Preliminary assessment of human-large carnivore conflicts and associated livestock husbandry practices in the Albanian and Macedonian sides of the Prespa Basin

Final Report

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[1] The PrespaNet is a network of nature conservation NGOs that work together for the preservation of Prespa on the transboundary level and consists of Protection and Preservation of Natural Environment in Albania (PPNEA), the Macedonian Ecological Society (MES) and the Society for the Protection of Prespa (SPP).

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Introduction

Human-predator conflicts are one of the main issues with regard to the conservation of large carnivores worldwide. Particularly in the European continent, where humans have culturally shaped and transformed natural landscapes over millenia the existence of predators has historically been seen as being in conflict with human interests, especially with stockbreeding and farming. The most prominent conflicts between humans and large carnivores concern livestock depredation; however there are considerable issues over crop and beehive damages by bears as well as competition for game species with hunters particularly with wolves and lynx. In most of Central and Western Europe where large carnivores are recenlty recovering after being exterminated by humans in the past, sharp conflicts between people and predators have risen, especially since in these areas farming and stockbreeding have been void of protection measures against predators for centuries. The situation seems to be drastically different in Eastern and Southern Europe, where large carnivores have persisted alongside human populations and have shared landscapes for millenia and higher levels of tolerance seem to prevail in these regions. This is concomitant with the fact that farming and livestock keeping have largely retained traditional co-existence elements and adaptation mechanisms to the presence of large carnivores.

Gray wolves (*Canis lupus*) and brown bear (*Ursus arctos*) are present in the Prespa basin shared by Albania, North Macedonia and Greece and they have never gone extinct; however they might have been subject of great population fluctuations over time. Eurasian lynx, represented by the critically endangered subspecies, the Balkan lynx (*Lynx lynx balcanicus*), have historically been present in the region, however, currently they have largely dissapeared, with only sporadic occurrences from time to time, but no signs of establishing a permanent presence or population. There is no systematic data or monitoring for bears and wolves in the whole Prespa basin, however it is assumed that their populations are stable. While there are continuous reports from local inhabitants on damages from large carnivores, the extent and severity of these problems is not adequately understood.

Continental-wide depredation from large carnivores is widespread and often subject to compensation mechanisms by states. A recent analysis by Linnell and Cretois (2018) indicates that, on average, some 19,500 sheep were compensated annually as being killed by wolves in the period 2012-2016, in 19 countries of the European continent, while bears were held accountable for 1400 sheep lost on average annually in the same period. Wolf depredation was seemingly more problematic in Portugal, Greece, Croatia, France and Italy, countries which took almost 75% of all compensations in the European Union. Data from Greece (Petridou et al., 2019) indicates that wolf depredation on livestock affects thousands of livestock farmers each year and is responsible for an average of €934,700 in compensation money every year. This corresponds to approximately 7,600 killed animals paid to producers from the Hellenic Farmers Insurance Organization (2010-2016 data, ELGA). Furthermore it is beleived that these numbers do not come close to representing the real magnitude of the problem in terms of depredation cases, as compensated losses can constitute only a portion of the actual losses livestock breeders suffer (Iliopoulos et al., 2000; Iliopoulos and Petridou, 2012).

While costs seem to be high in many EU countries, the extent of damage from large carnivores into the overall livestock 'population' is extremely low. Linnell and Cretois (2018) report that in total wolf depredation cases only account for 0.05% of the total sheep stock in the European continent. Nonetheless, generalisations like this might not be representative on the scale of damages suffered by single owners, or in more localised term; individual farmers or regions in particular might suffer abnormally high rates of depredations, often also linked with habituation of large carnivore individuals, availability (or the lack of) of natural prey and food, inadequate sheep-guarding or preventive methods as well as landscape and natural habitat particularities (Dickman et al., 2014; Linnell, 2013).

Little is known on the extent and particularities of human-predator conflict in the Prespa basin, however on the Greek side of the basin, a thorough study was comissioned by the authority of Prespes National Park in 2015. The study was completed in 2017 (Iliopoulos and Petridou, 2017) and is the first comprehensive summary on issues surrounding large carnivores in one part of the Prespa basin. Following this study, the organisations members of PrespaNet (PPNEA, MES and SPP) made the decision to expand the study of conflicts from large carnivores also in the Albanian and North Macedonian parts of the basin, largely following the same methodology and field tools of the study conducted in the Greek part. This reports summarises the findings of the study in the Albanian and North Macedonian parts of the Prespa basin and, by doing so, it completes an overview picture of human-large carnivore conflict dynamics in all the Prespa basin. The aim of this study is to provide a descriptive analysis on the livestock keeping systems in the Albanian and North Macedonian parts of the Prespa basin and evaluate the extent and types of conflicts existing between shepherds and large carnivores, by the means of a questionnaire survey that was conducted through face-to-face interviews between September 2019 and February 2020. The results are expected to inform adequate actions to management and wildlife authorities in both countries for addressing human-large carnivore issues in order to alleviate economic impacts to the local population and ensure the long term conservation of large carnivores in Prespa.

Methodology

Information about the area

Prespa is a Transboundary basin with two Lakes (Great and Lesser Prespa Lakes) shared by Albania, North Macedonia and Greece with very rich flora and fauna favoured by its geology, relief and biogeography.

On the Albanian side, the whole territory of Prespa basin is designated as a National Park (PNP), while on the Macedonian side the mountain ranges of Pelister and Galichica are designates as National Parks, the wetlands of Ezerani are declared as Nature Park and the lake area of Great Prespa Lake is designated as Monument of Nature. Having the areas declared as National Parks is related to the biodiversity richness of the Prespa Basin that is exceptionally high in comparison to its size. Throughout the basin there are many areas with particular conservation importance from the lakeshore to the top of the mountains. Prespa is home for many species and habitats of conservation interest as well as endemic species and many other species beyond their usual range. Among the 60 mammal species encountered in the area (Fremuth and Shumka, 2014), those of conservation importance on the national and international level include the Balkan lynx, grey wolf, chamois and the brown bear. Both Albanian and Macedonian sides of the Prespa basin while being National Park territories, they are also inhabited areas. With around 5000 inhabitants living in 12 villages in the Albanina side of Prespa and 17.000 in the 38 villages and 1 town on the Macedonian side of Prespa, with the majority of the population employed in the primary sector.

People and large carnivores have shared landscapes for centuries in the Prespa basin and the lives of both groups have been influenced by the behaviour of each group. Depredation by predators on livestock and by bears on crops have been reported frequently, as retaliation measures from humans have been taken as well, by persecuting and decimating large carnivore populations in the past (Keçi et al., 2008; Stojanov et al., 2012; Trajçe et al., 2008).

Survey instrument

The questionnaire used for the survey was adapted and translated version to the local context in Albania and North Macedonia following the questionnaire prepared by Greek experts, Yorgos Iliopoulos and Maria Petridou, for the study regarding the conflicts caused by the Large Carnivores on the Greek side of the basin (see Annex 1).

In order to follow the above mentioned differences in stockbreeding in all the three sides of the basin the structure of the questionnaire needed to be adapted accordingly, in order to encapsulate the differences in the questionnaire, also being able to collect all the necessary information that will be potentially valuable for comparisons. The adaptation was conducted in order not to lose the general structure and the information collected to be used for comparative analysis across the countries.

In preparation to conduct questionnaires we developed a list of stockbreeders that will be included in the survey, following certain criteria and the on ground situation as above mentioned. The sample size of the number of stockbreeders that would be involved in the survey was primarily calculated based on the numbers of inhabitants in each part of the basin, something that did not correspond with the actual situation on the ground.

There is not an official list or a standardized database of registered stockbreeders in either Albania or North Macedonia that could help determine the exact number of units keeping livestock on each side of the basin. So the shepherds included in the study were identified with the help of locals on the Albanian side and on the Macedonian side following the experience and results of a previous survey concerning the stockbreeders of the area conducted by MES as part of their wet meadow management activities related to grazing.

Following the survey results on the Macedonian side was estimated that the maximum number of stockbreeders that can be included in the survey was 20. The same number of stockbreeders was targeted for Albania as well, for a total of 40 stockbreeders in both countries.

The selection of 20 stockbreeders to be interviewed on each side was done also based on the number of their livestock units, frequency of taking the herds to the grazing areas, testimonials from the locals about their experiences and encounters with large carnivores. The farmers with larger number of livestock units were considered as a priority to be included in the survey since they are more frequently in the grazing areas and also covered larger geographical scope. Stockbreeding method was also considered when estimating necessary sample sizes on each side, especially on the Albanian side of the basin.

Other criteria that were considered during the sample selection were based also on the research results regarding the presence of the large carnivores near their living areas or areas where they take their livestock for grazing.

In the survey shepherds from the 12 villages living in the boundaries of the Prespa National Park on the Albanian side were included and villages around the Great Prespa Lake on the Macedonian side (Arvati, Krani, Nakolec, Lavci, Drmeni, Leskoec) that are also close or within the boundaries of Galichica and Pelister National Parks.

Stockbreeders and shepherds that come from outside the Prespa area but take their livestock for grazing within the area of the Prespa basin were not included in the survey, with the exception of once case in the Albanian side.

Interview with the stockbreeders

On the Macedonian side, the questionnaires were conducted by a MES-Prespa local officer and MES large carnivores experts. On the Albanian side the local officer conducted the interviews with the help of volunteers, the local population, and the students that assisted for identifying the

stockbreeders in the area. Interviewers received prior training to conduct questionnaires, by the author of the report.

The interviews lasted approximately 35-45 minutes. The interviewing process was organized in the manner of the conversation flow, the information provided from the shepherds, the interest expressed, the story telling, while prioritizing the main questions concerning the losses from the large carnivores and the possible conflicts present.

The data collected from the questionnaire was related to:

- The most common issues that the stockbreeders face.
- The methods and the intensity of surveillance of the herds.
- Methods of restriction used for the animals during the night, the use or not of fencing.
- The composition and the capacity of the herd.
- The grazing areas (with GPS coordinates included) during the summer and winter seasons, while defining the beginning and the end period of grazing in the defined areas.
- The mortality of the livestock from other causes rather than the Large Carnivores
- The number, quality and training of guard dogs as a repellent method for carnivores, also the basic health care and food provided to them.
- The number of lost animals (if any) and the number for which the stockbreeders received compensation for the years 2017 and 2018 (and in 2019 if any).
- The size of loss of livestock by wolf and / or bear attacks in 2017 and 2018 and/or 2019 and also in the past years, if the losses were not frequent.
- Recent data on the presence of the wolf and bear by mapping the reported encounters or observations on the map, chronologically. Reports related to the encounters or occurrences of individuals or group of individuals, breeding indicators, howl listening trend and history of the species presence according to the local population.

Results

Participants profile

In total, 19 shepherds were interviewed in Albania and 17 in North Macedonia. The majority were older men with an average age of 58.6 years in AL (range 20-88) and 51.3 years in MK (range 23-75). In Albania 18 shepherds identified themselves as seasonal movers (up-down the mountain), and 14 declared grazing their livestock locally (local grazers around villages), with some shepherds declaring practicing both seasonal movements and local grazing around villages. In N. Macedonia 5 shepherds declared themselves as being in a permanent/fixed location year round, 6 engaging in seasonal movements (up-down the mountain) and 6 local grazers around villages. Interestingly no shepherd in both Albania and N. Macedonia identified themselves as long-distance transhumance shepherds. This is concomitant with the fact that such a practice has been largely fading in the last decades in the entire Balkans and it is indicative of the overall decline and dissapearance of transhumanism as a form of keeping and rearing livestock from the region.

All respondents in Albania and N. Macedonia declared as being permanent residents in the respective regions of Prespa or (for one case in Albania) in the immediate vicinity of the basin.

While in Greece the stockbreeders seem to be usually more specialised and focussed exclusively on this activity (Iliopoulos and Petridou, 2017), in N. Macedonia few were also specialized stockbreeders, but nevertheless also focus on other activities, while in Albania the 'border' of what constitutes a stockbreeder and what not, is more vague as almost all inhabitants own at least a few livestock, while all households conduct a multitude of agricultural activities besides livestock keeping, including farming perennial and annual crops, beekeeping, plant collection, etc.

All the stockbreeders on both Albanian and Macedonian sides move within the boundaries of the basin. On the Macedonian side of the basin the most common stockbreeding method is the individual flocks, while on the Albanian side on Prespa, especially around Great Prespa Lake, the most common stockbreeding method is collective flocks, where the farmers take the herds for grazing, by taking turns, depending on the number of livestock units they have in the collective flock, and only very few stockbreeders have individual flocks.

Profile of flocks

There were some clear differences between the flock type, size and characteristics between Albania and N. Macedonia. While in N. Macedonia the system of herding seems to have transitioned into a more professional and specialised type, with larger and mono-species flocks being prevalent, in Albania the system retains elements of more traditional small-scale and subsistence type of herding. On average shepherds in N. Macedonia owned more livestock than shepherds in Albania. This was clearly evident in the case of sheep and bovines, where in N. Macedonia the average flock size for sheep owners was 252.9 (range 30-400) and for bovines 17.7

(range 14-20) per owner. In Albania the average flock size for sheep and bovines was 44 (range 2-220) and 7 (range 2-30), respectively. In the case of goats the difference was not so noticeable, with an average flock size of 44.7 (range 6-150) in N. Macedonia and 42.7 (range 2-220) in Albania.

Interestingly in N. Macedonia there seem to be no 'collective' flocks from the respondents confirmations. In Albania, on the contrary, it seems to be quite a widespread method of keeping and grazing livestock. Collective flocks are village-based flocks created by the joining of several smaller flocks owned by single owners/families within the village. The collective flocks, contrary to single-owned flocks, has a multitude of owners, where each owner takes turns in caring for and grazing the flock. The number of days each owner invests in looking after the collective flock is correlated with the number of livestock owned within the collective flock. The more livestock owned by a single person, the more days that person has to invest in looking after the collective flock. In Albania, 5 respondends confirmed in keeping their sheep and goats in collective flocks and 3 respondents confirmed in keeping their bovines in collective flocks. The collective flock is almost always mixed with sheep and goats and there is no division based on the species. The average size of collective flocks, without discrimination on the species, is 148.78 and range 70-250. The average size of collective bovine herds in AL is 66.75 and range 40-80.

The total size of the flock owned or grazed by the respondents in Albania was 484 sheep, 598 goats and 42 bovines for a total of 1124 livestock, whereas in N. Macedonia was respectively 3540 sheep, 268 goats and 53 bovines for a total of 3861 livestock.
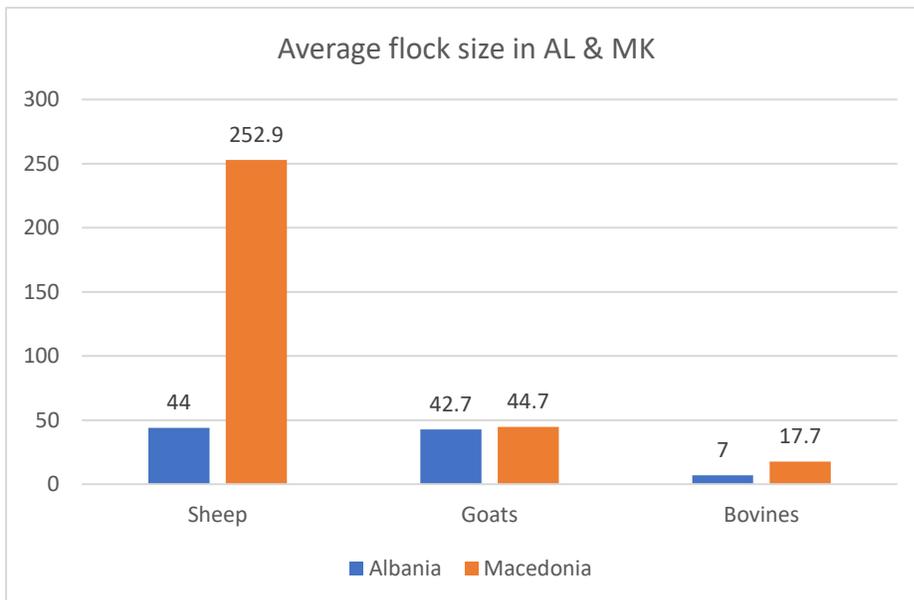

Fig. 1. Average flock size of livestock species in Albania and Macedonia

There seem to be some differences in the systems of flock surveillance between Albania and N. Macedonia. In N. Macedonia on average 2.31 shepherds (range 1 – 5) were involved in surveying the flock (Fig. 2). The involvement of the first shepherd was more intensive, for whom, 8 respondents confirmed that they are constantly with the herd and a further 7 respondents confirmed that they are with the herd during the day while they enclose them during the night (Fig. 3). The involvement of the second person in surveying the flock seemed to be spread on various levels of surveillance. In 12 cases there was an involvement of a second person. Their contribution was equally spread between 'visiting once', staying Morning & night, being constantly with the herd and being with the herd during day and enclosing during night (Fig. 3). 6 respondents confirmed the involvement of a third person in surveying the flock with half of them reporting that involvement as being with the herd during the day and enclosing during night (Fig. 3).

In Albania, the surveillance system seems to be a bit more simplistic as reported by the respondents. First of all, all (19) respondents confirmed that only one shepherd stays with the flock for surveillance purposes. There might be a bias here, with the process of grazing only, rather than the entire period of care for the livestock. Secondly, the involvement of a second person was mentioned by only three respondents, and even then, they were limited to only 'visit once' activities by their sons or wives, presumably to provide food and water during the grazing duty of the shepherd. In addition, the respondents were universally reporting that the system of surveillance was exclusively staying during the day with the livestock and enclosing them during night. Only one respondent differentiated this to be different during the summer period when the shepherd stays up in the *stani*[2] all the time with the livestock, while still maintaining the former surveillance system for the rest of the year. There was no 3rd person involvement at all in Albania.
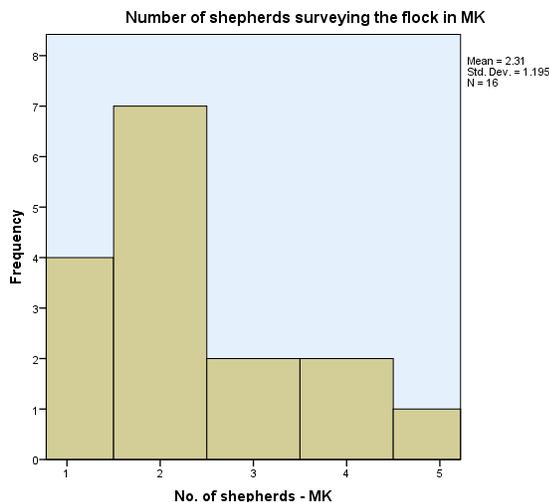

Fig. 2. Number of shepherds surveying the flock in North Macedonia

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[2] Stani are stockbreeding settlements high mountain pastures in Albania and usually consist of a summer hut or small house located on highland pastures, usually above the treeline or at the forest-pasture borderlands, and adjacent pens for gathering and keeping the sheep at night.
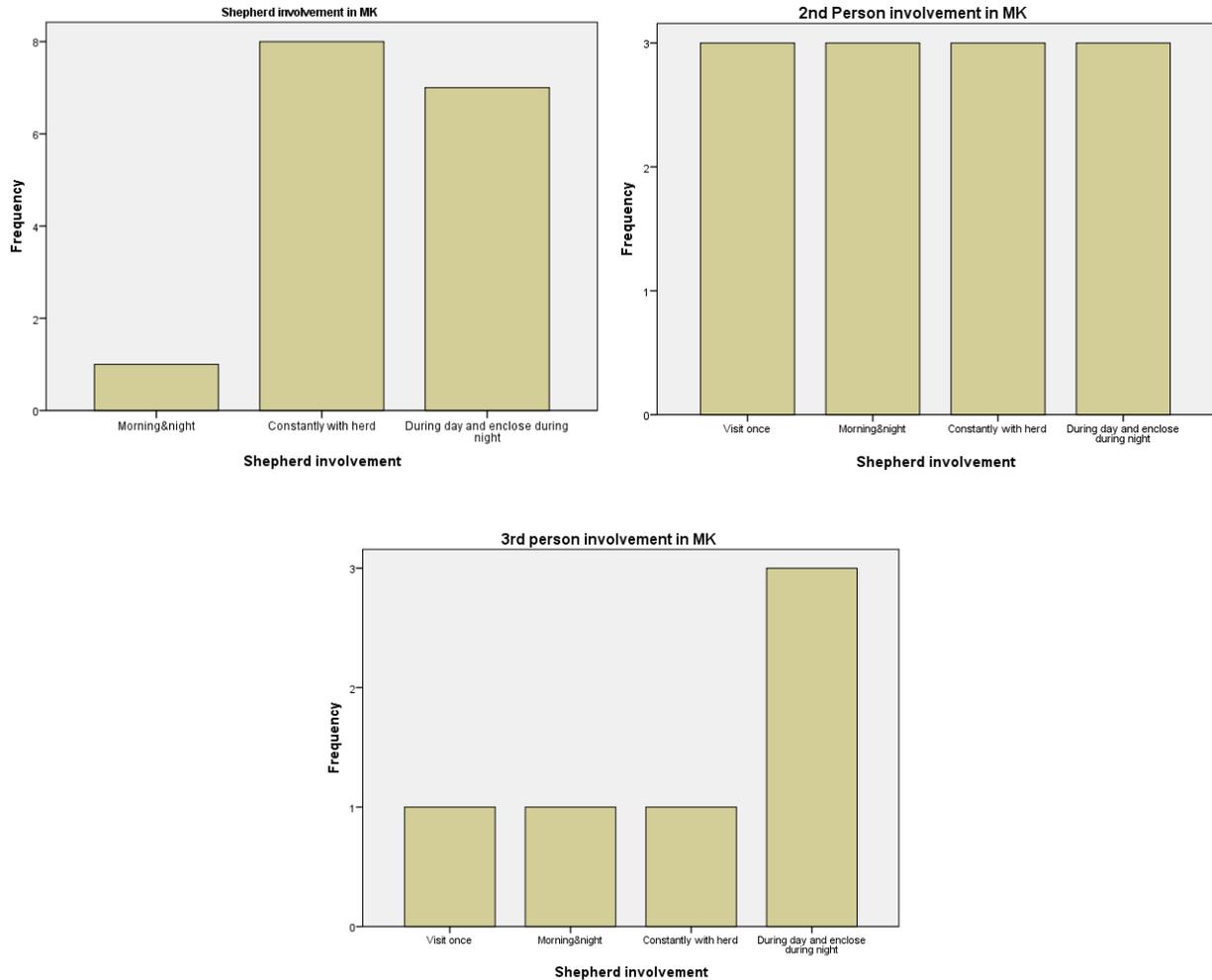
Fig. 3. Shepherd, second and third person involvement in flock surveillance in North Macedonia

Livestock rearing

Respondents in Albania reported a more clearly defined birthing period for sheep and goats than in N. Macedonia. The birth period seemed to span from December to April in Albania with a clear peak in December-February. No other months beyond the period between December and April was reported as a birth period for sheep and goats in Albania. In N. Macedonia respondents reported birth periods almost throughout the year with a clear peak in December-January. Only the months of May and August were not reported as a birth period by any of the respondents.

Bovines were reported as having not a clear period of birth in both Albania and N. Macedonia and newborn calves can be expected at any time of the year.
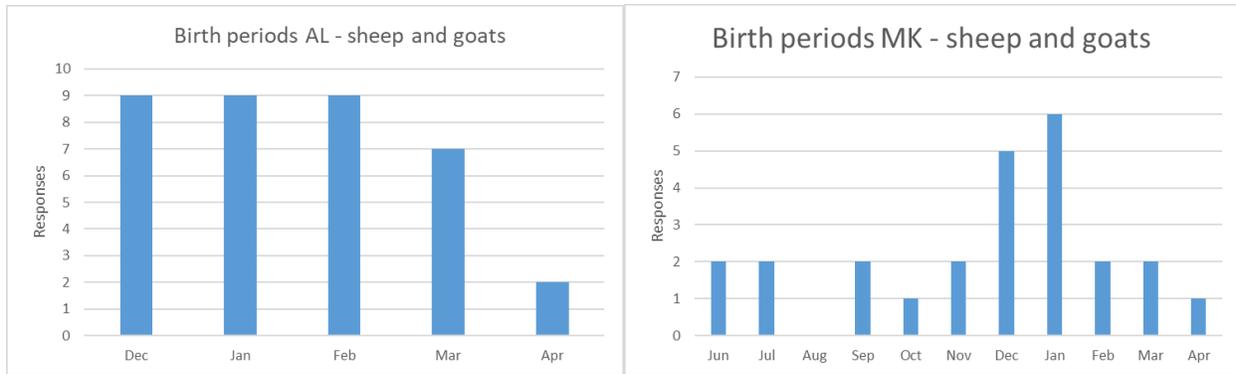
Fig. 4. Birth periods of sheep and goats in Albania (left) and North Macedonia (right)

The average age of integration of lambs and kids in Albania was 4.25 months (18) and range 0-6 months. The average age of integration of lambs and kids in N Macedonia was 2.58 months (13) and range 0-6.5 months.
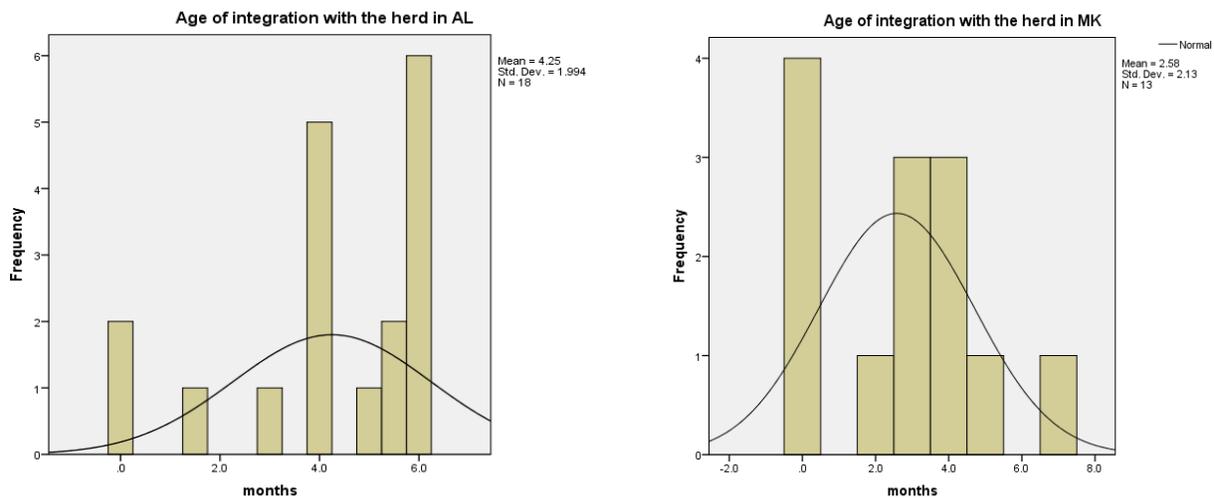
Fig. 5. Age of integration of lambs and kids in Albania (left) and North Macedonia (right)

Overnight guarding of flock

All respondents in Albania confirmed of enclosing their flocks during the night. The overnight summer structure in Albania seems to be mostly a fenced area, as reported by 14 respondents, while 5 of them reported of enclosing the flock in a building (Fig 6). 9 respondents confirmed using wooden fence for keeping their livestock in, while 5 specified the use of a built wall. Few respondents mentioned 'wire mesh' as a fencing material for the inkeeping of livestock (Fig 7). In N. Macedonia, the majority of respondents confirmed enclosing the livestock during summer

overnights, with 8 confirming that they enclosed the livestock in buildings and 7 in fenced areas. A similar pattern was confirmed for the winter period, where the majority of respondents confirmed enclosing livestock within a walled area (10), wooden fence or wire mesh (Fig 8). In Albania, the winter enclosure was almost universally a built structure with 18 respondents confirming that they keep livestock in a building during winter and only one stating that no structure was used at all. All respondents who confirmed keeping livestock in a building mentioned the use of a walled fence for the in keeping of livestock.
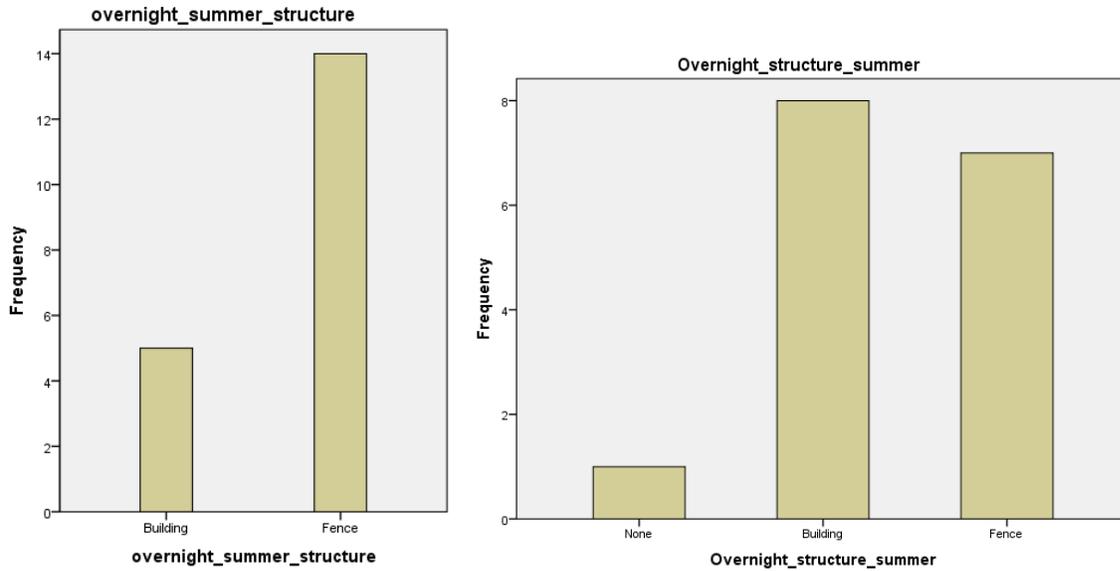
Fig. 6. Overnight summer structure for livestock in Albania (left) and North Macedonia (right)
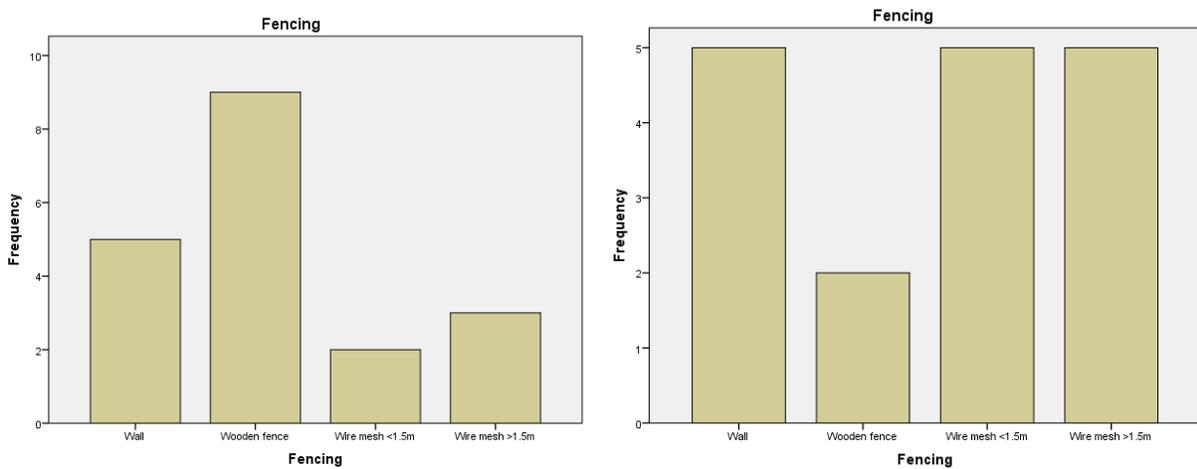
Fig. 7. Fencing material for livestock enclosures in Albania (left) and North Macedonia (right) during summer.
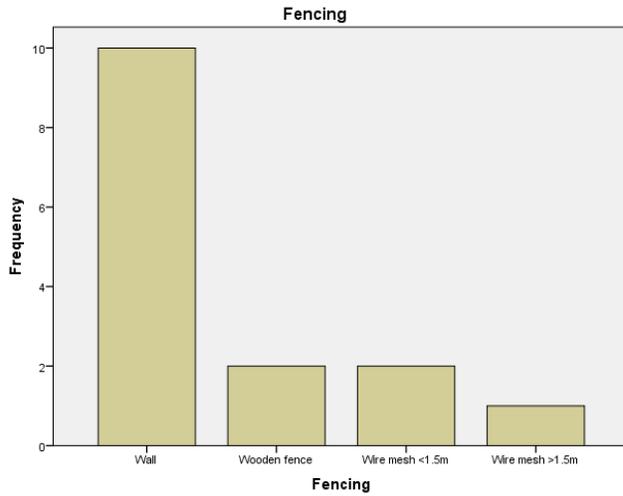
Fig. 8. Fencing material for livestock enclosures during the winter in N Macedonia
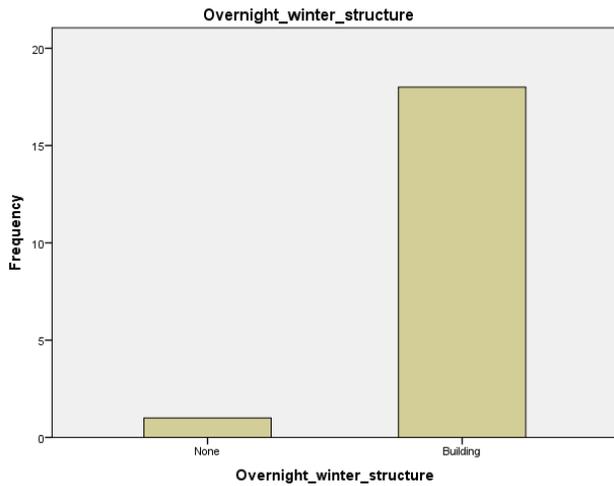
Fig. 9. Overnight winter structure for livestock in Albania.

In Albania, 100% of respondents who answered the winter fencing confirmed fencing them within walls in the winter.

Shepherd presence overnight

Most of the respondents (15) in Albania confirmed that the presence of the shepherd was not needed for staying with the livestock overnight during the summer, while only 3 confirmed that this was happening and one mentioned that it was happening occasionally.
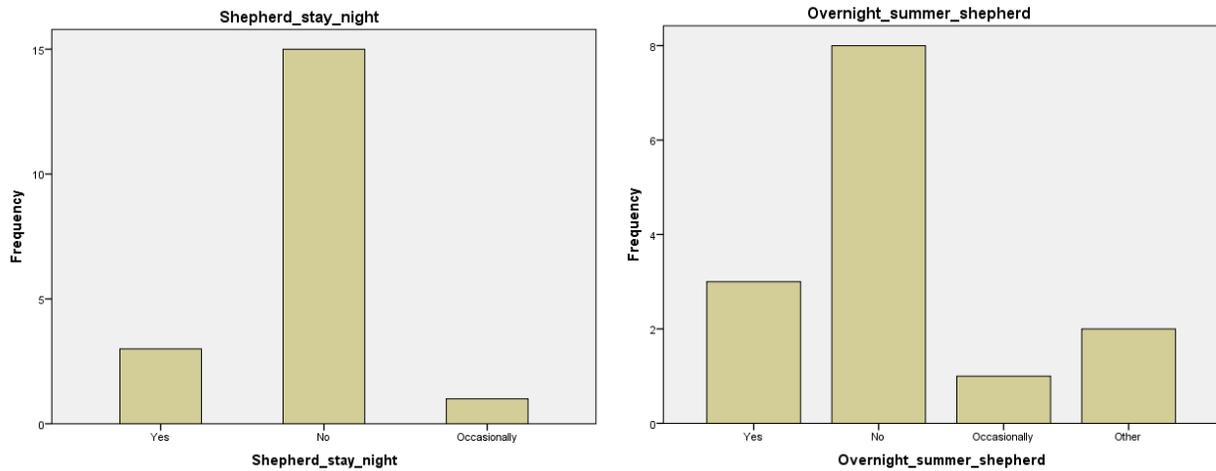
Fig. 10. Overnight stay of shepherds with livestock in Albania (left) and North Macedonia (right) during summer

In N. Macedonia, most of the respondents confirmed of not staying with the livestock overnight during the summer and this number was higher during the winter (11; Fig 10). In Albania, the ratio was higher with a considerable majority of respondents confirming of not staying with the livestock overnight during the winter (16 out of 19 respondents; Fig 11).
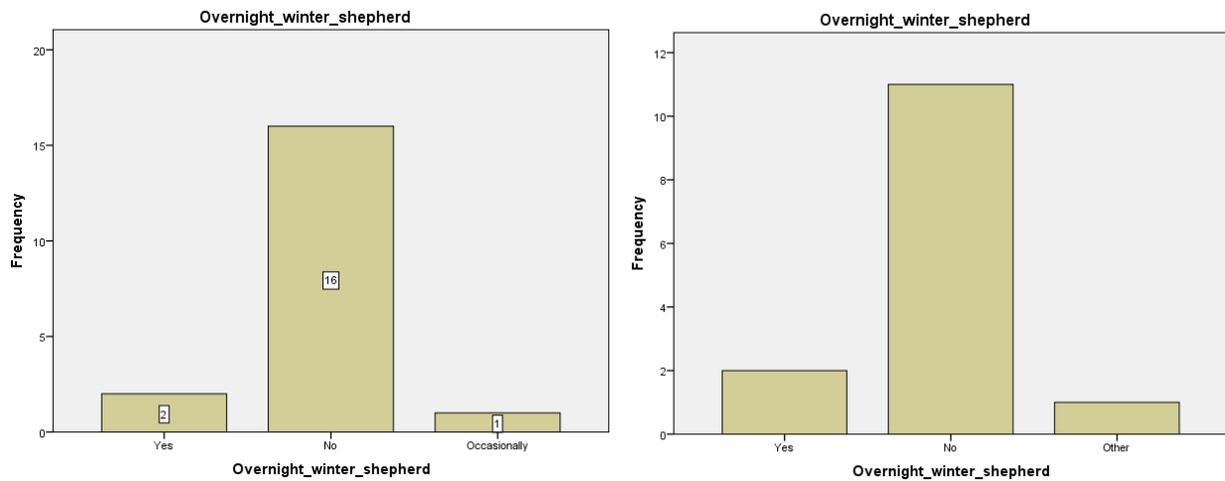
Fig. 11. Overnight stay of shepherds with livestock in Albania (left) and North Macedonia (right) during winter.

Use of guarding dogs

The use of guarding dogs was commonly reported both in Albania and N. Macedonia. In Albania, 18 out of 19 respondents reported owning at least one guarding dog for their livestock. The average number of guarding dogs per livestock owner was 2.42 dogs per flock (range 0-10). All respondents in N. Macedonia reported owning guarding dogs, and the average number of dogs per owner was 4.53 (range 1-9; Fig 12).
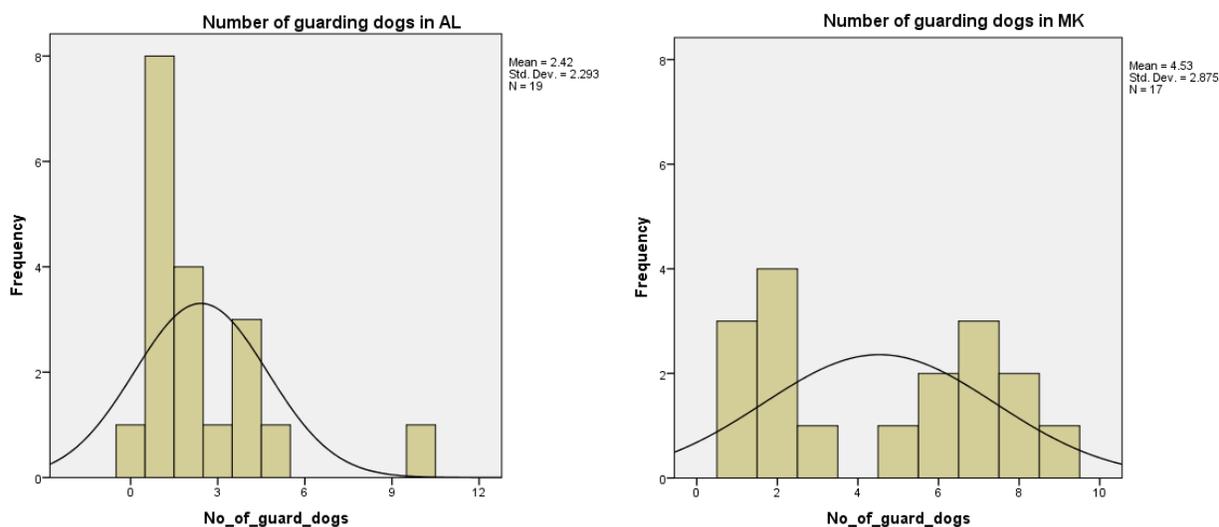
Fig. 12. Number of livestock guarding dogs (LGDs) per owner in Albania (left) and North Macedonia (right)

In AL, 11 shepherds confirmed that the breed of their dogs was from mixed race & from the area, colloquially known to locals as *stani* dogs or livestock dogs. These are not of any particular or standardized breed, but are dogs that are kept for the purposes of guarding sheep and other livestock. Three shepherds confirmed of having Sharplaninec dogs, a famous LGD from the Balkans, renowned for its effectiveness in protecting large flocks of livestock from predators. Two shepherds confirmed having dogs of the kangaal breed, while two more stated that their dogs were coming from neighboring countries (one from N Macedonia and one from Greece) without specifying any particular breed. Two shepherds did not know the breed/origin of the guarding dogs that they were using.

In N. Macedonia 10 shepherds confirmed that they had dogs with no clear race background and responded as 'mixed breed'. Two shepherd confirmed of owning at least one Sharplaninec dog, while six shepherds confirmed that they had at least one dog of the 'kangaal' race.

When asked about the training of puppies, most respondents in Albania (12) stated that they do not do anything in particular to train the puppies. Some five of them stated that puppies learn from older dogs (Fig. 13). In N. Macedonia most respondents (8) confirmed that puppies learn from older dogs, while five of them stated that they do nothing in particular to train the puppies. One shepherd confirmed using deterrents and encouragement commands in help of training the puppies (Fig 13). With regard to human contact with the dogs, most of the respondents in Albania

confirmed that there are no restrictions for the dogs' contact with humans (Fig 14), whereas in N Macedonia there were some restrictive measures for the contact with humans with five respondents reporting that their dogs had contacts only with the shepherd and family, four reported contacts only with shepherd, family and visitors and five others reported no restrictions of dogs with humans (Fig 14).
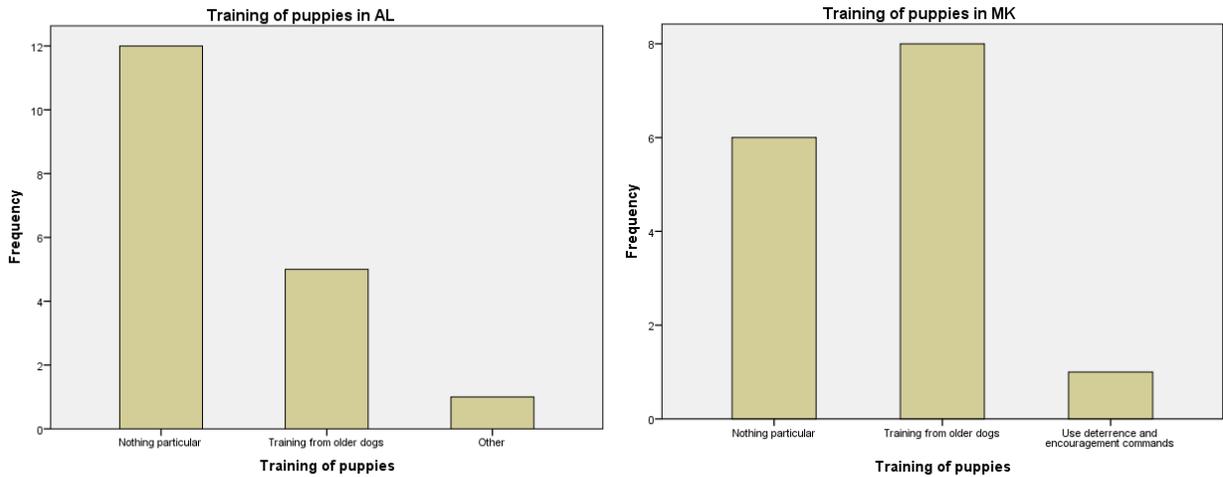
Fig. 13. Training methods for LGD puppies in Albania (left) and North Macedonia (right)
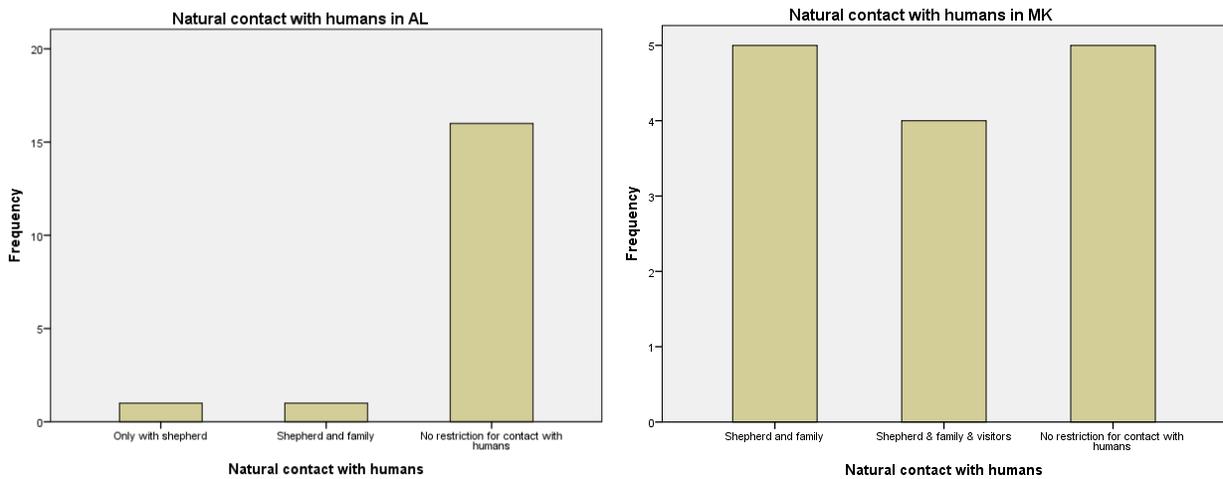
Fig. 14. Natural contact between LGD and humans in Albania (left) and North Macedonia (right)

In both Albania and N. Macedonia, 100% of shepherds confirmed that their dogs do not attack livestock at all. With regard to dogs attacking humans only one shepherd in AL and one shepherd in MK responded that their dogs 'occassionally attack' humans. The majority stated that their dogs do not attack people.

The age of integration of puppies in N. Macedonia was on average lower than in Albania. Puppies integrated with the flock at 2.58 months old on average in N Macedonia (range 0-6 months) while in Albania at 7.75 months old (range 2-18 months; Fig 15).

With regard to dog care, all respondents in N Macedonia confirmed that they were vaccinating their dogs, while in Albania only 53% of respondents stated that they were vaccinating their dogs; the rest did not do any vaccination whatsoever.

Feeding of dogs was primarily based on bread and food left-overs in both countries with only one respondent stating that they also fed their dogs 'dog food' in Albania. In N. Macedonia few also reported 'dog food', but also milk and others (Fig 17).
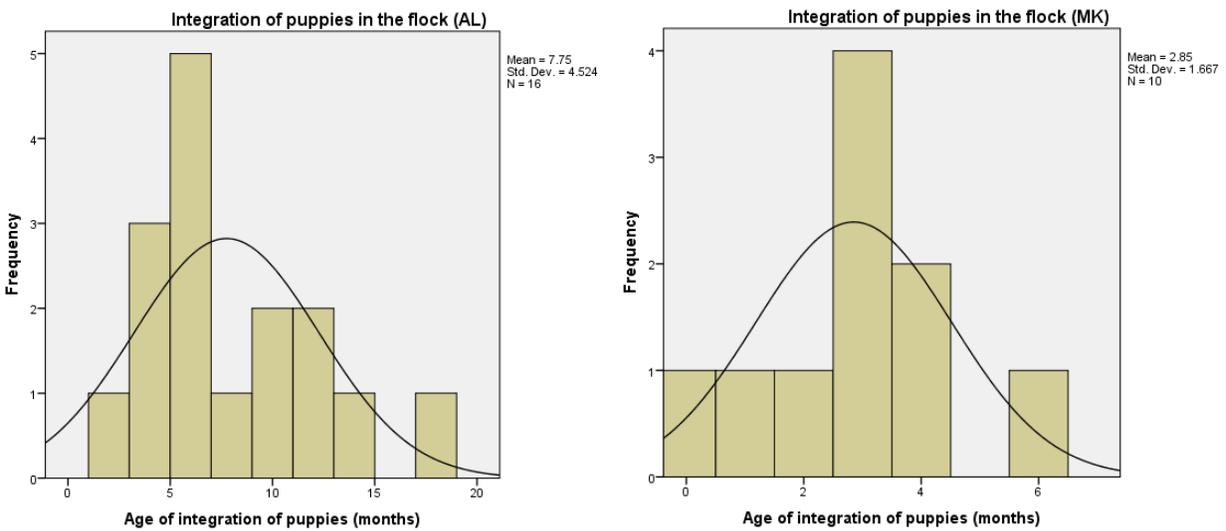
Fig. 15. Age of integration of LGD puppies with the flock in Albania (left) and North Macedonia (right)
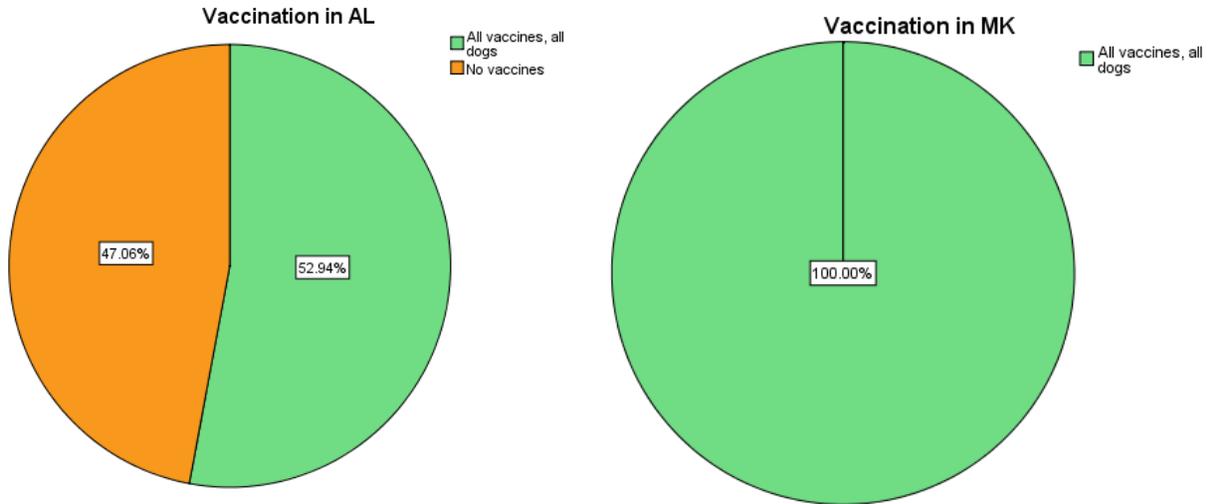
Fig. 16. Share of owners/shepherds confirming vaccination of LGDs in Albania (left) and North Macedonia (right)
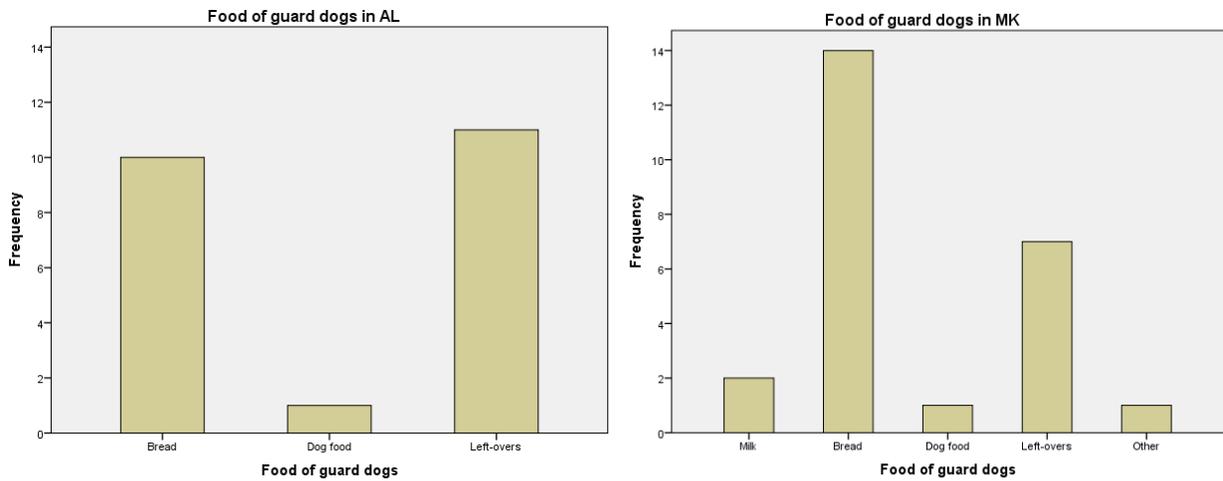
Fig. 17. Food provision for LGDs in Albania (left) and North Macedonia (right)

In N. Macedonia, 100% of respondents confirmed that their dogs would follow the herd, while in Albania only 11 respondents (64.7%) confirmed that dogs would follow the herd. In N. Macedonia, most respondents confirmed that dogs would overnight with the herd, as they did in Albania (Fig 18 & 19.)
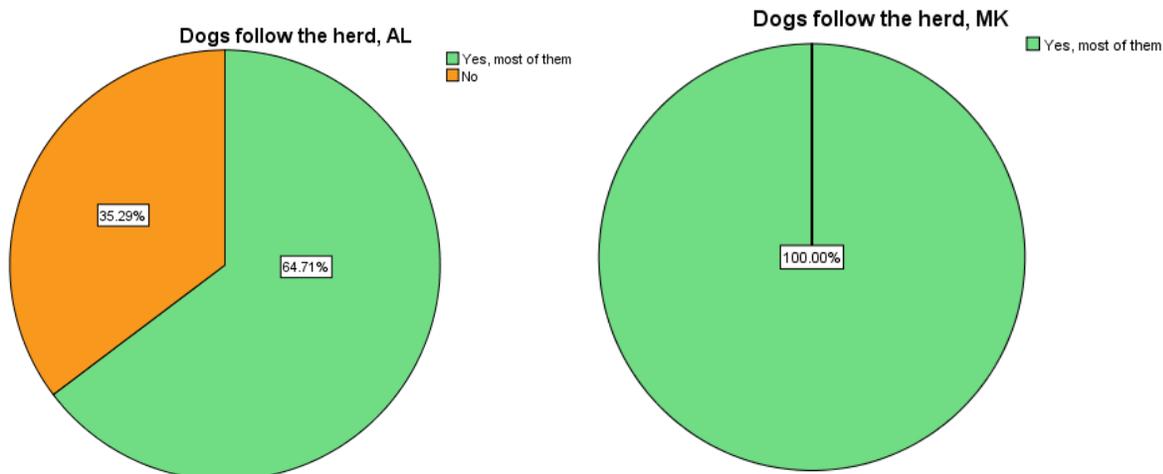
Fig. 18. Share of owners/shepherds confirming that their dogs were following the herd in Albania (left) and North Macedonia (right).
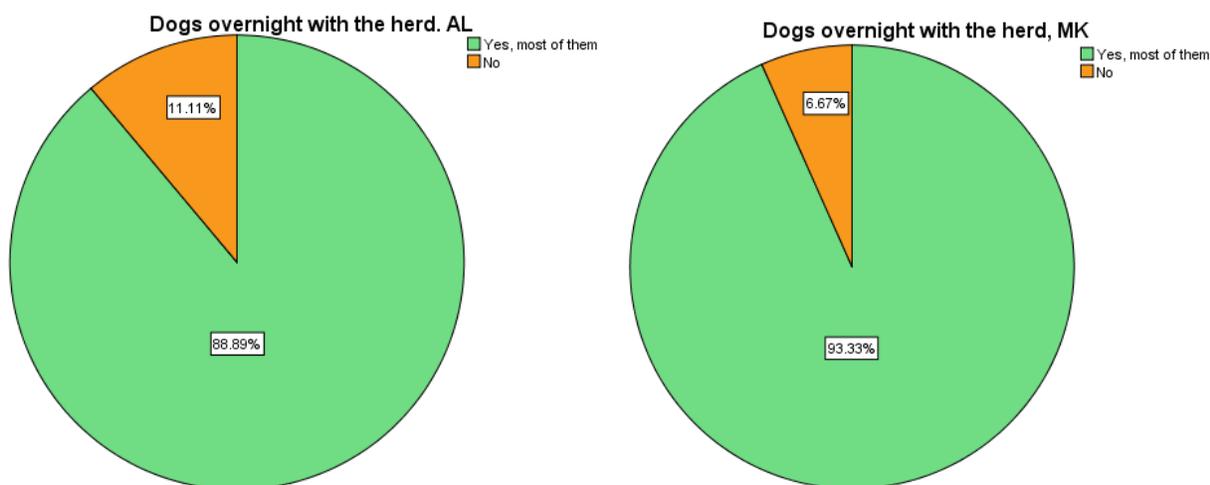
Fig. 19. Share of owners/shepherds confirming that their dogs were following the herd in Albania (left) and North Macedonia (right).

Some participants confirmed problems stemming from the use of guarding dogs. In Albania, eight shepherds confirmed that their dogs would often attack wild prey, while a further three confirmed that their dogs would do this occasionally. Seven shepherds stated that they would actively prevent their dogs from attacking wild prey. In N Macedonia, seven shepherds confirmed that their dogs would occasionally attack wild prey, while only two stated that this was a frequent occurrence (Fig 20).
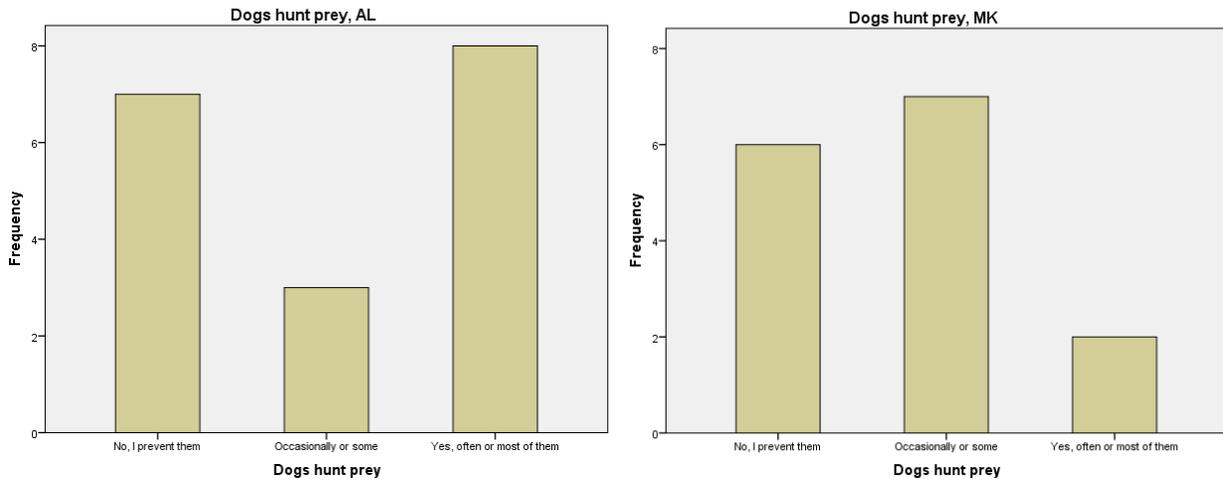
Fig. 20. Confirmations on LGDs attacking wild prey in Albania (left) and North Macedonia (right).

Guard dogs were reported to be a problem for hunting dogs as well, where in Albania most shepherds confirmed that guarding dogs would at least sometimes attack hunting dogs. In N Macedonia, this was reported to be less of a problem and most of the respondents confirmed that guard dogs do not attack hunting dogs (Fig 21).
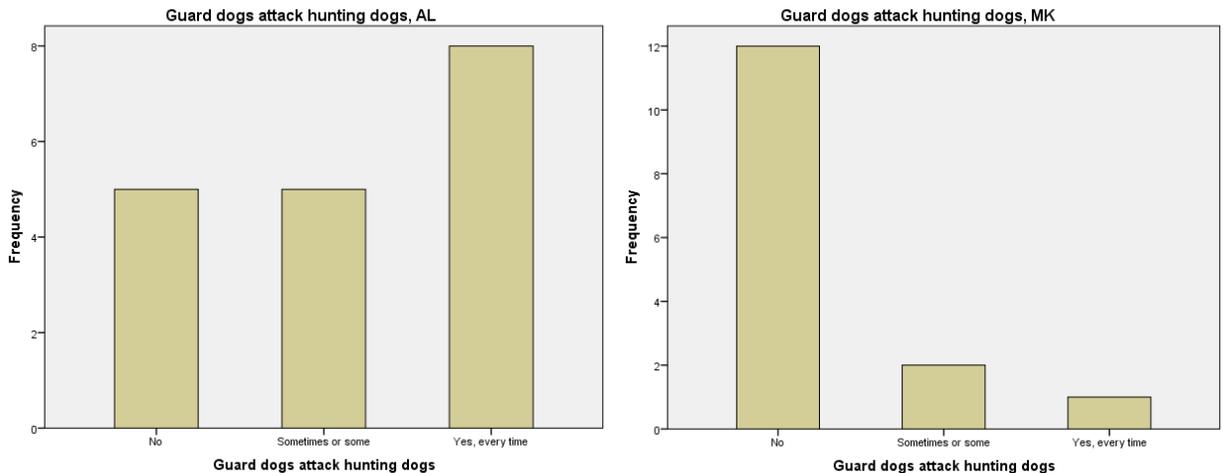
Fig. 21. Confirmations of LGDs attacking hunting dogs in Albania (left) and North Macedonia (right).

Responses to approaches of wolves and bears by guarding dogs were recorded as well. In Albania the most common reaction was 'barking' and to a much lesser degree 'attacking without physical

contact'. In N. Macedonia the responses were more varied, with the most common reactions being 'attacking without physical contact' and 'barking' respectively (Fig 22)
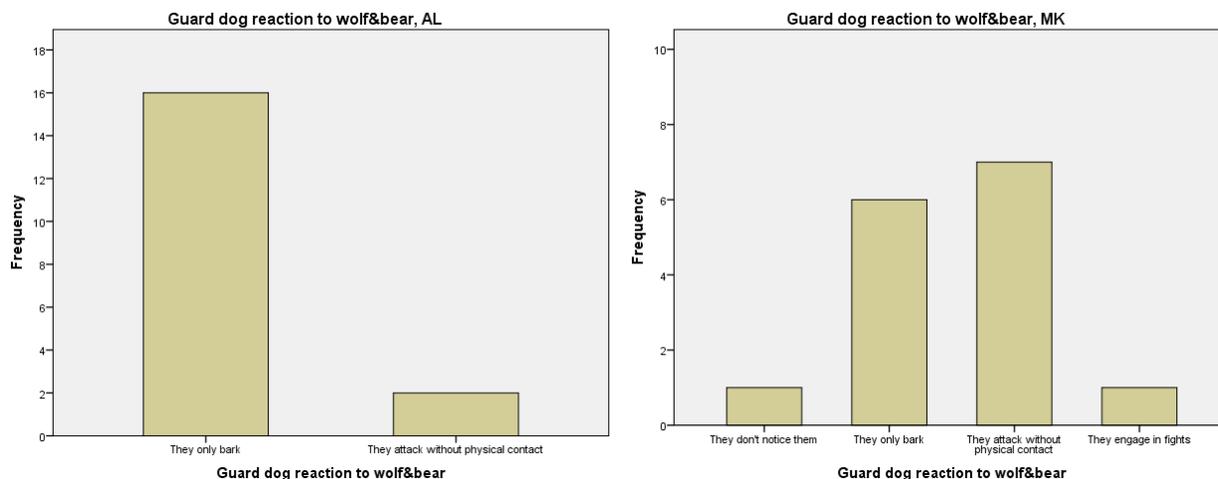
Fig. 22. LGDs reactions to large carnivores approaching flocks in Albania (left) and North Macedonia (right).

Livestock losses

Participants were asked about the various reasons for livestock losses among their flocks. On average, shepherds in Albania reported a loss of 2.39 livestock lost per shepherd from disease (range 0-23), while in N. Macedonia the number was much higher at 13.89 livestock lost from disease (range 1-40). Loss from wild animals (without discrimination of the species) was reported on average at 4.5 livestock lost per shepherd (range 0-25) in Albania and 11.29 livestock lost per shepherd (range 1-20) in N. Macedonia. Loss from other causes was reported on average at 1.83 livestock lost per shepherd (range 0-5) in Albania and 3 livestock lost per shepherd (range 1-5) in N. Macedonia.
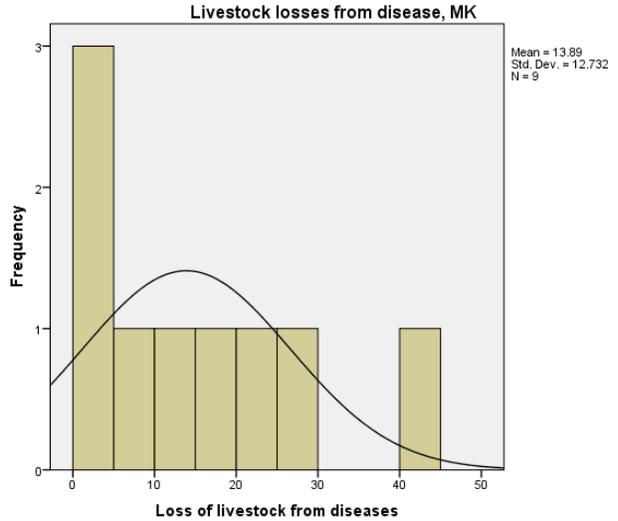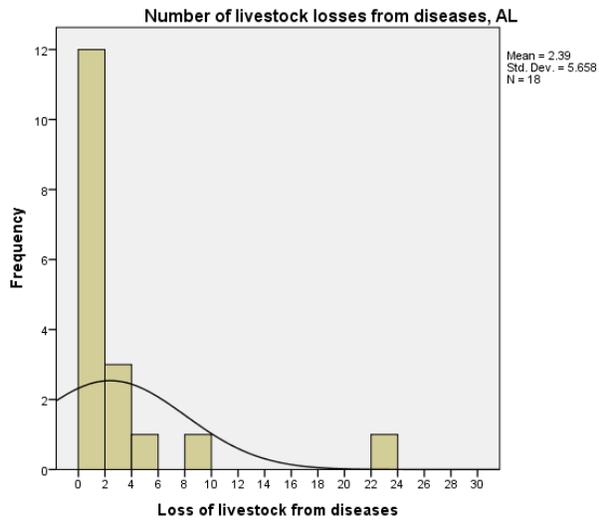
Fig. 23. Reported livestock losses from disease in Albania (left) and North Macedonia (right).
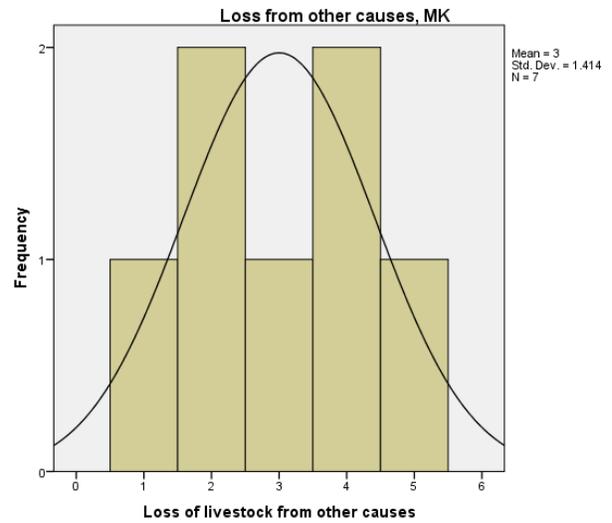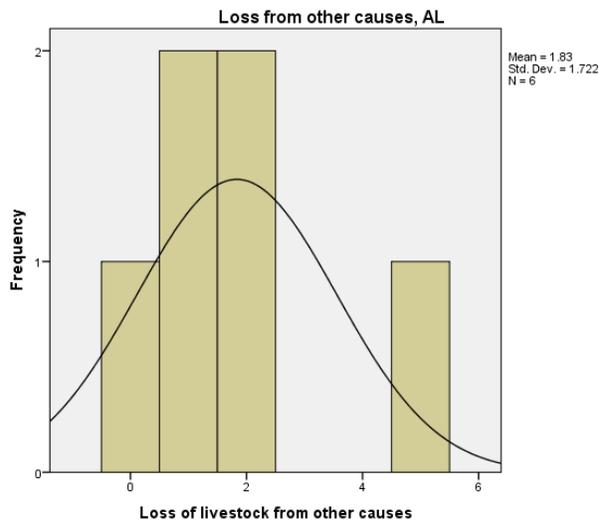
Fig. 24. Reported livestock losses due to other causes in Albania (left) and North Macedonia (right).
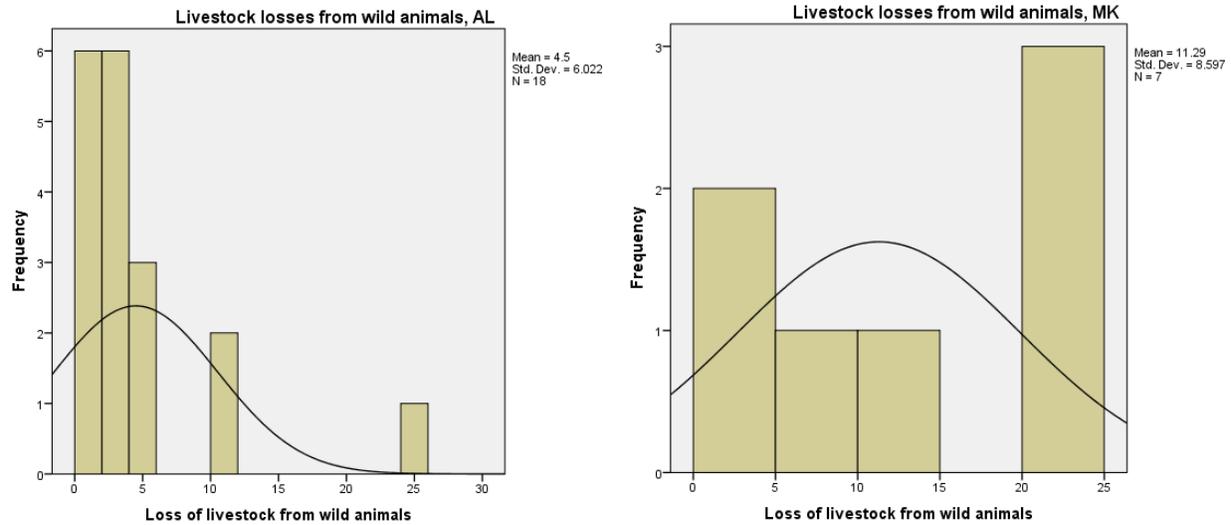
Fig. 25. Reported livestock losses due to wild animals in Albania (left) and North Macedonia (right).

Losses from large carnivores

In Albania, more shepherds had experienced damages from wolves than in N. Macedonia. 15 shepherds (out of 19) reported to have suffered losses from wolves in Albania while only 5 (out of 17) shepherds in N. Macedonia confirmed to have suffered losses from wolves.

On average, in Albania shepherds reported to have lost 3.27 livestock per shepherd (range 1-10) from attacks from wolves for a total of 49 livestock lost to wolves in the last year. In N. Macedonia the average was higher at 9.6 livestock lost to wolves per shepherd (range 1-34), however it is important to mention that one shepherd in particular reported a very high number of losses, 34 individuals, which increases the average substantially. The total number of livestock lost was 48, not much different from the number reported in Albania (Fig 27).
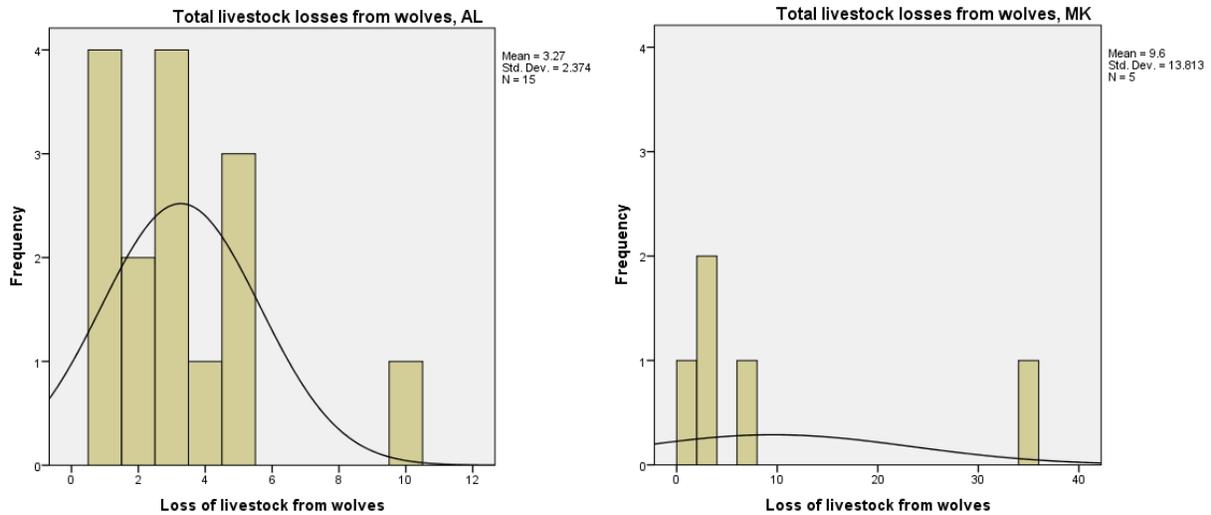
Fig. 26. Livestock losses due to attack from wolves in Albania (left) and North Macedonia (right).

Losses from bears seemed to be substantially lower than the losses from wolves. In Albania. losses from bears were reported by only 2 shepherds respectively reporting 2 livestock lost to bears for the period 2018-19, for a total of 4 animals lost to bears among the questioned shepherds. In N. Macedonia, four shepherds reported losses from bears in the last year, ranging from 3 to 15 individuals of livestock lost to bears, for an average of 8.25 livestock lost to bears per shepherd suffering losses. In total 33 livestock were reported lost to bears in N. Macedonia for the period 2018-19 (Fig 27).
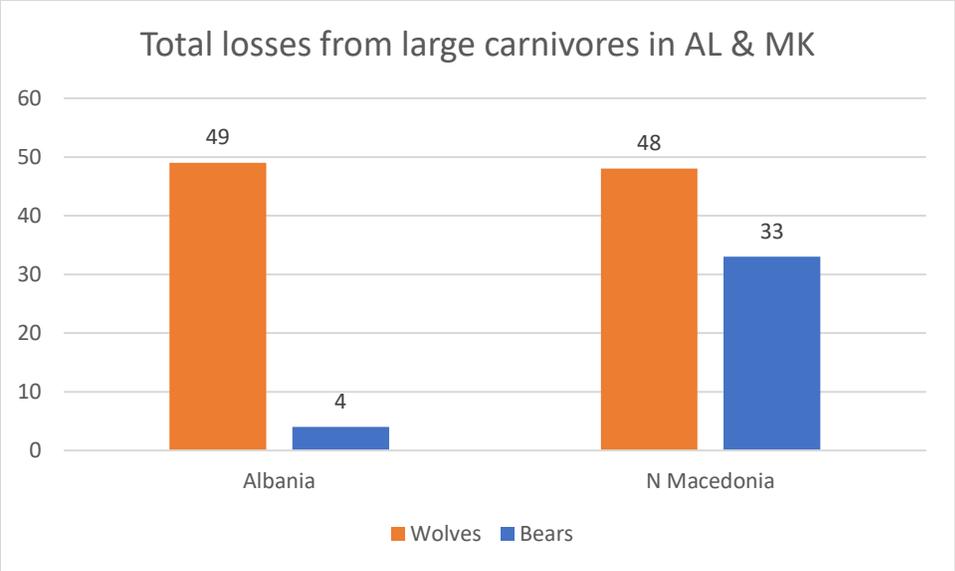
Fig. 27. Losses from large carnivores in Albania and Macedonia

With regard to the total flock owned, the losses from wolves amounted to 4.36% of the total livestock taken care after in Albania, whereas in N. Macedonia the ratio of losses was 1.24% of the total flock. Losses from bears accounted for 0.36% of the size of the total flock in Albania and 0.85% of the size of the total flock in N. Macedonia.
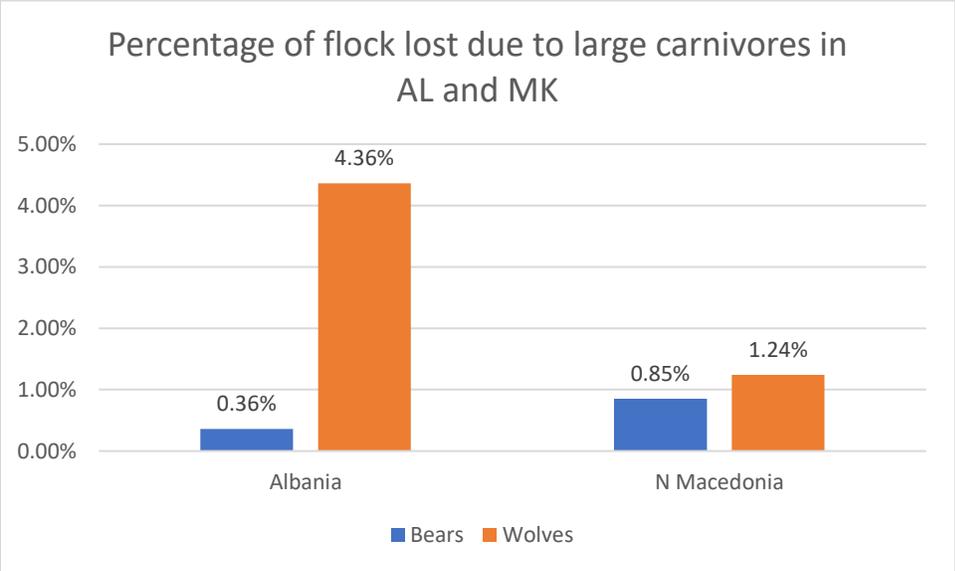
Fig. 28. Proportion of the flock lost to large carnivores in Albania and Macedonia.

Damages from large carnivores in context

We asked shepherds both in Albania and N. Macedonia to identify their major problems with regard to livestock keeping to get a sense of scale on how problematic the issues from large carnivores were when compared to other major issues shepherds in the area of Prespa are facing. In Albania, only four respondents identified damages from wildlife and large carnivores as being an issue of concern for their livelihoods, while the issues that were identified the most problematic were lack of subsidies or financial support by the state (18 out of 19 respondents), lack of young people involved in livestock rearing (18 out of 19 respondents) and lack of veterinary control and veterinary issues (14 out of 19 respondents). Similarly, in N. Macedonia depredation from large carnivores was not seen as the main issue of concern for livestock rearing, with only four shepherds identifying it as a major issue. Market instability/insecurities in selling the products and lack of involvement from young people in the profession were seen as the two main problems related to livestock keeping in N. Macedonia (Fig 30).
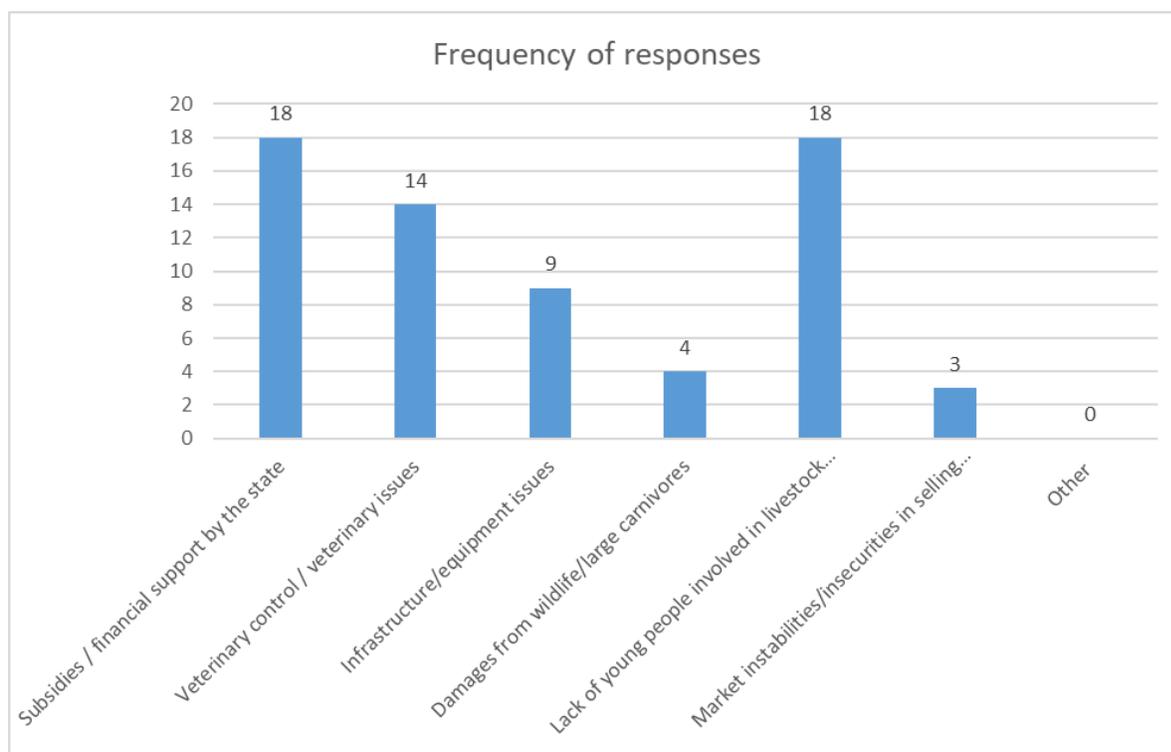
Fig. 29. Shepherds' confirmations on main issues related to livestock keeping on the Albanian side of Prespa
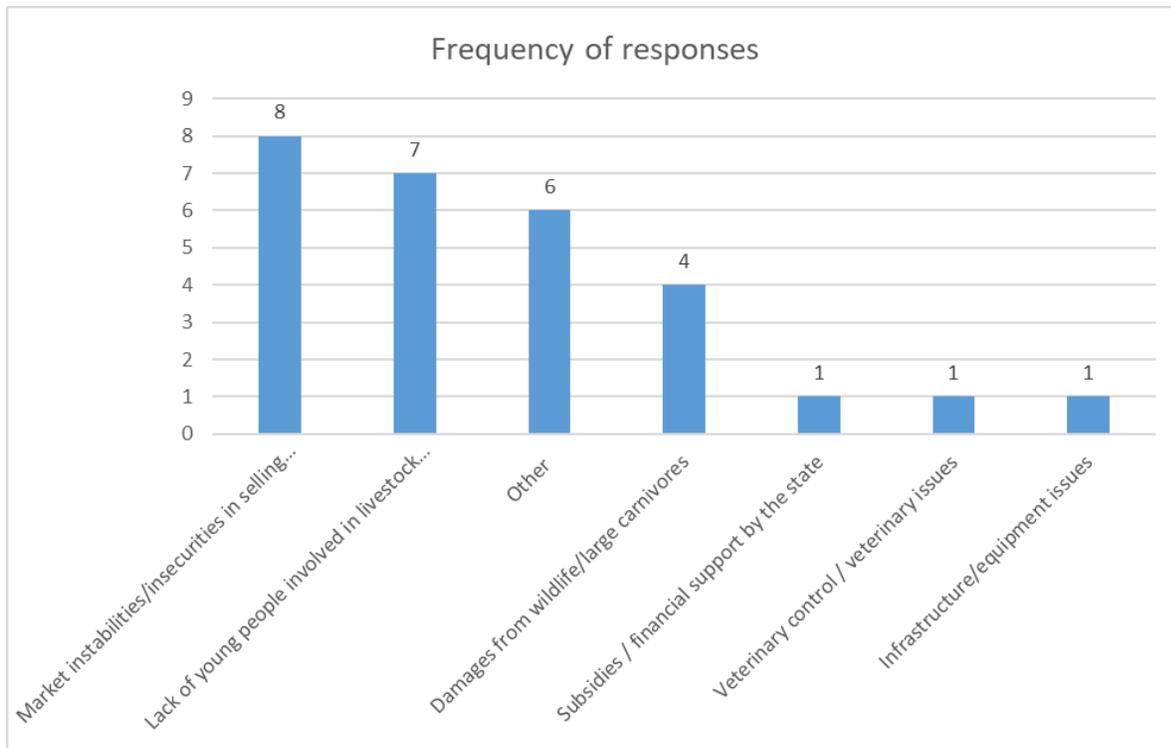
Fig. 30. Shepherds' confirmations on main issues related to livestock keeping on the N Macedonian side of Prespa

Conclusions

This study represents one of the very first attempts to collect and standardize information on human-large carnivore conflicts in the Prespa basin. Following the study on the Greek side of the basin, completed in 2016-17 (Iliopoulos and Petridou, 2017), the conduction of a questionnaire survey on the Albanian and N Macedonian side of the basin, using the same methodology and largely the same survey instrument, completes the picture on the situation of human-LC conflicts in Prespa. Further to that the results of this survey are important as they shed light on human-animal relationships for large carnivores as species that are of great conservation concern both on the national and European levels. The conservation of these high-profile species therefore causes concerns for the local population who shares the landscapes with them and who have to suffer the costs of their presence in nature. Knowledge on existing conflicts between people and predators can be of help in defining rightful mitigation strategies and solution mechanisms that will

ultimately benefit the local population and stakeholders and the conservation of large carnivore populations alike (Sillero-Zubiri and Laurenson, 2001; Treves and Karanth, 2003).

While there is an ever-increasing amount of literature that looks into conflicts between people and wildlife in general, and people and large carnivores in particular, such studies tend to be not evenly distributed in geographical terms, being mostly focused in regions where the interest is higher among stakeholders and where there is more funding available for research. In Europe, for instance, most of the research on conflicts between people and predators seems to be focused in western and northern Europe, primarily because these areas have been subject of large carnivore recolonization in the recent past, after having almost completely exterminated all large predators in the late 19th and beginning of 20th century. Given these changes, human-wildlife conflicts seem to be of a higher profile and interest in areas where large carnivores are re-appearing after being exterminated in the past. In areas where predators have persisted alongside people even through periods of active persecution, such as in most eastern and southern Europe, conflicts in-between seem to not be so prevalent and noticeable (Carter and Linnell, 2016; Dorresteijn et al., 2014; Trajçe et al., 2019), however at the same time, these regions usually lack an adequate amount of research that looks into these issues and are generally understudied. Such is the case for the south-western Balkan region, for which there is very little amount of research or data available to adequately assess human-large carnivore conflicts. In Albania, for instance, there is not even an institution, repository or database that keeps track of instances of depredation on livestock, something that is usual practice, particularly in countries where compensation mechanisms for large carnivore attacks exist (Kaczensky, 1999; Trajçe et al., 2014).

As such the results of this study, provide some very valuable information with regard to the particularities and extent of human-large carnivore conflict in the transboundary region of Prespa, between Albania and North Macedonia and complement the picture for the entire Prespa basin shared also with Greece. In addition, it looks into country-specific differences of conflicts and livestock husbandry systems and draws conclusions on the interaction of these two.

One of the major setbacks noticeable in research on human-predator conflicts, is that the existence of conflict in the sense of an antagonistic position between human interests and large carnivore presence is often presumed to be there without any assessment on whether this would be the case.

This is particularly true for quantitative studies that often go in with the presumption that conflicts are existing and that they are a major problem for the local population. Basically, if large carnivores are present in a certain area, conservationists and practitioners often assume that conflicts are also present and that they pose a threat for both the livelihoods of the locals and for the survival of large carnivores. While this might be true for many cases, in countries where people and predators have been known to share environments and coexist for prolonged periods of time it is often the case that conflicts are low and tolerance is high. The results of this questionnaire survey seem to confirm such a situation also for the Albanian and Macedonian parts of Prespa. When damages from large carnivores were put into the perspective of other issues that shepherds in this region might be facing, it was evident that shepherds in both countries largely regarded other issues as more pressing for their livelihoods. In Albania, shepherds considered the lack of subsidies, inadequate veterinary control and services and abandonment of the shepherd profession by the younger generation as much more worrying problems than damages from large carnivores. This situation was similar in North Macedonia where market instabilities, lack of young people to engage in shepherding and other issues outweighed problems connected to damages from large carnivores. From such results it can already be deducted that conflicts with large carnivores do not pose the main issue for the livelihoods of the shepherds in Albania and North Macedonia. Therefore, any measures or mitigation mechanisms addressing conflicts with predators should be carefully weighted against other potential measures addressing issues which are perceived of more importance by the local shepherds. This is an important conclusion that should inform adequate intervention and importance given to the human-large carnivore conflict when it comes to the conservation of large carnivore populations. While interventions addressing damages from predators and conflict with wildlife might be welcome by shepherds, they probably do little to address the main concern that shepherds themselves identify as the most important for their livelihoods and profession.

The abandonment of the shepherd profession was evident also when looking into the participants profile. Most of the interviewees were older men, permanently residing in the areas they worked. Transhumance shepherding seems to have been completely abandoned as a form of livestock rearing in Prespa, as all respondents confirmed to not venture anywhere long-distance for grazing and taking care of their flock and the most movement was confined to vertical movement within

the basin from mountain tops to valley bottoms depending on seasons, or just grazing around villages.

Livestock keeping and rearing had some clear country-specific differences. Almost all specificities related to livestock husbandry in Albania and N. Macedonia seemed to point to a general conclusion that livestock husbandry in Albania was more profiled towards a more traditional subsistence-based system, with smaller flocks and slower level of production, while in N. Macedonia the system seemed to have advanced to more intensive style of production, with larger flocks, specialization of the profession and a higher and faster level of productivity. This was clearly portrayed by the average flock size, which was higher in N Macedonia than in Albania (with the exception of goats, for which the flocks were more or less similar in both countries) and by the absence of 'collective' flocks in N. Macedonia, as a shared-responsibility system for taking care of livestock, which was present only in Albania. Further to that in N. Macedonia it was common practice for many people to look after one flock, while in Albania it was almost exclusively one shepherd who was present with the flock the entire time.

The surveillance of flocks and their shelter during the night mirrored the care of shepherds towards their flocks in both countries, as measures that largely prevent attacks form large carnivores and drastically reduce damages. Flocks were always surveyed by shepherds during the day and almost always enclosed in fenced or walled structures during the night.

The birthing period of sheep and goats and the age of integration of young kids and lambs with the flocks shows that N. Macedonia is oriented towards a more intensive system of production than Albania. While in Albania there seemed to be only one clear birthing season between December-March, in N. Macedonia births seemed to occur almost all-year round with a peak in December-January. Furthermore, the age of integration of younglings with the flock was substantially lower in N. Macedonia, averaging only 2.58 months, while in Albania it was 4.25 months on average.

The differences in the livestock husbandry system were further evident in the number and care of livestock guarding dogs that were used in both countries. In N. Macedonia, shepherds had on average more dogs than in Albania (4.53 vs 2.42 dogs per flock), integrated them sooner with the flock (2.85 vs 7.75 months/old as age of integration) and they seemed to invest more in their training and health care. All shepherds in N. Macedonia confirmed vaccinating their livestock guarding dogs while a little more than half the shepherds in Albania confirmed doing the same.

These evidences further indicate the differences in the systems of livestock husbandry existing in both countries, where in Albania more traditional and subsistence-based elements prevail while in N Macedonia more intensive and quantitative forms of production seem to be present.

Results on damages from large carnivores seem to be persistent with similar studies in the region (Karamanlidis et al., 2014; Keçi et al., 2008; Lescureux and Linnell, 2010; Trajçe, 2017; Trajçe et al., 2019). Wolves were reported as the most damage-causing species in both countries, however in N. Macedonia a much higher number of losses from bears were reported than in Albania (33 vs 4 livestock lost due to bears). In Albania, most shepherds confirmed having had attacks from wolves on their flocks, while in N. Macedonia only a few shepherds seem to have suffered attacks. The average number lost to large carnivores was higher in N. Macedonia than in Albania, however this number was heavily skewed by one particular case in N. Macedonia who had suffered an unusual amount of damage from wolves. While in Albania the main reason for losses on livestock was due to large carnivores, in N. Macedonia it seemed that disease was the main factor leading to losses on livestock. In terms of the total losses from large carnivores as a percentage of total flock size owned by all respondents, the impact was higher in Albania where wolves accounted for the loss of 4.36% of the total livestock flock in contrast to 1.24% in N. Macedonia. Such differences can be explained by differences in the livestock husbandry systems in both countries, where more intensively surveyed and cared flock in N. Macedonia mirrored less impacts by large carnivores in terms of overall percentage. At the same time, flocks in N. Macedonia seem to be more susceptible to disease than in Albania, characteristic of larger, individually owned and intensively kept flocks which facilitates easier disease transmission than smaller, 'collective' and scattered flocks.

It is important to mention that the results of this report are only a descriptive picture of the survey conducted in both countries. As such they provide an initial view into the characteristics of livestock husbandry in the Albanian and Macedonian sides of Prespa and the damages incurred from large carnivores, however, by no means can be considered as an exhaustive piece of research. Further analysis and research is needed to provide more thorough connections and conclusions from the data gathered in the field. However, in the interest of informing adequate conservation actions for large carnivores and mitigation measures for human-predator conflicts some preliminary well-informed recommendations stem from the results so far:

- Support to shepherds should be oriented towards issues that they self-identify as the most pressing for their livelihoods and work;
- Mechanisms promoting the engagement of young people in stockbreeding and ensuring the continuation of the shepherd profession need to be put in place by relevant authorities and institutions;
- Where possible, traditional and subsistence-based models of production in livestock keeping should be preserved and promoted to be kept in the long-term future given that such systems are known to foster and improve coexistence with large carnivores;
- Conflict-solution actions or measures should be oriented towards improving or strengthening current practices of livestock protection, rather than introducing new and untested practices for the region, given that the former seem to already ensure a low level of conflict and high tolerance for the presence of large carnivores in the region;
- Health care for guarding dogs should be improved, particularly for Albania, ensuring adequate vaccination, medical care, adequate feeding and training of LGDs.

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QUESTIONNAIRE:

Stockbreeder registration;

Damages from large carnivores;

Mitigation measures;

Data related to wolf and brown bear presence.

Opening question:

Which among the following is the most problematic issue that you face in livestock rearing/keeping?

- a. Subsidies / financial support by the state
- b. Veterinary control / veterinary issues
- c. Infrastructure/equipment issues
- d. Damages from wildlife/large carnivores
- e. Lack of young people involved in livestock breeding
- f. Market instabilities/insecurities in selling the products
- g. Other _____

1.Interview details and location

1.Code	2. Date	3.Researchers	4.Village	5.Municipality	6.1. X	
					6.2. Y	
7. Location		7.1. Livestock holding facility (shed/pen/*stani*)	7.2. Pasture		7.3.Other:	

2. Livestock breeder data

1.Code		2.Age		3.Movements		6. Telephone
4. Name				1.Permanent / fixed location		

		2.Nomad / transhumance	
5. Residency	Resident / temporary	3.Seasonal movements (short / up-down mountain)	
		4. Local grazer (around villages)	

3. Areas - grazing periods (months of year)

4.1.	Start	End	Village	Municipality	Location name	X	
						Y	
4.2.	Start	End	Village	Municipality	Location name	X	
						Y	
4.3.	Start	End	Village	Municipality	Location name	X	
						Y	
4.4.	Start	End	Village	Municipality	Location name	X	
						Y	

4.1. Capacity- livestock ownership

1. #Goats		2.# Sheep		3. # Adult bovines		4.# Calves	
1.1 Race:		2.1 Race:		3.1 Race:			

4.2. Capacity- collective flock[3]

1. #Goats		2.# Sheep		3. # Adult bovines		4.# Calves	
1.1 Race:		2.1 Race:		3.1 Race:			

[3] In cases when many livestock owners of small flocks collect them together and graze them in a rotation system, or when the shepherd does not own the flock, but is paid to look after it by the owner(s)

5. Capacity - Surveillance

1. Total individuals	2. Shepherd involvement	3. 2nd person involvement	4. 3rd person involvement
	1. Visit once	1. Visit once	1. Visit once
	2. Morning & night	2. Morning & night	2. Morning & night
	3. Constantly with the herd	3. Constantly with the herd	3. Constantly with the herd
	4. During day and enclose during night	4. During day and enclose during night	4. During day and enclose during night

6. Birth periods - integration of young animals in the flock

A. Goats-sheep			B. Bovines		
A.1. Birth periods		A.2. Age of integration (months)	B.1. Birth periods		B.2. Age of integration
1	2		1	2	

7. Restriction - retention of calves in different age classes

Age class (months)	A. Day		B. Night	
	A1. Inside a livestock shed	A2. Out, in pasture	B1. Inside a livestock shed	B2. Out, in pasture
1. (0-2)	Yes No	1.No 2.Yes, with fence. 3.Yes, without fence.	Yes No	1.No 2.Yes, with fence. 3.Yes, without fence.
2. (2-6)	Yes No	1.No 2.Yes, with fence. 3.Yes, without fence.	Yes No	1.No 2.Yes, with fence. 3.Yes, without fence.
3. >6 months	Yes No	1.No 2.Yes, with fence. 3.Yes, without fence.	Yes No	1.No 2.Yes, with fence. 3.Yes, without fence.

8. Overnight stay of livestock : Type of establishment-supervision

A. Summer period			B. Winter period		
1. Structure	**2. Fencing**	**3. Shepherd/stock breeder stay during night with livestock**	**1. Structure**	**2. Fencing**	**3. Shepherd/stoc kbreeder stay during night with livestock**
1. None	1. Wall	1. Yes	1.None	1. Wall	1.Yes
2. Wall	2. Wooden fence	2. No	2. Wall	2. Wooden fence	2.No
3. Building	3. Wire mesh <1.5m	3. Occasionally	3. Building	3. Wire mesh <1.5m	3.Occasionally
4. Fence	4. Wire mesh >1.5m	4. Other	4. Fence	4. Wire mesh >1.5m	4.Other

4. Livestock overnight outside the establishments?

Sheep & Goats	Bovines
1.Yes 2.No 3.Other:	1.Yes 2.No 3.Other:

5. Other preventive measures?

1.Lights 2.Electric fencing 3.Other:	1.Lights 2. Electric fencing 3.Other:

9.Guard dogs: capacity

1.Adult, no.		5. Origin	6. Foreign races?	7. Networking with shepherds for exchange?
2. Females:	**3. Males:**	1. Locals:	1.No	1.No 2.With locals only 3. From elsewhere:
		2.Other area:	2. Race/number:	
4. Puppies:				

10. Training of guarding dogs

1. Training of puppies	3. Natural contact with humans?	4. Attack on livestock?	5. Attack on humans?
1. Nothing particular 2. Training from older dogs 3. Kept separately with young animals 4. Use deterrence & encouragement commands 5. Other	1. Only with shepherd 2. Shepherd & family 3. 1&2 and visitors 4. 1&2&3 and at home	1. No, I deter them 2. Yes, without biting 3. Yes, biting 4. They occasionally kill and feed on livestock	1. No 2. Occasionally or some 3. Yes, often
		Remarks	
2. Age of integration (months)			

11. Healthcare and diet of guard dogs			
	A. Puppies	**B. Adults**	
1. **Vaccines** **(1st 4months five-fold, rabies, typhus & yearly)**	1.All puppies, all vaccines 2. Some puppies, sometimes 3. No, I don't do vaccines 4. I don't know what is needed, occasionally	1.All dogs, all vaccines, yearly 2. Some dogs, sometimes 3. No, I don't do vaccines 4. I don't know what is needed, occasionally	
2. **De-flea, De-worm (Internal & external parasites.: pills-paste, spray)**	1.All dogs, all that is needed 2. Some puppies, sometimes 3. No, I don't de-worm/de-flea 4. I don't know what is needed, occasionally	1.All dogs, every 3 months 2. Some dogs, sometimes 3. No, I don't de-worm/de-flea 4. I don't know what is needed, occasionally	

3. Food of guard dogs	1. Milk	2.Bread	3.Dog food	4.Left-overs	5.Other

12. Behavior - Effectiveness of guarding dogs				
1. Do they follow the herd?	**2.** **Do they overnight with the herd?**	**3.** **Do they hunt (roe deer, wild boar, hare)?**	**4.** **Attacks to hunting dogs?**	**5.** **Reaction to wolf/bear?**

				1. They don't notice them
1. Most of them, yes 2. Most of them, no 3. No	1. Most of them, yes 2. Most of them, no 3. No	1. No, I prevent them 2. Occasionally or some 3. Yes, often or most of them	1. No 2. Sometimes or some 3. Yes, every time 4. They kill 5. Other	1. They only bark 2. They attack without physical contact 3. They engage in fights 4. They kill wolf/bear cubs

6. Do they work without supervision?	1. Yes 2. No		**7. Were guard dogs observed at field?**	1. Yes, all 2. Yes, some 3.No

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13. Morphology – Observation of guard dogs					
8. Number of good guard dogs:		**#1 Guard dog**	**#2 Guard dog**	**#3 Guard dog**	**#4 Guard dog**
9. Age					
10. Origin/race					
11. Effectiveness*		1* 2* 3*	1* 2* 3*	1* 2* 3*	1* 2* 3*
12. Morphology		1* 2* 3*	1* 2* 3*	1* 2* 3*	1* 2* 3*
13. Do you wish to take part in an exchange network of guard dogs?	1. Yes		2.No		3. Under terms/maybe

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14. Loss of guard dogs from poisoned baits			
A. Summer pastures		**B. Winter pastures**	
1. Frequency	**2. Explanation**	**1. Frequency**	**2. Explanation**
1. Rarely 2. On a yearly basis 3. Very often	1. Fox eradication 2. Wolf/bear eradication 3. Hunting/Disputes 4. Garbage/random 5. Other:	1. Rarely 2. On a yearly basis 3. Very often	1. Fox eradication 2. Wolf/bear eradication 3. Hunting/Disputes 4. Garbage/random 5. Other
3. Last loss		**3. Last loss**	

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15. Losses of livestock A.

1. **Average yearly loss #animals**	**A. Diseases**	Number and description
	B. Other **(accidents, lightning, births..)**	Number and description
	C. From wild animals (large carnivores; snake bites...)	Number and description

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16. Losses of livestock C., from carnivores

1. Livestock species	1. Sheep 2. Goats 3. Sheep and goats 4. Calves 5. Adult bovines

to be filled depending on discrimination of categories by the shepherd	**A. Wolf**	**B. Bear**

	2018		2017		**2018**		2017	
	A.1.1 Summer	**A.1.2 Winter**	A.2.1 Summer	A.2.2 Winter	**B.1.1 Summer**	**B.1.2 Winter**	B.2.1 Summer	B.2.2 Winter
2. # Total of attacks								
3. # (in sheep pen/fenced)								
4. # Loss of animals total								
5. # (in sheep pen/fenced)								
6. # Found animals total								
7. # Wounded								
8. # Declared to authorities								
9. # Compensated by authorities								

17. Losses of hunting dogs by wolf

1. Hunter?	No	Wild boar	Hare	Birds	2. How many years do you hunt?	
3. Do you always hunt the same prey? If not, when did you change, from what to what and when?	5 . Occasionally*	A. Case1		B. Case2	C. Case3	
	5.1 Municipality/Village					
	5.3 X					
	5.4 Y					
	5.5 Date					
4. Incidents in total	5.6 Time					
4.1 Attacks/approaches		5.7 Prey or training;				
4.2. Injuries # dogs		5.8 Dog breed				
4.3. Kills # dogs, total		5.9 Did you witness the incident?	Yes No	Yes No	Yes No	
4.4. Confirmed (found)		5.10 # wolf presence				
4.5. Date of 1st incident.	5.11 #Injury					
4.6. Date of latest incident	5.12 #Kill					
	5.13 Consumption?	Yes No	Yes No	Yes No		

18. Wolf presence

	1. Maximum number	2. Most recent appearance	3. Most recent appearance > 2 inds.	4. Howl	5. Breeding (females with young)	6. Dead*	7. Dead*

Municipality							
X							
Y							
Date							
Adults							
Puppies /young							
Type	Direct Indirect	Direct Indirect	Direct Indirect	Direct Indirect	Direct Indirect	Direct Indirect	Direct Indirect
*Causes of death	1. Hunting	2. Drive hunt		3. Poison	4. Car	5. Other (description)	
8. Population trend (10 years)	1. Increase		2.Decrease	3. Stable		**9. Presence in your area**	
					1.Permanent	2.Occasionally / passing	

19. *Bear presence*							
	1. Most recent appearance	**2. Breeding (females with young)**	**3. Dead**	**4. Dead***	**5. Dens**	**6.**	**7.**
Municipality							
X							
Y							
Date							
Adults							
Cubs /young							
Type	Direct Indirect	Direct Indirect	Direct Indirect	Direct Indirect	Direct Indirect	Direct Indirect	Direct Indirect
Causes of death*	*1.* Hunting	*2.* Drive hunt		*3. Poison*	*4. Car*	*5. Other(description)*	
8. Population trend (10 years)	1.Increase		2.Decrease	3.Stable		**9. Presence in your area**	
					1. Permanent	2. Occasionally / passing	