Research Paper

THE USE OF LIVESTOCK GUARDING DOGS IN NORTH-EASTERN PORTUGAL:

THE IMPORTANCE OF KEEPING THE TRADITION

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1. Introduction

Livestock guarding dogs (LGDs) are regaining their important role as a non-lethal damage prevention tool, in the scope of efforts for the conservation of endangered large carnivores, due to their recognized adaptability and efficiency. In Europe, the return of grey wolves (*Canis lupus*) to parts of their former range has often been followed by the use of LGDs to mitigate human-wolf conflicts. Nevertheless, their implementation faces serious challenges, especially in regions where their use was discontinued following large carnivore extirpation, resulting in the loss of traditional habits and knowledge about their use, aggravated by the transformation of livestock husbandry to systems less suitable for coexisting with wolves and for working with LGDs. Promoting the use of LGDs in regions of low wolf densities or at the limits of current ranges is thus important to prevent further loss of knowledge and habits that would delay the effective implementation of LGDs. This is especially true if we consider the European trend in recent years, where most wolf populations have been increasing and expanding their areas of occasional presence (Kaczensky et al., 2013; Galaverni et al., 2015).

According to a census in 2012-2014, the wolf population in Spain is expanding southwards, with 47 new packs identified since 2007, representing a 16% increase (MAPAMA, 2014). In Portugal, since the last national census of 2002-2003, new packs have been identified at the limits of the wolf range (Álvares et al., 2015). Wolves in Portugal are highly dependent on livestock, since wild prey is generally scarce (Álvares et al., 2015), and thus the potential for conflict is high. Wolves are currently limited to less than 20% of their original distribution area that included the entire country (Petrucci-Fonseca, 1990; Pimenta et al., 2005). Wolves are opportunistic predators and if they return to parts of their original range they may cause considerable damage to livestock that is left unprotected. The wolf has been a protected species since 1988 and damages to livestock are compensated by the government if minimal requirements are met, namely the presence of shepherds and LGDs (one dog per 50 head

of livestock up to a maximum of five dogs), or if the livestock is confined (Law Decree Nr. 139/90).

The LGD Programme, implemented by Grupo Lobo since 1996, has donated more than 550 dogs of autochthonous breeds throughout the wolf range, with very good results (Ribeiro and Petrucci-Fosenca, 2005). Since 2012 this Programme expanded to the northeast region of the country, north of the Douro river, in the south of Bragança District, in a low wolf density area (Álvares et al., 2015). This was possible due to a compensatory measure (Medida MC8 do Aproveitamento Hidroelétrico do Baixo-Sabor) from the impact of building a large dam in the Sabor river, that could overlap the territories of some packs, and increase habitat fragmentation. Wolves are present at low densities and damage levels are low and so, although the importance of having LGDs is still acknowledged, not all shepherds use sufficient numbers of LGDs. Providing farmers with LGDs would reinforce the use of these dogs in a preventive way, in advance of the expected wolf recovery in the region. Here, we present the first results of this measure, namely an evaluation of the LGDs placed and the advantages of using them, even when predation risk is low.

2. Material and Methods

2.1. Study area

The measure was implemented in nine counties surrounding the Sabor river basin (Fig. 1). Two mountain ranges (up to 1,310 m) cross regions that are characterized by plateau areas (200-400 m) and river valleys, with a typical Mediterranean climate (hot summers and mild winters). Human density is relatively low for the Iberian Peninsula (<25 habitants/km^2), and the landscape is dominated by cereal fields and plantations, mainly of chestnut, olive and almond trees, with pine tree patches, and bushy grazing areas in higher grounds.

Livestock production is a major economic activity, mainly of sheep for meat production. Larger flocks are frequent at higher grounds whenever communal grazing areas exist. In mountainous areas goats are more frequent, whereas in warmer areas sheep are in higher numbers. Livestock breeds are mainly autochthonous, sometimes crossed with exotic breeds to increase production. Husbandry is usually of the extensive type and flocks are usually shepherded, sometimes kept in fenced areas during the hottest hours of the day and in night corrals during summer.

The local LGD breed, the Transmontano Mastiff, was traditionally used to protect livestock from wolves. It is still mostly used as a working dog, mainly in the north of Bragança District, being less frequent in the south and rare in the rest of the country. It is the largest Portuguese dog breed, with males reaching 85 cm at the shoulder and weighting up to 75 kg. The breed's provisional standard was only defined in 2004 and recognized by the Portuguese Kennel Club

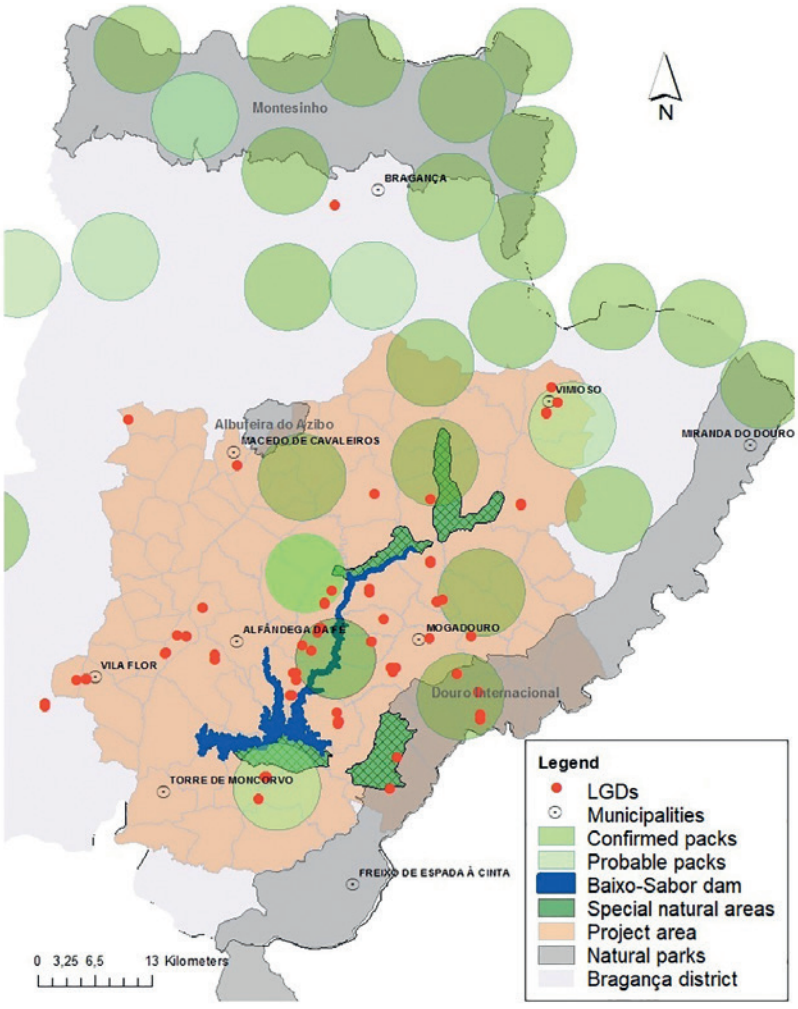

Fig. 1. Distribution of wolf packs identified in the last national census, 2002-2003, and in recent monitoring studies, in the NE of Portugal and the project intervention area (data from Álvares et al., 2015), showing the location of selected holdings where dogs were placed.

in 2012. According to data provided by this Club, the number of registries per year ranged from 154 to 411, between 2004 and 2015, being the 8th in rank among the 12 national breeds' registry in the last years.

Monitoring has identified seven confirmed and three probable wolf packs in the intervention area, indicating this to be a relatively low density area, with 3.3 packs per 1,000 km^2 (Pimenta et al., 2005; Álvares et al., 2015) (Fig. 1). Except for wild boar (*Sus scrofa*), which is common in the region, wild prey is scarce, although roe deer (*Capreolus capreolus*) is slowly increasing. According to official records provided by the Institute for Nature Conservation and Forests (ICNF), from 2012 to 2016 a total of 457 predation events were registered in the Bragança District, mainly of sheep and goats (89%), ranging from 0 to 20 annual events per parish, except in one particular parish of the intervention area (Felgar and Souto da Velha), where an average of 46.8 yearly events were registered during this period (Fig. 2).

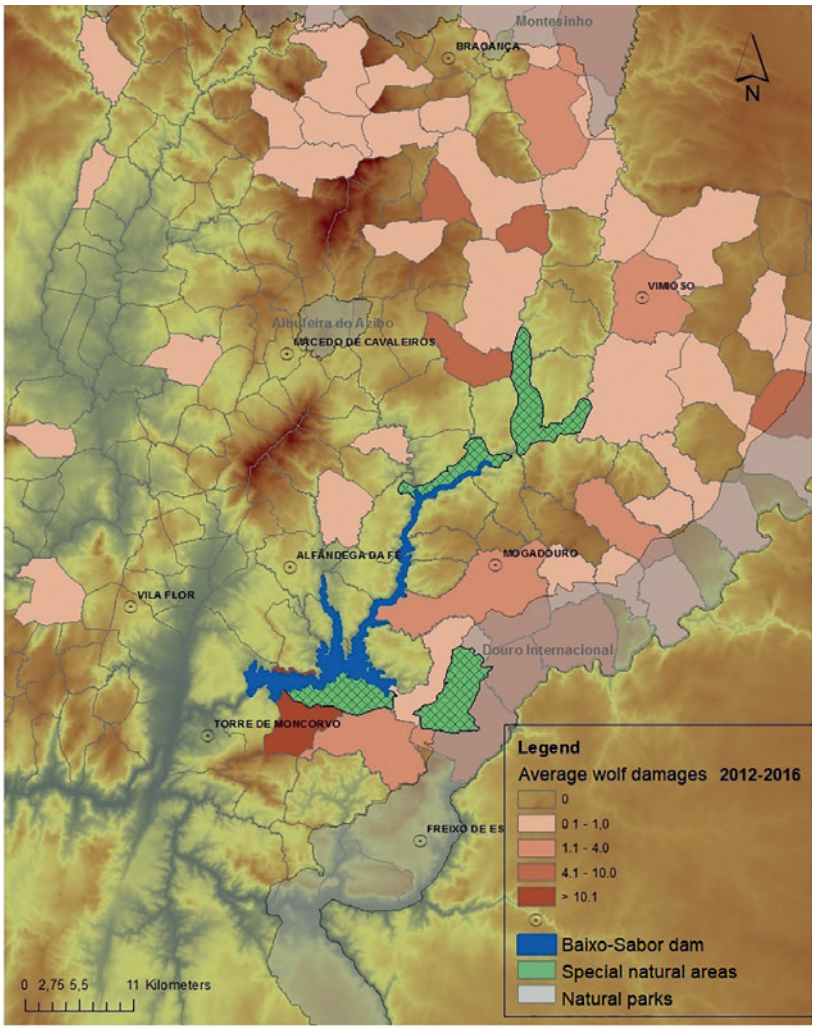

Fig. 2. Distribution of average yearly wolf damages recorded per parish from 2012 to 2016 in the NE of Portugal (data from ICNF).

2.2. Farmer selection and holding characteristics

A total of 221 farmers were interviewed in the study area to gather information on their livestock, husbandry system and level of damages, verify existing conditions and ascertain motivation to receive LGDs. Farmers owned one flock each that they usually shepherded themselves, although in some cases this was done by family members or shepherds were hired. During these interviews, 169 farmers were asked about their opinions on the advantages and disadvantages of using LGD. Contacts of farmers were obtained from local authorities (e.g. parishes), other farmers and from technicians of nearby protected areas (Montesinho Natural Park and International Douro Natural Park), who are responsible for assessing wolf damages.

A total of 48 farmers were selected based on flock size (minimum 50 head), higher level or risk of damages and need for good working LGDs, the existence of conditions to raise LGDs and interest to participate and follow guidelines. All holdings were located inside the study area except two: one sheep farm north of the study area (Bragança municipality) and one to the southwest (Candoso Parish, Vila Flor municipality).

2.3. Dog selection, placement and monitoring

Dogs were placed with livestock at 2-3 months of age to foster bonding. Pups were selected according to the behaviour and working abilities of the parents, breed standards and lack of abnormalities (e.g. light coloured nose, loose lids, malocclusion of teeth, hernias, dysplasia). Genealogy was also considered, especially when dogs were placed in the same or nearby flocks, to avoid inbreeding and promote variability. Dog breeds were selected according to the preference of the farmers, but the local breed, the Transmontano Mastiff, was preferred.

An agreement was signed with farmers to clarify responsibilities, ensure the dogs' welfare and provide adequate raising procedures to allow dogs to become efficient guardians. Food and veterinary assistance were provided by the Programme, as well as support to the farmers regarding dog raising, training, breeding, registering and legal aspects. Regular visits were made to monitor dog development, health and welfare and correct any problems that occurred.

2.4. Dog evaluation

Since wolf presence was not uniform in the intervention area, and predation levels varied greatly among flocks, damage variation was not the best criterion to evaluate and compare dog efficacy as it may not reflect the real performance of the dogs. Thus, adult dogs (>18 months old) were evaluated according to other criteria based on behavioural analysis, owner satisfaction and perceived effectiveness.

2.4.1. Behavioural observations

Behavioural observations were made during regular monitoring and also after dogs reached adulthood, by observing them with livestock while grazing for an average of 30 minutes, complemented with inquiries to farmers about specific behaviours and situations. Behaviour was evaluated according to the three behavioural components defined by Coppinger and Coppinger (1980): attentiveness, trustworthiness and protectiveness. Attentive dogs accompany and stay in the proximity of their flocks, following their movements. Attentive behaviour is based on the dog's attachment to livestock, and implies the establishment of social bonds with the animals in the flock (Coppinger et al., 1983). Trustworthiness refers to the absence of disruptive or harmful behaviours towards the animals in the flock. Behaviours that disturb the flock's activity or lead to injury/death of livestock must be prevented. The most appropriate behaviours are those of submission and social investigation (Lorenz and Coppinger, 1986). Protective behaviour relates to the ability of the dog to react adequately to strange situations and interrupt a predator attack (Lorenz and Coppinger, 1986). Each of these components was rated as either excellent, good, satisfactory or bad using the following scale of criteria:

Attentiveness: A LGD was rated excellent if it was always near the flock and accompanied its movements, was not attracted by the shepherd and exhibited appropriate social behaviours towards the livestock (e.g. submission, allo-grooming and social investigating, attentive and curious about the livestock, excitement when reunited with and not afraid of the stock). It was considered inattentive if it did not stay with the flock and did not exhibit behaviours indicative of having established social bonds with the animals in their flock.

Trustworthiness: A LGD was rated excellent if it never injured or disturbed the livestock (even during the younger developmental phases). It was considered bad if it killed or seriously injured animals in the flocks and continued to do so after adulthood.

Protectiveness: A LGD was considered to be excellent if it was mostly vigilant and alert to what was happening around the flock, reacted to abnormal livestock behaviour and strange situations around the flock including the presence of outsiders or unfamiliar livestock, barking and alerting to their presence, approaching and chasing intruders, but returning

swiftly to the flock. A bad LGD was one which did not alert to the presence of strange elements and did not approach them to investigate.

2.4.2. Farmer satisfaction and perceived effectiveness

Assessing farmers´ opinions is a good way to evaluate the success of the measure, since the implementation of damage prevention measures depends on their acceptance by farmers, which is ultimately based on their efficiency, but also on the effort and costs involved. Farmers were asked about the general performance of the dogs and about each behaviour component, and their degree of satisfaction with them. They were asked to assess this using a four-point scale, ranging from Excellent/Very Satisfied to Bad/Unsatisfied.

3. Results and Discussion

3.1. Holding characteristics and husbandry systems

LGDs were added to the 48 selected flocks of sheep (79%), goats (19%) or in one case of cattle (Table 1, Fig. 3). Flocks ranged in size from 50 to 600 head, averaging 160 head, while the cattle herd had 26 cows.

During winter, flocks were either confined to stables (52%) or kept in fences (48%) during the night. From March to October, 31% of the flocks were kept in fenced pastures during the night and the hottest hours of the day; 71% grazed also during the night

Fig. 3. Most dogs were placed with sheep, but some with goats.

Fig. 5. Some flocks were kept in fenced pastures during the hottest hours of the day.

(Fig. 4). The cattle herd was always kept in fenced pastures. An average of 2.6 adult LGDs, including the dogs donated by the LGD Programme, were present per flock (ranging from 1-5, with an average of 69 head/dog), accompanied by one herding dog on average (Fig. 5). Hunting dogs were also present in nine flocks which, according to the farmers, allowed them to get some exercise and, since they investigated a wide area around the flock, helped the work of the LGDs by providing early warning of the presence of strange animals, and as an additional benefit could even catch some small game.

3.2. Dogs donated

A total of 72 dogs, 88% of them Transmontano Mastiffs, were donated (Table 1, Fig. 1). One to three dogs were placed per flock, and if both male and fe-

Fig. 4. Flocks were usually accompanied by a herding dog.

Table 1. Dogs donated per type of livestock species.

Breeds	Litters	Males	Females	Total Dogs	Cows	Sheep	Goats	Total Farms
Transmontano Mastiff	32	32	31	63	0	37	7	44
Estrela Mountain Dog	8	3	5	8	0	1	2	3
Castro Laboreiro Dog	1	1	0	1	1	0	0	1
Total	41	36	36	72	1	38	9	48

male were donated together they belonged to the same breed but were unrelated. Pups were selected from 41 litters descending mostly from working dogs (78%) (Fig. 6). Dogs were kept intact and breeding was controlled by confining the females in heat.

Fig. 6. Selected pups descended mostly from working stock.

3.3. Health and mortality

A total of 39 cases required veterinary assistance, mostly to treat light wounds and traumas including bites from other dogs (11 cases), which is normal in these working dogs, but a few cases of mange (9), tick-borne diseases (4), and gastrointestinal problems (3) were also treated. Some dogs were found to be infested with thelazia (8), or leishmania (2), and treated accordingly. Thelaziosis is caused by an eyeworm and can lead to blindness. It is spreading in Europe, having been identified for the first time six years ago in Portugal, and is currently very prevalent in the study area (Vieira et al., 2012). Leishmaniases are endemic to the Mediterranean region and, if not treated, can result in multi-system failure and frequently death. Both parasites are transmitted by flies, and are increasing in prevalence and range as a consequence of global warming (WHO, 2010;Vieira et al., 2012), as are tick-borne diseases (Sainz et al., 2015).

So far 26% of dogs placed by the LGD Programme have died or disappeared, eight of them males and 11 females. The average age of mortality was 20 months. The main known causes of death were road accidents (26%) and disease (16%). One dog died due to injuries caused by a wild boar and there were two cases of suspected poisoning. The latter diagnosis was based on clinical symptoms exhibited by the dog, since it was not possible to confirm the presence of toxins through laboratory analysis. In two cases the cause of death could not be determined while a further 6 dogs simply disappeared.

3.4. Dog behaviour

A total of 46 LGDs in 32 flocks were evaluated: 26 males and 20 females, 40 of which were Transmontano Mastiffs. Almost all dogs scored good-excellent for attentiveness to livestock (98%), trustworthiness (98%) and protectiveness (93%) (Fig. 7).

3.4.1. Behaviour problems

Wildlife chasing

Most LGDs (91%) were reported to chase wildlife, especially foxes (89%), wild boar or roe deer (72%) and rabbits/hares (42%). Chases were of shorter duration in the case of smaller species such as rabbits. Chasing bigger game could last longer and usually involved several dogs. In some cases, the presence of hunting dogs seemed to stimulate this behaviour and farmers may have encouraged them to catch wild boar.

Sixteen LGDs (35%) were observed killing wildlife, mainly wild boar or roe deer (17%), foxes (15%), and rabbits/hares (13%).

Aggressiveness to people and other dogs

Some farmers mentioned problems of aggressiveness towards other dogs with 11 LGDs (24%) chasing and attacking dogs that approached the flock, in three cases resulting in the death of the other dogs. LGDs usually barked at unfamiliar people, sometimes approaching but seldom showing any aggressiveness (Fig. 8). On one occasion a juvenile dog (7-8 months old) jumped onto a person that was passing through the flock, but without biting or causing injuries.

3.5. Farmer satisfaction and perceived

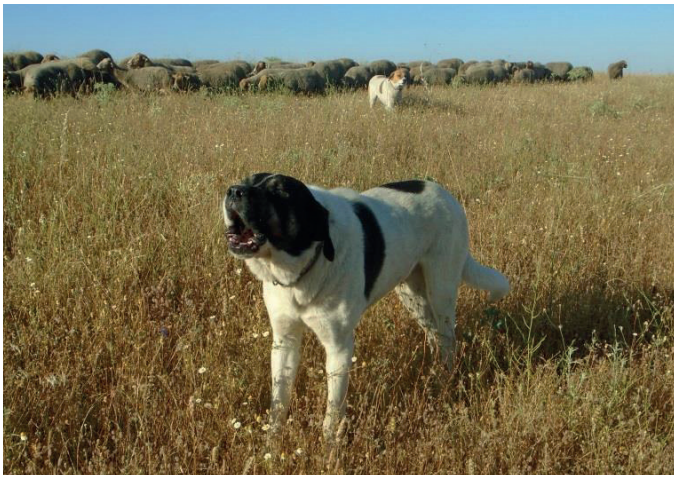

Fig. 8. LGDs usually responded to the presence of unfamiliar people by barking and approaching, but seldom with aggression.

effectiveness

Farmers rated most dogs (96%) as having an excellent or good performance, and none was considered bad. Specifically, most dogs were rated excellent-good in attentiveness (98%), trustworthiness (96%), and protectiveness (96%).

Farmers were also satisfied-very satisfied (96%) with their dogs. Only two were less satisfied: one because the dog in question chased cars and in the other case the dog had difficulty in accompanying the flock due to a debilitating disease (leishmaniasis).

3.6. Advantages and disadvantages

Fig. 7. Most dogs were attentive and trustworthy to livestock, not disturbing and accompanying the flocks' movements, as well as protective, being alert and chasing intruders away from the flock.

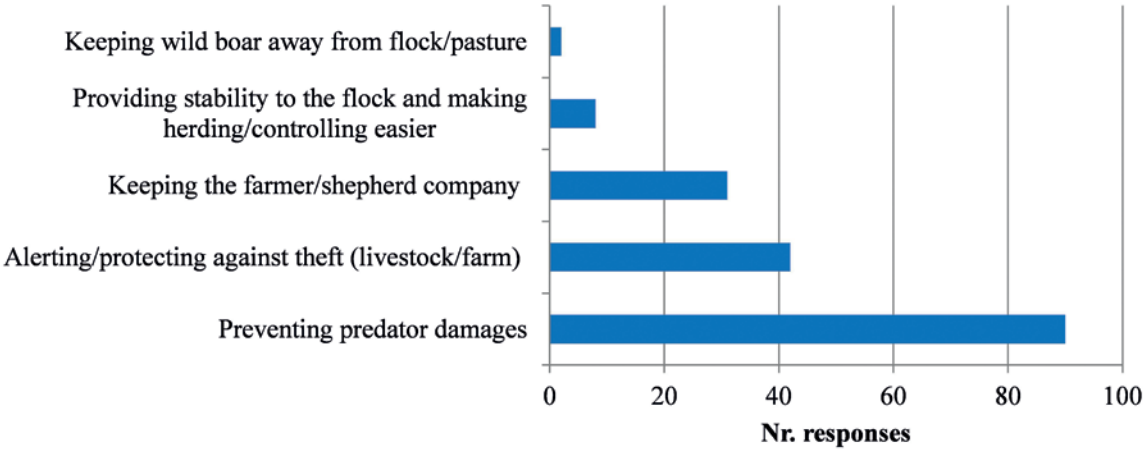

Fig. 9. Advantages mentioned by farmers regarding the use of LGDs.

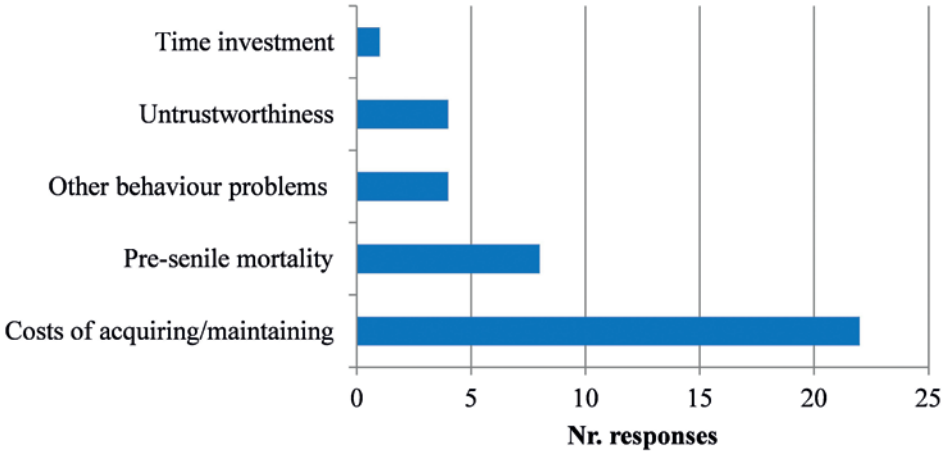

Fig.10. Disadvantages mentioned by farmers regarding the use of LGDs.

of using LGDs

Of the 169 farmers who were asked this question, 67% provided one or more answers regarding the advantages of using LGDs, and only 20% identified one or more disadvantages. Of those who identified advantages, 79% mentioned prevention of predator-caused damages (by wolves, but also foxes and stray dogs) as one of the main advantages of using LGDs (Fig. 9). Alerting and protecting against theft of livestock and guarding the farm was mentioned by 37% of farmers. Other advantages included keeping the farmer or shepherd company (27%), and providing stability to the flock and making herding/controlling easier (7%). Two farmers mentioned LGDs were also useful for keeping wild boar away from the flock.

Concerning disadvantages, the cost of acquiring and maintaining dogs (food and veterinary care) was mentioned by 56% of respondents, and pre-senile mortality by 21%, while untrustworthy behaviour (disturbing/injuring livestock) and other behavioural problems (shyness or aggressiveness towards people, car chasing, damaging neighbours' vineyards/orchards) were each mentioned by 10%. Time investment was mentioned only once (Fig. 10).

4. Discussion and management implications

Farms in our study were at the edge of current wolf range, hence only a minority suffered predation. Nevertheless, the majority of farmers considered the advantages of having LGDs to outweigh the costs and they were interested in maintaining them in their flocks.

The behaviour analysis reveals that dogs performed well, which was also supported by the assessment and satisfaction of farmers. Our scores for dog behaviour are similar to those obtained in other regions of Portugal (Ribeiro and Petrucci-Fonseca, 2005), but higher than those obtained elsewhere (Coppinger et al., 1988; Marker et al., 2005). However, since this concerns qualitative data from studies conducted in different

conditions, comparisons should be considered with caution. We found a much higher degree of satisfaction with LGDs among farmers in NE Portugal than was reported in Namibia (Marker et al., 2005), though only slightly higher in comparison to other regions of Portugal (Ribeiro and Petrucci-Fonseca, 2005).

Chasing wildlife was more frequent than observed in Namibia (Marker et al., 2005), but similar to that found in Norway (Hansen and Smith, 1999) and in other regions of Portugal (Ribeiro and Petrucci-Fonseca, 2005). The killing of wildlife was much more frequent in our study compared to others (Ribeiro and Petrucci-Fonseca, 2005; Potgieter et al., 2016). These behaviours may be dependent on wildlife density and diversity, as well as the type of terrain and vegetation that may influence its onset and outcome. In areas with higher densities of game, chasing is expected to be more frequent and thus the probability of killing of game is also expected to be higher.

While deterring foxes and wild boar may be useful to farmers, chasing or even killing game species may result in conflicts with hunters and have an impact on their populations, especially when small. However, chasing wild ungulates away from the flock and the pastures can reduce potential damages they cause to pastures and agriculture fields, prevent harassment and even attacks or injuries to livestock and reduce the risk of disease transmission (Ver-Cauteren et al. 2012). Nonetheless, this behaviour should be controlled by the shepherd to avoid wildlife mortality, injuries to the dogs and reduce the time that LGDs are away from or less attentive to livestock.

The proportion of LGDs lost to pre-senile mortality (<10 years of age) during the 3.5 years of our study (26%) was similar to that reported during longer periods in other regions of Portugal (Ribeiro and Petrucci-Fonseca, 2005: 26% in 7.5 years) as well as in South Africa (Rust et al., 2013: 22% in 6 years). However, mortality is usually higher in the first years of working dogs' lives (Lorenz et al., 1986), i.e. the period covered by our study.

Disease was a significant cause of mortality despite the provision of veterinary care and, together with road accidents, endemic diseases can limit dog survival and efficiency in this region. In regions where the prevalence of such diseases is high, financial aid should be higher to compensate the increase in prophylactic and treatment expenses, as well as the higher mortality rate.

The LGD Programme in Portugal has achieved good results thanks to the support it provides, but also due to the existing knowledge and high motivation of farmers to use LGDs. In areas where the practice of using LGDs was lost, reintroducing these dogs is harder, due to the lack of motivation, experience, knowledge and affinity towards these dogs by the farmers and the local community. It is thus important to promote their use in areas where wolves have disappeared and where its future expansion is expected, in order to ensure the use of LGDs is not disrupted. In such areas, since the maintenance cost of LGDs can be a constraint, financial aids should be in place to allow farmers to be prepared in advance of wolf recovery since LGDs may take some time to implement.

Photo: Joaquim Pedro Ferreira.

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References

Álvares F, Barroso I, Ferrão da Costa G, Espírito-Santo C, Fonseca C, Godinho R, Nakamura M, Petrucci-Fonseca F, Pimenta V, Ribeiro S, Rio-Maior H, Santos N, Torres R (2015) Situação de referência para o Plano de Ação para a Conservação do Lobo-ibérico em Portugal (Reference situation to the action plan for Iberian wolf conservation in Portugal). ICNF/CIBIO-INBIO/CE3C/UA, Lisboa, 70 p.

Coppinger L, Coppinger R (1980) So firm a friendship. Natural History, 89, 12-26.

Coppinger R, Coppinger L, Langeloh G, Gettler L, Lorenz J (1988) A decade of use of livestock guarding dogs. Proc. Thirteen. Vertebr. Pest Conf., pp. 209–214.

Coppinger R, Lorenz J, Glendinnig J, Pinardi P (1983) Attentiveness of guarding dogs for reducing predation on domestic sheep. Journal of Range Management, 36, 275-279.

Galaverni M, Caniglia R, Fabbri E et al. (2016) One, no one, or one hundred thousand: how many wolves are there currently in Italy? Mamm. Res., 61, 13.

Hansen I, Smith ME (1999) Livestock-guarding dogs in Norway Part II: Different working regimes. Journal of Range Management, 52, 312-316.

Kaczensky P, Chapron G, von Arx M, Huber D, Andrén H, Linnell J (Editors) (2013) Status, Management and Distribution of Large Carnivores - Bear, Lynx, Wolf and Wolverine - in Europe. Report to the EU Commission, Part1, 72 p.

Lorenz J, Coppinger L (1986) Raising and training a livestock-guarding dog. Extension Circular 1238. Oregan State University Extension Service.

Lorenz J, Coppinger R, Sutherland MR (1986) Causes and economic effects of mortality in livestock guarding dogs. Journal of Range Management 39, 293–295.

MAPAMA (2014) Censo 2012-2014 de lobo ibérico (*Canis lupus*, Linnaeus, 1758) en España (Iberian wolf survey 2012-2014 in Spain). Ministério de Agricultura y Pesca, Alimentación y Medio Ambiente, Madrid, 8 p.

Marker LL, Dickman AJ, Macdonald DW (2005) Perceived effectiveness of livestock-guarding dogs placed on Namibian farms. Rangel. Ecol. Manag., 58, 329–336.

Petrucci-Fonseca F (1990) O lobo (*Canis lupus signatus* Cabrera, 1907) em Portugal. Problemática da sua conservação (The wolf in Portugal. Problematics of its conservation). Dissertação de Doutoramento. Faculdade de Ciências da Universidade de Lisboa, Lisboa, 392 p.

Pimenta V, Barroso I, Álvares F, Correia J, Ferrão da Costa G, Moreira L, Nascimento J, Petrucci-Fonseca F, Roque S, Santos E (2005) Situação Populacional do Lobo em Portugal: resultados do Censo Nacional 2002/2003. Relatório Técnico. Instituto da Conservação da Natureza/Grupo Lobo, Lisboa, 158 p.

Potgieter GC, Kerley GIH, Marker LL (2016) More bark than bite? The role of livestock guarding dogs in predator control on Namibian farmlands. Oryx 50, 514-522.

Ribeiro S, Petrucci-Fonseca F (2005) The use of livestock guarding dogs in Portugal. Carnivore Damage Prevention News, 9, 27-33.

Rust NA, Whitehouse-Tedd KM, MacMillan DC (2013) Perceived efficacy of livestock-guarding dogs in South Africa: Implications for cheetah conservation. Wildlife Society Bulletin, 37, 690-697.

Sainz A, Roura X, Miró G, Estrada-Peña A, Kohn B, et al. (2015) Guideline for veterinary practitioners on canine ehrlichiosis and anaplasmosis in Europe. Parasites & Vectors, 8, 75.

VerCauteren KC, Lavelle MJ, Gehring TM, Landry JM (2012) Cow dogs: Use of livestock protection dogs for reducing predation and transmission of pathogens from wildlife to cattle. Applied Animal Behaviour Science, 140, 128-136.

Vieira L, Rodrigues FT, Costa A, Diz-Lopes D, Machado J, et al, (2012) First report of canine ocular thelaziosis by Thelazia callipaeda in Portugal. Parasites & Vectors, 5, 124.

WHO (2010) Control of the leishmaniases: report of a meeting of the WHO Expert Committee on the Control of Leishmaniases, Geneva, 22-26 March 2010. In: Technical Report Series, 949. WHO, Geneva, 186 p.