Escape movements of family groups of wild boar Sus scrofa influenced by drive hunts in Lower Saxony, Germany

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Source: Wildlife Biology, 9(s1) : 43-49

Published By: Nordic Board for Wildlife Research

URL: https://doi.org/10.2981/wlb.2003.063

Escape movements of family groups of wild boar *Sus scrofa* influenced by drive hunts in Lower Saxony, Germany

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Sodeikat, G. & Pohlmeyer, K. 2003: Escape movements of family groups of wild boar *Sus scrofa* influenced by drive hunts in Lower Saxony, Germany. - Wildl. Biol. 9 (Suppl. 1): 43-49.

The population density of wild boars in Lower Saxony, Germany, has increased drastically during the last decade. High wild boar density causes severe damage to crops and increases the risk of occurrence and distribution of the Classical Swine Fever disease (CSF). Consequently, a reduction of the population density by hunting wild boar in hog cholera zones is necessary. An effective hunting method is the drive hunt performed with beaters, hunters and dogs (terriers), which force wild boars to leave their resting sites. Drive hunt, however, increases the risk of spreading wild boars over a wider area, and this leads to a greater risk of infecting other wild boars with the CSF-virus. Since 1998, ecological and behavioural data of a wild boar population in Lower Saxony, Germany, have been collected. Based on telemetric observations, data of home range size, habitat use and daily and nightly movements were collected. We investigated the effects of several drive hunts on the movements of seven radio-marked wild boar groups, and analysed 10 hunting situations and wild boar escape behaviour. In spite of heavy hunting pressure, in six of the 10 hunting situations, the escaping wild boar groups remained within their home range; in four hunting situations, the wild boar groups left their core area after the drive hunt and relocated up to 6 km away. But after four to six weeks at the latest, the groups had returned to the centres of their home ranges.

Key words: escape behaviour, home range, hunting, Sus scrofa, swine-fever-disease, wild boar

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A continuously high wild boar population seems to be reflected in the annual hunting bag statistics of Lower Saxony, Germany, where 6,076 wild boars were shot in 1960. In the following 40 years, the hunting bag has increased, and in the hunting season 2001/2002, 48,847 boar were killed.

The changes in agricultural products (more corn and wheat), higher output of acorns and beechmast combined with milder winters are some of the factors that enhance wild boar reproduction. Selective hunting, which spares females, is another factor that enhances population growth.

Because of the increase in the wild boar population, the damage to crops has increased and contamination with European Classical Swine Fever disease (CSF) has become a serious problem. In order to stop further infection, vaccination baits have become a regular preventive method and endangered areas are baited with drugs twice a year by local hunters and the Forestry Commission.

Another attempt to stop the spread of the disease is by lowering the wild boar density by means of drive hunts that include up to 80 hunters on up to 500 ha per drive. Additionally, the hunting season for yearlings has been extended by two more months than the hunting of adults. There are contrasting opinions on which method of hunting is the most effective. They vary from complete prohibition of hunting in CSF-contaminated areas

over high seat single hunt and explicit drive hunts with dogs and beaters. Drive hunts have the highest success rate in reducing the wild boar population. High seat single hunts alone cannot be sufficiently efficient if a quick reduction of the population size is required. A problem of drive hunts is, that dogs and beaters force wild boars to permanently leave their home ranges.

At the Institute of Wildlife Research (IWFo), we have studied wild boar spatial behaviour, its daily and nightly movements before and after drive hunts, and the first results have been presented (Sodeikat & Pohlmeyer 2000).

Material and methods

Study area

Since 1998, the Institute of Wildlife Research has studied the wild boar's movement in a study area situated in the north of Germany near Hannover (Fig. 1).

The study area is approximately 4,000 ha and comprises about 50% forest and 50% farm land. The central research area is a forestry commission land of approximately 1,000 ha in which pine *Pinus sylvestris* covers 55% of the woodlands, spruce *Picea abies* and oak trees *Quercus robur* and *Q. borealis* which each covers 10%, and larch *Larex europaea* and beech *Fagus sylvatica*, which covers 4% and 3%, respectively. The remaining 17% is covered by other deciduous trees. The bordering farm land mostly includes meadows (70%), and fields with grain (18%), corn (3%), potato (3%), rape (3%) and sugar beet (2%).

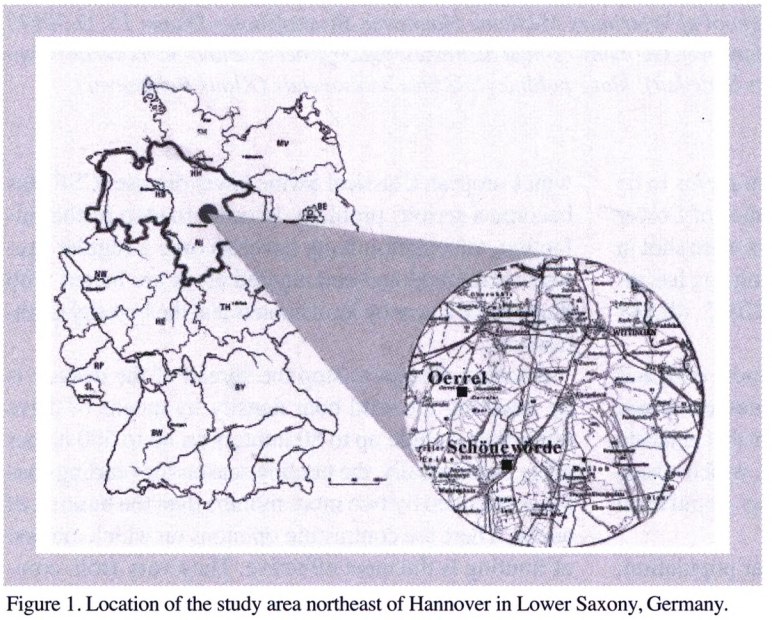

Figure 1. Location of the study area northeast of Hannover in Lower Saxony, Germany.

The neighbouring hunting estates, which covers 20,000 ha and comprises about one third forest land and two third farm land, were also included in the research programme.

The research area is situated within a CSF-contaminated area that is monitored by veterinarians. The wild boar density is not surveyed, but on the forestry commission land, 4.8 boars per 100 ha were shot during the 1999 hunting season. Single hunting is carried out all year round, whereas the drive hunt season lasts from November to the end of January.

Trapping and tagging methods

In the study area, wild boars were trapped in automatically triggered wire traps situated along the main game paths (wire cages mainly baited with corn) and marked with ear tags and ear-tag transmitters. The size of the trap (3 x 1 x 1 m) allowed several boars to be trapped at each trapping session.

Trapped wild boars weighing more than 30 kg were transferred into a smaller cage with a moveable wall that allowed the animals to be fixated to facilitate the ear-tag attachments. Animals weighing less than 30 kg were transferred into a smaller wire cage from which they were taken for marking, measuring and weighing by hand. This way of handling wild boars made the use of anaesthetising drugs unnecessary and prevented the negative effects of such drugs, e.g. lack of mobility and disorientation.

The wild boars were tagged with coloured and numbered plastic ear tags. Some of the larger individuals of a family group were fitted with radio transmitters from Biotrack, England. The ear-tag transmitter (weighing 40 g) provided a range of 1,000 m and had a longevity of about six months.

Telemetric observations

Data of home range sizes, preferred areas within the home ranges and the wild boars daily and nightly movements were collected by use of radio tracking. We traced the position of the wild boars by cross-bearings or triangulation depending on the animals' movements and positions. The accuracy of the locations is estimated using an error polygon size of 1.3 ha during night-time observation and an error polygon size of 0.3 ha at daytime. For data analysis we used only one day-time location per day, where-

as nocturnal locations were taken as simultaneous triangulations or cross-bearings every 30 minutes.

Any effect of drive hunts on temporal and spatial use of the habitat was estimated by comparing the home ranges of the same wild boar family group before and after the drive hunts. The effects of the hunting method could only be interpreted correctly by obtaining knowledge of the wild boar's 'normal behaviour'. The observation period before the drive hunt (lasting 2-10 weeks) of the various wild boar groups depended on the date of trapping. Until the start of the drive hunting season, the wild boars were more or less undisturbed. The observation period after the drive hunt (lasting 1-5 weeks) ended either when the radio-tagged wild boars were killed by hunters or when the transmitter broke down due to technical defects. In some cases, the radio-tagged wild boars were killed before or during the drive hunt, or the wild boars were outside the drive hunt area.

During the drive hunts, the transmitter-fitted wild boars were observed from five telemetry-equipped vehicles and high stands simultaneously, thereby facilitating instant tracking of their movements. Additional records of wild boar sightings were made by the participating hunters. The hunts always began at 10:00 and ended at 13:00.

Neither the organiser of the drive hunt nor any of the beaters knew the position of the transmitter-equipped wild boars during a hunt. Therefore, it was coincidental if transmitter-equipped animals were within the driving zone at the time of the hunt or not. For this reason we calculated only the home range before and after the drive hunt of seven of the 16 transmitter-tagged wild boar family groups.

For data analysis, we used the ranges V program (Kenward & Hodder 1996). The home ranges were given as minimum-convex polygons (mcp) and displayed as 100% and 95% area. The 60% home ranges were marked as core areas. The range span, i.e. the longest distance between two locations within the home range, was also calculated. Additionally, the fixed kernel method was used.

Results

During January 1998-August 2000, 99 wild boars, mostly piglets, were captured in the traps and ear tagged. Of the trapped animals, 45% were males and 55% were females; 49 animals were marked only with ear tags and 50 individuals were equipped with a transmitter. The observation period of tagged wild boars lasted from just a few days to 13 months.

Size of home ranges

The registered 100% home ranges (mcp) of 21 transmitter-equipped wild boar family groups within the study area were between 166 and 2,244 ha. These sizes were determined after having observed the wild boar family group for an observation period of at least one month and after a minimum of 40 relocations. The distances of the nightly movements varied between 1.1 and 9.4 km per night in 98 monitored nights. The nightly average movement of all observed animals was 3.7 km.

Because it was coincidental whether ear-tagged boars were within the hunting area or not, only seven boar groups could be observed during a total of seven drive hunts within the research period (Table 1). Some of the boar groups were within the hunting area twice, e.g.

Table 1. Data on observations, home range sizes (mcp and kernel), range span and escape behaviour of seven wild boar family groups before and after seven drive hunts. See text for definitions.

Group #	Date of drive hunt	Weeks of observation before hunt	Home range before hunt (mcp) (ha)	Home range before hunt (kernel) (ha)	Weeks of observation after hunt	Home range after hunt (mcp) (ha)	Home range after hunt (kernel) (ha)	Locations (N) before hunt	Locations (N) after hunt	Range span before hunt (ha)	Range span after hunt (ha)	Leaving the central area	Return after weeks
18	18.11.1999	2	278	328	5	2160	2857	31	156	2952	8987	yes	6
	26.01.2000	4	206		4	376	865	12	40	4775	2996	yes	≥4
16	27.11.1999	8	203	207	3	785	2055	76	163	1984	6040	yes	4
	29.01.2000	3	248	135	4	78	35	56	59	2080	1910	no	--
		--	--		12	96		--	80	--	1910	--	--
12	18.11.1999	7	455	388	1	970	210	93	33	3535	8720	yes	6
	26.01.2000	3	29	9	--	killed	--	21	--	800	--	--	--
8	03.12.1998	3	503	479	4	538	610	74	59	4186	4360	no	--
		--	--		9	928	1726	--	156	--	5507	--	--
7	03.12.1998	3	471	611	3	414	597	60	54	3361	3330	no	--
15	18.11.1999	7	543	780	1	29	10	106	18	3036	1200	no	--
1	10.01.1998	--	--	--	2	296	639	--	35	--	3189	no	--
	27.01.1998	2	296	639	4	133	84	35	54	3189	2118	no	--
		--	--	--	7	415	1023	--	93	--	3820	--	--

groups #8, 12 and 18. The escape behaviour of boar group #16 was observed three times during drive hunts. The observation time before drive hunts was 2-8 weeks and 1-12 weeks after the hunt.

Two groups (#12 and 16) left their central home range areas after the first hunt and moved on. The range span of the two wild boar groups varied from almost six to nine kilometres. One group (#18) left its well-known core area after each of the two drive hunts. However, in all cases the wild boar family groups returned within a time period of 4-6 weeks to their former central home ranges.

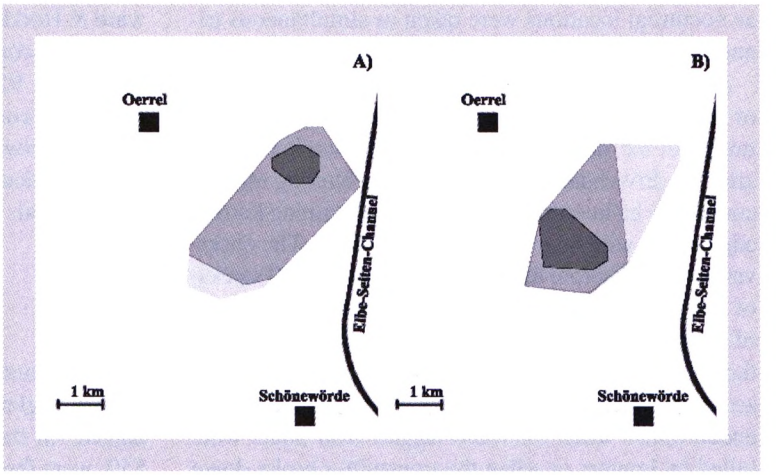

Figure 2. Home range before (A) and after (B) a hunt performed on 3 December 1998 of wild boar group #7, containing one sow and at least four piglets trapped on 3 November 1998, and observed the last four weeks before the hunt and three weeks after the hunt. The symbols indicate: 60% home range (47.5 ha before and 109 ha after hunt); 95% home range (445.5 ha before and 326 ha after hunt); 100% home range (471 ha before and 414 ha after hunt).

The 100% home range sizes (mcp) of the seven wild boar groups varied between 29 ha and 543 ha (kernel method: 9-780 ha) before the first hunt, and after the hunt they varied between 29 ha and 2,160 ha (kernel method: 10-2,857 ha). This last extensive home range after the drive hunt of group #18 was the result of its leaving the central area. On the other hand, groups #7 and 8 retained almost the same home range before and after the hunt. During a four weeks observation period, group #1 reduced its 100% home range (mcp) from 296 ha to 133 ha after the second hunt.

Variation in escape movements

Two examples illustrate the variations in escape movements by the various wild boar family groups. The first example involves home ranges of wild boar family groups #7 and 8 before and after a drive hunt on 3 December 1998 in a drive hunt area of 226 ha (it included 63 hunters,15 beaters and 23 dogs).

On 3 November 1998, four piglets of group #7 were caught. The 100% home range size (mcp) of this group in the four weeks before the drive hunt was estimated at 471 ha (Fig. 2). On 12 November 1998, three piglets of group #8, which included at least five animals which had their home range mainly in the northern woodlands of the research area, were trapped and transmitter marked. The 100% home range size (mcp) three weeks before the hunt was 503 ha (Fig. 3). Groups #7 and 8 tolerated each other, but did not roam through the forest together.

In the four weeks following the drive hunt, the two wild boar groups remained within their well known territory. Group #7 used a 100% home range (mcp) of 414 ha, but shifted its former core area (60% home range) to the southern part of its home range (see Fig. 2). In the four- week period after the drive hunt, group #8 used a 538 ha 100% home range (mcp), which was nearly identical to the area used before the hunt (see Fig. 3).

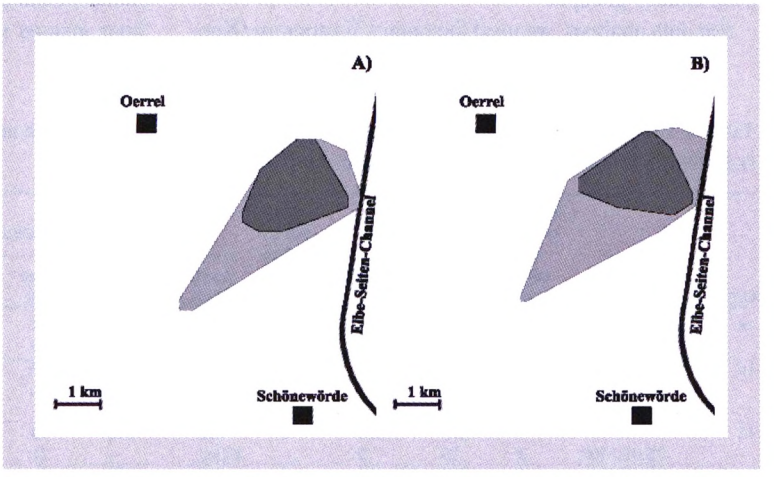

Figure 3. Home range before (A) and after (B) a hunt performed on 3 December 1998 of wild boar group #8, containing one sow and at least five piglets trapped on 12 November 1998 and observed the last three weeks before the hunt and four weeks after the hunt. The symbols indicate: 60% home range (253 ha before and 220 ha after hunt); 95% home range (503 ha before and 538 ha after hunt); 100% home range (503 ha before and 538 ha after hunt).

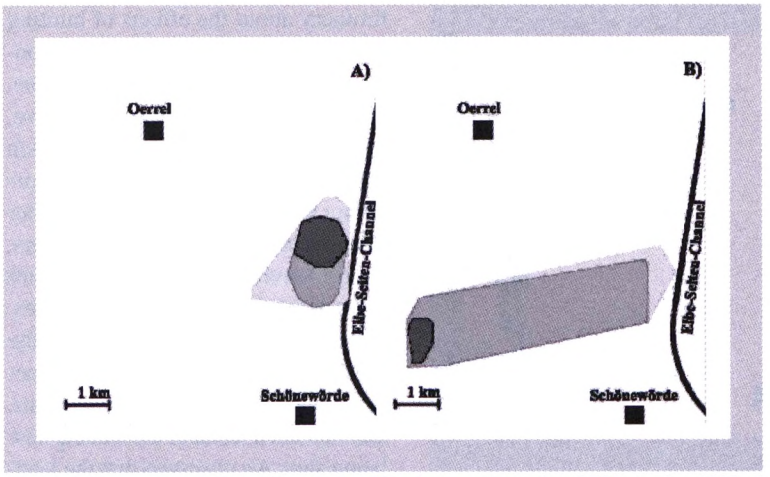

Figure 4. Home range before (A) and after (B) a hunt performed on 27 November 1999 of wild boar group #16, containing one sow and five piglets trapped on 4 November 1999 and observed the last four weeks before the hunt and four weeks after the hunt. The symbols indicate: 60% home range (67.5 ha before hunt and 34.5 ha after hunt); 95% home range (136 ha before hunt and 715.5 ha after hunt); 100% home range (203.5 ha before hunt and 785 ha after hunt).

At 7 o'clock in the morning of the drive hunt, both wild boar group #7 and 8 were situated in their daytime resting areas and remained separated from each other. The hunters' meeting point before the drive hunt was at the edge of the forest area where the two groups rested. Apparently, both groups were scared off by the hunters' cars and moved on to another area. Both wild boar groups moved westwards within the drive hunt area, and when the drive hunt began, some members of group #8 were resting near group #7.

The beaters and dogs caused the mixed wild boar groups to split up during the drive hunt. Group #7 fled one km into dense brushes outside the drive hunt area, and stayed there until the hunt ended. In the afternoon, group #7 moved back into the former drive hunt area and at night it moved approximately 3.4 km into a southern direction and stayed in swampy woodland that was within its home range.

Wild boar group #8 behaved quite differently. The dogs and beaters forced it southwards, and it moved about 2 km to the south of its original resting area into birch-alder woodland.

After group #7 had also arrived in this part of the forest and had joined group #8, both groups moved back towards the drive hunt area during the late hours of the night. The following morning, both groups had arrived at their separate day-time resting areas in the centre of their home ranges at the edge of the drive hunt area.

The second example involves wild boar group #16's home range before the hunt. During the drive hunt season in November 1998, at least three groups of wild boar had their home ranges within the eastern part of the research area. Of the five piglets belonging to group #16, caught and tagged without the leading sow had been caught, three had transmitters attached to their ears. Some of the piglets of group #16 were caught several times in the same trap. The group had a 100% home range (mcp) of 203 ha eight weeks before the hunt (Fig. 4).

The escape behaviour of group #16 is illustrated during and after two drive hunts. When the first drive hunt began on 27 November 1999 in a drive hunt area of 220 ha (it included 40 hunters, 10 beaters and eight dogs), group #16 was lying in its day-time resting area. The two traceable piglets and some other members of the group fled through only two forest sections, but neither the beaters nor the dogs were able to scare them out of their hiding place or make them move any further. They stayed there until the hunt was over. At 7 o'clock in the evening, when it was dark, they had already started moving to the south only to move back up north again later that night to their day-time resting place. The following night they could not be found there anymore. On 29 November 1999, they had left their central home range and had drifted westwards, where the three piglets and their group were traced to a position about 6 km from their former resting area. They apparently used a well-known trail as the area seemed well-known to the group.

Since the immigrating wild boar group #16 was tolerated by the local wild boar group, the groups seemed to somehow be related to each other and to have had used the same living space before. The distance of their movements during night covered 2.2 km only, and at this time wild boar group #16 used an area of about 34 ha, which equalled their 60% home range. After having stayed in the new area for three weeks, wild boar group #16 returned without stopping to the original central home range they had occupied before the hunt. During the three weeks after the first hunt, wild boar group #16 used a 100% home range (mcp) of 785 ha (see Fig. 4). After their return, a second drive hunt was performed within the home range of group #16. During a period of three weeks before the second hunt on 29 January 2000 in a drive hunt area of 220 ha (that included 50 hunters and 11 dogs), group #16's 100% home range was 248 ha (Fig. 5). After the drive hunt, the group reduced its 100% home range to 78 ha (see Fig. 5). Even 12 weeks after the second drive hunt, group #16 stayed with-

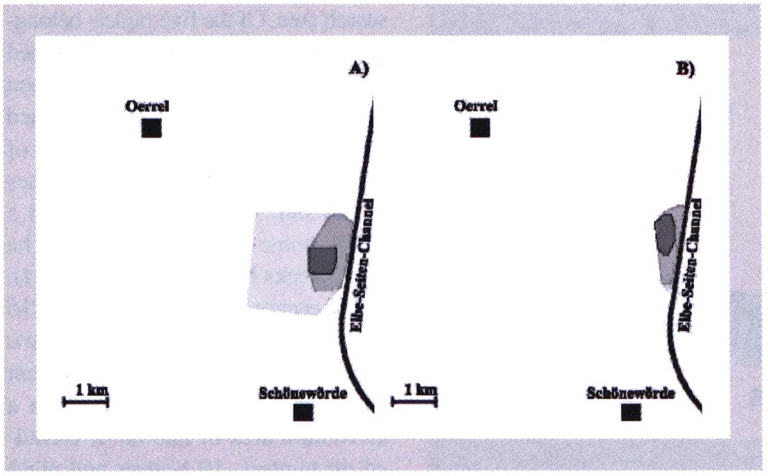

Figure 5. Home range before (A) and after (B) the second hunt performed on 29 January 2000 of wild boar group #16. Observations were made four weeks before and four weeks after the hunt. The symbols indicate: 60% home range (27 ha before hunt and 23.5 ha after hunt); 95% home range (74 ha before and 75 ha after hunt); 100% home range (248 ha before and 78 ha after hunt).

in its former core area with a very small 100% home range of only 96 ha. This was unlike the situation after the first drive hunt, after which they left their main territory.

Discussion

Only few observations exist on the effects of hunting on wild boar movements (Baubet, Brandt & Touzeau 1998, Brandt, Vassant & Jullien 1998, Jullien, Brandt, Vassant & Chantecaille 1991, Gaillard, Vassant & Klein 1987, Maillard, Fournier & Fournier-Chambrillon 1996). Baubet et al. (1998) reported on home range sizes affected by hunting in France. In their study, some wild boars reduced their resting-place territories to small areas, which often corresponded to quiet, poorly or unhunted zones; in other cases, wild boars increased their resting-place areas.

The effects of hunting with hounds on the size of resting ranges of eight wild boar groups in a Mediterranean habitat is described by Maillard & Fournier (1995) and Maillard et al. (1996). They observed a marked increase in the resting site areas beginning in October, which was apparently induced by the onset of the hunting season, and the winter ranges (3,139 ha) were relatively large.

When wild boars are frequently driven away by hunting activities, they will finally leave their summer home range in search of a more quiet range, and this was also the case for nine out of 15 wild boar groups observed (Maillard et al. 1996).

The first results of our study lead us to conclude preliminary about the effects of hunting wild boar in swine-fever-disease contaminated areas. At this point of time, and with the amount of data we have, we observed that wild boars, which tend to live in dense forest stands bordering fields and meadows, even after massive pressure by dogs and beaters, do not leave their home ranges after drive hunts in the majority of cases. However, in those cases in which the wild boar family groups' 100% home-range sizes increased after drive hunts, this was not a result of the leading sow being shot; we observed that the leading sow was still with the remaining wild boar family group.

If central resting areas of wild boars are put under extreme pressure of disturbance during a drive hunt and the surrounding environment remains uninfluenced by hunting, wild boars, if at all, will only move to the borders of their usual home ranges. After leaving their hiding spots, they return to their regular resting areas.

During our research up to the present day, we have not observed long-distance movements or migrations to areas situated farther than 10 km from their original ranges by disturbed wild boar family groups.

In swine-fever-disease contaminated areas, the main goal of hunting has been to drastically reduce the piglet population, which is the age group that is most likely to be infected by the Classical Swine Fever (CSF) disease. Piglets are the major carriers of the disease. Principally, the social structure of a wild boar group must be maintained by preserving the leading sow. This ensures that the group does not break up and spread out uncontrollably over much larger home range areas (Gaillard et al. 1987), which would probably cause a higher amount of aggressive social contacts with unknown groups and consequently lead to a much higher risk of being infected by the swine-fever-disease for all involved wild boars.

Especially in swine-fever-disease contaminated areas, sensible hunting is required. Profound knowledge and understanding of both the hunting range and the wild boar's behaviour are still decisive requirements for hunting in such areas.

Acknowledgements - this study was financially supported by the Ministry of Agriculture, Food and Forestry of Lower Saxony, Germany.

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