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A review and estimation of the financial implications of livestock predation in South Africa

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Abstract

Assessing and estimating the total financial implications of predation in the livestock farming sector of South Africa is essential in implementing a national system of coordinated predation management and providing information to aid the livestock production sector. The main objective was to estimate and assess the financial implications of livestock predation in South Africa. Data from previous studies were used as a benchmark and then predicted/updated to estimate the possible financial loss experienced by livestock producers due to predation losses in 2019, assuming the small and large livestock sectors respectively accounted for 13% and 1% of predation losses (at the highest predation levels experienced by livestock producers). Predation losses for small and large livestock were highest in the Northern Cape and KwaZulu-Natal Provinces. The Western Cape Province was the least affected by predation. Most predation losses occurred with lambs/kids between lambing and weaning. Data from previous studies were used as benchmark and then predicted/updated to estimate the cost of predation in 2019, assuming the small and large livestock sectors respectively accounted for 13% and 1% of predation losses. The direct cost of predation losses for small and large livestock, respectively, amounted to ZAR2 710 million and ZAR511 million. It is suggested the only meaningful way to reduce the cost of predation at a national level is by implementing a system of coordinated predation management in South Africa. However, the first step is to understand the financial and economic implications that predation has on the livestock and associated economic sectors in the South African economy.

KEYWORDS: Financial cost, gross domestic product - GDP, large livestock, management system, predation, small livestock

INTRODUCTION

Predation is a stark reality in many parts of the world and farmers of small and large livestock experience huge losses due to predation. De Waal (2020, 2021) provided a comprehensive historic timeline of predation in South Africa. Predation usually becomes problematic where there is competition for the same natural resource (Moberly *et al.* 2003). Two medium-sized predators, the Black-backed jackal *Lupulella mesomelas* (De Waal 2017) (previously known as *Canis mesomelas*, Atickem *et al.* 2017) and the Caracal *Caracal caracal* are important predator species and are also essential components of South African wildlife (De Waal 2009; Du Plessis 2013).

Considerable research has been conducted in several countries, including South Africa, on the extent of predation on domestic animals and the resulting marked damage caused in this and in related sectors including wildlife ranching (Schepers 2016). Most literature indicated that there was a direct financial implication from animal losses due to predation on a producer level, whether it was domesticated livestock or wildlife (Moberly 2002, Zimmermann *et al*. 2005; De Waal 2009; Thorn *et al.* 2012; Wielgus & Peebles 2014). In South Africa, the direct financial cost experienced by producers due to predation losses in the small livestock (sheep and goats) sector was estimated at over ZAR1 390 million (Van Niekerk 2010). By contrast, direct costs of large livestock (cattle) predation losses exceeded ZAR393 million (Badenhorst 2014).

About 80% of the land available in South Africa for agriculture comprises arid and semi-arid natural pastures (veld) that can only be utilised by herbivorous animals such as grazing ruminants (De Waal 1990; DAFF 2017). Therefore, livestock is the primary income source for farmers in the arid and semi-arid areas of South Africa. Livestock plays an essential role in the rural agriculture of South Africa, with associated activities rippling through the entire economy. In 2017/2018, agricultural production accounted for more than 2.2% of the gross domestic product (GDP) of South Africa. The gross value for agricultural products was estimated at ZAR277 078 million in 2018/2019, with animal products, horticulture products, and field crops contributing 49.2%, 30.3%, and 20.5%, respectively, to the gross value of agricultural production (DAFF 2019).

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The profit of a livestock farmer is a function of the number of animals born against the number of animals lost between birth and sales. Such losses include those ascribed to predation, disease, stock theft, drought, as well as other mortalities (Moberly *et al*. 2003b; Strauss 2009; Lombard 2016; Du Plessis *et al.* 2015). A livestock farmer typically aims to minimize losses, including predation losses, in order to maximize profits.

The economic implications of predation can be divided into different stages: firstly, the livestock farmer faces the direct physical losses of animals. Then, in combination with the direct production losses, are the additional indirect costs associated with management strategies to reduce the level of predation (Moberley 2002; Van Niekerk *et al.,* 2016). The second stage, which is mostly overlooked, relates to economic "spill overs" or induced effects on the livestock industry and related sectors and is to a considerable extent transferred to the end consumer (Bodenchuk *et al.* 2000; Shwiff & Bodenchuk 2004). Many management techniques and strategies are available to prevent predation losses; however, resources devoted to preventing livestock losses are likely to be traded off against the cost of those losses. For example, a farmer must decide what strategy or level of preventive measures will be used and implemented; this choice will differ between farmers and across regions (Van Niekerk 2010; Badenhorst 2014).

The effectiveness of various predation management techniques are questionable when done in isolation or in an uncoordinated manner (Ray *et al.* 2005; Darrow *et al.* 2009; Du Plessis *et al*. 2015). Implementation of a nationally coordinated predation management strategy has been shown to be optimal at reducing predation losses on a national level in South Africa and abroad (Shwiff & Merrell 2004; Avenant & Du Plessis 2008; De Waal 2009, 2015, 2020, 2021). The implementation of such a national system of coordinated management will entail a considerable investment of capital and resources, which can be provided from government or must be generated by producers' organisations. By understanding and estimating the financial losses (direct and indirect) experienced by livestock producers a more complete representation of predation losses can be calculated in the livestock producing sector of South Africa.

MATERIAL AND METHOD

Study area and data

Research on predation losses in the small livestock (sheep and goat) sector focused on the five primary small livestock producing provinces in South Africa, namely the Eastern Cape, Free State, Northern Cape, Mpumalanga, and Western Cape. At the time, these five provinces accounted for over 90% of the estimated sheep population and over 55% of the goat population (Van Niekerk 2010). Badenhorst (2014) investigated the economic implications of predation on large livestock (cattle) by surveying over 86% of the national cattle herd located in the Northern Cape, Free State, Eastern Cape, KwaZulu-Natal and Mpumalanga provinces, as indicated by a map of South Africa in Figure 1.

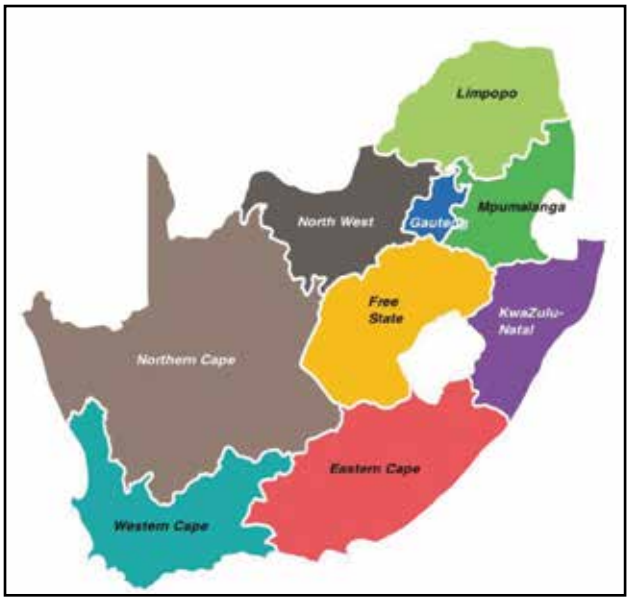

Figure 1. Map of South Africa showing the nine provinces. Source: www.touropia.com.

It should be noted that in the studies of Van Niekerk (2010) and Badenhorst (2014), livestock numbers only included those owned by commercial livestock farmers. In the current study the livestock predation losses were updated by using current livestock numbers in South Africa for 2019, provided by the South African Department of Agriculture Land Reformed and Rural Development (Figs. 2 to 5), and assuming the level of predation remained constant for 2019. However, it must be noted that livestock numbers decreased towards the end of 2019, because of severe drought in large parts of South Africa (Maré *et al*. 2018). In Figs. 2 to 5, the livestock numbers in South Africa reported by Van Niekerk (2010) and Badenhorst (2014) are compared with the updated livestock numbers of 2019.

DATA COLLECTION

Van Niekerk (2010) used stratified random sampling to collect primary data on predation losses experienced by small livestock producers in the five largest small livestock producing areas of South Africa. A total of 1 500 small livestock farmers were sampled. Sampling for each province was drawn based on the percentage that each magistrate district contributed to the total small livestock population (the percentage distribution was based only on estimated sheep numbers). A structured questionnaire was developed

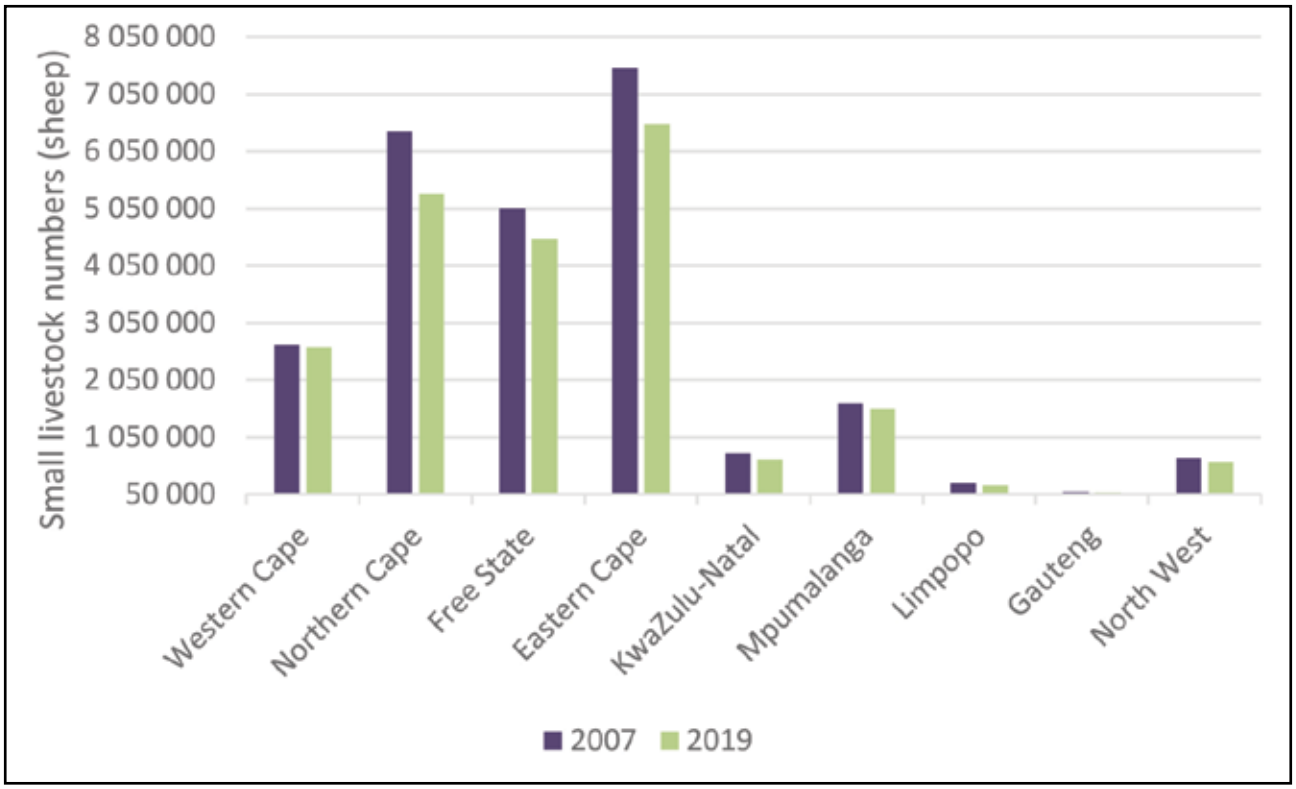

Figure 2. Comparison of South African sheep (small livestock) numbers in 2007 and 2019. From van Niekerk (2010) and DALRRD (2019).

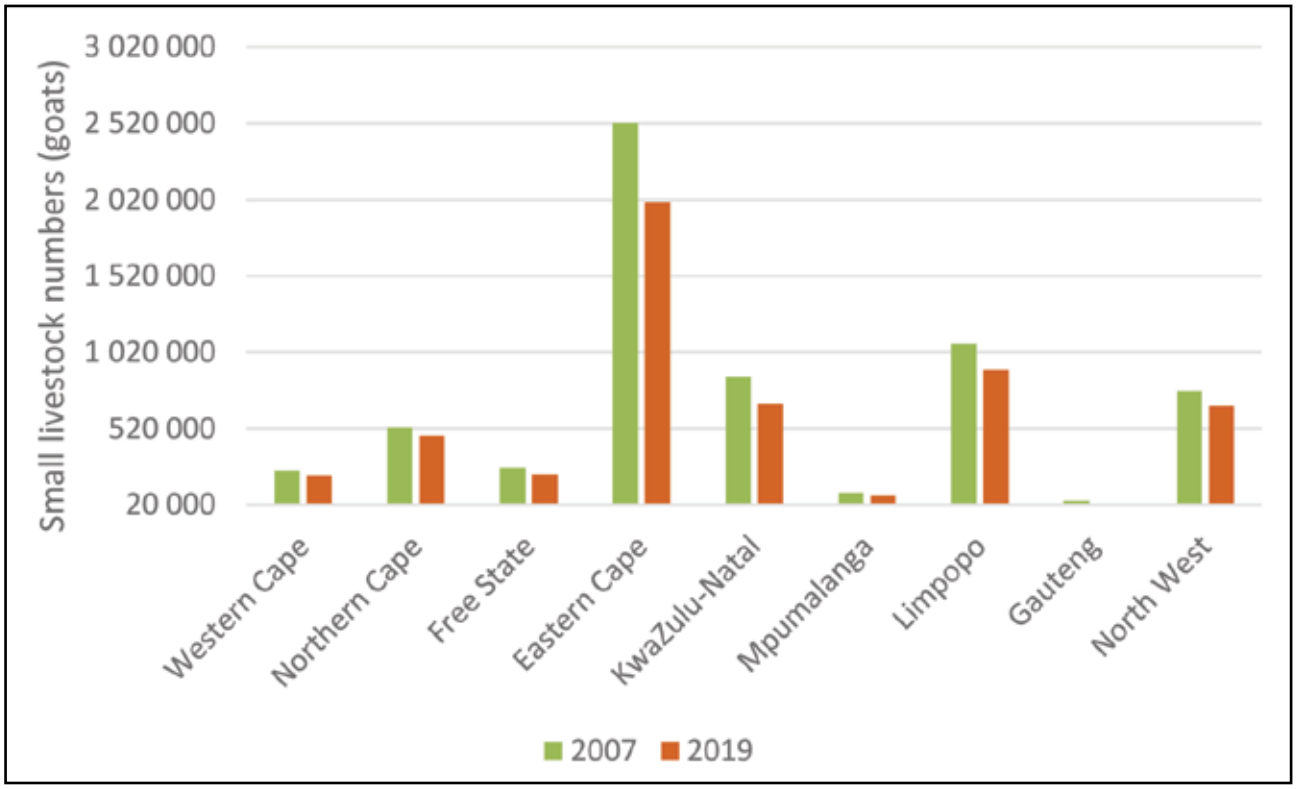

Figure 3: Comparison of South African goat (small livestock) numbers in 2007 and 2019. From van Niekerk (2010) and DALRRD (2019).

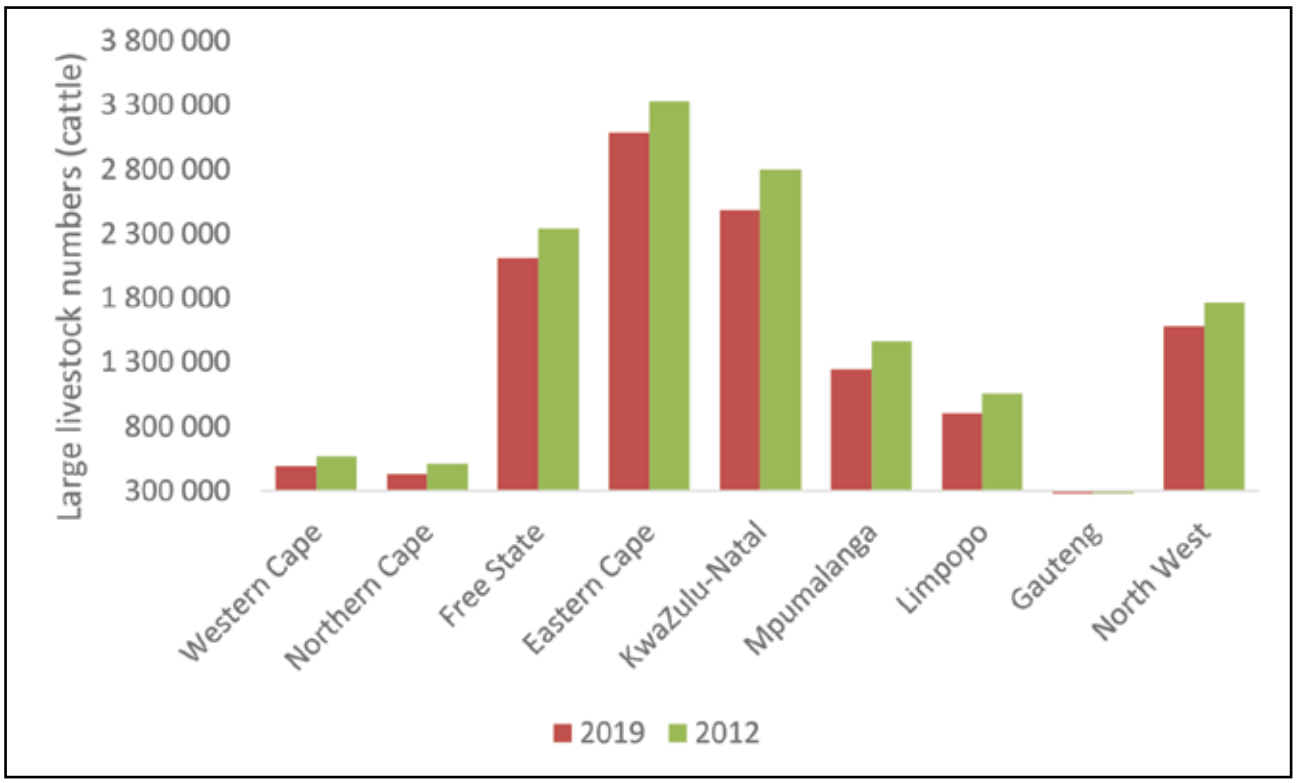

Figure 4. Comparison of South African large livestock (cattle) numbers in 2012 and 2019. From Badenhorst (2014) and DALRRD (2019).

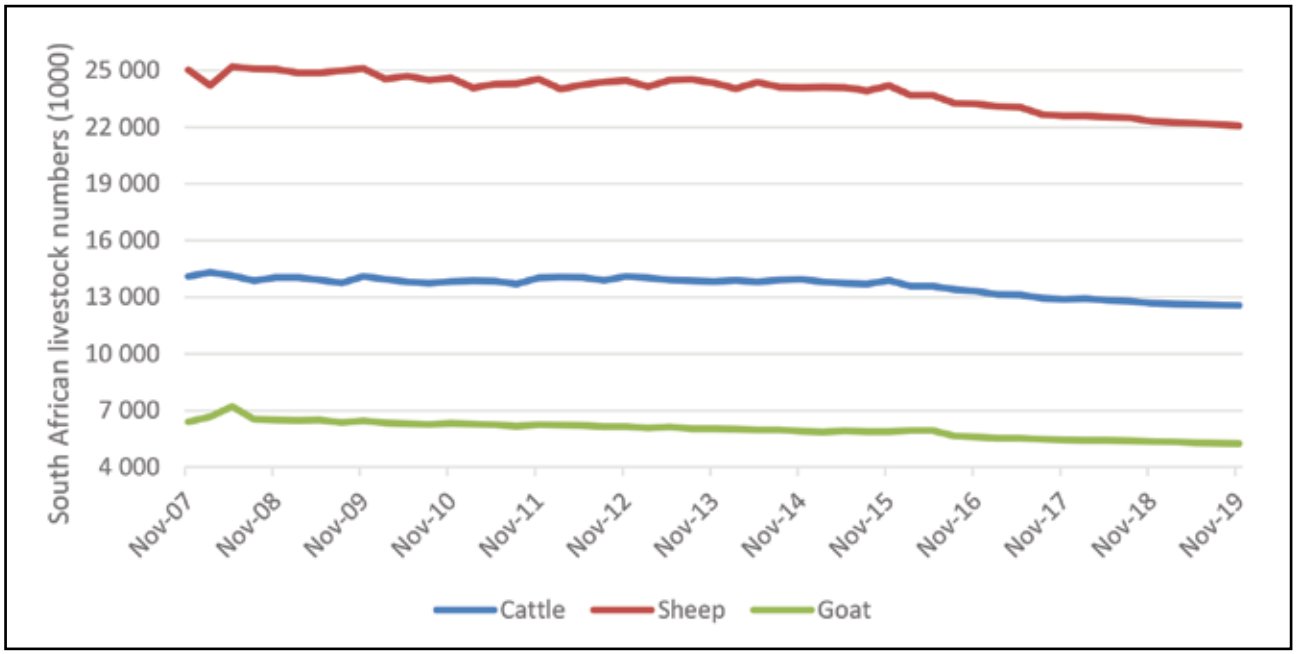

Figure 5. South African livestock (cattle, sheep, and goats) numbers fell markedly in November 2019 due to severe, nation-wide drought conditions. From DALRRD (2019).

to obtain relevant information during short telephone interviews; data collected covered the years 2006/2007 (Van Niekerk 2010). The questionnaire included questions on management, type of losses, control methods, and topography of the farms.

Badenhorst (2014) followed a similar approach to that developed by Van Niekerk (2010), allocating the number of farmers per province included in the random survey according to the distribution of the national cattle herd. Seven provinces, namely Northern and Eastern Cape, Free State, KwaZulu-Natal, Mpumalanga, Limpopo and North-West participated. The two mentioned studies of Van Niekerk (2010) and Badenhorst (2014) differed in terms of the sample area; in the former, it was

assumed that the predation losses occurred primarily in small livestock producing areas, while in the latter the extent of predation losses occurring in large livestock was unknown, which led to the inclusion of all provinces of South Africa. The Western Cape and Gauteng provinces opted not to participate. Again, a structured questionnaire (Badenhorst 2014) was developed in line with the study by Van Niekerk (2010) to obtain information on predation for cattle farmers. A random sample of 1 500 cattle farmers was surveyed by telephone over a period of two production seasons. However, Badenhorst (2014) gave more attention to the indirect costs of predation than Van Niekerk (2010). The indirect costs of predation included the use of non-lethal and lethal methods to prevent or minimise predation.

For this paper, livestock numbers (small and large) were updated using recent data from DALRRD (Department of Agriculture Land Reform & Rural Development 2019). These livestock numbers include commercial and non-commercial (communal and traditional forms of livestock holdings) producers and are illustrated in Figs. 1 to 3. The values for head of livestock lost was updated using data from the National Livestock Theft Forum, for 2019, to estimate total losses due to predation in South Africa. These recent values are compared to estimates of predation costs (direct and indirect) from Van Niekerk (2010), Badenhorst (2013) and Schepers (2016).

METHODS

The financial impact (direct cost) of predation losses was calculated as the total number of animals lost annually as follows.

$$L = R \times S \quad (1)$$

Where L represents the level of predation losses experienced by producers, R represents the percentage of predation losses (%), S the total number of livestock in the area or province. Once the total losses are determined a monetary value of losses due to predation can be calculated as:

$$C = L \times P \quad (2)$$

Where L represents the total number of livestock lost due to predation per year, P the monetary value allocated (per head) to livestock lost and C the total direct losses incurred by livestock producers. The same approached was followed by Lombard & Bahta (2019) in order to estimate the economic impact of sheep and goat theft in South Africa.

Data for the variables in equations 1 and 2 was obtained from various sources as explained below. As of 2020, the National Livestock Theft Forum valued one head of small livestock (sheep) at ZAR2 000, one head of small livestock (goat) at ZAR2 200 and one head of large livestock (cattle) at ZAR13 000. These values provided a common price per head of livestock, but some over or underestimation of economic cost is possible due to the different methods of estimating livestock values between the analyses utilised in this study. Van Niekerk (2010) used ZAR600 for one head of sheep and goat younger than six months and a value of ZAR1 000 for one head of sheep and goat older than six months, where Badenhorst (2014) used a value of ZAR10 400 in the case of large livestock.

It is challenging to accurately estimate the indirect cost of predation due to the many different permutations of predation management employed in South Africa. Factors that influence these management and farming activities can range from the age of the farmer to the topography of the area (Van Niekerk 2010; Badenhorst 2014; Schepers 2016). The methods and approach used for estimating indirect cost of predation used by these studies were very simplistic. To calculate the capital spent to prevent predation, Badenhorst (2014; see Table 2, Column 8) divided the total capital spent by the number of cattle in the province to obtain a representative value for the province. While the indirect costs presented in these studies cannot be assumed to represent the entire industry, and may be subject to over or underrepresentation, it still provides a good indication of costs involved in preventing predation.

To estimate the indirect cost due to damage-causing animals for in the livestock sector for 2019, several factors must be kept in mind: firstly, there is no indication if there was a change in management strategies by livestock farmers. Secondly, the studies by Van Niekerk (2010), Badenhorst (2014) and Schepers (2016), indicate that management of damage-causing animals, including aspects such as the intensity of management or level of predation, differed between segments (small livestock, large livestock, or wildlife ranching), as well as between provinces and production areas.

The time value of money principal can be used to update the financial costs calculated by Van Niekerk (2010), Badenhorst (2014) and Schepers (2016). According to Louw *et al.* (2013) the time value of money is a fundamental concept in financial management. The equation reflects the combined influence of interest and time, which is essential for financial decision making and to understand the value of money in the future, by taking into account interest rates and the period of time elapsed. To estimate a representative value for 2019, the following the formula applied:

$$FV = PV\,(1 + r)^n \quad (3)$$

Where: PV = present time value
FV = future value
r = rate of interest
n = number of years

The percentage allocation between the indirect cost and total cost of predation in large livestock, can be used to estimate a possible value for the indirect cost of predation for the small livestock sector. Indirect costs associated with large livestock predation were estimated at 21.4% of the total direct cost of predation losses (Badenhorst 2014). Schepers (2016) indicated a percentage contribution to the total cost of predation in the wildlife ranching industry of between 13 to 31%, keeping in mind the overvaluation of certain wildlife species in 2016. However, a simplified assumption can be made by keeping the percentage distribution for the small and large livestock sectors the same, because predation management aspects were relatively similar (Badenhorst 2014; Schepers 2016).

RESULTS AND DISCUSSION

Small livestock predation losses

It was estimated that small livestock predation losses increased from ZAR1 545 million in 2010 to ZAR2 710 million in 2019. The predation losses for 2007 and 2019 in the five primary small livestock producing provinces are compared as shown in Table 1.

According to Van Niekerk (2010), the five provinces represented over 85% of the national sheep and goat herds of South Africa. The highest predation losses occurred in the Northern Cape province, with a total loss of 6% and 13% production. Of the five provinces surveyed, the Western Cape province was the least affected by predation. Most predation losses were incurred in lambs/kids between lambing and weaning (younger than six months).

Large livestock predation losses

The highest large livestock predation losses, in terms of value, occurred in KwaZulu-Natal; this province has the second-largest cattle herd of all nine provinces (Table 2). Limpopo Province experienced the highest predation level (0.89%), followed by North-West Province (0.53%). The overall cost of predation losses was estimated at ZAR471 million in 2014, without considering the indirect cost of predation as calculated by Badenhorst (2014). By 2019 it amounted to ZAR511 million (Table 2), using updated livestock numbers.

Estimating the cost of predation in South Africa is challenging due to several factors: (i) the costs of conducting research on predation at a national level, (ii) the reliability of available data, especially outdated data, and (iii) over or underestimation of predation losses. Extrapolation of a cost estimate to a national level can easily be misjudged although it remains an estimation. This is particularly prevalent when calculating indirect costs of predation because certain assumptions have to be made; for example, it is assumed that predation intensity remains constant over time with farmers spending the same amount annually on preventing predation. Evidence from the literature suggests that the indirect cost of predation amounted to over 21% (of the total cost of predation) in the large livestock sector and varied between 13 to 31% in the wildlife sector (Badenhorst 2014; Schepers 2016). An updated estimate of the indirect cost of predation for 2019, using the equation to calculate future value of money (FV, equation 1) in the large livestock sector is shown in Table 2. The findings concurred with those of Kerley et al. (2018a, b) who highlighted that predation losses in South Africa on commercial farms amount to R2.8 billion per annum; with casualties incurred by small livestock producers estimated at R2.34 billion (R1.39 billion in 2007), and R479 million for large livestock producers (R383 million in 2012).

Effect on macro-economic variables

The agricultural gross product value for 2018/2019 was estimated at ZAR277 078 million, with animal products contributing 49.2% or ZAR136 322 million (DALRRD 2019). If the estimated value of predation losses for 2019 is used, the effect of predation on the total value of animal contributions in the small and large livestock sectors accounted for 2% (Table 1) and 0.37% (Table 2), respectively. At a macro-economic level, small and large livestock predation losses amounted to a decline from ZAR136 322 million to ZAR133 101 million in the animal contribution of agricultural GDP. This decrease accounts for only the direct implications of predation in the small and large livestock sectors and does not include indirect losses of related macro-economic variables. The livestock industry has ripple effects throughout the economy of South Africa affecting various industries, in many areas, especially isolated rural ones, it is the core of the local economy. Predation not only influences the viability of livestock production but has knock-on effects on the livelihoods of those that depend on this industry. Livestock producers generate more than 200 000 of the available jobs in agriculture, while mixed farming contributes an additional 50 000 jobs. These statistics do not include agricultural jobs created through secondary and tertiary linkages which further increases the importance of the red meat industry as a contributor to employment (DAFF 2017; StatsSA 2017). Further, commercial, and non-commercial large livestock producers are the sources for South Africa's commercial feedlots, of which there are 100 for cattle

Table 1. Financial implications of small livestock predation losses; a comparison between 2010 and 2019.

		Number of small livestock (2007)	Number of small livestock (2019)	Average predation losses (%)	Losses due to predators (2010)	Losses due to predators (2019)	Unit cost per animal (ZAR) (2010)	Uni cost per animal (ZAR) (2019)	Cost of predation (ZAR) (2010)	Cost of predation (ZAR) (2019)
Eastern Cape province										
Sheep	< 6 months	7 501 575	6 530 887	11.3	847 678	737 990	600	1 200	508 606 785	885 588 277
	> 6 months	7 501 575	6 530 887	0.5	37 508	32 654	1 000	2 000	37 507 875	65 308 870
Goats	< 6 months	242 798	206 836	11.3	27 436	23 372	600	1 320	16 461 704	30 851 658
	> 6 months	242 798	206 836	0.5	1 214	1 034	1 000	2 200	1 213 990	2 275 196
Total		**7 744 373**	**6 737 723**		**913 836**	**795 051**			**563 790 354**	**984 024 001**
Free State province										
Sheep	< 6 months	5 055 942	4 518 109	7.4	374 140	334 340	600	1 200	224 483 825	401 208 079
	> 6 months	5 055 942	4 518 109	0.2	10 112	9 036	1 000	2 000	10 111 884	18 072 436
Goats	< 6 months	260 230	217 475	7.4	19 257	16 093	600	1 320	11 554 212	21 242 958
	> 6 months	260 230	217 475	0.2	520	435	1 000	2 200	520 460	956 890
Total		**5 316 172**	**4 735 584**		**404 029**	**359 904**			**246 670 381**	**441 480 363**
Northern Cape province										
Sheep	< 6 months	6 398 526	5 304 939	12.9	825 410	684 337	600	1 200	495 245 912	821 204 557
	> 6 months	6 398 526	5 304 939	0.1	6 399	5 305	1 000	2 000	6 398 526	10 609 878
Goats	< 6 months	525 169	469 063	12.9	67 747	60 509	600	1 320	40 648 050	79 872 048
	> 6 months	525 169	469 063	0.1	525	469	1 000	2 200	525 169	1 031 939
Total		**6 923 695**	**5 774 002**		**900 080**	**750 620**			**542 817 657**	**912 718 421**
Mpumalanga province										
Sheep	< 6 months	1 633 752	1 553 872	8	130 700	124 310	600	1 200	78 420 096	149 171 712
	> 6 months	1 633 752	1 553 872	0	0	0	1 000	2 000	0	0
Goats	< 6 months	98 584	79 193	8	7 887	6 335	600	1 320	4 732 032	8 362 781
	> 6 months	98 584	79 193	0	0	0	1 000	2 200	0	0
Total		**1 732 336**	**1 633 065**		**138 587**	**130 645**			**83 152 128**	**157 534 493**
Western Cape province										
Sheep	< 6 months	2 667 370	2 623 448	6.1	162 710	160 030	600	1 200	97 625 742	192 036 394
	> 6 months	2 667 370	2 623 448	0.1	2 667	2 623	1 000	2 000	2 667 370	5 246 896
Goats	< 6 months	242 798	206 836	6.1	14 811	12 617	600	1 320	8 886 407	16 654 435
	> 6 months	242 798	206 836	0.1	243	207	1 000	2 200	242 798	455 039
Total		**2 910 168**	**2 830 284**		**180 430**	**175 478**			**109 422 317**	**214 392 764**
Total loss (direct)									**1 545 852 837**	**2 710 150 042**
Total Agriculture contribution to GDP										**277 078 000 000**
Total value of animal contribution to total agriculture production										**136 322 376 000**
% value loss to small livestock predation										**1.99%**

Table 2. Cost of large livestock predation losses; a comparison between 2014 and 2019.

	Number of large livestock (2012)	Number of large livestock (2019)	Average predation losses (%)	Losses due to predators (2014)	Losses due to predators (2019)	Unit cost per animal (ZAR) (2014)	Unit cost per animal (ZAR) (2019)	Cost of predation (ZAR) (2014)	Cost of predation (ZAR) (2019)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Northern Cape province									
Direct cost	493 233	432 907	0.0963	475	417	10 400	13 000	4 939 827	5 419 563
Indirect cost of control								14 836 679	22 309 272
Total								**19 776 506**	**27 728 834**
Free State province									
Direct cost	2 359 137	2 108 659	0.2687	6 339	5 666	10 400	13 000	65 925 612	73 657 568
Indirect cost of control								55 699 633	83 753 126
Total								**121 625 245**	**157 410 693**
Eastern Cape province									
Direct cost	3 222 849	3 082 214	0.064	2063	1 973	10 400	13 000	21 451 283	25 644 020
Indirect cost of control								760 837	1 144 038
Total								**22 212 120**	**26 788 058**
KwaZulu-Natal province									
Direct cost	2 884 131	2 481 278	0.4375	12 618	10 856	10 400	13 000	131 227 961	141 122 686
Indirect cost of control								18 790 779	28 254 881
Total								**150 018 740**	**169 377 567**
Mpumalanga province									
Direct cost	1 483 630	1 242 875	0.3213	4 767	3 993	10 400	13 000	49 575 793	51 913 646
Indirect cost of control								13 799 176	20 749 223
Total								**63 374 969**	**72 662 869**
Limpopo province									
Direct cost	1 047 498	898 491	0.8932	9 356	8 025	10 400	13 000	97 305 022	104 329 181
Indirect cost of control								8 266 017	12 429 252
Total								**105 571 039**	**116 758 433**
North West province									
Direct cost	1 814 303	1 578 239	0.5335	9 679	8 420	10 400	13 000	100 664 788	109 458 766
Indirect cost of control								16 542 986	24 874 972
Total								**117 207 774**	**134 333 737**
Total loss (direct and indirect)								**599 786 392**	**705 060 192**
Direct loss									**511 545 430**
Total Agriculture contribution to GDP									**277 078 000 000**
Total value of animal contribution to total agriculture production									**136 322 376 000**
% value loss to small livestock predation									**0.38%**

and a small but unknown number for sheep. Many of the large feedlots have their own abattoirs and are thus vertically integrated (Spies 2011).

CONCLUSION AND RECOMMENDATIONS

In this study only the small and large livestock industries were studied in detail, however, the economic implications of predation are shared by the small and large livestock, as well as the wildlife ranching sectors in South Africa. While there is a difference between sectors, the impact of damage-causing animals is a combined challenge that influences the sustainability of all affected. Damage-causing animals do not differentiate or discriminate between farm fences, borders, or sectors. The objective of this study was to estimate and assess the financial cost of livestock predation in South Africa. The contribution of this article lies, in seeing predation losses in the large and small livestock production sector collectively, and in providing more up to date data on the effects of predation (new values of livestock lost) and the financial implications thereof.

Data from studies by Van Niekerk (2010) and Badenhorst (2014) were used as benchmarks to predict an estimate of the cost of predation in 2019, assuming the small and large livestock sectors respectively accounted for 13% and 1% of predation losses. The direct cost of predation losses for small and large livestock in 2019, respectively, amounted to ZAR2 710 million and ZAR511 million.

According to De Waal (2009), '*scientific data is mostly lacking, but indications are that predation by black-backed jackal and caracal has spread widely over South Africa and is still on the increase*.' Therefore, it is increasingly necessary to obtain more recent and accurate information on predation losses by livestock farmers and wildlife ranchers to assess the current situation. This data can be anticipated from the literature in a manner like the current study, but it would also be beneficial to obtain real-world numbers to check those assumptions against. These data would be highly beneficial in measuring changes or creating changes in policy or management aspects to improve predation management by livestock farmers. Continued fragmentated activities and uncoordinated approaches to predation management can hardly solve the widespread levels of predation (De Waal 2009, 2015, 2020, 2021). The Scientific Assessment or 'PredSA' (Kerley et al. 2018a, b) set out to assess the impact of predation on livestock in South Africa. It was broadly envisaged that such information should inform and assist the development of a national system of coordinated predation management (De Waal 2020, 2021).

The contribution of the South African scientific community has not yet led to the development of an impactful human-predator conflict strategy aimed at decreasing predation losses by damage-causing animals in southern Africa (Kruger 2019). The implementation of such a management strategy will require funding from various entities. Addressing the impact of predation in the livestock sector should be comprehensive and inclusive and not only focus on direct and indirect losses due to predation. The nature of the chosen management strategy is irrelevant for the purpose of this study. The first step is to understand the total economic implications of predation on livestock and related sectors, empowering role players and decision-makers with sufficient knowledge to make informed decisions on predation management. Understanding the economic implications of predation in the livestock industry requires considering direct, indirect, and downstream or "spill overs" effects resulting from predation which ripples throughout the economy of South Africa. However, to make economic sense, the cost of implementing strategies should not exceed the total economic implications of predation.

It is has been suggested that the only comprehensive approach to reducing the cost of predation in South Africa is by implementing a national system of coordinated management (De Waal 2009, 2020, 2021). This initiative should be informed by a comprehensive understanding of the total economic costs and implications of predation on the livestock industry, as well as on associated sectors of the South African economy.

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