

Livestock-guarding dogs in Norway: Part I. Interactions

INGER HANSEN AND MORTEN BAKKEN

The authors are with the Planteforsk Tjøtta Rural Development Centre, N-8860 Tjøtta, Norway and the Agricultural University of Norway, P.O. Box 5025, N-1432 Ås, Norway respectively.

Abstract

We documented behaviors of Great Pyrenees livestock-guarding dogs toward people, livestock, dogs, horses, reindeer, and bear to determine if they might be suitable for protecting livestock in Norway. None out of 13 dogs showed aggressive behavior towards unfamiliar people, and aggressiveness towards dogs and livestock was also low. However, 91% of the dogs tested chased reindeer. A willingness to chase bears was apparent in all 3 dogs tested. Although the Norwegian strains of the Great Pyrenees are bred mainly for exhibition, they obviously have retained some behavioral patterns important for the livestock-guarding function. Their nonaggressive behavior towards people, dogs, and livestock, and their active reaction towards bears suggest that this breed could be suitable for use as livestock-guardians in Norway. However, the dogs' tendency to chase reindeer is a trait that may cause conflicts in reindeer-herding areas.

Key Words: Great Pyrenees, behavior, strangers, cattle, sheep, horses, reindeer, bear, predation

In Norway, 2.5 million sheep (*Ovis aries* L.) are grazed on mountain and forest summer range (SSB 1995), and more than 100,000 of these disappear each year. In some areas depredation on sheep may exceed 70% (Kvam et al. 1995b; Mysterud et al. 1994) of the total loss. Scandinavian brown bears (*Ursus arctos* L.), lynx (*Lynx lynx* L.) and wolverines (*Gulo gulo* L.) are the main predators of livestock in Norway. Only bears and wolves are fully protected. Wolverines are hunted by licence in northern Norway and a quota of lynx are hunted during a regular hunting season.

Livestock-guarding dogs may be an effective way of protecting sheep from predators (Andelt 1992; Coppinger et al. 1988; Green and Woodruff 1990; Lorenz et al. 1986), but widely dispersing sheep make using guarding dogs dif-

This project was funded by the Directorate of Nature Management and the Department of Agriculture. We would like to thank Ole Jakob Sørensen (Norwegian Inst. for Nature Science) and Even Bjørnes (County Governor, Dept. of Environmental Affairs) for valuable support during trial III. We also wish to thank the dog handlers; Katrine Eldegaard, Hildebjørg Haugan, Torill Jørgensen, Brynjulf Liland, Aud Ringsø, and Hanne-Brith Vold for indispensable assistance. Thanks are also due to the private Pyrenees owners.

Manuscript accepted 18 Apr. 1997.

Resumen

Documentamos el comportamiento de los perros guardianes de ganado de raza "Great Pyrenees" hacia la gente, ganado, perros, caballos, renos y osos para determinar si ellos pudieran ser apropiados para proteger el ganado en Noruega. Ninguno de los 13 perros mostraron comportamiento agresivo hacia la gente desconocida y la agresividad hacia perros y ganado también fue baja. Sin embargo, 91% de los perros bajo prueba persiguieron los renos. La disponibilidad para perseguir osos fue aparente en los 3 perros probados. Aunque la líneas noruegas de la raza "Great Pyrenees" son criados para exhibición, ellos obviamente han retenido algunos patrones de comportamiento importantes para la función de proteger el ganado. Su comportamiento no agresivo hacia la gente, perros y ganado y su reacción hacia los osos sugieren que esta raza pudiera ser apropiada para usarla en Noruega como perros guardianes de ganado. Sin embargo, la tendencia de los perros a perseguir renos es una característica que pudiera causar conflicto en áreas donde hay manadas de renos.

ficult in Norway. In addition, rangeland is by law publicly accessible (Lov om friluftslivet 1957), and wildlife (Viltloven 1981), free-ranging livestock (Lov om ansvar for skade på bufe ved hund m.v. 1926), and domestic reindeer (Reindriftsloven 1978) are legally protected from stray dogs. Consequently, before the use of livestock-guarding dogs can be considered in Norway, we need to know the behavioral traits of the dogs which could cause conflicts with people, wildlife, and other animals.

Significant differences in success between breeds of livestock-guarding dogs were not found (Green and Woodruff 1983; Green and Woodruff 1988), but among different breeds evaluated, the Great Pyrenees was one of the least aggressive towards people, livestock, and other dogs. For this reason, we started with the Great Pyrenees before examining other breeds. However, there is no tradition for using livestock-guarding dogs in Norway, so the Norwegian lines of the Great Pyrenees are mainly bred as show dogs.

This publication focuses on interactions between Great Pyrenees and strangers, livestock, dogs, horses, reindeer, and bear. Different ways of using guarding dogs under Norwegian conditions will be reported in a Part II paper.

Material and Methods

Dogs

A total of 13 Great Pyrenees from 7 litters and 2 breeders were tested. They were all reared on sheep farms, but due to the strong influence of the breeders and Kennel Club, the dogs were not reared with sheep until the age of 12–16 weeks and were handled a lot by people. Consequently, they were more socially bonded to people than to sheep. The dogs were sired by the most common stud males and should therefore represent the major genes of Great Pyrenees lines in Norway. All males were castrated, whereas none of the females were spayed.

Trial I. Test of Interactions between Pyrenees and “Strangers”

Of the 13 dogs tested, 11 were males. Seven were 1 year old and 6 were 2 years old. The test was performed inside a 4-ha enclosure, which was part of a pasture for 40 ewes and lambs that were familiar with Pyrenees. The dogs were tied to a long chain inside the enclosure the night before being tested.

The dogs were tested 3 times each at different days on 5 types of “stranger” in the following sequence: an unfamiliar man; an unfamiliar dog guided by a man; a herd of 6 sheep that were not used to dogs; an unfamiliar horse; and an unfamiliar Hereford cow with calf. The livestock were followed by a shepherd. The unfamiliar man wore 3 types of clothings: hunting clothes while bearing a shotgun, hiking clothes with a large backpack, and a rainsuit with a bucket used for picking berries. The 3 unfamiliar dogs were males of different breeds: a Kleiner Münsterländer (bird dog), a Siberian Husky, and a medium-sized mixed breed. The horse and the cow/calf pair were not the same in all presentations, however they were identical for all dogs within the same repetition number.

The strangers entered the open field from 2 different entrances, all following a path that turned 90 degrees at a distance of 50 m from the test dog. In this way the stranger was assumed not

to have provoked the dogs by entering their personal space. The test dog was tied to a long leash at a starting-point located 150 m from both entrances, but was released by a dog handler at the moment it became aware of the unfamiliar being.

The following observations were recorded: the dog’s behavior when the stranger entered the arena (behav.1); the behavior when the stranger left the arena (behav.2); the minimum distance between dog and stranger (min.dist); the latency time from when the dog discovered the stranger until the former sought physical contact (cont.time); and whether the dog barked (bark) or urinated (uri). In cases where the dog did not make contact with the stranger, the cont.time was recorded as a maximum time of 300 seconds. The behavioral repertoire (behav.1 and behav.2) was categorized into 13 behavior patterns including defensive aggression; fleeing; uninterested; staying/lying/sitting motionless, but attentive; ambivalent; approaching, but keeps a distance and makes no contact; approaching and making contact; non-aggressive greeting; playful; playfully jumping upon the stranger; chasing without attacking, the dog stops by itself; chasing without attacking, but the observer has to stop the dog; and aggressive attack. Because these behaviors could be categorized on a scale from strongly defensive to strongly offensive, they were evaluated statistically by both nonparametric and parametric tests.

Trial II. Interactions between Pyrenees and Reindeer

Ten male Pyrenees and 1 female were tested on a small flock of 20 reindeer on an island. None of the dogs had previous experience with reindeer. A maximum of 3 dogs were tested per day, and each dog was tested only once. The dogs were released one-at-a-time and, as long as no critical situations occurred, they were allowed to follow/chase the reindeer until the dogs stopped themselves. Distance to the reindeer at the moment the dog became aware of them, minimum distance between dog and reindeer, and total time of the chase were recorded.

Trial III. Interactions between Pyrenees and Bear

The Norwegian Institute of Nature Research allowed us to arrange the first controlled confrontation between a radio-tracked bear and 3 radio-tracked dogs. The dogs tested were a 2-year-old female and two 3-year-old males (male A and B). The female and male B might have had earlier experience with bears during a field study (Hansen. 1996). The bear was a 150 kg, 3-year-old male (Kvam et al. 1995b; Kvam et al. 1996) that previously had killed sheep, and sheep were grazing in a mountain area 5 km south of the bear’s location. The dogs were released at 5-minutes intervals at a distance of approximately 100 m from the bear, which was hidden in dense vegetation.

Statistics

Unless otherwise stated, data are presented across breeding line, age, sex, and rearing conditions. Standard SAS procedures (SAS 1987) are used. Categorized behavioral data were tested by non-parametric tests (Mann-Whitney U-test, Spearman’s ranked correlation, and Chi-square), whereas variables following the normal-distribution were treated by analysis of variance (GLM) and two-tailed t-tests. Except for the descriptive presentation in Table 1, data regarding Trial I are pooled across the 3 repetitions for each type of stranger. All differences discussed are statistically significant at the 5% level unless otherwise stated.

Results

Trial I. Test of Interactions between Pyrenees and Strangers

None of the 13 dogs showed any kind of aggressive behavior towards unfamiliar people (Table 1). Two Pyrenees displayed a highly dominant/threatening posture toward the husky and the mixed breed, but without fighting. One dog behaved aggressively towards the cattle, and 4 dogs chased the flock of 6 sheep that were unsocialized to dogs. One dog displayed fear towards cattle.

Table 1. The most common behavior pattern displayed by the dogs (N=13) when the different types of “stranger” entered the arena (behav. 1) and when they left (behav. 2), as shown by the number of dogs performing these behaviors at least twice¹ (N=13), and by the percentage of total trials per stranger type (N=39).

Stranger	Variable	Most Common Behavior Pattern	No. of Dogs	% of Total Trials
Man	Behav. 1	Standing/lying/sitting motionless, but attentive	5	39
	Behav. 1	Uninterested	2	21
	Behav. 2	Uninterested	7	44
	Behav. 2	Non-aggressive greeting	5	33
Dog	Behav. 1	Approaching to make contact	9	72
	Behav. 2	Non-aggressive greeting	9	59
Sheep	Behav. 1	Approaching, but keeps a distance and makes no contact	3	28
	Behav. 1	Standing/lying/sitting motionless, but attentive	3	26
	Behav. 2	Uninterested	5	41
	Behav. 2	Chasing	3	18
Horse	Behav. 1	Approaching, but keeps a distance and makes no contact	3	36
	Behav. 1	Standing/lying/sitting motionless, but attentive	2	36
	Behav. 2	Uninterested	4	31
	Behav. 2	Approaching, but keeps a distance and makes no contact	3	26
Cattle	Behav. 1	Standing/lying/sitting motionless, but attentive	5	39
	Behav. 1	Approaching, but keeps a distance and makes no contact	5	39
	Behav. 2	Uninterested	4	26
	Behav. 2	Standing/lying/sitting motionless, but attentive	3	28

¹These 2 measures will not correspond, because each dog may show different behavioral patterns during the 3 trials.

Each dog showed consistency in behavior pattern between the 1st, 2nd and 3rd meeting with same stranger type ($P>0.05$). Therefore, the 3 repetitions for each dog were pooled ($df = 64$).

Of the 5 stranger types, unfamiliar dogs elicited the most offensive behavior pattern regarding behav.1 and behav.2 (Table 1). They also triggered the fastest contact time (Fig. 1) and the least minimum distance (Fig. 1). In addition, the strange dogs induced the Pyrenees to urinate more often and to follow them out of the pasture more often. The contact time and minimum distance between the other stranger types were not significantly different (Fig. 1). The Pyrenees barked most frequently at cattle and least often at sheep (15% versus 3%).

The dogs detected the entering stranger at ≤ 50 m in 8% of the trials, at 51–100 m 67% of the trials, and at ≥ 100 m (200m max.) in 25% of the occasions. In 62% of the trials, the dogs did not seek physical contact with the stranger at all (cont.time = max = 300sec.). In 15% of the times the contact time was <30 seconds.

Dogs that showed the most offensive behavior when the stranger entered the arena (behav.1) also were the most offensive when the stranger left (behav.2, $r_s=0.78$). The faster the Pyrenees approached to investigate the stranger (cont.time), the closer contact they established (min.dist., $r_s = 0.86$). No significant differences in behav.1, behav.2, cont.time or min.dist between 1-year-old and 2-year-old dogs were found.

Trial II. Interactions between Pyrenees and Reindeer

Ten of 11 dogs chased reindeer (Table 2), and all were interested in the unfamiliar scent. However, none of the dogs achieved physical contact with the reindeer. One dog was afraid of the flock. This dog also displayed fear towards the cattle in Trial I.

Our observer had to intervene and stop 2 dogs during the testing. The first had chased a reindeer for more than 1 km, and the second chased a female out into the sea. Most often, singles or small family groups were chased. The reindeer had no problems outrunning the dogs, and the reindeer were often found in the same area immediately after being chased. Panic among reindeer was observed only during the 2 occasions described above.

Trial III. Interactions between Pyrenees and Bear

When first released and after smelling the bear, the dogs ran about rather unsystematically, trying to locate the bear. The bear started moving in a circle around the dogs and observers at 60–100 m away, but out of sight. Ten minutes after the last dog was released,

Table 2. Distance to the reindeer at the moment the dog discovered it (discovery distance), the closest distance between dog and reindeer (minimum distance) and chasing time.

	Mean	Minimum	Maximum
Discovery distance(m)	86	10	300
Minimum distance(m)	59	5	100
Chasing time(sec)	176	60	400

they finally began chasing the bear. The chase lasted approximately 25 minutes, by which time the bear moved about 1 km away. However, radio-tracking revealed that the bear was already on its way back to the starting-point one hour later. Of the 3 dogs, the female was consistently the most offensive and remained closest to the bear, whereas male B returned to the observers twice. The dogs' response towards the bear was modest compared with other breeds bred for bear hunting as the Laika, Karelsk bjørnehund or Jämthund (Sørensen, pers. comm.). None of the dogs were injured during the test.

Discussion

The Pyrenees tested showed no aggressive behavior towards unfamiliar people and only slight aggressiveness towards dogs and livestock. These findings agree partly with characteristics of the breed documented by Green and Woodruff (1983), who found that 4% of 437 Pyrenees injured people, 7% injured sheep and 67% were aggressive to dogs. These results are of course dependent on the quality and the strength of the socialization to other species during rearing. Further, the dogs in this study did not show any offensive protective behavior, i.e. they did not seem to be highly protective of the sheep. A stronger bonding to the sheep and a longer habituation period inside the test area would probably have resulted in more aggressive behavior towards the intruders.

When the sheep that were unfamiliar with dogs discovered the Pyrenees, they immediately turned and ran out of the arena. This flight behavior triggered a chase by some of the youngest dogs. Nevertheless, none of the 40 grazing sheep that were familiar with dogs were ever chased. These episodes indicate that there could be difficulties involved in using guarding dogs on open rangeland where different herds graze together, as seen elsewhere (Green and Woodruff 1990; Lorenz and Coppinger 1986). This problem will be focused further in Part II.

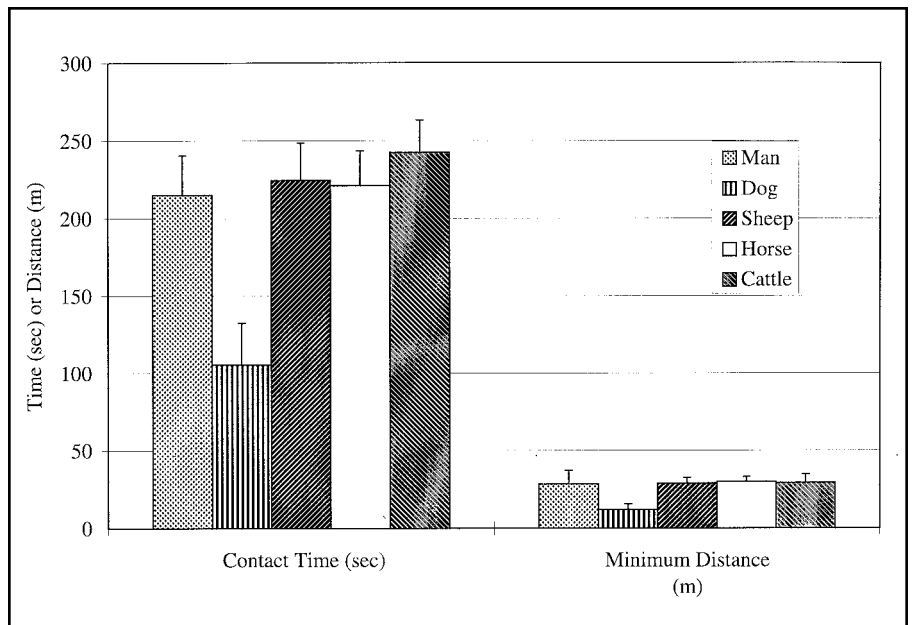


Fig. 1. Time from when the dog discovered the "stranger" until it sought physical contact with the unfamiliar being (contact time) and minimum distance between dog and "stranger" after discovery (mean \pm SE).

In Norway, sheep and reindeer grazing areas often overlap. Reindeer farmers are, in general, opposed to the use of dogs since stray dogs often chase their reindeer. More than 90% (10 dogs) of the Pyrenees that participated in this trial chased reindeer; thus the use of guarding dogs in reindeer grazing areas could result in conflicts. Indeed, the mere presence of a dog can be enough to cause reindeer to avoid an area. This was observed during another field trial, where dogs barked frequently at night (Hansen 1996). The problem should be discussed with the Reindeer Farmers' Association. Perhaps, through cooperative efforts, methods for preventing dogs from chasing reindeer could be found. One solution to this problem could be aversive conditioning of the dogs using electric shock collars. A better solution might be to expose pups regularly to reindeer. Because reindeer are also subject to severe predation (20% of the flock can be preyed upon annually (Kvam et al. 1995a)), one could even try using dogs to guard reindeer herds. This might help change the attitude of reindeer farmers towards guarding dogs.

The dogs proved their bear-chasing capacity. They chased the bear away from the close surroundings and

returned to their flock (the observers) relatively soon after the encounter, which is typical for canine guardians (Green and Woodruff 1990). However, the bear returned soon thereafter. This observation corresponds to a very similar trial in Pasvik (Norway) during the summer of 1994, where 3 other Pyrenees were allowed to chase bears (Wikan 1996). A bear needed at least 4–5 encounters with dogs before it finally left the area. This is also in accordance with the experiences of encounters between livestock-guarding dogs and grizzlies (Green and Woodruff 1989). The 2 Norwegian trials show that the willingness to chase bears is latent in all 6 Pyrenees tested thus far.

The behavior displayed towards bears is also applicable toward lynx and wolverines. In another study (Staland et al. 1998) we documented that the female from the bear-dog interaction chased a wolverine in much the same way that she chased the bear. Furthermore, losses of lambs due to lynx were reduced in the presence of guarding dogs (Hansen et al. 1997). Due to the strict legislations for dog-keeping, predation by stray dogs is not a large problem in Norway. This study shows, however, that the Pyrenees may be less effective

tive against stray dogs. Under Norwegian conditions this could be best, since hikers might walk their dogs through the sheep herding area.

Livestock-guarding dogs have behavioral characteristics that distinguish them from other breeds. They are submissive and show no predatory behavior towards livestock; they are strongly bonded to their flock-mates whom they will protect; and they show ambivalent behavior (barking and approach/withdrawal) rather than aggression when something novel approaches (Lorenz and Coppinger 1986). The result is a "preventive" defense, usually without physical contact between dog and predator. Because the livestock-guarding dogs' way of working is more subtle than that of the bear-hunting dogs, which are generally bred to be extremely eager hunters, the guarding dogs' working capacity is often misinterpreted.

Conclusions

Although the Great Pyrenees in Norway are bred mainly for exhibition, they have obviously maintained some of the behavioral patterns important for their use as livestock-guarding dogs. Based on their calm and nonaggressive behavior towards people, dogs and livestock, and their conservative (i.e., minimal physical contact) way of chasing predators, we believe the Great Pyrenees breed has a good potential for use as livestock guardians in Norway. Still, there may be other breeds, yet to be tested, that are as good or better. The problems with dogs chasing reindeer must be solved before guarding dogs are used on rangeland used by both sheep and reindeer.

Literature Cited

- Andelt, W.F. 1992.** Effectiveness of livestock guarding dogs for reducing predation on domestic sheep. *Wildl. Soc. Bull.* 20:55–62.
- Coppinger, R., L. Coppinger, G. Langeloh, L. Gettler, and J. Lorenz. 1988.** A decade of use of livestock guarding dogs. *Univ. of Calif., Davis. Proc. Vertebr. Pest. Conf.* 3:209–214.
- Green, J.S. and R.A. Woodruff. 1983.** The use of three breeds of dog to protect rangeland sheep from predators. *Appl. Anim. Ethol.* 11:141–161.
- Green, J.S. and R.A. Woodruff. 1988.** Breed comparisons and characteristics of use of livestock guarding dogs. *J. Range Manage.* 41:249–250.
- Green, J.S. and R.A. Woodruff. 1989.** Livestock-guarding dogs reduce depredation by bears. *Bear-People Conflicts. Proc. of Symp. on Management Strategies. North-West Territories, Dept. of Renew. Res.*
- Green, J.S. and R.A. Woodruff. 1990.** Livestock guarding dogs: Protecting sheep from predators. *USDA Agr. Info. Bull.* No. 588. 32 p.
- Hansen, I. 1996.** Bruk av vokterhund som vern mot rovdyr i beiteområder for sau. *Planteforsk Tjøtta fagsenter. Sluttrapport.* 26 p.
- Hansen, I., A. Ringsø and T. Staaland. 1997.** Bruk av vokterhund som vern mot rovdyr i beiteområder for sau. *Erfaringer fra feltforsøk i Hattfjelldal. Planteforsk Tjøtta fagsenter, Rapport No. 7/97.* 21 p.
- Kvam, T., K. Nybakk, K. Overskaug, O.J. Sørensen, and K. Brøndbo. 1995a.** Gaupa tar mye mer rein enn antatt. *Reindriftsnytt (4),* 40–43.
- Kvam, T., O.J. Sørensen, T. Eggen, K. Knutsen, K. Overskaug, F. Berntsen, and J.E. Swenson. 1995b.** Årsrapport fra Rovdyrprosjektene i Nord-Trøndelag 1994. *NINA Oppdragsmelding No. 364.* 37 p.
- Kvam, T., O.J. Sørensen, K. Overskaug, T. Eggen, F. Berntsen and J.E. Swenson. 1996.** Årsrapport fra Rovdyrprosjektene i Nord-Trøndelag 1995. *NINA Oppdragsmelding No. 424.* 40 p.
- Lorenz, J. and L. Coppinger. 1986.** Raising and training a livestock-guarding dog. *Ore. St. Univ. Exten. Circ.* 1238.
- Lorenz, J., R. Coppinger, and M.R. Sutherland. 1986.** Causes and economic effects of mortality in livestock guarding dogs. *J. Range Manage.* 39:293–295.
- Lov om friluftslivet. 1957.** Lov av 28. juni, nr. 16, § 2.
- Lov om ansvar for skade på bufe ved hund m.v. 1926.** Lov av 9. juni, nr. 4, § 3.
- Mysterud, I., J.T. Warren, T. Lynnebakken. 1994.** Tap av sau i Målselv 1993. *Sau og geit 1/94,* 66–70.
- Reindriftsloven. 1978.** Lov av 9. juni, nr. 49, Kap. VII, § 29.
- SAS. 1987.** SAS/STAT Guide for Personal Computers, 6 Ed. *Stat. Anal. Sys. Inst., Inc. Cary, N.C.*
- Staaland, T., A.J. Ringsø, and I. Hansen. 1998.** Vokterhund som forebyggende tiltak mot rovdyrskader. *Proc. Husdyrfor-søksmøtet, Norges landbruksøgskole, Ås, Febr. 10.–11. 1998.* 453–457.
- Statistisk sentralbyrå (SSB). 1995.** NOS Jordbruksstatistikk 1994.
- Viltloven. 1981.** Lov av 29. mai, nr. 38, Kap. XI, § 52.
- Wikan, S. 1996.** Bruk av pyreneerhunder mot bjørn. *Erfaringer fra Pasvik 1994. Svanhovd miljøsenster. Rapport No. 23.* 25 p.