are climate changes, predator problems, and exploitations to mention some of them. The reindeer population contains of 65-70 % females and thus, represent the main part of the population. Studies have been made on productivity and calf survival with results showing that the weight and condition of the female is positively correlated with calf survival. Two reindeer-herding districts (Udtja and Gällivare) in northern Sweden suffer from high bear predation and this study was performed to see if maternal conditions affect calf survival within these districts. Females were weighed and tested for pregnancy in April 2011 and 2012. In June, during calf marking, observations were made to register whether or not the females reared a calf. Mean weights were calculated in both districts with the purpose to determine a difference between the districts. In 2011 there was a significant difference in mean weight (t.test=, $P<0.0001$), but in 2012, the difference was weakly significant (t.test=, $P<0.082$). Between the two districts in total mean weight, the difference was significant (t.test=, $P<0.0001$). Udtja had the highest mean weights in both 2011 and 2012, as well in total. The observations during calf marking showed that Gällivare district had the highest calf survival with survival rates of 56.7 % in Gällivare, whereas Udtja only had 42.0 %. It was not possible to determine the importance of good maternal condition based on the results from the present study, even though other studies within the same subject found correlations between good condition in females and calf survival.

1. INTRODUCTION

1. 1 Reindeer husbandry in Sweden

Reindeer husbandry is an important Sámi industry reserved for the Sámi people according to the Swedish constitution, and the right is based on ancient traditions (Sámi Parliament, 2014). Reindeer herding has experienced great changes through the centuries (Rehbinder & Nikander, 1999). There are stories from 98 A.C. about people hunting reindeer, and in the 9th century stories about this folk taming reindeer were told (Sámi Parliament, 2014). In the 16th century reindeer husbandry changed and turned into a more significant economy for the Sámi people, with this a more intense herding system developed (Sámi Parliament, 2014). Reindeer were used for transportations as well as, milk- and meat production.

After the 1940s, reindeer herding changed dramatically into extensive herding with meat production as the most important income (Rehbinder & Nikander, 1999). The extensive herding system required larger herds and reindeer herding went towards a more industrial production. Approximately 2 000 tons of reindeer meat is produced annually and reindeer husbandry converts about 230 millions of Swedish crones in the same period (Sarri, 2014). There are between 225 000 and 280 000 domesticated reindeer (*Rangifer tarandus tarandus*) in Sweden. The reindeer are owned by 4 600 Sámi, from these about 2 500 are dependent on the income from reindeer husbandry. There are 51 reindeer-herding districts located on 52 % of the land area in Sweden (Sámi Parliament, 2014). The districts are divided into mountain-, forests- and license districts. In the mountain districts reindeer are moved between the mountains in the summer and the forest in the winter. In the forest district, the herd is located in the forest all year around (Sarri, 2014). The County admission boards where a herding district is situated decide the upper limit of number of reindeer for that district based on the lands productive capacity (Sarri, 2014). A herding district is organised as an economic association and have a managing board (Danell *et al*., 1998). The district owns the facilities within it and the managing board organise all the work with the reindeer, but the direct responsibility lies on the individual reindeer herder (Danell *et al*., 1998).

1. 2 Selection and breeding

The reindeer year starts with calving in May, and continues with marking of the calves in June-August. The exact date depends on where the district is located in the country. The reindeer year continues with slaughter in September followed by the rut during the same month. The year ends in the winter when the reindeer are separated into smaller winter groups between in November-April (Rehbinder & Nikander, 1999). This also depends on the district, since winter comes earlier in the North of Sweden.

To achieve high productivity, selection is made during slaughter in autumn. The females are culled depending on their production rate, weight, maternal abilities and growth rate on both herself and her offspring (Petersson *et al*., 1990). The calves are selected on their own and their mother's traits. However, every herder decides how to select their own animals and they also decide themselves whether to have a certain breeding programme. Since modern reindeer husbandry in Sweden is developed towards more slaughter of calves than bulls, breeding programs with directed selection, especially of male calves, is required (Rönnegård *et al*., 2003). A high share of productive females in their best age, a low share

of males and calf slaughter is the best combination to improve meat production (Danell & Gaare, 1998). Also, one advantage of slaughtering calves in autumn and not letting them become adults is that less reindeer will share the winter pastures which will increase the possibility for the animals in the winter herd to survive (Danell & Gaare, 1998). Within reindeer husbandry mating is not controlled as in other animal production systems and the sires of the calves are always unknown (Rönnegård *et al*., 2003). To be able to gain high productivity within reindeer husbandry, the sires would also need to be selected on traits (Danell, 1999).

1. 3 Challenges for reindeer husbandry

Because of the extensive foraging system within reindeer husbandry, reindeer are sensitive to climate and environmental changes (Rönnegård & Danell, 2001). Reindeer husbandry is facing problems from climate changes e. g. increased parasitic pressure and harsher winters with more snow and ice cover on pastures (Tryland, 2012). Harsher winters can lead to more supplementary feeding which in turn may lead to more infectious outbreaks within the herds due to the higher population density during feeding which results in more contact with other infectious animals (Tryland, 2012). However, an even larger threat may be reindeer predation which causes reindeer husbandry in Sweden to be critically close to both biological and ecological collapse (Danell, 2009). In 2013, the total number of reindeer in Sweden in the winter herd was 248 000 whereof 172 000 were females (Doj, 2014). Over the past 20 years the female share has been 65-70 % of the reindeer population (Doj, 2014). According to estimations in 2008 of reindeer predation rate in Sweden, between 59 000 and 64 000 reindeer are predated (Labba, 2014), which mean that a high percentage of these are females since the majority of the reindeer population are females (Doj, 2014).

The large carnivore species wolf (*Canis lupus*), wolverine (*Gulo gulo*), brown bear (*Ursus arctos*), lynx (*Lynx lynx*) and golden eagle (*Aquila chrysaetos*) are located in Northern Europe within the reindeer herding ranges (Pape & Löffler, 2012). There are few studies performed on the effect of predation from wolves or eagles in Sweden, but some have been made in Finland (Karlsson, 2011). A study made on lynx predation showed that more than 90 % of their diet consisted of reindeer. Estimations were made of the predation rate and it showed that one lynx family were expected to kill 30.2 reindeer every winter (Pedersen *et al*., 1999). In another study made in Finland 2006-2008, the results showed that predators killed 32.4 % of all calves annually and brown bear had killed 20.3 % of the predated calves (Nieminen, 2010).

1. 4 Weight and condition of female reindeer

The female reindeer have a withers height of 87-140 cm (Winqvist, 2014) and a weight of 60-90 kg in autumn (Danell *et al*., 1998). The female gain her maximum weight at an age of 4-7 years (Danell *et al*., 1998), but is normally already sexually mature in an age of 1 ½ (Rehbinder & Nikander, 1999). There are genetic factors that set the limit for growth ratio and ultimate body mass in reindeer, but there are environmental factors that control it and the body size attained (Reimers, 1983). Reindeer has a natural adaptability to the different seasons (Danell *et al*., 1998) and they undergo great variations in body mass during the year (Chan-McLeod *et al*., 1999). During summer there is plenty of high-quality forage and to gain their body mass peak in September, the reindeer rapidly increase in weight

during this period (Chan-McLeod *et al*.,1999), and in winter they most often lose weight (Reimers, 1983). During the short summer the forage is rich in protein and the reindeer energy- and protein storages are filled before winter when forage is poor and isolated under the snow cover (Danell *et al*., 1998). Females loose about 15 % of their weight during winter and spring. Reproduction costs as an effect of energy (Danell *et al*., 1998) and for pregnant females the period before and after calving is extra demanding since it occurs before green-up (Post *et al*., 2003). They need to rely on their body reserves to be able to produce milk to the calf (Danell *et al*., 1998), therefore lactation is the most costly investment a female makes but it is also the most important factor of maternal care (Holand *et al*., 2012).

Antler size is correlated with body size and dominance (Clutton-Brock, 1982; Holand *et al*., 2004; Holand *et al*., 2012). The females keep their antlers through the winter while the males loose them after the rut (Sarri, 2014), and according to Roberts (1996) one explanation of antlers in females is that they use them for intra-specific competitions. During wintertime, larger females can protect their forage crater against smaller females and males, and provide the calf with food (Roberts, 1996). This also increases the chances of the calves to maintain their body mass through the winter since the calves save energy from pawning for food (Kojola, 1989). Calves with a less dominant mother lose more weight during winter, since dominant females and calves often take the craters from them (Kojola, 1989).

In general, reindeer give birth to one calf (Rehbinder & Nikander, 1999) that weighs 4-6 kg (Danell *et al*., 1998). The mother-offspring bond is strong and sometimes kept until next calving even though the calf is weaned (Lent, 1974 in Holand *et al*., 2012). A study made on productivity on wild caribou in Canada show that the best offspring, demonstrated with high body mass in neonatal calves, are produced by females with an age of 5 years or older (Adams, 2005). The size of the neonatal calves was positively related to the size of the female (Taillon *et al*., 2012). In the study by Adams (2005) the author also found that females older than 14 years had a lower productivity than females in the age-span of 6-13 years. In the present study investigations about the relationship between female weight and calf survival will be made and the hypothesis is that heavier females have higher survival rates of their calves than smaller females.

1. 5 Purpose and questions

The purpose of this study is to examine if the maternal condition of domesticated reindeer affects calf survival and how two reindeer-herding districts, with high bear predation, differ.

The specific questions are:

- How does female weight affect calf survival?
- Do mean weight in pregnant females and calf survival rates differ between two reindeer-herding districts?
- If, what explanations can be found?
- Is it possible to increase mean weight and calf survival through breeding?

2. MATERIAL AND METHOD

2.1 Subjects and observation area

Data for the present study was collected in Udtja and Gällivare reindeer herding districts in the north of Sweden during 2011 and 2012 on behalf of a bear predation project. The aim with the project was to estimate how many reindeer calves that were predated by brown bear every year in these districts. Data were collected by researchers within the project. The districts, that were forest-districts, were located next to each other. Udtja district had approximately 2800 reindeer in the winter herd and Gällivare district had about 7000 reindeer.

A total number of 2859 females >2 years of age in these districts were weighed in April and tested for pregnancy and provided with a collar with an id-number, depending on the result of their pregnancy test. Udtja entered the bear predation project in 2010 and females were tested for pregnancy. Females that were pregnant this year were assumed being pregnant in 2011 and 2012 too, therefore, no pregnancy tests were made in Udtja in 2011 and 2012. Only the weight was registered in a protocol for those females during these years. In Gällivare, pregnancy tests were performed during 2011 and 2012. The weight and the results from the tests were registered in a protocol for each individual. In total, 1812 out of 2859 females from both districts in 2011 and 2012 were assumed being pregnant.

In June of 2011 and 2012, the reindeer herds were collected within the districts for calf marking and observations of whether the females reared a calf or not were made. The numbers of the collar on the females were registered and a “yes” or a “no” was written in the column of “calf observation”. All females were observed and a total number of 2974 females were observed and registered. The same females observed in the study in 2011 could also be observed in 2012, hence the different numbers of females from weighing/pregnancy testing and observing.

Both districts had already existing corrals on their area that could hold all the reindeer within the districts. In addition to these, a special designed portable corral-system was built and used for the purpose of weighing and pregnancy testing the females. This portable corral was attached to one of the existing corrals and a smaller amount of approximately 50 reindeer were moved into it. From there, a narrow passage led to another small corral. In the end of the passage, there was a station with a special designed scale with the opportunity for a veterinarian to do a pregnancy test. The reindeer, one at the time, were moved through the passage and put onto the scale. No anesthetize was used and there was no possibility for the reindeer to reverse or turn over inside the scale.

2.2 Data processing

Acquired data from the protocols with weight and pregnancy tests were compiled in Excel and listed over years and districts. Since no pregnancy tests were performed in Udja 2011 and 2012, females <60 kg were assumed not to be pregnant based on results from earlier studies (Eloranta & Nieminen, 1986; Danell *et al.*, 1998). Records including females <60 kg were therefore excluded from calculations on mean weight. Data from Udtja in 2010 were also excluded since Gällivare did not participate in the bear predation project that year. Mean weights with standard error of females ≥60 kg were calculated for both districts

divided by year. Total mean weight with standard error in all females within the district was calculated. Two-sample t-tests were performed in Minitab®17 to analyse if the mean weights differed between the districts. Data from observations of females rearing a calf or not were also compiled in Excel and separated upon year and district. During these calculations, all females independent of weight were included. Numbers of females that reared a calf were divided into the whole amount of females in the certain district and year to receive the percentage of calf survival. The mean values of calf survival were also calculated in the districts. This was repeated in both districts and years.

3. RESULTS

A total number of 1812 female reindeer were considered pregnant in Udtja and Gällivare district. In Udtja district there were 1055 (58.2 %) females and in Gällivare district there were 757 (41.8 %). The greatest samples of females were from 2011 in both districts (Tab. 1). A total number of 2974 females in all weight classes were observed during calf marking (Tab. 1). 1740 of the females were observed in Udtja and 1234 of them in Gällivare (Tab. 1).

Table 1. Number of pregnant and observed females distributed over district and year.

District	Year	Pregnant females (≥60 kg)	Observed females (all females)
Udtja	2011	811	753
Gällivare	2011	510	627
Udtja	2012	244	776
Gällivare	2012	247	822

In 2011, the mean weight of the females ≥60 kg in Udtja was 73.5 (±0.27) kg and for females ≥60 kg in Gällivare it was 70.8 (±0.36) (Fig. 1). There was a significant difference of 2.7 kg in mean weight between the two districts in 2011 (t.test=, $P<0.0001$). Mean weight for females in Udtja 2012 was 72.0 (±0.44) kg and in Gällivare it was 71.0 kg (±0.39) (Fig. 1). The means between the districts differed with 1.0 kg this year and it was weakly statistically significant.

The total mean weight for Udtja district was 73.2 (±0.23) kg and for Gällivare it was 70.9 (±0.27) kg. A significant difference in mean weight of 2.3 kg was found between the total mean weights in these districts (t.test=, $P<0.0001$).

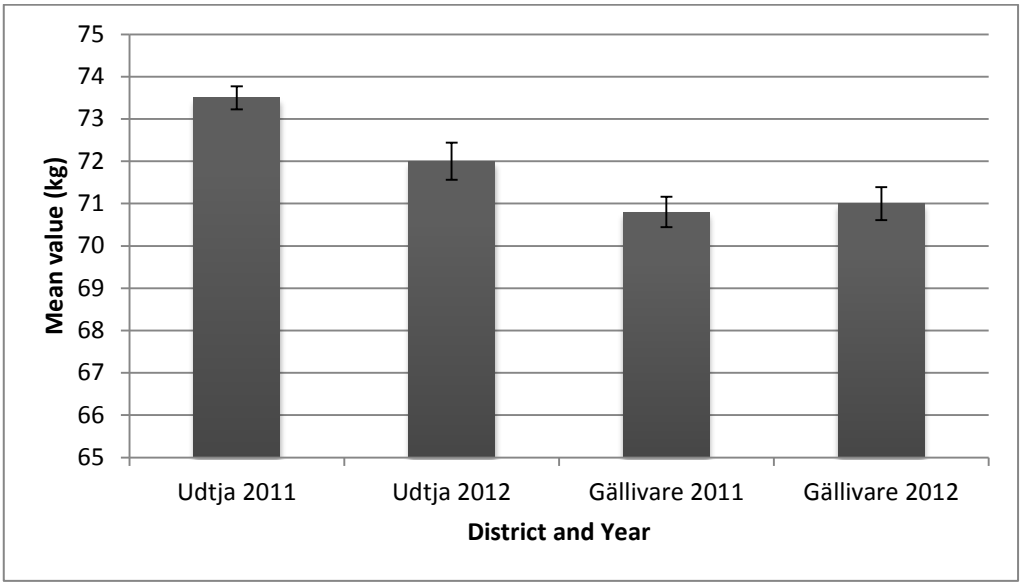

Figure 1. Mean weights (±SE) in pregnant females (≥60 kg) in Udtja and Gällivare districts in 2011-2012.

The highest percentage of calf survival occurred in Gällivare in 2011 with 58.2 % (Tab. 2). In Udtja in 2012 the calf survival rate was only 33.5 % (Tab. 2) which was the lowest share. The mean value of calf survival in Udtja district was 42.0 %, whereas Gällivare district had a mean value of 56.7 %.

Table 2. The percentages of whether the females reared a calf or not, during calf marking in June.

	Yes (%)	**No (%)**
Udtja 2011	50.5	49.5
Udtja 2012	33.5	66.5
Gällivare 2011	58.2	41.8
Gällivare 2012	55.2	44.8

In Udtja and Gällivare 2011 the numbers of females that reared a calf was almost equal (Fig. 2), while in 2012, the districts differed. In Udtja there were only 260 females that were observed with a calf and 516 females that were not observed with a calf (Fig. 2).

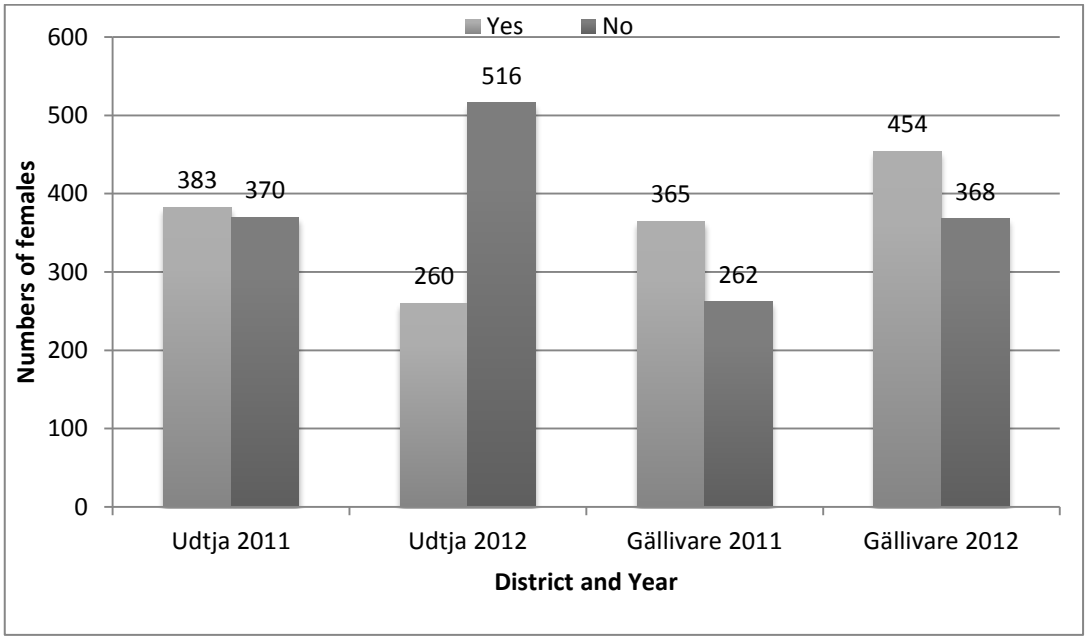

Figure 2. Numbers of observed females that reared a calf (yes) or not (no) in Udtja and Gällivare districts during calf marking in 2011-2012.

4. DISCUSSION

Female reindeer in the two reindeer herding districts were weighed and observed with the purpose to see if their weight and condition affected the survival of the offspring. Mean weights were calculated for each district and year and the result showed that Udtja district had the highest total mean weight and also the highest mean weight if separated by year. The percentages of calf survival showed that Gällivare had a higher survival rate than Udtja in both years. The hypothesis that the reindeer population with larger females would have higher survival rates among the calves was therefore rejected.

4. 1 Mean weight

The mean weights found in the present study significantly differed between the districts in 2011. The following year, there was a weak significant difference, but the total mean weight differed. There can be more than one factor that affect the weight of the females, but Rönnegård *et al*. (2003) suggest that one reason can be different breeding strategies within both districts and individual herders. For example, in Udtja there might be herders with strategies that include selection of heavy females and therefore the mean weight is elevated. Herders within Gällivare might also have selected the heavier females, but not all of those herders were included in the bear predation project and therefor, the mean weight became lower than in Udtja.

To be able to compare the two districts Udtja and Gällivare, all females weighing less than 60 kg were excluded, even though pregnancy tests were performed on all of the females in Gällivare. This was based on the results from a study performed by Eloranta and Nieminen (1986) since their findings showed that reindeer females weighing less than 60 kg had a pregnancy rate of 44.5 %. Females weighing 60-80 kg had a rate of 82.2 % and all females weighing more than 80 kg were pregnant. The study was conducted on a total of 1100

female reindeer during a 14-year study period, and therefore the study is of high credibility. Mean weights found in the present study were all in the range of 60-80 kg, which could, according to the findings in the study of Eloranta and Nieminen (1986), mean that not all of the females were pregnant. It implies that some females in this study could have been anoestrous. This is a source of error in the present study and must be included in the interpretation of the results. Furthermore, the mean weights calculated in the present study do not reflect the true mean weights of the females in the districts since females below 60 kg were not included in the calculations.

There is also a correlation between age and weight (Rönnegård *et al*., 2002; Adams, 2005). In the study by Rönnegård *et al*. (2002) they found that female mass increased until 7-8 years of age and consequently the younger females were lighter than the older. In the present study, age is not included in the calculations of mean weights, but it is known that only females older than 2 years were included. The upper limit of age is unknown and since herders breed animals in different ways old barren females could have been included in the calculations because they can weigh more than 60 kg. As Adams (2005) found, females older than 14 years have a significant lower productivity than younger females. Eloranta and Nieminen (1986) found that the best productive age of a female reindeer was between 5-12 years of age. If age would have been available in the data used in the present study, females older than e.g. 12 years could have been excluded from the calculations of mean weight to secure that a true share of pregnant females actually were used in the study. Regardless, the best would have been to use pregnancy tests on all females instead of excluding females below 60 kg.

Cameron *et al*. (1993) found parallels between parturition rate and body condition in caribou. Females that frequently produced calves had 7.5 kg higher mean weight than those that did not. Hence, larger females have a higher productivity rate. It was also found that the summer weight of the females had correlations to the time of parturition and viability of the calves. However, the development of the fetus occurs during late pregnancy without irrespective of the condition of the female. If females suffered from poor nutrition during the later stages of the pregnancy, it increased the chance of delayed parturition as a consequence (Skoglund, 1983; Cameron *et al*., 1993). It was found in a study performed on domesticated reindeer in northern Norway that females with mean weights of 47-53 kg either died or miscarried before calving (Tveraa *et al*., 2003). Based on that, it is obvious that females with these weights are inadequate within reindeer husbandry. Moreover, in caribou Adams (2005) found that severe winter conditions, e. g. longer winter, during pregnancy affected the birth masses of the calves and the growth ability. This was also found in domesticated reindeer in northern Norway, where a harsher winter affected the weight of the females negatively and the offspring as well (Tveraa *et al*., 2003). Hence, high weight in females and mild winters seem to be a good combination for high productivity.

4. 2 Calf survival

The calf survival rates in the present study differed between the districts, Gällivare had the highest rates in both years. What needs to be addressed is that the females that were observed in the districts were all females including those who weighed below 60 kg. This gives a skew picture of the result since it is not exactly the same females that were included when the mean weights were calculated. Consequently, this source of error may

have affected the result of the calf survival rates. However, it can be concluded that both districts suffer from high calf mortality, regarding to the results from the study. In Udtja in 2012, for example, the calf survival rate was only 33.5 %, which means that only every third female still reared a calf in June during calf marking. This indicates that Udtja suffer from high predation, since the calf survival is found to be very low, especially shown in 2012. As mentioned, some of the females could have been barren and therefore the calf survival rate decreased. The bear predation project was conducted in Udtja and Gällivare because these districts suffer from high bear predation. Thus, predation is assumed to be the major contributing factor to the high calf mortality.

The total number of brown bears was estimated inside the study areas and the result showed that Udtja, with approximately half the area size of Gällivare in the study, had 69 bears whereas Gällivare had 58. Calculations made on their predation showed that these bears may have killed 491 calves in the study area in Udtja, and 407 calves in Gällivare, annually (Karlsson *et al*., 2012). The bear project was conducted in smaller areas within the districts, which may indicate that more bears than those estimated may exist. Even though both districts suffer from high predation, Udtja seems to have suffered more from bear predation than Gällivare since they have a higher number of bears and a lower rate of calf survival.

It would be of interest to perform a longer study to see how the calf survival is affected over time in districts with high predation. The results in the present study display the losses during the first month, from calving in May to calf marking in June, and it could be of interest to investigate the distribution of calf survival throughout the whole year until weaning. A study with the purpose of linking pregnant and weighed females with calf survival until both calf marking and the slaughter in autumn is being performed on the same data as the one used in the present study. The result will demonstrate how calf survival is distributed from calving until slaughter and this will provide researchers and the herders within the districts a more accurate number of calf survival.

In a study performed in northern Norway, correlation between small females, calf survival and predation was found (Tveraa *et al*., 2003). Calf survival was significantly lower in smaller females since the calves needed a few days to gain strength after calving. It is crucial to be able to follow the mother directly after delivery and weak calves are an easy prey for predators (Tveraa *et al*., 2003). Furthermore, in the study where mean weights and predation rates also were estimated, calves born from females with a mean weight of 59 kg died within weeks after birth mostly due to predation. The larger females, weighing 65 kg had higher calf survival and this indicates that larger females produce stronger and more viable calves that suffer less from predation (Tveraa *et al*., 2003). It is difficult to compare this study and the study by Tveraa *et al*. (2003) since their study population was smaller, with only 138 individuals, and the mean weight of the females differed too much from those in Udtja and Gällivare. The number of predators was also significant lower, compared to the estimated numbers of bears in Udtja and Gällivare and there were no bears included in the study made by Tveraa *et al* in 2003.

4. 3 Evaluation of comparisons

The present study was conducted in forest-districts in northern Sweden. The reindeer-herding area in Sweden is located from the middle of Sweden and to the north. This gives a

wide range of districts with different condition and climate as the geography changes. For example, in the forest-districts, e.g. Udtja and Gällivare, the reindeer herd is located in the forest all year around. In mountain-districts the herd is moved to mountains in spring for calving (Nikander & Rehbinder, 1999). What is presented from the study made by Karlsson *et al*. (2012), Udtja and Gällivare district suffer from high bear predation, but almost none from wolverine or lynx. Districts in south of the reindeer-herding area might suffer more from other predators such as wolves, wolverines and lynx. Therefore, it would be motivating to perform similar studies in mountain-districts to see distribution of predation in calves there. It could be determined how extensive predation rates are in southern herding-districts and which predator that predates the most on reindeer calves. A consequence of that type of study could be to establish the right compensation for predation since this is a known problem for herders. It would also be of interest to determine if there is a difference between southern and northern herding districts regarding to mean weights and calf survival.

There are many external factors that influence the conditions within the districts, such as different exploitations of nature, climate changes that affect both summer and winter pastures and the impact of large carnivores (Pape & Loffler, 2012). These factors may be expressed differently in each district, hence the results from the present study cannot be applicable on all districts within the reindeer-herding area. It was, however, possible to compare Udtja and Gällivare on many occasions. Firstly, both districts were forest-districts and located next to each other. Secondly, their main predator was brown bear and this was conducted as a main reason for high predation within both districts. At last, the chosen method in the present study made it possible to compare the different populations of female reindeer within two forest-districts in northern Sweden.

4. 4 Selection and breeding

Reindeer herding is strongly related to Sámi culture and many herders breed their animals on a cultural basis, with little or no interest in developing towards meat production (Rönnegård, 2003). Reindeer herders' income depends mostly on the profits of reindeer meat sales (Danell, 1984). According to Danell (1999) there are three factors to take into account when it comes to optimal production. First of all, adaptions of the population size were made to the amount of pasture to keep a good condition in the reindeer. Then, the herd needs to consist mostly of productive females and lastly, improvement of the genetic material within the population. Calf slaughter is common in Finland which has led to a higher amount of productive females in a herd (Danell, 1999). In conclusion, the breeding programmes that select females with good maternal traits and perform directed calf slaughter may attain a more sustainable reindeer herd, higher productivity and females that are more resistible to predation due to this combination.

Since positive correlations exist between heavy females and heavy offspring, these females will lactate more than smaller ones and provide the offspring with plenty of food resources. During these circumstances and with high-quality forage during the summer, female calves may become pregnant in autumn (Danell *et al*., 1998). If this happens, the calves' development will slow down and could delay pregnancy the following year according to the same authors. This indicates how important it is to achieve a balance. Roughly, too small females are not good for reproduction and survival, and too heavy females can negatively influence early maturating in female calves. For future research it would be of

interest to study females to establish the optimal size productivity. The outcome of that type of study would be to determine a weight class where females should vary to both produce calves annually and have a high calf survival rate. This could increase production rate and the herders' income.

5. CONCLUSION

The present study has compared mean weights and calf survival in two different reindeer-herding districts in Sweden with the purpose of examining the importance of good condition in females for calf survival. Parallels between good female condition and calf survival cannot be found from the results in the present study since there are too many sources of errors that may have affected the outcome of the result. Nevertheless, the present study gives an insight in how mean weights are distributed and how calf survival can be expressed in a forest-district with high bear predation. Furthermore, what needs to be remembered is that districts differ from each other depending on conditions such as, climate, predation, and exploitations and therefore no general conclusion can be made from this study. It is important with studies within this subject since reindeer husbandry in Sweden is heading towards a biological and economic collapse because of predation.

The present study presents with summarized facts from other studies that highlight the importance of females in good condition. Therefore, this study can serve as an overview for reindeer herders and others with an interest in reindeer breeding. It is not a solution of the predation problem, since it is far more complex and needs to be addressed in a political way to be solved. If females are being bred with the aim of increasing in weight, the reindeer populations may increase in quality as a result. Further advantages of that, could be higher productivity and better calf survival, which is crucial for the survival of reindeer husbandry.

POPULÄRVETENSKAPLIG SAMMANFATTNING

Renskötsel är en näring som är förbehållen den samiska befolkningen i enighet med svensk lagstiftning. Det finns ungefär 2500 renskötare i 51 samebyar i Sverige som tillsammans äger mellan 225 000 och 280 000 renar. Länsstyrelsen bestämmer över högsta renantal och det är beteskapaciteten som styr. Ett renskötselår startar med kalvning i april/maj, fortsätter med kalvmärkning i juni/juli/augusti för att övergå i slakt i september/oktober och avslutas med separering i vintergrupper i november-februari. Dagens renskötsel övergår mer och mer från sarvslakt till kalvslakt och det finns samebyar som har speciellt utformade avelsprogram men det är långt ifrån alla och det är upp till den enskilde individen att bestämma hur denne vill avla sina djur.

Renar är känsliga för klimat- och miljöförändringar och hotas av det allt varmare klimatet på grund av mer nederbörd vintertid vilket resulterar i istäcken över den värdefulla renlaven som renen betar vintertid. Förutom detta hotas renen av hög predation där siffror mellan 59 000 och 64 000 rovdjursdödade renar är årliga förluster. Detta har lett till en start på en biologisk kollaps inom renstammen i Sverige, enligt forskare. Ett

björnpredation projekt startade i två samebyar i norra Sverige för att utreda hur hög den faktiska predationen var samt hur man skulle kunna motverka predation.

En renhjord bör innehålla störst andel högproducerande vajor med hög vikt och goda maternella egenskaper. Det är de genetiska faktorerna som avgör hur stor potential vajan har att växa och det är miljön som kontrollerar tillväxten i form utav gott bete och få yttre störningar. Studier har gjorts både på caribou och renar där kopplingen mellan god kondition hos vajan, ålder, produktivitet och kalvöverlevnad har studerats. Studier har visat på att det finns positiva kopplingar mellan dessa och att hög vikt hos en vaja påverkar både vikt och överlevnad hos kalven.

Denna studie har inriktat sig på att räkna ut medelvikter hos dräktiga vajor i samma samebyar där predation projektet pågick, samt att se hur kalvöverlevnaden sett ut fram till kalvmärkning för dessa populationer. Totalt beräknades 1812 vajor vara dräktiga och de totala medelvikterna på dessa beräknades vara 73,2 kg för Udtja och 70,9 kg för Gällivare. Medelvikterna beräknades på samtliga vajor som vägde över 60 kg eftersom den procentuella dräktigheten skiljer sig markant mellan vajor som väger under 60 kg och över 60 kg.

Hypotesen i studien var att samebyn med lägst medelvikter skulle ha lägre kalvöverlevnad på grund av att tidigare studier visat på detta samband. Det visade sig dock att Gällivare med lägst medelvikter hade högst kalvöverlevnad båda åren. Något skrämmande med kalvöverlevnaden var att den totala överlevnaden i medel uppgick till 42,0 % för Udtja och 56,7 % för Gällivare under de här två åren. Samebyn med lägre medelvikter hade högre kalvöverlevnad och detta förklarades bland annat av högre björnpredation eller möjligtvis andra avelsstrategier. Slutsatsen av studien är att medelvikter kan se olika ut i olika samebyar och kalvöverlevnadsprocenten kan se annorlunda ut, samt att det är viktigt med goda maternella egenskaper hos renvajan.

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