

## Activity pattern of calf and its integration into herd in European bison, *Bison bonasus*

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Received 1 March 2005; Accepted 7 November 2005

**A b s t r a c t.** Eleven calves from the European bison breeding centres of Białowieża National Park (Poland) were observed during the first 3 months of life to investigate their integration patterns into a group. Spatial relations of the calf with other bison in a group were reflected in the distance to group members of various categories and in the extent to which individuals synchronized their behaviour. Data on changes in the calf's activity pattern provided information on the transformation in feeding habits. Three main phases were identified in the early period of European bison's life: (1) establishment of mother-infant bond, (2) incorporation of a calf into a calf subgroup, and (3) integration of the calf into the whole group. Incorporation of the calf into a herd started in week 2. The pattern of calf's integration was determined by transformation of its activity pattern. At first similarity of activity patterns among calves resulted in synchronization of their behaviour and proximate company. In the next phase, the change in the primary source of nutrition from nursing to grazing and gradual alteration of activity pattern towards an adult's one led to non-specific spatial relations with group members and integration of the calf into the herd.

**Key words:** *Bison bonasus*, synchrony of activity, spatial relations, calf's socialization

### Introduction

In gregarious ungulate species, the cohesiveness of social units forms the basis for activities such as foraging, roaming or predator avoidance. For calves, their presence in a group ensures various advantages like higher safety, playmates, learning adult's diet through imitation or gaining familiarity with forage and water distribution. Neonates, being new members of a social unit, have to integrate into a group. E g e r t o n (1962) recognises two processes involved in the social integration of an American bison *Bison bison* calf. The first one is the development of the calf and changes in its behaviour to resemble that of adults. When a calf is 3 to 4 months old, its behaviour is the same as in yearlings, with the exception that it suckles and plays. The second process is the gradual loosening of the initially close mother-calf bond so that the calf becomes an independent member of the herd (E g e r t o n 1962). The changes in spatial relations of calves with other group members are reflected in the distance from other bison and in the extent to which individuals synchronize their behaviour (G r e e n 1992b).

In European bison a cow may calve while within a group (D a l e s z c z y k & K r a s i ń s k i 2001) or she leaves the group for parturition and returns with her newborn calf after a few days (K r a s i ń s k i et al. 1999). This means that in this species a calf stays within a social unit virtually from the beginning of its life. Mother-calf relationships in European bison during the early period of calf's life were studied previously (D a l e s z c z y k 2004). The objective of this study was to analyse changes in activity pattern of a calf and in its spatial relations with group members other than the mother in order to discover the pattern of social integration of a calf in this species.

## Material and Methods

Research was conducted at the European bison captive breeding and show centres in Białowieża National Park, Poland, from July 1998 to October 2000. Eleven calves (4, 7) were observed from birth to the 14th week of calf's life. Observations were conducted from dawn to dusk and during long summer days alternately from dawn to midday and from midday to dusk constituting a whole observation day out of two successive days. Subjects were observed every day in the first week of the calf's life and one day a week during the rest of research period. Instantaneous scan samples were conducted at 5-minute intervals to note the distance between calves and other bison in a group, and the types of activity performed by them; sucking posture of a calf was noted during focal animal sampling (Altmann 1974). Total observation time of one calf averaged 196 h. For comparison purposes, the same data was gathered for four calves born the previous year.

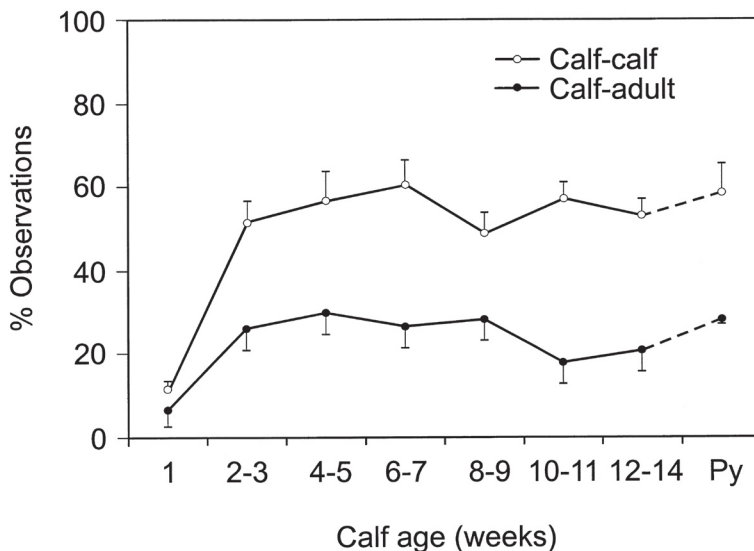
A distance of about 3 m was assumed to be an important boundary in the social interactions of European bison (Daleszyk 2004). In analysis of distance between the calf and other group members I took into consideration two categories of bison: peers (other calves in a group up to one year of age) and adults other than the mother. To describe the activity pattern and activity synchrony, the following terms were used: (1) Resting: includes lying and standing without foraging. (2) Foraging: includes also exploring of surroundings. Exploring consisted mainly of sniffing and tasting various objects and differentiating it from real foraging was sometimes arbitrary. (3) Activity of observed animals was considered to be synchronized when: (a) both individuals rested, (b) both foraged, (c) both walked without foraging, (d) both played, (e) both calves sucked or mother gave suck/calf sucked. I also checked whether nursing in one calf could be a factor initiating nursing in another one. Nursing bouts of various calves were considered to be linked when they were not separated by more than 5 minutes. Details of living conditions of observed animals and methods used were given elsewhere (Daleszyk 2004).

In statistical analysis mainly parametric tests were used (ANOVA, repeated-measure ANOVA – RMANOVA, and t-test for independent samples). For RMANOVA, the weeks of a calf's life were grouped as follows: 1, 2–3, 4–5, 6–7, 8–9, 10–11, 12–14, and the mean in each period were repeated measures. Two calves were omitted from this analysis because data was not available in all periods. Chi-square test ( $\chi^2$ ) was used for comparison of frequencies. Prior to parametric analyses, data was tested for normality and percentages were transformed log or into the form  $\arcsin\sqrt{x}$  to achieve normal distribution. Post hoc comparisons were calculated with the Tukey HSD test for unequal sample size (Spjotvoll-Stoline test). Two-tailed statistical tests were used throughout. All analyses were performed using *STATISTICA* software (StatSoft 1984–2000).

## Results

In week 1, calves were seldom recorded within 3 m from bison other than their mothers (Fig. 1). From weeks 2–3 this distance considerably decreased, to higher degree in the case of peers than of adults (ANOVA  $F_{7,133} = 2.24$ ,  $p = 0.035$ ). However, in the calves born the previous year there were no dissimilarities in the frequency of records within 3 m from group members belonging to various categories (post-hoc test).

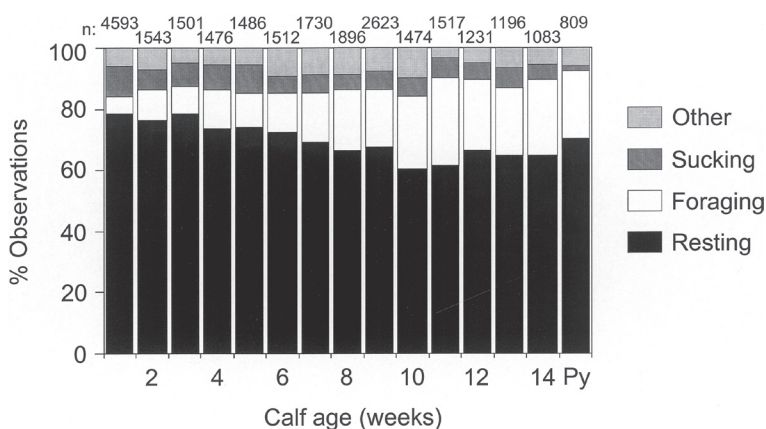
During the first 3 months of life proportions of time calves spent on sucking and resting decreased (Fig. 2; ANOVA  $F_{13,123} = 2.88$ ,  $p = 0.0012$ ;  $F_{13,123} = 2.32$ ,  $p = 0.0085$ , respectively), while proportion of time devoted to foraging increased ( $F_{13,123} = 6.06$ ,  $p < 0.0001$ ). Earliest observations of rumination involved calves 2–3 weeks old. Sucking fraction was considerably



**Fig. 1.** Mean percentage of scan samples in which calves were at a distance of 0–3 m from other calves and adults other than their mothers, in relation to calves' age. 'Py' denotes the calves born the previous year. Vertical bars represent SE. Sample sizes were from 2266–4298 for the calves 1–14 weeks old and from 764–964 for the calves born the previous year.

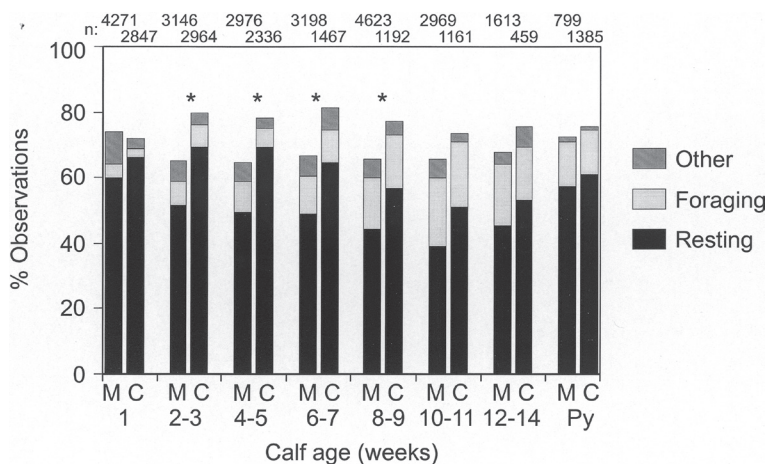
higher than foraging in week 1 (test  $t = -2.83$ ,  $p = 0.01$ ) and lower from week 6 on (from week 6 test  $t \geq 3.11$ ,  $p \leq 0.006$ ). Comparison of activity patterns between calves 14 weeks old and the calves born the previous year revealed no differences concerning time spent on foraging or resting ( $\chi^2_1 = 1.48$ , NS, and  $\chi^2_1 = 2.08$ , NS, respectively), but sucking occupied considerably less time in older calves ( $\chi^2_1 = 14.76$ ,  $p < 0.0001$ ).

The calf sucked standing parallel to the mother's side or from behind between the mother's hind legs. The latter posture was characteristic for sucking while the mother was foraging or when she tried to terminate nursing by walking away before her calf was satiated. Percentage of nursing time spent while sucking from behind rose with calf's age from 21% in weeks 1–4 to 37% in weeks 11–14 ( $\chi^2_6 = 88.70$ ,  $p < 0.001$ ).



**Fig. 2.** Mean percentage of scans in which calves performed various types of activity, in relation to calves' age. 'Foraging' includes also exploratory behaviour. 'Py' denotes the calves born the previous year. Sample size (n) is given above each column.

In weeks 2–9, calves synchronized their activity significantly more often with activities of peers than with activities of their mothers (Fig. 3). The linkage between the nursing bouts of different calves was checked in groups containing 3 and 4 calves born in a given year. Fifty-six percent of nursing bouts recorded were linked.



**Fig. 3.** Mean percentage of scan samples in which calves synchronized various types of activity with activity of mothers (M) and activity of other calves (C), in relation to calves' age. Sample size (n) is given above each column. Stars (\*) denote significant differences in the total amount of activities synchronized (t-test,  $p < 0.05$ ).

## Discussion

Three main phases can be identified in the early period of European bison's life. These are: (1) formation of mother-calf bond, (2) gradual incorporation of a calf into a calf subgroup, and (3) integration of the calf into the group as a unit. The earliest period of an ungulate's life is a phase of establishing the mother-infant bond (review in L e n t 1974), and in European bison this phase typically lasts week 1 (D a l e s z c z y k 2004). At that time the distance between calf and mother is especially small and maternal care is especially intense while contacts with other group members are limited (D a l e s z c z y k 2004). Results of present study suggested that integration of the calf into a group began in week 2 and it started through incorporation of the calf into the peer subgroup. Some behaviours like sucking, exploring surroundings or playing are typical for calves only. The proportions of time spent on other activities (long rest, short foraging) were similar among calves and differed considerably from that of adults (see D a l e s z c z y k 2004, Fig. 5). Similar pattern of activity formed the base for close spatial relations among calves, synchrony of their behaviour and spending time in proximity of each other. A high fraction of nursing bouts being linked among calves provided another evidence of them influencing each other behaviour and acting as a unit. Simultaneously, the bond with the mother gradually loosened and the time mother and calf spent at a short distance progressively diminished (D a l e s z c z y k 2004). In Maremma cattle, calves are recorded close to peers more frequently since week 2, along with an increasing distance from the mother (V i t t a l e et al. 1986). In wildebeest *Connochaetes taurinus* and American bison, calves seem to be more independent and reduce their efforts at contact maintenance with mothers when other conspecifics are near (E s t e s & E s t e s 1979, G r e e n 1992a) so the presence of herd accelerates independence of infants (G r e e n 1992b).

In month 2, a mothers' contribution to maintaining nursing contact considerably declines (D a l e s z c z y k 1004). To satisfy growing nutritional needs, calves had to maintain nursing contact by themselves, which was manifested in the change in their sucking posture (this study). The limited amount of milk obtained could be one of the factors stimulating grazing, which intensified and since month 2 overtook nursing. Physiological changes connected with a shift in feeding habits and gradual maturing of activity pattern (declining sucking and resting time, increase in foraging) were reflected in levelling of activity synchrony between the sets of calf-calf and calf-adult (its mother) and in disappearance of differences in the distance to peers, the mother and other adults (D a l e s z c z y k 2004, this study). Maturing American bison calves also synchronize their activities with the rhythm of the group (M c H u g h 1972), and month 3 is a transition period when calves change their behaviour to resemble that of adults (G r e e n 1992b). Thus, development of the European bison calf and transformation of its activity pattern determine the pattern of its integration into a herd, and the presence of other calves in a group facilitates the process. It seems that by one year of age, a European bison is completely incorporated into the group. Although it still may suck, it is independent with regard to its nutritional demands and shows no preferences in its distance to group members of various categories.

#### A c k n o w l e d g e m e n t s

I am very grateful to Prof. M. K r a s i ń s k a for useful comments on the manuscript and E. B l a v a s c u n a s for correcting the English text. I am indebted to Dr Cz. O k o ł ó w , the Director of the Białowieża National Park, for the permission to conduct the study and the staff of BNP for facilitating the work. I thank the students who helped with the collecting data. The study was partly supported by the State Committee for Scientific Research, Poland, grant 6 P04G 057 21.

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