Anna Nilsson successfully defended her PhD-thesis in Animal Science on 5 June 2003 at Department of Animal Breeding and Genetics, Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden. The title was: **Adaptation of Semi-domesticated Reindeer to Emergency Feeding**. Professor Knut Hove, NLH, Ås, Norway was the opponent and the evaluation board consisted of Professor Timo Soveri, University of Helsinki, Finland, Professor Kjell Holtenius, SLU, Uppsala, Sweden, Dr. Terje Josefsen, Veterinary Institute of Tromsø, Norway, Dr. Monica A. Sundset, University of Tromsø, Norway and Assistant Professor Lena Lidfors, SLU, Skara, Sweden. Supervisor has been Assistant Professor Birgitta Åhman, SLU, Uppsala together with assistant supervisors Professor Öje Danell and Professor Kerstin Olsson from SLU, Uppsala and Dr. Michael Murphy, Lantmännen Animal Feed Division, Stockholm, Sweden.

Anna Nilsson (b. 1967), M.Sc. in Animal Science, became involved in reindeer research via a three-year long study starting in winter 1992/93 at Vuolda, Arjeplog, Sweden dealing with feeding of silage based diets to reindeer intended for slaughter. During these experiments she got interested in the often difficult first phase of adaptation to a new diet, a situation that is especially problematic when the reindeer are in poor condition as in an emergency feeding situation. In winter 1995 she and her group of supervisors got research grants from FORMAS and the Sami Fund in Sweden for a PhD-project to investigate the physiological characteristics of reindeer in relation to nutritional status and transition from pasture to feeding. The intention of the experiments conducted was to mimic a practical feeding situation as closely as possible. To detect how the adaptation affected the whole animal, a wide range of sampling procedures were performed and analysed, *e.g.* feed intake, body mass and depot gains or losses, blood metabolites, rumen metabolism, animal behaviour and meat quality. Techniques to be used were tested and developed in studies prior to the main experiment which was performed at Oulu University, Finland in winter 1996/97.

The thesis was based on the following five papers:

I. **Nilsson, A., Danell, Ö., Murphy, M., Olsson, K. & Åhman, B.** 2000. Health, body condition and blood metabolites in reindeer after submaintenance feed intake and subsequent feeding. – *Rangifer* 20(4): 187-200.

II. **Nilsson, A., Murphy, M. & Åhman, B.** 2003. Rumen content in reindeer (*Rangifer tarandus tarandus*) after submaintenance feed intake and subsequent feeding. (Manuscript).

III. **Åhman, B., Nilsson, A., Eloranta, E. & Olsson, K.** 2002. Wet belly in reindeer (*Rangifer tarandus tarandus*) in relation to body condition, body temperature and blood constituents. – *Acta Veterinaria Scandinavica* 43: 85-97.

IV. **Nilsson A., Norberg, H., Olsson, K.. & Redbo, I.** 2003. Behaviour in semi-domesticated reindeer during submaintenance feed intake and subsequent feeding. (Manuscript).

V. **Wiklund, E., Nilsson, A., & Åhman, B.** 2000. Sensory meat quality, ultimate pH values, blood metabolites and carcass parameters in reindeer (*Rangifer tarandus tarandus* L.) fed various diets. – *Rangifer* 20(1): 9-16.

Abstract: Emergency feeding of reindeer occasionally becomes necessary due to deep snow or ice crust preventing the reindeer from reaching the vegetation on the ground. The artificial feedstuffs available are not optimal for reindeer in poor condition and adaptation problems may occur. The aim of the thesis was to compare emergency feeding strategies based on lichens and feed stuffs commonly available in practice. Seventy-two reindeer calves were kept outdoors and continuously followed by observing their behaviour and collecting physiological data. The reindeer were first fed insufficient amounts of a lichen-based diet, followed by one starvation day to mimic a feed emergency situation. Four feeding strategies were then applied and the adaptation of these calves was compared with a control group, which received the lichen diet ad libitum. The control group remained healthy and showed consistent behaviour throughout the experiment and a group fed the lichen diet, after the starvation day, quickly recovered. This may be related to a substrate specific group of lichen utilizing bacteria that was found in their rumens. The adaptation to diets based on commercial reindeer feed and silage resulted in initial problems with diarrhoea and malnutrition. Another symptom was "wet belly syndrome", which started during the restriction period and continued during feeding. The fluid making the reindeer fur wet was found to be of internal origin, but the disease was not linked to any specific diet. As feeding proceeded, the animals adapted to the commercial feed and their behaviour became similar to the control group. Increased concentrations of protein, urea and insulin in the blood plasma, higher counts of protozoa and concentrations of volatile fatty acids in the rumen and gains in muscle and fat depots confirmed the adaptation. The thesis shows that collection of a wide range of physiological data, together with behaviour studies in animals kept under equal conditions was a suitable method to evaluate

the adaptation of reindeer to emergency feeding. It became clear that the general condition of the animals, before the feeding started, as well as the diet composition, affected the ability of the reindeer to adapt to feeding.

Thesis distribution: Department of Animal Breeding and Genetics, SLU, P.O. Box 7023, S-750 07, Uppsala, Sweden.

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Robert Bertrand Weladji (b. 1967 in Cameroon) sucessfully defended his dissertation ***Climatic Influences on the Life History and Population Dynamics of a Northern Ungulate,*** **Rangifer tarandus** for the degree Doctor Scientiarum at the Agricultural University of Norway (NLH), Ås, on June 19th, 2003.

Robert Weladji completed his B.Sc. degree in *Wildlife and Forest Ecology* at the Department of Forestry, University of Dschang (Cameroon) in 1994. He then started working for the Department of Wildlife and Protected Areas, Ministry of Environment and Forestry in Cameroon. Thereafter, he joined the NLH where he obtained his M.Sc. degree in *Management of Natural Resources and Sustainable Agriculture* in 1998, at the Centre for International Environment and Development Studies. He started his doctoral work in 1999 at the Department of Animal and Aquacultural Sciences of the NLH, where he is currently a postdoctoral fellow.

The State Loan Educational Fund of Norway (subsistence allowance) and the Norwegian Reindeer Husbandry Development Fund (running costs for the project) provided financial support for the work.

The thesis is based on the following five papers:

I. **Weladji, R.B., Klein, D.R., Holand, Ø. & Mysterud, A.** 2002. Comparative response of *Rangifer tarandus* and other northern ungulates to climatic variability. – *Rangifer* 22: 33-50.

II. **Weladji, R.B., Steinheim, G., Holand, Ø., Moe, S.R., Almøy, T. & Ådnøy, T.** 2003. Temporal patterns of juvenile body weight variability in sympatric reindeer and sheep. – *Annales Zoologici Fennici* 40: 17-26.

III. **Weladji, R.B., Holand, Ø. & Almøy, T.** 2003. Use of climatic data to assess the effect of insect harassment on the autumn weight of reindeer (*Rangifer tarandus*) calves. – *Journal of Zoology* 260: 79-85.

IV. **Weladji, R.B. & Holand, Ø.** 2003. Global climate change and reindeer: effects of winter weather on the autumn weight and growth of calves. – *Oecologia* 136: 317-323.

V. **Weladji, R.B. & Holand, Ø.** 2003. Sex ratio variation in reindeer: a test of the extrinsic modification hypothesis. – *Wildlife Biology* 9: 29-36.

Summary: There are increasing evidence that climate influences life history traits and population parameters of ungulates, and thereby their population dynamics. Climate effects on ungulates may be direct (*e.g.* increased energetic costs of moving through deep snow and in accessing forage through snow) or indirect (*e.g.* effect on forage plant biomass and quality, level of insect harassment and associated parasitism). Reindeer inhabit extremely seasonal environment, but has received little attention in the research of climatic effects on large herbivores. Using data from five reindeer grazing districts in Norway, the aim of the thesis was to analyse the relationship between climatic conditions (local and global) and interannual variation in body weight, growth rate and offspring sex ratio in reindeer, controlling for the effect of density. The prediction that summer rather than winter grazing conditions are more important for juvenile body growth in reindeer was also tested. An index of the North Atlantic Oscillation (NAO), the dominant mode of winter climate variability in the North Atlantic region, was used as a measure of large-scale climate. The results showed that autumn body weight of reindeer and sheep, as well as autumn growth rate and offspring sex ratio of reindeer varied between years. Autumn weights of reindeer also varied between populations. Despite sheep being fed indoors during winters, there was a positive relationship between autumn weights of sympatric reindeer and sheep, with no difference in the intrinsic variability of the two co-existing species. Interannual variations in body weight and offspring sex ratio of reindeer were influenced by local weather (winter and summer), global climate (measured by the NAO winter index) and population density. Local summer conditions appeared to be relatively more important than local winter conditions for reindeer body growth. Warm summers negatively affected autumn weight of reindeer calves, suggestively through insect harassment, with females being more vulnerable. The proportion of male calves decreased with increasing summer temperature and precipitation. An increase in the NAO winter index when calves were in utero, negatively influenced reindeer body