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The Need to Address Black-backed Jackal and Caracal Predation in South Africa

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ABSTRACT: Prior to 1990, the four provincial governments of South Africa had a variety of programs in place to manage predation by black-backed jackals and caracals through lethal and nonlethal management in close cooperation with livestock farmers. During the 1990s the official programmes were phased out due to a multitude of factors including lower predation rates. Today, thousands of livestock (primarily sheep and goats, but also cattle and wildlife) are lost each day in South Africa due to black-backed jackal and caracal predation. The actual numbers are not known because not all losses are accounted or reported. It also does not account for the scores of cattle and wildlife lost to black-backed jackals and caracals, nor does it include livestock predation from other predators. To address the losses, the major producer organizations including the National Wool Growers' Association of South Africa, the South African Mohair Growers' Association, the Red Meat Producers Organization, and Wildlife Ranching SA formed the Predation Management Forum in 2009. The overall goal of the Predation Management Forum is to address predation by black-backed jackals and caracals by reestablishing a national program to include the national government of South Africa, provincial governments, and producers. Currently, the Predation Management Forum is actively engaging in initiatives to address predation in South Africa to ensure food security, biodiversity, and jobs.

KEY WORDS: black-backed jackal, caracal, cattle, goats, livestock, predation, sheep, South Africa, wildlife damage management

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INTRODUCTION

Predation has been recognized as a management issue for livestock owners for centuries in southern Africa (Stadler 2006). When the Nguni-speaking people migrated into present day South Africa, notably the northern and eastern parts, predation of their cattle (*Bos spp.*) caused them to design kraals - an enclosed area around the homestead that protects livestock from predation (Spocter 2012). Following the arrival of the Dutch colonists at Table Bay in 1652, the first Governor Jan van Riebeeck instituted the first bounty system in 1656 for predators to protect and maintain a viable source of livestock and food for the colonists, but primarily to supply ships rounding the Cape en route to and from Batavia. In 1659, the Dutch colonists used the Liesbeeck River, a hedge row, and a fence to create a defensive barrier to protect livestock from predation.

Over centuries and in part due to the demise of large predators during subsequent centuries, black-backed jackals (*Canis mesomelas*) and caracals (*Caracal caracal*) became the primary predators of livestock and wildlife in southern Africa. A number of tactics were developed and/or promoted to mitigate predation effects in the 19th and 20th Century. Throughout the majority of the 19th Century, black-backed jackals were minimally or not even discussed as a game animal, thus shooting was only used for wildlife damage management (Brayden 1899). Lord Charles Somerset, British Governor of the Cape, brought the art of English fox hunting to South Africa during the early 1800's as a control technique for black-backed jackals (Beinart 1998). Poisoning clubs began to target predators through coordination and education in the 1880s (Beinart 1998). The government renewed bounties for jackals and subsidized the use of strychnine.

Due to the potential toll on non-targets and predator aversion to bitter-tasting strychnine, a movement was made towards vermin-proof fencing in the early 20th century. Fencing was made compulsory in sheep (*Ovis aries*) producing areas and consisted of cyclone woven wire fence (vermin proof), Kitzelman woven fence or wire-netting fencing (Wilson 1904). Fencing was cost-shared by the government who

paid for half of the cost of installation and one half of the maintenance (Agriculture Union of Cape Colony 1908). The Fencing Act of 1912, and amended in 1922, provided for loans and mechanisms for individuals and neighbors to install vermin-proof fencing (Beinart 1998).

By 1914, hunting clubs were replacing poisoning clubs (Beinart 1998). Black-backed jackals continued to be considered the worst form of vermin known to man in his struggle to colonize South Africa (Fitzsimons 1919b; p 103). It should be noted that the primary focus was on the black-backed jackal occurring widely in the country; the side-striped jackal (*Canis adustus*) occurred mostly in the north-eastern parts of South Africa (ALPRU 2013). Livestock producers and ostrich (*Struthio camelus*) farmers used firearms, trapping, strychnine, bounties, fencing, and dogs. Caracals were also considered an agriculture pest with farmers controlling them by shooting, trapping, dogs, and toxicants (Fitzsimons 1919a; p 155). It was estimated that in 1916, 7.5-10% of the 15 million wool sheep in the Cape were killed by vermin each year (Beinart 1998). In 1924, the Vermin Extermination Commission estimated that annual losses were 1.5 million sheep.

Around World War I, an outspoken vocal proponent for black-backed jackal control, Sir Frederic de Waal, Administrator of the Cape, stated that South Africa should follow the example of the United States wherein the government engaged in a campaign against the coyote (*Canis latrans*) through the hiring of specialist hunters and trappers (Beinart 1998). During the war and post war years, from 1914-1923, over 317,000 black-backed jackals and >25,000 caracals were taken.

Prior to and during World War II, prussic acid was used in glass vials hung around sheep necks or placed in animal carcasses to poison predators (Hey 1964). The Provincial Administration of the Cape phased out bounties between 1951 and 1957. Bounties were replaced by supplementing hunting clubs in the Cape Province and providing educational programs (Gunter 2008). The governments of the Transvaal and Cape established hound breeding and research stations to further assist hunters in managing predators (Hey 1964, Gunter 2008).

In 1957, problem animal control was allocated to the Department of Nature Conservation in the Province of the Cape of Good Hope (Hey 1974). Shortly thereafter in 1959, Dr. Douglas Hey, Director of Nature Conservation, Cape Provincial Administration, visited the United States on a fact finding mission. Following Dr. Hey's visit, an official with the US Fish and Wildlife Service (precursor to today's US Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services [WS]) traveled to South Africa in 1961 and introduced the Coyote Getter to control black-backed jackals (Hey 1974).

During the 1960s, the government was still subsidizing hunt clubs with 110 such clubs located in the Cape Province alone (Hey 1964). By 1967, the government felt that predators were relatively under control (Hey 1967). This action had been accomplished through the use of hunt clubs, technical transfer including Coyote Getters, and education without the government conducting direct control. Management of predators continued into the 1970s with improvement made on trapping caracals (Hey 1974) and testing of alternative toxicants such as Compound 1080 (Hey 1967). District Councils maintained a supply of Compound 1080 Livestock Protection Collars (Toxi-Col) in the late 1980s and early 1990s for sheep producers to use (McBride 1990). Maintenance switched to pooling collars with farmers and hunt clubs with 82% reporting black-backed jackal or caracal taken when the technique was used (Toxi-Col 1991). As the political climate became more influenced by animal rights groups and with a lack of funding, the provincial and national governments phased out their official subsidization of predator control. By all accounts, the government was out of the predator control business by the early 1990s (De Waal 2009a). Some officials retained the necessary skills and knowledge to provide limited advice regarding predator control.

Due to changes in government interest and the continued impact of predators on livestock farmers, a National Policy and Strategy for Problem Animal Control in South Africa was formulated by the National Problem Animal Policy Committee under the direction of its Chairman, Mr. Peter Kingwill, on 18 November 1992

in Pretoria (De Waal 2009a). A culmination of the process was the Problem Animal Control Forum at the Golden Gate Highlands National Park which brought together the National Wool Growers' Association of South Africa, the Red Meat Producers' Organization, Nature Conservation and Administrations of the four provinces, and representatives from problem animal control organizations and the Regional Services Councils (Fair 1993). The Forum and Policy addressed four strategies, namely: communication, control, training, and research and development that needed coordination for the protection of livestock and biodiversity (De Waal 2009a).

The political landscape changed in 1994 when South Africa held its first democratic elections with the birth of its nine new provinces (changing South Africa's internal boundaries) and the inevitable creation of nine provincial governments (De Waal 2009a). The African National Congress was voted into office and Nelson Mandela was elected President. Much of the institutional knowledge was fragmented, lost, or forgotten with the sweeping change in government. The Bill of Rights in the Republic of South Africa's new constitution (Act 108 of 1996, Section 25) allowed for land reform and environmental protection. Specifically, the Bill of Rights states that "everyone has a right to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that, (i) prevent pollution and ecological degradation; (ii) promote conservation; and (iii) secures ecologically sustainable development of natural resources while promoting justifiable economic and social development." Thus, the need for coordinated management of predation had to wait for a new day.

Definition of current initiatives:

The Predation Management Forum (PMF) was formed in 2009 to represent the livestock industry in South Africa and pay specific attention to predation on livestock. Membership includes the Red Meat Producers' Organisation of South Africa, the National Wool Growers' Organisation of South Africa, the Wildlife Ranching South Africa, and the South African Mohair Grower's Association (De Waal 2009a). The

Canis Caracal Programme was launched in 2004 by the African Large Predator Research Unit (ALPRU) at the University of the Free State, Bloemfontein, South Africa, with the primary goal to boost efforts to resuscitate the dormant, or more aptly described non-existent, coordinated system of predator management on a national basis (ALPRU 2013; De Waal 2009a; De Waal 2009b; De Waal 2012). This programme provides a scientific advisory role to the PMF. It is conducted in three phases, comprising several independent but related facets that will run concurrently, namely (ALPRU 2013):

Phase 1: Collect and interpret all available data and information and after scientific evaluation, relevant and appropriate information on the black-backed jackal and the caracal will be disseminated to stakeholders and role players.

Phase 2: Initiate, support, and conduct scientific studies on the ecology of these two predator species and their natural food base.

Phase 3: Assist, in partnership with farmers and conservation authorities, in formulating new or updating existing scientific management strategies and policies to regulate these two predator species at the national and provincial levels.

Studies in the second phase eluded to above are conducted in several steps (Avenant et al 2006), namely: (1) the gathering of basic information; (2) the gathering of information regarding the successes and failures of control measures; (3) the gathering of information regarding the successes / failures of farm management practices to minimize stock losses, (4) proper ecological studies; (5) the formulation of a management hypothesis after taking all of the above information from a spectrum of areas into consideration; (6) independent testing of this hypothesis in smaller areas; and (7) contribution towards a revised national policy on predator control measures.

DISCUSSION AND REVIEW OF CURRENT INITIATIVES

Phase 1: Collect and interpret all available data and information and after scientific evaluation, relevant and appropriate information on the black-backed jackal and the caracal will be disseminated to stakeholders and role players.

From the start, the new initiative by ALPRU identified the paucity of available information on predation in South Africa (Avenant et al. 2006; De Waal et al. 2009). Therefore, the Canis Caracal Programme compiled a bibliographic list of publications on larger African predators in 2004. The initial report was a 132 page bibliographic list of large African predators in relation to their habitats and prey species (De Waal 2004). In addition to other activities, two representatives of ALPRU participated in 2006 at a Workshop held at the Ganzekraal Conference Centre, Western Cape, South Africa (Avenant et al 2006) where specific goals regarding predation management were set (Daly et al. 2006). Sadly and in spite of high hopes held by many for positive outcomes, very little tangible progress was made on most of these goals. However, ALPRU accepted the challenge and three postgraduate studies have been successfully completed by Gunter (2008), Strauss (2009) and Van Niekerk (2011). Gunter (2008) used historic data from two erstwhile predator hunting clubs in the Western Cape to develop software to assist in quantifying and assessing the impact of predation on livestock; the scope and focus of the study by Gunter (2008) has since been broadened and is currently advanced at the doctoral level. In the most recent study in this regard, Dr. Jurie du Plessis has graduated in 2013 with his Ph.D. thesis at the University of the Free State (De Plessis 2013).

Phase 2: Initiate, support, and conduct scientific studies on the ecology of these two predator species and their natural food base.

In one of the studies by the Canis Caracal Programme of ALPRU, Van Niekerk (2011) documented predation losses in the top 5 small livestock producing provinces of South Africa including the Eastern Cape, Free State, Northern Cape, Mpumalanga, and the Western Cape. The estimated direct cost of predation by black-backed jackals and caracals was more than ZAR 1.4 billion per year. Producers in the Free State identified climatic conditions, predation, and disease as having the greatest influence on red meat production (Spies 2011). In a study conducted by Strauss (2009) at the Glen Agricultural Institute near Bloemfontein in the Free State, the extent of predation by black-backed jackals

and caracal on Merino and Dorper sheep flocks caused the flock to be unsustainable. This study was concluded under the auspices of ALPRU and quantified the devastating impact on reproducing sheep; some of the ewes could not replace themselves with offspring in a breeding cycle of six years (Strauss 2009). Another post-graduate student, Mr. Coenraad Badenhorst successfully concluded an extensive structured survey during 2012 among about 1,400 beef cattle farmers in South Africa to determine the impact of predation among cattle. The results are currently being analyzed for publication towards the end of 2013.

Avenant and De Waal (2006) suggested that to understand the influence of various predator control and farming practices in different areas, small mammals would have to be sampled as part of the monitoring program that will assess habitat change. Avenant and Du Plessis (2008) and Avenant et al. (2011) followed through with this suggestion by looking at caracal food habits. Avenant (2011) included references to previous studies that serve as baseline for current knowledge and justification for more focused studies. These authors are currently investigating whether caracals in a high predation scenario in the southern Free State move to rodent prey rich habitats and will switch to larger prey during times of high energy demands. A review of predator management practices in one area in the Karoo found there was less need to remove predators when incorporating various nonlethal methods in response to sheep predation instead of year-round predator management (Avenant et al. 2009).

Phase 3: Assist, in partnership with farmers and conservation authorities, in formulating new or updating existing scientific management strategies and policies to regulate these two predator species at the national and provincial levels.

Most official structures that existed in South Africa regarding predation control faded away during the early 1990s (De Waal et al. 2009; De Waal 2009a). As part of the new initiatives, the PMF and ALPRU both engaged actively in efforts to draft legislation in 2008 for problem animals. During the course of 2009, Norms and Standards for the Management of

Damage-Causing Animals in South Africa were drafted under the auspices of the Department of Environmental Affairs and Tourism (DEAT). The process was biased and during discussions and in all the submissions it was maintained that the environmental and agricultural departments must both participate in developing a coordinated system for managing damage-causing animals (De Waal 2009a; De Waal 2012).

Due to the biased process, on July 2, 2009, the National Animal Damage Control Forum was created under the dedicated leadership of Mr. Petrus de Wet by the wildlife and ranching industries to provide a platform for liaison and coordination of activities of farmers and commodity organizations in the livestock and game ranching sectors, aimed at reducing losses incurred as a result of damage causing animals by means of ecologically and ethically acceptable methods which protect the biodiversity of South Africa (De Waal 2009a; De Waal 2012). The forum subsequently changed its name to the PMF of South Africa. The Forum recognized that conflict with damage causing animals is an inherent risk for farmers whose core business is livestock or game ranching. Management of losses caused by predators is part of farmers' and ranchers' production process, the responsibility which rests with the landowner or user. The Forum acknowledged that the responsibility of government is the interest of the community as a whole. However, government has the responsibility to ensure that its mandate to maintain an overarching and enabling environment in terms of legislation that does not translate to discrimination against one or more sectors within the community. These efforts succeeded and culminated in a meeting on 28 September 2009 with the Minister for Agriculture, Forestry and Fisheries (DAFF). The initiative to advance the justification of a coordinated system of predation management was widely communicated among the scientific community in South Africa (De Waal et al. 2009).

During April 2010, officials with USDA Wildlife Services (USDA-WS) met with officials from the Canis Caracal Programme to discuss sympatric predation issues, the US program for managing coyotes and other predators, and to look for opportunities for educational exchange and support. Within a month, two individuals

from the Canis Caracal Programme (representing the University of Free State and the National Museum in Bloemfontein), a member of the South African Mohair Growers' Association, and an official of the DEAT traveled to the US on a fact finding mission (de Wet 2010b; De Waal 2012). Objectives of the trip were to review USDA-WS programs in Colorado, Wyoming, Utah, Arizona, and Texas and to meet with state and local government officials and producers. The information gathered on managing predators would be used to guide and support management efforts for black-backed jackals and caracals in South Africa through a coordinated program (De Waal 2012). In addition, the information gleaned during the fact finding tour to the USA was broadly communicated in presentations at scientific forums (De Waal et al. 2011) and local popular press (De Waal 2012).

Following the educational trip to the United States, the PMF met with the Republic of South Africa's Portfolio Committee for Agriculture, Forestry and Fisheries on 2 November 2010 to present information gathered during their fact finding mission to the United States. They also presented information collected by the Canis Caracal Programme on ecology and economics. The redrafted Norms and Standards were released on 26 November 2010 with comments due on 26 December 2010 (de Wet 2010a). The Norms and Standards were contested by the PMF (de Wet 2010a).

The PMF held a strategic planning session at the Farmers Folly in Pretoria during July 2012. The planning session was facilitated and included government officials, members of the PMF, a representative of the Canis Caracal Programme and an official of USDA-Wildlife Services. The group spent two days outlining a strategic plan that could be used to promote and unite South Africa with a common goal to manage black-backed jackal and caracal predation. Elements of the plan included: grassroots support, the need to identify champions, successful partnerships, inclusion of multiple governmental agencies including wildlife, agriculture, health, producers, nongovernment organizations, tools for resource owners, minimization of bureaucratic red tape, key messages, the use of an integrated wildlife damage management plan to en-

sure biodiversity, provide food security and maintain jobs for South Africa.

LOOKING TOWARD THE FUTURE

Predation continues to be an issue for South Africa causing SAR 1.4 billion in losses per year. Since 2005 the Canis Caracal Programme advocated that efforts will succeed if predators such as black-backed jackal and caracal are viewed and managed as a national priority (De Waal 2009b; 2012). The government and farmers are equal partners with specific responsibilities: the state agencies are responsible for policy, co-ordination, training, extension, research, and monitoring. However, they must refrain from dominating the scene. The livestock farmers and wildlife ranchers are responsible to safeguard their animals and controlling predators. A coordinated system of predation management must include the recreation and maintenance of an institutional memory regarding all relevant information on predation in South Africa (De Waal et al. 2009; De Waal 2012). The need to develop and maintain an institutional memory regarding predation has been emphasized as a high priority and should be high on the agenda in future activities in South Africa (De Waal 2012).

It would seem the government is beginning to listen. The South African Department of Agriculture allegedly has budgeted SAR 140 million for 2012/2013 for research on predation and predation management (Anonymous 2011). To kick off the program, the Agriculture Department offered to put forward SAR1 million so that research into predation could be commenced as soon as possible, while a further SAR600 thousand was made available in 2012 by the Environmental Department to advance more research. The PMF has pledged to match some of the government's funding from their own resources.

The Red Meat Research and Development of South Africa (RMRD) will act as lead service provider and grantor on research in terms of predation management for the Predation Management Forum. The group released a draft "Research and development plan for predation management within the large and small stock and wildlife industries in South Africa during

April 2012. The plan includes 8 parts: data collection; economics; best management practices; predation management tools; predator behavior and feeding ecology; methodology for training; and, methodology for extension practices. A new study under the auspices of ALPRU has been mandated and funded by the RPO and the funding is channeled through the RMRD. A postgraduate student, Mr. Coenraad Badenhorst has concluded an extensive structured survey during 2012 among about 1,400 beef cattle farmers to determine the impact of predation. The results are currently being analyzed for publication towards the end of 2013.

The much needed government funding will be used to support the research and development to answer many of the producers, ecologists, and government officials' questions. The hope is that by combining research, policy, grassroots support, education, extension, and lessons learned, South Africa will be able to develop a

LITERATURE CITED

- AFRICAN LARGE PREDATOR RESEARCH UNIT (ALPRU). 2013. <http://natagri.ufs.ac.za/content.aspx?DCCode=100&DivCode=D029>.
- AGRICULTURE UNION OF CAPE COLONY. 1908. Vermin-proof fencing. *Agriculture Journal of the Cape of Good Hope* 33: 221.
- ANONYMOUS. 2011. The government will fund research on predation. *Farmer's Weekly*, 24 June.2011. <http://www.farmersweekly.co.za/news.aspx?id=6623&h=Government-will-fund-research-on-predation>.
- AVENANT, N. L. 2011. The potential utility of rodents and other small mammals as indicators of ecosystem integrity of South African grasslands. *Wildlife Research* 38: 626-639.
- AVENANT, N., E. STEENKAMP, and H. O. DE WAAL. 2009. Reviewing a case study on the effects of different management options to reduce predation of small livestock in the Karoo. *South African Wildlife Management Association*, Thaba 'Nchu, Free State, South Africa. 38pp.
- AVENANT, N. L., and H. O. DE WAAL. 2006. The potential importance of rodents in managing two problem carnivores, and subsequently in promoting ecosystem conservation and sustainable small stock farming practices in Southern Africa. 3rd International Conference on Rodent Biology and Management.
- AVENANT, N., H. O. DE WAAL, and W. COMBRINCK. 2006. The Canis Caracal Programme: a holistic approach. Pages 23-25 in B. Daly, H. Davies-Mostert, W. Davies-Mostert, S. Evans, Y. Friedmann, N. King, T. Snow, and H. Stadler, editors. 2006. *Prevention is the Cure. Proceedings of a Workshop on Holistic Management of Human-Wildlife Conflict in the Agricultural Sector of South Africa*. Endangered Wildlife Trust, Johannesburg.
- AVENANT, N. L., and J. J. DU PLESSIS. 2008. Sustainable small stock farming and ecosystem conservation in southern Africa: a role for small mammals. *Mammalia* 72: 258-263.
- AVENANT, N., C. POHL, A. SLIWA, and G. OLBRIGHT. 2011. The impact of small mammals on caracal ranging behaviour and animal damage control practices. The 11th African Small Mammal Symposium, Kwaluseni, Swaziland. 89pp.
- BEINART, W. 1998. The night of the jackal: sheep, pastures and predators in the Cape. *Past and Present* 158: 172-206.

- BRAYDEN, H. A. 1899. Great and small game of Africa: an account of the distribution, habits, and natural history of the sporting mammals, with personal hunting experiences. R. Ward, London. 600pp.
- DALY, B., H. DAVIES-MOSTERT, W. DAVIES-MOSTERT, S. EVANS, Y. FRIEDMANN, N. KING, T. SNOW, and H. STADLER, editors. 2006. Prevention is the Cure. Proceedings of a Workshop on Holistic Management of Human-Wildlife Conflict in the Agricultural Sector of South Africa. Endangered Wildlife Trust, Johannesburg. 111pp.
- DE WAAL, H. O. 2004. Bibliography of the larger African predators and related topics on their habitat and prey species. ALPRU African Large Predator Research Unit. University of the Free State, Bloemfontein South Africa. 132pp.
- DE WAAL, H. O. 2009a. Recent advances in coordinated predator management in South Africa. *Merino SA Focus* 2009: 44-46.
- DE WAAL, H. O. 2009b. Predator debate needs level heads. *Farmer's Weekly* 3 July 2009: 6.
- DE WAAL, H. O. 2012. Koördineer tog! *Landbouweekblad* 27 Januarie 2012: 32-34.
- DE WAAL, H. O., H. N. VAN NIEKERK, and N. L. AVENANT. 2009. Recent advances in the quest for a co-ordinated predator management system in South Africa. Southern African Wildlife Management Association Symposium. 13-16 September 2009. Black Mountain Leisure and Conference Hotel, Thaba Nchu.
- DE WAAL, H. O., S. QUINETTE, H. N. VAN NIEKERK, and N. L. AVENANT. 2011. Advances towards a system of coordinated predation management in South Africa. 7th International Wildlife Ranching Symposium, Kimberley, South Africa.
- de WET, P. December 9, 2010a. Letter to Director General Thomas Mbedzi on Comment draft Norms and Standards document No. 33806.
- de WET, P. 2010b. Predation management South Africa vs. USA. *Wolboer Wool Farmer* July 2010 issue. 24pp.
- DU PLESSIS, J.J. 2013. Towards the development of a sustainable strategy for *Canis mesomelas* and *Caracal caracal* on range-land. Ph.D. thesis, University of the Free State, Bloemfontein, South Africa.
- FAIR, J. 1993. Proceedings of the Problem Animal Control Forum, 4th-5th May 1993. Harrismith :Wolox (PO Box 1058, Harrismith 9880).
- FITZSIMONS, F. W. 1919a. The natural history of South Africa: mammals. Vol. 1. Longsman Green and Company, London. 178pp.
- FITZSIMONS, F. W. 1919b. The natural history of South Africa: mammals. Vol. 2. Longsman Green and Company, London. 195pp.
- GUNTER, Q. 2008. A critical evaluation of historical data on two damage causing predators, *Canis mesomelas* and *Caracal caracal*. M.Sc. Dissertation, University of the Free State, Bloemfontein, South Africa.
- HEY, D. 1964. The control of vertebrate problem animals in the Province of Cape of Good Hope, Republic of South Africa. Proceedings of the 2nd Vertebrate Pest Control Conference. Paper 11.
- HEY, D. 1967. Recent developments in the control of vertebrate problem animals in the Province of the Cape of Good Hope, Republic of South Africa. Proceedings of the 3rd Vertebrate Pest Conference. Paper 30.
- HEY, D. 1974. Keynote address—vertebrate pest animals in the Province of the Cape of Good Hope, Republic of South Africa. Proceedings of the 6th Vertebrate Pest Conference. Paper 20.
- MCCBRIDE, R. 1990. LPC at work in South Africa. *Ranching Magazine* 71: 8, 10-11.
- SPIES, D. C. 2011. Analysis and quantification of the South African red meat value chain. Ph.D. dissertation, University of the Free State, Bloemfontein, South Africa.
- SPOCTER, M. 2012. Gated developments: international experiences and the South African context. *Acta Academia* 44:1-27.
- STADLER, H. 2006. Historical perspectives on the development of problem animal management in the Cape Province. Pages 11-16 in B. Daly, W. Davies-Mostert, S. Evans, Y. Friedmann, N. King, T. Snow & H. Stadler, editors. Proceedings of a Workshop on Holistic Management of Human-Wildlife Conflict in the Agricultural Sector

- of South Africa. Endangered Wildlife Trust, Johannesburg.
- STRAUSS, A. J. 2009. The impact of predation on a sheep enterprise in the Free State Province. M.Sc. Dissertation, University of the Free State, Bloemfontein, South Africa.
- TOXI-COL. 1991. 1991 livestock protection collar survey. <http://www.livestockprotection.net/testimonials.htm>
- VAN NIEKERK, H. N. 2011. The cost of predation on small livestock in South Africa by medium-sized predators. M.Sc. Dissertation, University of the Free State, Bloemfontein, South Africa.
- WILSON, G. 1904. Jackal fencing--ancient and modern. The Agriculture Journal of the Cape of Good Hope 25:719-720.