

# LIVESTOCK PREDATION, HOUSEHOLD ADAPTATION AND COMPENSATION POLICY: A CASE STUDY OF SHOROBE VILLAGE IN NORTHERN BOTSWANA

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## ABSTRACT

Human-wildlife conflict is a worldwide phenomenon. Through a household survey supplemented by informal interviews, this study attempts to understand the dynamics of livestock predation by carnivores at village level in Botswana. The study reveals that farmers perceive hyenas and lions to cause more livestock losses than other predators. In order to reduce predation, attempts should be made to put livestock in enclosures at night and also to herd them during the day. These practices comply with the conditions of the new government compensation policy for livestock losses caused by carnivores. The study recommends a review of the compensation rates and suggests that they should be closer to the market value. Such changes, accompanied by strict animal husbandry practices, may bring about the increased willingness of households to co-exist with predators.

## 1 INTRODUCTION

Human-wildlife conflict is a worldwide phenomenon and is common in Africa as well as in developed countries. While this conflict has been in existence since time immemorial, its intensity has increased in recent years. The driving forces behind

this problem include the following: (1) growth in the human population; (2) increase in land usage to harness the land and its resources for economic activities; (3) loss of the wildlife habitat; (4) migration of people as a result of shocks such as floods, droughts and civil unrest; (5) direct persecution of wildlife due to perceived economic losses resulting from livestock predation or crop raiding; and (6) an increase in wildlife populations (Graham, Beckerman & Thirgood, 2004). According to the Food and Agricultural Organization (FAO, 2009), the impact of human-wildlife conflict is more serious in the tropics of the developing world than in the developed world because of these countries' greater dependence on livestock as a livelihood strategy and source of income. According to Smith (2007), there are four aspects of human-wildlife conflict, namely: (1) space conflict; (2) crop raiding; (3) death of humans; and (4) predation on livestock.

Livestock predation is the most common human-wildlife conflict, particularly near protected areas (Holmern, Nyahongo & Roskat, 2007). It can have a significant impact on rural livelihoods, as demonstrated by a few case studies in Africa. In Gokwe Village, which is situated near the Sengwa Wildlife Research Area in Zimbabwe, the loss of livestock resulting from predation during the period January 1993 and June 1996 accounted for 10 per cent of households' income (FAO, 2009). According to Holmern *et al.* (2007), 27 per cent of the households interviewed in seven villages outside the Serengeti National Park in Tanzania reported that they had lost 4.5 per cent of their livestock due to predation during 2003. Other studies undertaken in different parts of the world have also documented the killing of predators by farmers in response to losses of livestock by predation (e.g., Woodroffe, Thirgood & Rabinowitz, 2005). These studies suggest that predation of livestock is a key driver behind the persecution of carnivores by human beings (MacIennan, Groom, Macdonald & Frank, 2009; Nyhus, Osofsky, Ferraro, Madden & Fischer, 2005).

Compensation schemes have been introduced in a number of countries in an attempt to resolve the problem of human-wildlife conflict (Nyhus *et al.*, 2005). These schemes pay households for losses resulting from human-wildlife conflict, such as damage to livestock or crops caused by wildlife. The compensation remuneration may range from above-market value to a small fraction of the value of the damage (Nyhus *et al.*, 2005). The FAO (2009) mentions a number of challenges associated with the implementation of these schemes, including moral hazards; high costs of processing claims; difficulties experienced by less literate farmers in processing the compensation claims; and problems of verifying the damage. In some countries households are only compensated if they have adopted certain animal husbandry practices. This measure is taken to avoid potential moral hazards, for instance where households may deliberately not adopt practices that may reduce the risk of livestock damage by carnivores, as they know they will be compensated for losses (FAO, 2009).

Human-wildlife conflict is also of great concern in Botswana (Gusset, Swarner, Mponwane, Keletile & McNutt, 2009; Mmopelwa & Mpolokeng, 2008). Subsequently, the reduction of the carnivore population in Botswana is attributed to the human-carnivore conflict (Hemson, 2003). As in other parts of the world, carnivores in Botswana are killed mainly because they kill farmers' livestock and threaten human lives. Although the Government of Botswana has introduced a compensation scheme aimed at offsetting the costs of livestock predation by carnivores, a number of studies suggest that the scheme has not succeeded in changing the willingness of households to co-exist with predators (Nyhus *et al.*, 2005). As a result of the persecution of lions by humans in response to lions' predation of livestock, the Government of Botswana has introduced restrictions on killing lions to reduce their high mortality rate (DWNP, 2005). Despite the importance of the human-wildlife conflict in the context of sustainable development, there has been limited research on this subject in Botswana. Recent studies on this subject include those on the human-lion conflict in Makgadikgadi and on livestock predation by the wild dog in northern Botswana villages (Gusset *et al.*, 2009; Hemson, 2003). These studies focused on specific carnivore species and did not compare the predation of livestock by different carnivores. They also did not assess the perceptions of households towards the compensation policy for livestock damage caused by predators. The policy outlines the guidelines that specify the conditions under which compensation for losses of livestock by predation will be made. These guidelines also show compensation rates for different livestock species as well as the damage-causing species of wildlife for which households will be compensated.

This article attempts to improve the understanding of the dynamics of livestock predation in Botswana by asking the following specific questions: (1) "What methods are adopted by households to reduce livestock predation by carnivores?" (2) "What are the perceptions of households on factors that might have led to an increase or decrease in the level of livestock predation?" (3) "What are the perceptions of households towards the new compensation system for livestock damage by carnivores?" and (4) "What strategies can households adopt to reduce livestock predation?" It is expected that the findings of this study will contribute towards the improvement of policies related to human-wildlife interactions in Botswana and in other countries.

The rest of the article is organised as follows; in section 2, the study area and methods used are described, in section 3, the results on perceptions of farming households on livestock predation and compensation policy are presented. In section 4 the results are discussed and concluding remarks and policy implications are also presented.

## 2 STUDY AREA AND METHODS

### 2.1 Study area

Although the area under study is Shorobe Village (19°45' S, 23°40' E) in Ngamiland District, it is necessary to provide a short description of the Okavango Delta, which is the region in which this village is located, in order to provide a broader context. The Okavango Delta is situated in Ngamiland District in northern Botswana. According to the 2001 census, the population of Ngamiland was estimated to be 125 000, of which 76 per cent were based in the Delta area. The Okavango Delta, which is an alluvial fan in geomorphological terms, is an important landscape feature in Ngamiland District (Kgathi, Kniveton, Ringrose, Turton, Vanderpost, Lundqvist & Seely, 2006). It is supplied with water by the Okavango River, which originates in central Angola. This delta is a globally renowned Ramsar Site and is also an important tourist attraction with tourism being the second most important economic activity (after mining) in Botswana.

Shorobe Village is situated in the lower part of the Okavango Delta, 30 km east of Maun, the capital of the Ngamiland District (Figure 1). Livestock predation is a problem in Shorobe Village due to its proximity to the protected area of Moremi Game Reserve and the surrounding Wildlife Management Area (WMA). The village is also situated in a communal area and it is close to the Veterinary Cordon (Buffalo) Fence that *separates* cattle from wildlife to prevent the transmission of the foot and mouth disease. The fence is primarily designed to prevent large herbivores from accessing local inhabitants' land. However, it is difficult to maintain this fence. Predators such as lions and hyenas often leap over or burrow under it to prey on farmers' livestock.

In 2001, the population of Shorobe was 955 and there were an estimated 201 households (CSO, 2001). The main livelihood activities are basket-making, dryland and flood recession (*molapo*) farming, participation in government assistance programmes and beer brewing (Kgathi, Ngwenya & Wilk, 2007).

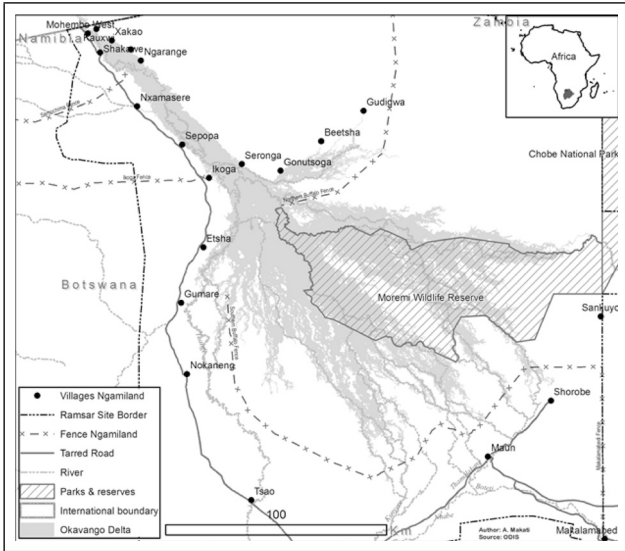


Figure 1: Map of the Okavango Delta showing the study area

## 2.2 Data collection

Three methods were used to collect data for this study, namely: reviewing relevant literature; conducting informal stakeholder interviews; and conducting formal household interviews. The literature review was undertaken in order to understand the national and global problem of the human-wildlife conflict. National and global scientific literature on the human-wildlife conflict as well as official papers on wildlife conservation in Botswana were consulted. The household survey was undertaken in Shorobe Village in June and July 2009. It was based on a detailed questionnaire that included questions related to demography, assessment of the level of predation, adaptations of households to predation and the perceptions of households on the new system of compensation for the predation of livestock. All households that were involved in livestock farming during the survey were interviewed. There were 46 such households, which represented 25 per cent of all of the households in this village. Lastly, informal interviews were held with different stakeholders in the villages of Maun and Shorobe. These included various officers from the Department of Wildlife and National Parks and the traditional leader of Shorobe Village. The aim of the interviews was not only to obtain data on the human-wildlife conflict, but also to verify some of the information that had been obtained from the relevant literature. These interviews focused on aspects of livestock predation by carnivores and the existing guidelines of the compensation system regarding the losses resulting from predation.

## 2.3 Data analysis

The Statistical Package for Social Sciences (version 17.0) was used for data analysis. Data analysis included measures of central tendency and dispersion, frequency tables and charts. A T-test was used to test for significant differences between the means of the number of livestock owned by female and male respondents, as well as between the means of suggested compensation values and those of the new compensation guidelines. The Chi-square Test of Independence was used to determine whether there was any association between variables such as “being affected by predation” and “perceptions about compensation policy”.

## 3 RESULTS

### 3.1 Livestock ownership

Livestock owned by farmers included cattle (94% of the households), goats/sheep (80%), donkeys (61%) and horses (33%). The maximum number of cattle owned by a household was 90 and the average number of cattle owned was 19 (Table 1). An independent T-test revealed that the average number of livestock owned by female-headed livestock-farming households was not significantly different ( $p < 0.05$ ) to that of male-headed livestock-farming households. Farmers mentioned that their cattle were kept in farming areas situated 5–20 km around the village. Informal interviews in the village revealed that most farmers keep their cattle in *kraals* (enclosures for livestock) at night and release them in the morning to graze.

Table 1: Average number of livestock owned by farmers in Shorobe Village in 2009

Type of livestock owned	Mean	Mode	Range	Total reported
Cattle	19	10	89	804
Horses	3	2	8	24
Goats/sheep	12	15	30	458
Donkeys	5	6	19	135

Source: Field survey

### 3.2 Types of predators

Lion, leopard, cheetah, hyena, wild dog and jackal were reported to be the common problem animals in the study area. Most households (89%) reported that lion were the most common predator in the area, followed by hyena (85%), then leopard and jackal (35%) (Figure 2). The cheetah was not reported as a common problem animal, being cited by only 7 per cent of the respondents.

While lion were reported to be the most common predator in the area, hyena were reported to cause the highest livestock losses in the area. Households revealed

this data when ranking carnivores in terms of being the first, second or third highest cause of damage. Most households (41%) ranked hyena to be in the most important category of damage-causing predators, followed by lion (39%), leopard (11%), jackal (7%) and cheetah (2%). In the second most important category, households ranked carnivores in order of decreasing damage: lion, hyena, leopard and jackal. The wild dog was perceived not to attack livestock frequently. In terms of prey targeting, farmers reported that predators such as lion and hyena mostly kill goats, donkeys and cattle, while cheetah and leopard kill goats, calves or foals.

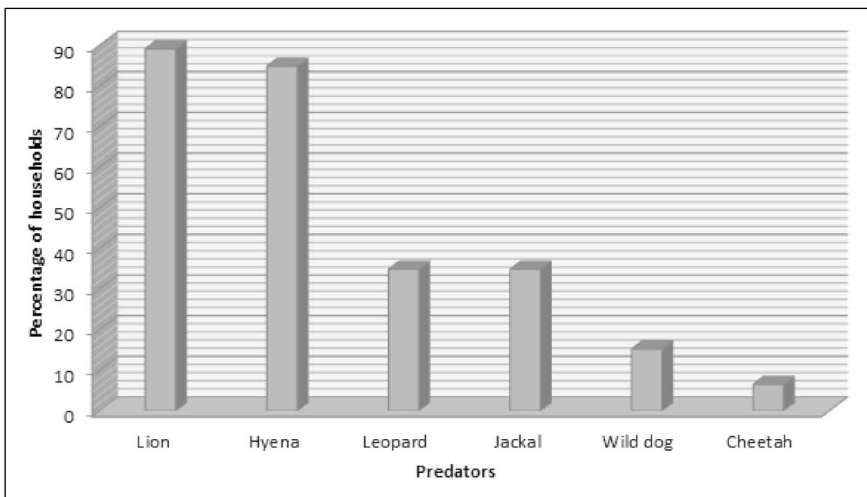


Figure 2: Ranking of importance of predators by households in Shorobe Village, Ngamiland

### 3.3 Incidence of predation in 2009 (January to July 2009)

Sixty-three per cent of respondents reported that predators had killed some of their livestock since the beginning of 2009. Predators reportedly killed a total of 114 goats and 55 cattle during 2009 (Figure 3). The maximum reported number of cattle and goats killed by predators per household was 10 and 15, respectively. However, the household per capita number of cattle, goats, horses and donkeys lost was 1.2, 2.48, 0.09 and 0.22, respectively.

In monetary terms, the damage represented financial values of BWP123, 750 for cattle and BWP39, 900 for goats in 2009. According to the respondents, cattle are more vulnerable to predatory attacks than other species of livestock because they are not easily controlled and they can wander in places where they are vulnerable to attacks by carnivores. For instance, cattle have a tendency to graze very close to the Buffalo Fence, where they are easily attacked.

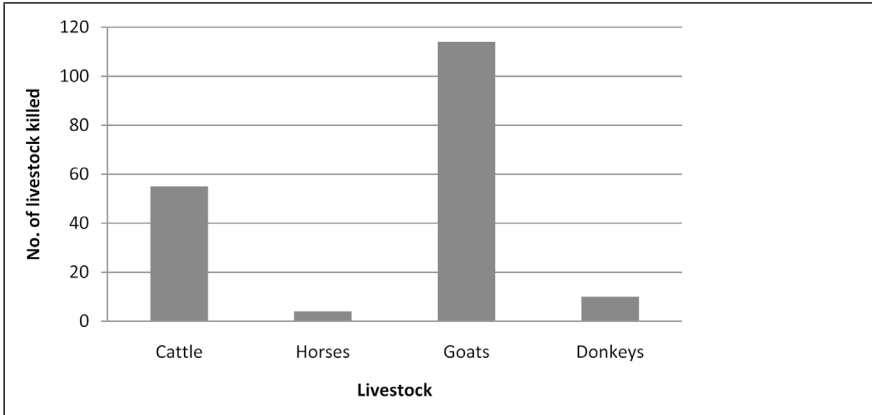


Figure 3: Livestock killed between January and July 2009 around Shorobe Village, Ngamiland

### 3.4 Perceptions of farmers on the level of livestock predation

Considering past predation levels, most farming households (90%) perceive the present level to have increased, while 10 per cent did not think that there had been any change. Factors such as increased number of predators (87%), proximity of cattle grazing areas to the Buffalo Fence (52%), lack of a strong fence to separate livestock and predators (9%), and poor management of livestock (2%) were cited by farmers as having contributed to the increased levels of predation in the area. Available data for reported cases of livestock killed in 2008 and 2009 in and around Shorobe Village show that livestock predation increased by 67 per cent in the two-year period. Furthermore, farming households often do not report cases of livestock damage for which they will not receive compensation and the actual cases of livestock damage are, therefore, usually higher than what has been reported.

### 3.5 Household adaptation to livestock predation

Livestock predation has long been a problem. As such, farming households have developed animal husbandry control strategies or measures, including kraaling livestock at night, herding during the day, killing predators, using guard dogs (especially for goats) and scaring predators away. Predators were reported to attack their prey at various times of the day. Lion, cheetah and leopard were reported to kill their prey during the day and at night, while hyena kill their prey mostly at night. More than half of the respondents (52%) indicated that most predators attack livestock during the day and at night and, therefore, methods to prevent



attacks, such as herding and night kraaling would be more appropriate for the prevention of daytime and night time attacks respectively.

The most common strategies used in the past were kraaling livestock at night and herding, which were mentioned by 94 per cent and 85 per cent of the households, respectively (Table 2). Most of the respondents (70%) were of the opinion that these strategies were effective, as predation on livestock had been very low in the past.

**Table 2:** Percentage of households in Shorobe village using past and current methods to control predation

	Night kraaling	Herding	Predator killing	Using guard dogs	Scaring predators	Fire burning around kraals
Past methods	93.5	84.8	54.3	10.9	2.2	–
Current methods	100	17	–	4	–	2

Although some of the strategies that were used in the past are still currently being used to reduce the predation of livestock by carnivores, the perceptions of households indicate that some of the current strategies are not being used as much as they were in the past. For instance, over 90 per cent of the households stated that they had kraaled their cattle in the past. They also mentioned strategies that they did not use in the past, such as burning fires around the kraal, a practice that is now being used to reduce the predation of livestock by carnivores (Table 2). As indicated in Table 2, all of the households stated that they kraaled their cattle at night to reduce the predation of livestock. Only a small proportion of the households stated that they herded their livestock (17%), used guard dogs (4 %) and burned fire at night around the kraals (2%).

### 3.6 Perceptions of farmers on the compensation system

#### 3.6.1 *The compensation guidelines*

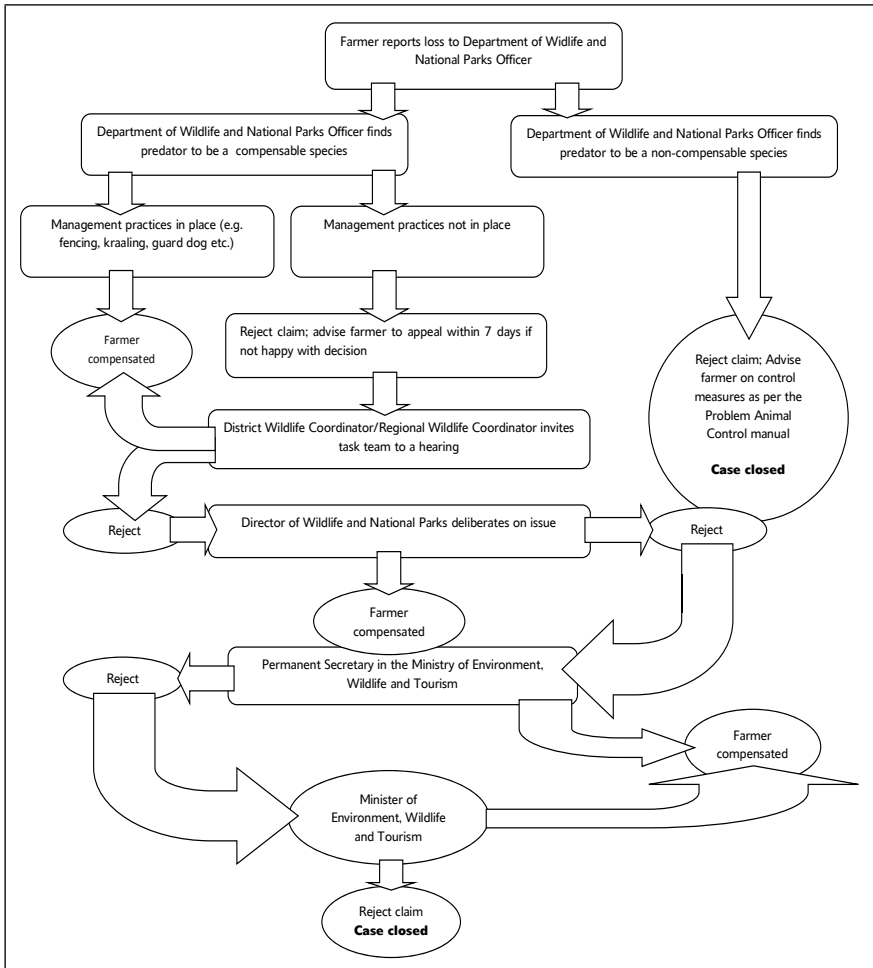
In April 2009 the Government of Botswana introduced new guidelines for compensating households for damage to their livestock caused by predators. These guidelines replaced the old ones that had been introduced in 2001. According to these guidelines, predation by the following species qualifies for compensation: lion, leopard, wild dog and cheetah (DWNP, 2009). Damage by some of the common predators such as hyena and jackal, does not attract any compensation, as the remuneration is also based on how life threatening a particular wildlife species is (Rutina, 2011). For instance, farmers are exposed to greater danger when they protect their livestock from predation by a lion than when they protect their livestock from predation by a hyena. While the guidelines indicate the species

for which compensation may be paid in respect of damage they have caused, they also indicate that compensation is only payable if there is sufficient evidence that a farmer has been herding his or her livestock during the day and kraaling them at night, and if he or she possesses well-constructed kraals (DWNP, 2009). Figure 4 shows a flow chart explaining how the decision to compensate households is made. The decision-making process regarding compensation can be a convoluted process, which may result in the farmer appealing to the responsible minister if he or she is not satisfied with a rejected claim. As illustrated in Figure 4, the wildlife officer in the district makes the initial assessment of the claim. If all of the conditions for compensation are satisfied (i.e., the predator species is compensable, proper management practices are in place, etc.), the farmer will be compensated according to the Wildlife Conservation and National Parks Act of 1992.

However, as illustrated in Figure 4, lack of management practices is enough to disqualify a claim for compensation. A claim disqualified for this reason can then be taken by the farmer through all the different decision-making steps illustrated in the figure before appealing to the Minister of Environment, Wildlife and Tourism, who can then make the ultimate decision.

### *3.6.2 Household perceptions on compensation policy*

When respondents were asked if they were satisfied with the compensation policy, more than half (63% of the households) stated that they were not. Thirty-seven per cent of the households thought it was satisfactory. The Chi-square Test of Independence revealed that lack of satisfaction with compensation was not associated with whether or not a farming household had experienced predation at 5 per cent level of significance ( $p > 0.05$ ;  $df = 1$ ). Those who were not satisfied with the compensation system were asked to state what they thought was lacking in the guidelines for compensation or what needed to be done to improve the system. Some of the households suggested that when predators kill a unit of livestock, it should be replaced or they should be paid an equivalent value to that of the lost livestock. The majority of households (80%) were of the opinion that the compensation rates for livestock predation were very low (Figure 5). Similarly, 87 per cent of the households thought that the compensation rates for a calf, foal, goat or sheep were low compared to the damage caused.



**Figure 4:** Flow chart illustrating the decision to compensate farmers whose livestock were killed by predators

**Source:** Based on informal discussion with stakeholders

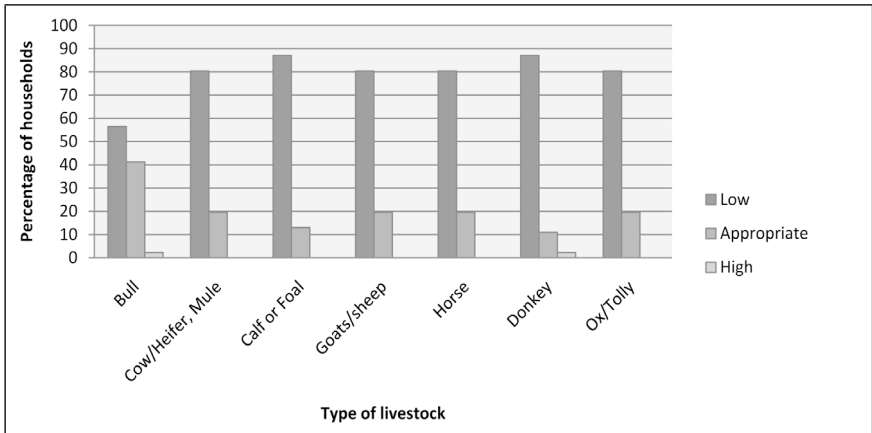


Figure 5: Opinions on households on compensation rates

Table 3: Amounts compensated versus the amounts that households regard as fair compensated

Livestock	Compensation amount (BWP)	Mean amount households would like to be paid (BWP)	P-value
Bull	1925.00	3689.00	0.000024
Ox/tolly	1050.00	2589.00	0.000000
Cow/heifer mule	1050.00	2305.00	0.000000
Calf or foal	350.00	1041.00	0.000000
Goat/sheep	157.50	507.00	0.01
Horse	1400.00	3182.00	0.0005
Donkey	120.00	564.00	0.000021

N = 46

Households that indicated that the compensation rates offered for the various categories of livestock species were either low or high suggested what they perceived to be “appropriate” compensatory levels. Table 3 lists the prevailing compensation amounts as well as the amounts households think are appropriate. A T-test revealed that there is a significant difference ( $p < 0.05$ ) between the amounts compensated and the average amounts suggested by households (Table 3). The amounts households are currently compensated for are 40 per cent, 46 per cent and 31 per cent of the amounts suggested as appropriate for an ox, a cow and a goat, respectively. In general, the actual amounts compensated for all species represent about 38 per cent of the average amount suggested by households. According to

Pako (2010), the compensation rates for damage by predators in Botswana account for 35 per cent of the market value of the livestock, a figure that is close to the above-mentioned proportion of 38 per cent (amount compensated as a percentage of the amount suggested by households).

## 4 DISCUSSION AND CONCLUSION

### 4.1 Types of predators and time of livestock predation

This study has revealed that hyena, lion and jackal are the major predators in Shorobe Village in Ngamiland District, Botswana. Hyena and lion are perceived by farming households to cause more livestock losses than other predators. The study has also revealed that most of the predators, except hyena, are not restricted to a particular time of attack, with attacks occurring during the day and at night. This is because livestock (especially cattle, donkeys and horses) are not always enclosed at night, which exposes such livestock to predation risk. Even if livestock are enclosed, predators sometimes jump over or dig under the *kraal* in order to attack them.

These results on the predation of livestock in Botswana are consistent with those of other studies in Africa. For instance, a study undertaken by Holmern *et al.* (2006) in seven villages adjacent to the Serengeti National Park in Tanzania revealed that the spotted hyena was perceived by the majority of households (98%) to be the major cause of livestock predation in the area, followed by lion (90.1%), leopard (1.6%), baboon (0.4%) and black-backed jackal (0.1%). The total number of livestock killed in 2003 was 708, of which the majority were goats (55.5%), sheep (30.1%) and cattle (13.6%), with the remainder comprising pigs (0.7%) and donkeys (0.1%) (Holmern *et al.*, 2006). The study also showed that the proportion of donkeys killed by predators was quite small. This finding supports the view that donkeys have a low vulnerability to attacks by predators. In other parts of the world, they are even used as guard animals, just like dogs (FAO, 2009).

### 4.2 Adaptation to predation

The study also revealed that in the past, herding of livestock was one of the most important methods used to reduce predation of livestock by carnivores. This method is no longer used as much as it was in the past, probably because of the emergence of new livelihood activities in Ngamiland District, and because there has been a reduction in the number of non-school-going family labour available. Night kraaling is still a common method of minimising predation. However, some studies (e.g., Ayantunde, Fernández-Rivera, Hiernaux, Van Keulen, Udo & Chanono, 2000) have revealed that night kraaling leads to reduced weight gain of livestock because they have reduced grazing time and forage intake, which

sometimes necessitates supplementary feeding. In the Sahel region, Ayantunde *et al.* (2002) found that night grazing complements the daytime grazing of cattle. Kraaling animals at night is therefore, associated with an opportunity cost. Another method that is no longer practised is the killing of predators. Some commentators suggest that favourable conditions for compensating farmers for the damage to their livestock are created because they are not allowed to kill predators. In Botswana, farmers are allowed to kill animals (except lion and cheetah) if they cause, or have caused, damage to their crops or property (DWNP, 2005). While there is a total ban on the killing of cheetah, the following restrictions apply to the killing of lion: (1) “a person may kill a lion where a lion or group of lions has killed livestock, or a lion or a group of lions threatens human life in terms of section 47 of the Act”; and (2) “where a group of lions is involved, a person may kill only one lion in a group” (DWNP, 2005). Although the literature shows that donkeys may be effective in deterring predators (FAO, 2009), none of the respondents in the study area were using them to control predation.

### 4.3 Compensation scheme

Households were not satisfied with the compensation policy, which aims to alleviate human-carnivore conflict by compensating farming households for the losses resulting from predation by carnivores. The compensation rates for damage by predators in Botswana are about 35 per cent of the market value of the livestock, but households expected to be paid a higher percentage of the market value. While the old compensation system in Botswana paid farmers regardless of the animal husbandry practices adopted, the current system reimburses farmers only if there is evidence that efforts have been made to reduce the risk of predation by adopting good animal husbandry practices. According to Nyhus *et al.* (2005) and Maclennan *et al.* (2009), denying compensation to those who use poor animal husbandry methods is meant to solve the potential moral hazard problem. The findings of this study are consistent with those of other studies in that households were not satisfied with the compensation policy (Distefano, 2005). These studies suggested that the amount of compensation should at least be equivalent to the financial loss resulting from predation (Distefano, 2005; Hemson, 2003).

### 4.4 Policy implications

The study recommends that attempts should be made to put cattle in enclosures at night in order to reduce predation. This practice should be implemented carefully, as it entails an opportunity cost in terms of loss of grazing time. Putting cattle in enclosures is also consistent with the conditions of the compensation policy. These strategies should be combined with other strategies, such as using guard dogs,

burning fires near kraals and locating cattle posts far from the Veterinary Cordon (“Buffalo”) Fence. The findings suggest that separating predators and livestock with a properly constructed fence or an electric fence could help reduce the predation of livestock. This idea is widely supported and it is recommended that fences be constructed in such a way that predators cannot dig under them (CCB, 2008; Distefano, 2005). While electric fences are seen to be the most effective, they are not widely used because they are expensive to construct and maintain (CCB, 2008; Distefano, 2005; Tjibae, 2001).

Finally, the compensation scheme should be reviewed to ensure that the compensation rates are closer to the market prices of livestock. Such changes, accompanied by strict animal husbandry practices, may increase the chances that the scheme will succeed in changing the willingness of households to co-exist with predators. Nyhus *et al.* (2005) mention that one of the characteristics of successful compensation schemes is their ability to verify damage by livestock rapidly and accurately. If the compensation scheme were to adopt this characteristic, it may reduce conflicts between farmers and wildlife officers.

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