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## Social Aspects of Wallowing Behaviour in Red Deer Herds

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*With 3 figures*

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Wallowing behaviour has been observed in various ungulate species, often combined with pawing and horning the ground ("Bodenforkeln" or "-hornen"). It has been described especially for bovidae and cervidae. MCHUGH (1958) and LUMIA (1972) described it for the American buffalo, SCHLOETH (1961) for cattle inhabiting the Camargue, GEIST (1963) for moose, STRUHSAKER (1967) for wapiti, MCCULLOUGH (1969) for the Tule elk, SCHALLER (1967) for *barasingha*, and DARLING (1937) for red deer. In case of antelopes this type of behaviour has not been observed (WALTHER 1968).

MCHUGH (1958) and SCHLOETH (1961) have emphasized the social function of this special behaviour in the bovid species. In the various cervid species so far studied, all the authors discussed wallowing activities, but only in connection with pre-rut and rutting behaviour (e. g. displacement activity, redirected aggression etc.). This phenomenon has also been observed in connection with extreme temperatures combined with insect attacks, in the winter season, and in spring-time and early summer during the hair change.

It is felt that, in the case of red deer, there should be more factors explaining the biological function of wallowing, as this behaviour was observed during other seasons too.

SCHLOETH (in MÜLLER-USING and SCHLOETH 1967) suggests that territorial and social behaviour in connection with wallowing should be more stressed than a purely functional interpretation. In this paper some social behaviour aspects of wallowing will be discussed.

### Sources of information

The data pertains to the random observations made during a 4 year field study in an alpine region (Gossow 1971), and during an experimental study in the Black Forest (SCHÜRHOLZ 1972), which lasted for a few weeks. These data will now be utilized for analysing the wallowing behaviour, not in all its aspects, but confined to special social ones.

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Two herds which were observed in the Black Forest enclosures contained 4 and 6 animals respectively. Its sociological composition (and social rank order as well) was as follows:  
*Aildwald*-enclosure: a 5 years old stag, a 6 to 7 years old ♀ with a calf, and a female yearling.

*Tonbach*-enclosure: an over-aged, but nevertheless still dominant 23 years old stag, an 1 year old spike (22 months), a 10 years old ♀ without calf, a 3 years old ♀ with a calf, and a 22 years old ♀.

The herd in the alpine population was free ranging. During the summer months approximately 150 animals were concentrated in one group, mainly stags of all age classes (in velvet), accompanied by some barren and yearling ♀♀.

The number of wallows in the enclosures was greater than the number of animals living there. The summer home range of the big red deer herd is a high altitude pasture (for cattle grazing), surrounded by light forests and dense thickets, rocks and valleys. Within the grassy plains and in the forested areas a number of wallows existed, which were big enough to provide place for 20 to 30 stags at a time (Fig. 1).



Fig. 1: Some 35 red deer stags (antlers still in velvet) in and around a wallow pool. Predominantly the big antlered stags are really wallowing, the smaller antlered ones are only passively participating. (After a photograph by H. Gossow)

### Observations

Obviously the wallows cannot be called a limited ecological resource, neither in the enclosures, nor in the alpine study area. So far, it has been observed that the wallowing activity of the herds often is confined to only one particular wallow at a time. All the members of the herd go to this particular wallow, even if there are many empty wallows nearby. Because of the limited space available in one wallow, it was not always possible to accommodate all the members of the herd.

The wallowing behaviour of the enclosure animals could be repeatedly observed as described in the following two typical examples (see also Fig. 2 and 3):

February 26th:

17.28 hrs. The calf (D) walks to the wallow A6, pawing the muddy ground, then frolicking (jumps with arched back and straddled legs, the head pointed downwards).

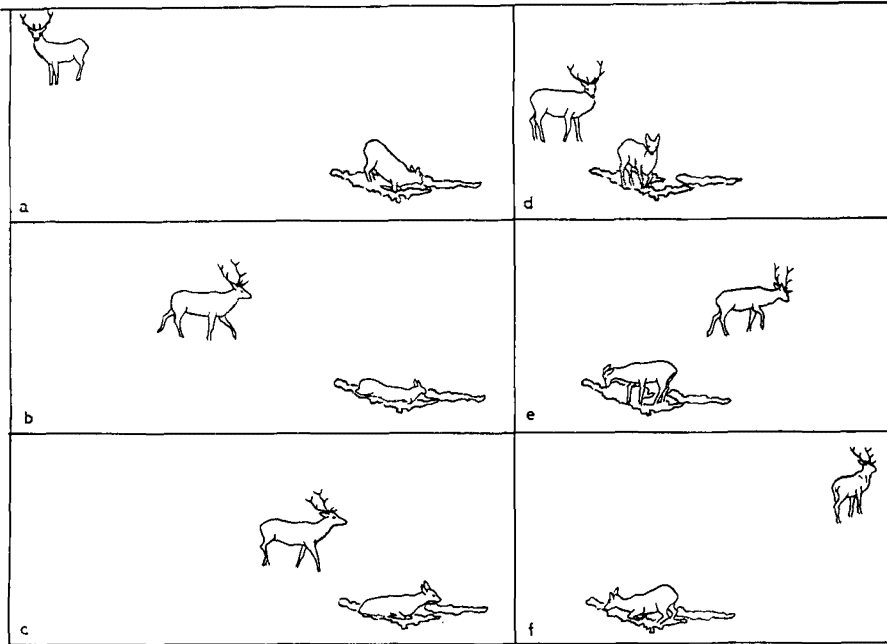


Fig. 2: A female yearling starts wallowing, but is chased away by a stag, who then departs; the ♀ again starts wallowing. (After a photograph series by G. SCHÜRHOLOZ)

17.34 hrs. — pushed away by the stag (A), who afterwards “horns” the ground and wallows intensively; A leaves the wallow, and stops after a 5 m walk; looking around. Now C, the yearling ♀, makes use of the opportunity and lies down in the wallow; as soon as A sees that C is in the wallow, he turns back and pushes C out with an violent antler threat. B, the other ♀, tries to wallow now, but is also pushed away by an antler threat and a jump in her direction by A. This procedure is repeated once more by both animals, and then A chases B about 30 m away; this is continued in a more playful manner for approximately 12 min.

February 29th:

12.55 hrs. — A horns the mud of a wallow, lies down and wallows intensively, leaves the wallow, B takes the opportunity, lies down, wallows, gets up, kicks the mud with a front leg, leaves the wallow; the calf takes her place, paws the mud, lies down and stretches the head, rubbing the throat in the mud. C tries to approach, but is chased away continuously by B, who goes in the wallow at different times, wallowing on her back from one side to the other. B reacts very aggressively towards C; she tries to bite and to kick the yearling ♀ and pursues her over short distances. B again in the wallow; D approaches and kicks B with a front leg; B jumps up, kicks the calf and pursues it over a long distance; biting of C occurs 5 times, and B can be seen in the wallow 8 times. A appears and chases B out of the wallow with an antler threat, but does not wallow this time. D comes again, lies in the mud but is again chased away by the ♀ B. The wallowing procedure of the group ends with a playful “tag and catch”, lasting approximately 10 minutes. All group members participate.

The preparation and behaviour before wallowing seemed almost to be ritualized — given that the animals had the time for doing so. This ritualized behaviour pattern includes different steps in the following order:

Pawing the mud of the wallow with one front leg, — pawing the mud with the other front leg, — touching the mud with the forehead and soft rubbing, — kneeling down with the forelegs, — lying down, — rolling from one side over the back to the other.

Rolling over the back was quite typical for the antlerless ♀♀, but was observed only once for an antlered stag.

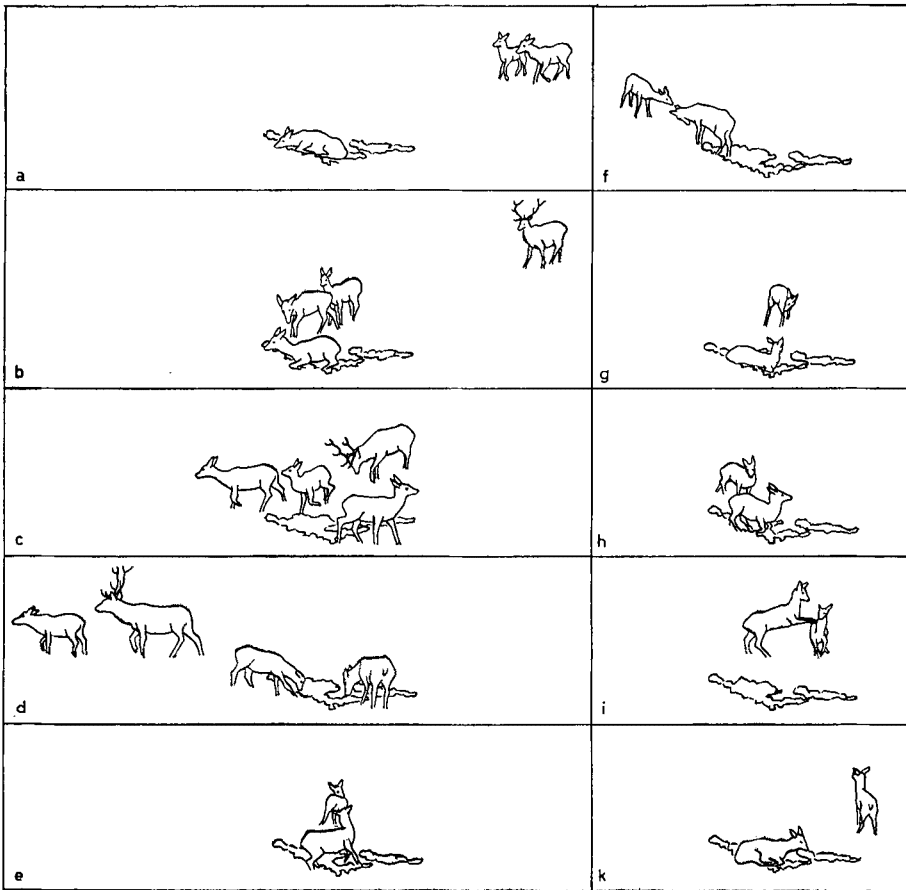


Fig. 3: A red deer hind with her calf approaches a wallowing yearling ♀, which gets up. But then all three animals make way for a stag, who concentrates his thread behaviour on the hind (= next in the social hierarchy to him; cf. text). Afterwards the calf repeatedly tries to chase off the yearling ♀ from the wallow pool, but without success. (After a photograph series by G. SCHÜRHOLOZ)

Within the big summer herd of stags in velvet, mass wallowing was observed repeatedly. In contrast to the enclosures where wallowing was observed at all times of the day, wallowing of the big herd seemed to be confined to the late noon hours (between 13.00 hrs. and 16.00 hrs.). This coincides with the time when the animals flock together again for their common activities in the afternoon and in the night. Usually the herd splits up in the early morning hours after a common feeding period in the open pastures, and the animals disperse in the neighbouring forest.

The wallowing of both, the summer and the enclosure herds, seemed to be initiated at random by any animal (no specific age). The trigger for the other deer can be either the sight or the sound, e. g. pawing, snorting, groaning, of already wallowing animal(s), causing the wallow to be filled within a very short time.

Aggressive social interactions, similar to those described for the enclosure groups, were observed here too. After a successfully finished wallowing, frolicking and jumping occurred especially amongst younger stags; other animals

were simply lying down and resting beside the wallows. The whole procedure could be finished already after 10 to 15 min, ending in a quick, flight like departure of a group (especially if initiated by older, high ranking stags), or be continued up to 30 and more min, before the herd moved to other areas for feeding or resting.

At this stage one could differentiate between animals which had participated in wallowing and which had not. The bright red coats of the latter ones were clearly distinguishable from the mud-covered, grey and blackish ones; the color depends upon the consistence of the wallows (peat wallows with a high content of organic material, or wallows in more loamy ground).

### Quantitative data

Detailed behaviour observations could be done during wallowing in the enclosures because of the optimum conditions. The small number of animals in the groups enabled the observer to collect individual data according to the rank order positions. The best information was gathered from the *Ailwald* enclosure (see Table 1).

Table 1: Competition activities of 4 red deer at wallows in an enclosure

Rank order	Animal (sex, age)	is dominant over (tolerates wallowing of) <threatens back against>			competition activities in total
		B	C	D	
A	♂, 5 y	7 (1)	6 (1)	5	18 (2)
B	♀, 7 y		8	5 (1)	13 (1)
C	♀, yr/ig			6	6
D	♂, calf	<1>	<2>		<3>
Total		7 (1) <1>	14 (1) <2>	16 (1)	37 (3) <3>

It could be seen that most of the repression activities were exhibited by the dominant stag A; here the frequency of the social encounters decreased with decreasing rank order positions. The threats and counter threats of the calf D of the *Ailwald* enclosure are, according to the observations, similar to those observed in calves of free-ranging herds. This age class is not fully integrated yet in the social hierarchy of the herds, which seems to be the reason for the often observed uncoordinated "nuisance" activities of the youngest group members.

The stags in velvet (antlers still growing at this time of the year) within the large summer herds are very tolerant in their behaviour to each other. Aggressive behaviour like pushing, threatening, kicking, biting, and pursuing which often can be observed during other seasons and which is typical for cow herds, is at this time of the year in the stag herds rare. When it does occur then it is concentrated around the wallows and in the time shortly before common resting periods (fights for the best resting places). These big summer herds do not seem to have a well established social rank order (Gossow 1971 b; Lincoln et al. 1970) as long as the stags are in velvet. But the social encounters are obviously influenced by some mechanism, which may be based on behavioural differences

within the animals (e. g. degree of self-confidence) and/or morphological differences between the various age classes (e. g. size, proportion, antler length and structure). The mane, a very important factor during the rut, is at this time of the year not developed yet.

Since only a few animals within the large groups were individually known (no marked animals), a correct age determination was not possible.

Antler length, expressed in "ear length" times  $n$ , was used as a parameter for an approximate age classification for this herd; this classification seemed to correspond to the rank order, since competitive behaviour was mainly observed amongst stags with similar antler length (Gossow in prep.).

The wallowing activities in 2 herds of differing size and composition and at different occasions are quantified in Table 2.

In the summer herd, in the two cases when wallowing was fully recorded, a similar pattern of behaviour was observed in the various sociological classes (classes according to antler length). The total number of animals, participating in the wallowing, was 52 % and 50 %. The wallowing activity was concentrated in the class of large antlered bulls. Single ♀♀ and spikes seemed to be more successful in finding a place to wallow than the middle aged and younger stags.

Table 2: Wallowing activities in two free ranging red deer herds containing 147 (91) animals

	Sociological classes (cf. text):							N
	barren & yrlyg. ♀♀	stags : spikes	antler length till 1.0	classes 1.5	classes 2.5	classes 3.5	classes (ear length x n) ≥4.0	
animals of each class present in the herds	20 (15)	10 (5)	17 (12)	10 (10)	19 (9)	43 (26)	28 (14)	147 (91)
wallowed animals	4 (4)	1 (1)	2 (1)	1 (1)	6 (4)	36 (24)	23 (12)	73 (47)
expected to wallow : 50 (52) %	10 (8)	5 (3)	8 (6)	5 (5)	9 (5)	22 (13)	14 (7)	73 (47)
wallowed animals (%)	20 (27)	10 (20)	12 (8)	10 (10)	32 (44)	84 (92)	82 (86)	49.7 (51.6)

## Discussion

Both, the enclosure herd in late winter and the large summer herd, showed a similar behaviour pattern during the wallowing procedure. Small deer groups seem to have a fixed (most often linear) rank order pattern during all seasons. This was clearly observed for the enclosure herds (SCHÜRHOLZ 1972) as well as for free-ranging winter herds which received supplementary food (Gossow 1971 a), but not so distinctly for the large summer herds (Gossow 1971 b; LINCOLN et al. 1970). Limited ecological conditions (food, resting places, salt licks etc.) strengthen the implications in the social hierarchy. In the observed cases of wallowing, the wallows were not a limited ecological resource, since there was a sufficient number of them in the range of each single animal. But the concentration of the wallowing activity of the whole herd around one wallow at a time caused that particular wallow to become a limiting factor and strengthened the social encounters and activities. This seems to form the background of the social function of wallowing in red deer herds outside the rutting season.

Wallowing is often initiated by younger group members, and seems to arouse the interest of the older dominant animals. This leads to the observed competition situation (rank order demonstration).

During the summer season high quality forage is abundant and food competition rare; there is no reason for aggressive encounters under these conditions, as there would be, for example, in the winter time, when the food becomes a limiting factor. It was pointed out before that stags in velvet are highly tolerant of each other and do not show the continuous defending behaviour of their social rank as they do when their antlers are hard. It can therefore be concluded that wallowing and competition in the described manner serves as a means for the social integration of the younger group members into the bachelor herd.

It seems to be curious that the above discussed social integration should be connected especially with wallowing. This could be due to the important meaning (display effect) of wallows and wallowed stags during the rutting season for (on) younger subdominant  $\delta\delta$  (cf. DARLING 1937).

The wallowing of the summer herds usually occurred at the beginning of their common activity periods. This seems to be a mechanism for synchronizing the activity. This hypothesis is supported by the observations that on days without initial wallow 'parties' the big herd was more dispersed over the range, and often for a longer time, than on days with wallowing.

### Summary

An obvious feature of wallowing behaviour in red deer outside the rutting season is its correlation with rank order positions and/or age classes (antler size). Usually rank order patterns do become apparent, especially under ecologically limited conditions. Wallow pools proved to be in surplus in the investigated red deer ranges and enclosures. But the restricted wallowing activity of the whole herd (of 4, 6 or about 150 animals) to *one* pool changes this particular pool into a limited resource. Here the rank order becomes apparent.

Functional aspects of this type of wallowing behaviour seem to be: improved social integration of the younger herd members as well as a better synchronization of herd activities.

### Zusammenfassung

Eine auffällige Eigenart des Suhlers beim Rotwild ist eine oft zu beobachtende Rang-Gebundenheit. Vorzugsweise ranghohe Tiere bzw. geweihstarke (ältere) Hirsche kommen dann in den Genuß des Suhlers; an den Suhlpätzen kehren sie ihre Position oder Stärke oft demonstrativ hervor.

Rangordnungsbeziehungen werden üblicherweise unter ökologisch limitierten Bedingungen besonders deutlich. Suhlen waren in den untersuchten Rotwildgebieten bzw. -gattern im Überfluß vorhanden. Beschränkung der Suhlaktivität in den beobachteten Rotwildrudeln (im Gatter 4 bzw. 6 Tiere, sowie im Freiland bis zu 150 Stück starke Sommer-Rudel) auf jeweils nur eine Suhle ließ diese dann allerdings zu einem limitierten ökologischen Requisit werden.

Funktionelle Aspekte dieses besonderen Verhaltenstyps scheinen nach den Freilanduntersuchungen zu sein: Verbesserte soziale Integration jüngerer Artgenossen (insbesondere Hirsche) in die Rudel-Lebensweise, sowie eine bessere Synchronisierung der Rudel-Aktivitäten.

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