Chapter 6: General discussion

6.1 Limitations to this study

When interpreting the findings of this questionnaire survey, it must be kept in mind that these are opinion surveys and they do not reflect an objective examination by researchers (Lawson 1989). Rather, the data reflects the information that the respondent's choose to provide. The data may thus suffer from certain biases inherent in this type of research. It may be that some respondents artificially inflate their stock losses hoping that this will motivate conservation authorities to assists in alleviating carnivore-livestock conflict (Lawson 1989; Holmern *et al*. 2007). Since these stock losses were based on the farmers' identification of the predator involved, the possibility exists that respondents that did not accurately identify the culprit, and reported stock losses might not accurately reflect the actual cause of predation or the severity thereof (Lawson 1989). Respondents may also wrongly accuse certain predators of killing livestock that died of natural causes, because of lack of vigilance in determining the actual cause of death or prejudices towards these carnivore species (Rasmussen 1999), or the desire to shift the responsibility for their stock losses from themselves.

Most farmers in the BMR do not receive any compensation for livestock losses attributed to carnivores. Some farmers that form part of the Baviaanskloof Farmers Association receive limited compensation for leopard-stock losses from a local NGO. Therefore the reporting of stock losses attributed to other predators is unlikely to be biased. There is also no outreach programme currently employed by the Eastern Cape Parks Board, and therefore farmers do not gain anything by overinflating their livestock losses (Holmern *et al*. 2007). Thus, despite the flaws pointed out previously, these results are considered valid, and provide useful insights into carnivore-livestock conflicts.

6.2 Synthesis of findings

The most import result from this study is that leopards are not necessarily the most important causes of livestock mortality in the BMR. On average, leopards killed significantly less livestock (0.7% livestock per year) than black-backed jackals (4.7% per year) and caracal (2.5% per year). So why does so much attention fall on leopards? The two major reasons for this are: (1) leopards kill relatively large numbers of livestock in one incident (den Hertog 2008), and (2) leopards in

South Africa are a protected species and legally cannot be lethally controlled by land managers without a permit from DEDEA, whereas the other predators of livestock can be controlled in this fashion. Irrespective of the relatively small amounts of livestock losses attributed to leopards, most (67%) respondents in this survey had negative attitudes towards leopards.

It was found that these negative attitudes are not driven by the amount of stock lost to leopards, as was originally hypothesised, but are influenced by the total amount of stock lost. Thus, in order to change the attitudes of farmers in the BMR, livestock predation by all predators has to be reduced. This requires cooperation between ECP, DEDEA, and the farmers in order to implement appropriate and ecologically acceptable predator control strategies and livestock management techniques, since the techniques employed by the farmers do not appear to reduce predation by predators, according to the data provided by landowners. In other words, livestock losses in the BMR cannot be reduced by simply focussing on specific predators or causes of livestock mortality, a holistic predator management plan is required. However, this will only happen if the relationship between DEDEA and the farmers is improved. This study shows that most farmers do not make use of the predator control strategies provided by DEDEA, even though those who use these services deem them as being either moderately or very effective. For whatever reason, this leads one to question the level of trust and cooperation between farmers and DEDEA.

If this relationship between conservation authorities and farmers is not restored and effective management techniques put in place to reduce stock losses, the negative attitudes towards leopard will remain. This may result in further killing of leopards and other carnivores, because most respondents will take management steps to prevent these predators from settling on their properties (Marker *et al*. 2003). These retaliatory killings may have severely negative effects on the BMR leopard population. Further reducing this relatively small population, can result in a potent edge effect, which may lead to the local extinction of these leopards (Woodroffe & Ginsberg 1998).

Leopard predation is much higher on properties that border the Baviaanskloof Nature Reserve directly. When comparing these predation incidents to the relative available habitat, intriguing results emerge. It appears that leopards prefer the mountainous area, based on stock losses. Several reasons for this are mentioned (e.g. presence of thicket vegetation which provides cover to the leopards for hunting purposes), however no data were collected to support any of

these. Farmers responded by withdrawing their livestock from these area. Therefore, these areas can be important in conservation terms, and have been shown to assist in mammal conservation (Macdonald *et al*. 2008), but not necessarily biodiversity conservation. However, if these areas correspond with the critical biodiversity areas identified by the Baviaanskloof Mega-Reserve Conservation Plan (see Boshoff *et al.* 2008), the influence of leopards can assist in biodiversity conservation by reducing the vegetation impacts of livestock in these areas. The areas that are not being farmed can effectively be seen as an extension of the Baviaanskloof Nature Reserve.

These areas are also important in terms of predator interactions. When comparing stock losses attributed to leopards to the other predators of livestock, it produces novel results. In areas with leopard-stock interactions, there is significantly less predation by black-backed jackal and caracal. This indicates the possibility of interspecific competition between these carnivores, which may result in ecological separation (caracal and leopards in the mountains of the Western Cape, Norton & Henley 1987; cheetah and lions and hyaenas in Namibia, Marker 1998) or avoidance behaviour (black-backed jackals and leopards in the Kruger National Park; Bailey 1993). However, the exact mechanisms producing these trends are not known. These findings can assist in the education of land managers regarding the nature and extent of carnivore predation on livestock and may also assist in improving their attitudes towards leopards.

6.3 Management recommendations

This study provides valuable insights into the ecological and socio-economic factors that influence carnivore-stock farmer conflict in the BMR, with particular reference to leopard-stock farmer conflicts. Understanding these factors plays an important role in the conservation of leopards and other carnivores in the BMR. Even though leopards are not considered endangered or threatened in South Africa, this study shows that the regional extinction of leopards is a real possibility. Therefore, there is a need for a regional approach to leopard conservation, as a national approach might overlook the critical issues linked to the regional survival of leopard populations, such as the BMR leopard population. Combining the information

6.3.1 Linking leopard predation with conservation planning and implementation

i. <u>Conservation planning opportunities</u>

The spatial data presented in this study shows that leopard impacts on livestock vary across the landscape and in different habitat types. This provides the basis for a conservation

planning approach in which ‘leopard hotspots’ could be identified. These ‘hotspots’ reflect areas that may represent agricultural challenges due to high stock losses attributed to leopards. The problem areas can also be viewed as conservation opportunities as they are areas of high leopard activity. Therefore, by developing these identified ‘hotspots’ into conservation planning layers and incorporating them into the protected areas network, the problem of leopard-stock farmer conflict on a local scale will be reduced and the potential leopard habitat will also be expanded. This will assist in the conservation of the BMR leopard population.

ii. Withdrawal of livestock

This study has identified tracts of privately owned land where agricultural activity has been ceased due to the threat of leopard predation. These areas should be viewed as voluntary conservation areas. These areas should be linked to the conservation agencies, which in turn, should support and assist the landowners in the management of these areas. These areas may also provide incentives to the landowners via the new property tax bill, whereby landowners may receive tax rebates if portions of their properties are managed as conservation areas. This will assist in the conservation of leopards on a local scale, by providing additional habitat and reducing leopard-stock farmer conflict.

6.3.2 Livestock and predator management

The majority of livestock management techniques and predator control strategies employed by farmers in the BMR are not 100% effective in reducing livestock losses to carnivores, according to the data provided by the farmers. This is because livestock management techniques do not affect stock losses due to predators (Graham *et al.* 2005). These techniques are positively correlated with net primary production instead (Graham *et al.* 2005). The fact that these techniques are being used, irrespective of efficacy, indicates that farmers base their management decisions on anecdotal evidence such as common sense, personal experience, and hearsay. Provision of alternative and effective management techniques is a major component of carnivore conservation strategies (Marker-Kraus *et* al. 1997). There is thus a need for the use of holistic predator management techniques that have been proven to reduce or prevent stock losses to predators in the BMR (evidence-based management; Sutherland *et al.* 2004). At the moment, none of the available techniques for livestock and predator management have been verified by independent research or has been proven to reduce or prevent stock losses to predators in the

BMR. However, there are several other techniques, not extensively employed by farmers in the BMR, which have been shown to reduce livestock depredation by carnivores, elsewhere. Some of these are:

i. Livestock management

Livestock management is a very broad category and include any management decision or intervention related directly to livestock. Several techniques have been proven to reduce livestock losses to predators. These include:

- The synchronisation of calving or lambing seasons between farms (Marker 2002). This reduces year-round availability of calves, lambs and kids, which form the largest proportion of livestock consumed by predators.
- Timing the lambing and calving season so that it does not overlap with the breeding season of carnivores; Lawson (1989) suggested that black-backed jackal pups are born in winter and therefore more livestock is taken in winter when there are more pups to feed.
- Changing livestock breeds to indigenous breeds that have better anti-predator responses, such as native cattle (Marker 2002, Middleton in Rasmussen 1999). Several respondents to this survey suggested that Damara sheep have a better grouping behaviour and are more vigilant for predators.
- Lambing and calving in corrals (Marker 2002).
- Kraaling livestock at night (Ogada *et* al. 2003; Holmern *et al*. 2007). This technique did not reduce livestock losses in the BMR. However, by improving these corrals (creating visually closed corrals) there may be a reduction in the amount of livestock lost to predators (Rasmussen 1999), especially leopards.
- The use of protective livestock collars. Some initial evidence from the farmers in the Baviaanskloof Agricultural Society indicates that these collars reduce stock losses substantially (80 – 100%). This result differs from that of this study, because these collars were not extensively used when this survey was done. Therefore, protective livestock collars seem to be one of the most effective techniques in reducing livestock predation by leopards and caracal.

ii. Livestock guarding animals

There is a wide variety of livestock guarding animals available (Llamas sp, Alpaca sp, Anatolian shepherd dogs, and donkeys). The most widely used animal is the Anatolian shepherd dog. The effectiveness of these Anatolian Shepherds in reducing livestock predation by carnivores has been widely proven (Marker 2002; Rigg 2004). According to Marker (2002), farmers with these dogs reported a decrease in livestock losses of almost 90%. The use of Anatolian shepherd dogs in the BMR is a relatively recently adopted technique, and consequently most dogs are still in the training phase. For this reason, these dogs did not significantly reduce the amount of stock lost to predators during this survey. However, one farmer that had working dogs had a total stock loss of only 3% per year compared to the average stock losses of 13% per year. With proper education and training regarding Anatolian dog management and use (Marker 2002), it is a possibility to use these dogs in the BMR. However, these dogs require, food, veterinary care and might not be as cost effective as other techniques (e.g. livestock collars). Therefore, proper research as to the effectiveness of these animals in reducing livestock losses in required.

iii. Restoration of natural prey base

Several studies have shown that there is a correlation between low natural prey availability and high predation rates on domestic livestock (Lawson 1989; Woodroffe *et al*. 2005, Kolowski & Holekamp 2006; Holmern *et al* 2007). According to Marker (2002), farmers who maintain the natural prey base of carnivores, have lower predation rates on their livestock. Reasons for this are that predators hunt and kill prey that are the most effectively located. This is because livestock management techniques do not affect stock losses due to predators (Graham *et al.* 2005). These techniques are positively correlated with net primary production instead (Graham *et al.* 2005), and many carnivore species prefer to prey on natural prey (Graham *et al.* 2005), which is also the case for leopards in the BMR (Ott *et al*. 2007). This is because leopards have a preferred prey weight range of 10 – 40 kg (Hayward *et al.* 2007), which excludes most adult livestock.

Five respondents in this survey are employing this technique, three of which have low total stock losses (1 -3% per year), whilst the other two have high total stock losses (> 7% per year). Even though there was no difference in stock losses between farmers who employed this technique and those who did not, this technique shows great potential in reducing stock losses to

carnivores in the BMR. However, it may take several years for the prey base to be restored, depending on the degree of habitat degradation. Therefore farmers are encouraged to actively restore the natural habitat and thereby restore the natural prey base of carnivores.

As showed in this study, no single technique will be effective in reducing or preventing livestock depredation. Thus, a combination of these techniques is required to significantly reduce livestock losses to carnivores (Ogada *et al*. 2003).

6.3.3 Leopard conservation

In order for the conservation of leopards in the BMR to be effective, there should be a level of cooperation between ECPB as managing authority of the Baviaanskloof Nature Reserve and their neighbours (the majority are livestock farmers). This is because the leopard population in the BMR is fundamentally a shared population, with individual leopards moving freely between conservation areas and privately owned land (Rogers 2008). The first step to accomplishing this is to restore the trust between these two parties. In order to achieve this, a three-pronged strategy is required:

i. Education

The majority of farmers in the BMR either believe that leopards do not control other predators, or they do not know if leopards control other predators. However, here I have shown that leopards reduce the amount of stock lost to black-backed jackal and caracal. Thus, farmers need to be educated regarding the ecological role carnivores play in an ecosystem as well as the benefits of having leopards on their properties. This should significantly improve their attitudes towards carnivores (Woodroffe *et al*. 2005; Holmern *et al*. 2007) and consequently conservation.

ii. Incentives

Because attitudes towards leopards are driven by the financial losses due to livestock depredation, the only clear way to change the attitudes of farmers is to provide financial incentives or compensation for stock losses (Thavarajah 2008). According to respondents of this survey, there two major complications with compensation schemes. Firstly, farming operations are extensive and it is not always possible to inspect all the flocks daily. The majority of farmers take approximately one week to inspect all their livestock. If some livestock are missing, it is thus often too late to identify the cause of mortality, as the carcass has already started

decomposing or it may have been scavenged upon by other predators, especially bushpig. Secondly, the terrain is very rugged and the vegetation very dense. Therefore, it is not always possible to locate the carcasses. Thus, the causes of mortality for only a small proportion of livestock losses can be identified. Therefore, governmental institutions (DEDEA) often underestimate the actual stock losses and the economic implications thereof.

The establishment of such a scheme is indeed difficult in the BMR. However, the responsibility of an effective conservation scheme falls both on the farmers and on the DEDEA.

- Farmers need to be more vigilant and need to change their management practices in such a way that livestock losses can be detected quickly and efficiently. This includes the withdrawal of livestock from areas with high leopard predation (this study). These areas will effectively be "conservation area" and the South African Government is planning on passing a bill where any conservation land receives tax rebates. Therefore, farmers that are already withdrawing livestock from certain portions of their property in response to leopard predation, can attain incentives for the 'unused land' by setting these tracts of land aside as conservation areas. Farmers are also encouraged to report all stock losses to DEDEA in order to obtain an accurate measure of stock losses.
- DEDEA needs to assign environmental officers to all the areas that fall within the planning domain in order to assist in verification of the causes of mortality and the submission of claims to DEDEA. Therefore, the onus is on DEDEA and the Agricultural Union of the Eastern Cape (AgriEC) to establish a predator programme that accurately records stock losses in the BMR. DEDEA should be the authority that is responsible for securing funding and for compensation payments to farmers.

iii. Eco-tourism

At the moment, farmers undervalue the tourism potential of leopards in the BMR. In order to change their attitudes towards carnivores and leopards in particular, they need to see the financial benefits of eco-tourism. Even though eco-tourism potential and opportunities did not significantly influence attitudes towards leopards, respondents that practised some form of tourism had positive attitudes towards leopards. Community based conservation schemes have

been widely used to change attitudes towards wildlife and assist in conservation (see Hackel 1999 for a review). However, I do not believe that this will be an effective strategy in increasing the tolerance of farmers towards carnivores. This is primarily because most farmers would rather farm than run a tourism operation. Therefore, tourism ventures need to be used as a component of a larger predator management scheme.

6.4 Further research

This study only focused on a small portion of the factors that play a role in carnivore-livestock conflict in the BMR. Thus, there is a large amount of research to be done regarding this issue, especially in the BMR. However, during the course of my research it became apparent that there are several areas that require further research attention.

- Ecological and behavioural information on the dominant predators of livestock in the BMR (black-backed jackals and caracal), as well as leopards, needs to be collected and analysed. This will assist in identifying the ecological factors (prey preference, habitat use on private lands, habitat preferences, etc.) that play a role in livestock predation as well how to prevent these losses in the BMR.
- Effective livestock and holistic predator management techniques should be determined. This can be done via long-term trial experiments that determine the effectiveness of techniques in the BMR. This will assist in determining which techniques are effective in reducing livestock predation by carnivores in the BMR.
- Information regarding the behavioural processes (territoriality, intra-specific competition, habitat selection, and dominance) of leopards in the BMR as well as their interactions with other carnivores (social-dominance, inter-specific competition, etc.) needs to be collected. More accurate information regarding the densities and biomass of rodents and other small mammals should be collected, as this forms a major portion of the leopard diet (Ott *et al* 2007). This will assist in the improvement of the leopard-model presented here, which will give a more accurate prediction regarding the population status of the Baviaanskloof leopard population. In addition to this the population size of leopards must be verified using techniques such as genetics or photo surveys.

- The connections between the BMR leopard population and other, nearby populations need to be assessed. These corridors will allow the flow of genes between the various leopard populations, and are important for the long term conservation of leopards.
- There is a need to predict the movements of leopards in the BMR in order to assist in predator control as well as the development of eco-tourism.

Addressing these various issues will improve our understanding of the various factors that influence the BMR leopard population and will significantly contribute to the reduction in carnivore-stock farmer conflict and assist in effective conservation of carnivores in the BMR.