Hippotragus equinus – Roan Antelope

Regional Red List status (2016)	**Endangered C2a(i)+D*†‡**
National Red List status (2004)	Vulnerable D1
Reasons for change	Non-genuine: New information
Global Red List status (2008)	Least Concern
TOPS listing (NEMBA)	Vulnerable
CITES listing	None
Endemic	Edge of Range

*Watch-list Data †Watch-list Threat ‡Conservation Dependent

Despite being widely distributed throughout Africa, this species is a habitat specialist and occurs at low densities where most populations are declining due to an array of threats (Havemann et al. 2016).

Taxonomy

Hippotragus equinus (É. Geoffroy Saint-Hilaire 1803)

ANIMALIA - CHORDATA - MAMMALIA - CETARTIODACTYLA - BOVIDAE - *Hippotragus* - *equinus*

Common names: Roan Antelope (English), Bastergemsbok (Afrikaans), Inoni (Ndebele, Zulu), Kgama (Sesotho), Kwalata (Setswana), Ndunguza (Shona), Litagayezi (Swati), Thavha-nda-lila (Venda), Iliza (Xhosa)

Taxonomic status: Species

Taxonomic notes: Six subspecies have been described, but the validity of most of these is still in doubt, and recent genetic studies have shown that only the western African subspecies (*Hippotragus equinus koba*) constitutes a genetically separate group from those in the rest of Africa (Alpers et al. 2004). Management authorities therefore work with Evolutionarily Significant Units (ESUs) and use *H. e. equinus* as the putative indigenous subspecies within the assessment region. *Hippotragus e. cottoni* should also be seen as an indigenous subspecies. The *equinus*/*cottoni* complex is treated as one by nature conservation authorities as there may be no significant genetic differences between the two. Many of the Roan Antelope in South Africa are *H. e. cottoni* or *equinus x cottoni* (especially on private properties).

Assessment Rationale

This charismatic antelope exists at low density within the assessment region, occurring in savannah woodlands and grasslands. Currently (2013–2014), there are an observed 333 individuals (210–233 mature) existing on nine formally protected areas within the natural distribution range. Adding privately protected subpopulations and an estimated 0.8–5% of individuals on wildlife ranches that may be considered wild and free-roaming, yields a total mature population of 218–294 individuals. Most private subpopulations are intensively bred and/or kept in camps to exclude predators and to facilitate healthcare. Field surveys are required to identify potentially eligible subpopulations that can be included in this assessment. While there was an historical crash in Kruger National Park (KNP) of 90% between 1986 and 1993, the subpopulation has since stabilised at *c*. 50 individuals. Overall, over the past three generations (1990–2015), based on available data for nine formally protected areas, there has been a net population reduction of *c*. 23%, which indicates an ongoing decline but not as severe as the historical reduction. Further long-term data are needed to more accurately estimate the national population trend. The main threats to this species are a reduction in habitat quality (for example, from overgrazing as they are specialist grazers), loss of genetic diversity from hybridisation with West African Roan Antelope (*H. e. koba*), limited suitable habitat in formally protected areas, the lack of suitable incentives for conservation of wild subpopulations by the private sector resulting in a shift from extensive ranching to intensive breeding practices, and the emerging threat of climate change reducing potentially suitable habitat. Thus, we list this species, under a precautionary purview, as Endangered D as the minimum confirmed wild mature population within the natural range is < 250 individuals; and Endangered C2a(i) given the net ongoing decline over three generations. Regular monitoring of these systems and subsequent revision of its status is critical. Key interventions for this species should include increasing the area of suitable habitat available within the natural distribution range under formal protection, providing incentives to private wildlife ranches for managing Roan Antelope populations in a way that contribute to its long term conservation, restoring habitat quality and developing a national metapopulation plan for sustaining the genetic diversity and resilience of the species and reducing the threat of further genetic contamination with *H. e. koba*. Such interventions rely on partnerships with the private sector.

Regional population effects: Although this species is on the edge of its range within the assessment region, its range is not continuous. Private, and most state populations, are isolated by fencing. The only dispersal routes that might exist are between the KNP, Zimbabwe

Recommended citation: Kruger J, Parrini F, Koen J, Collins K, Nel EJ, Child MF. 2016. A conservation assessment of *Hippotragus equinus*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

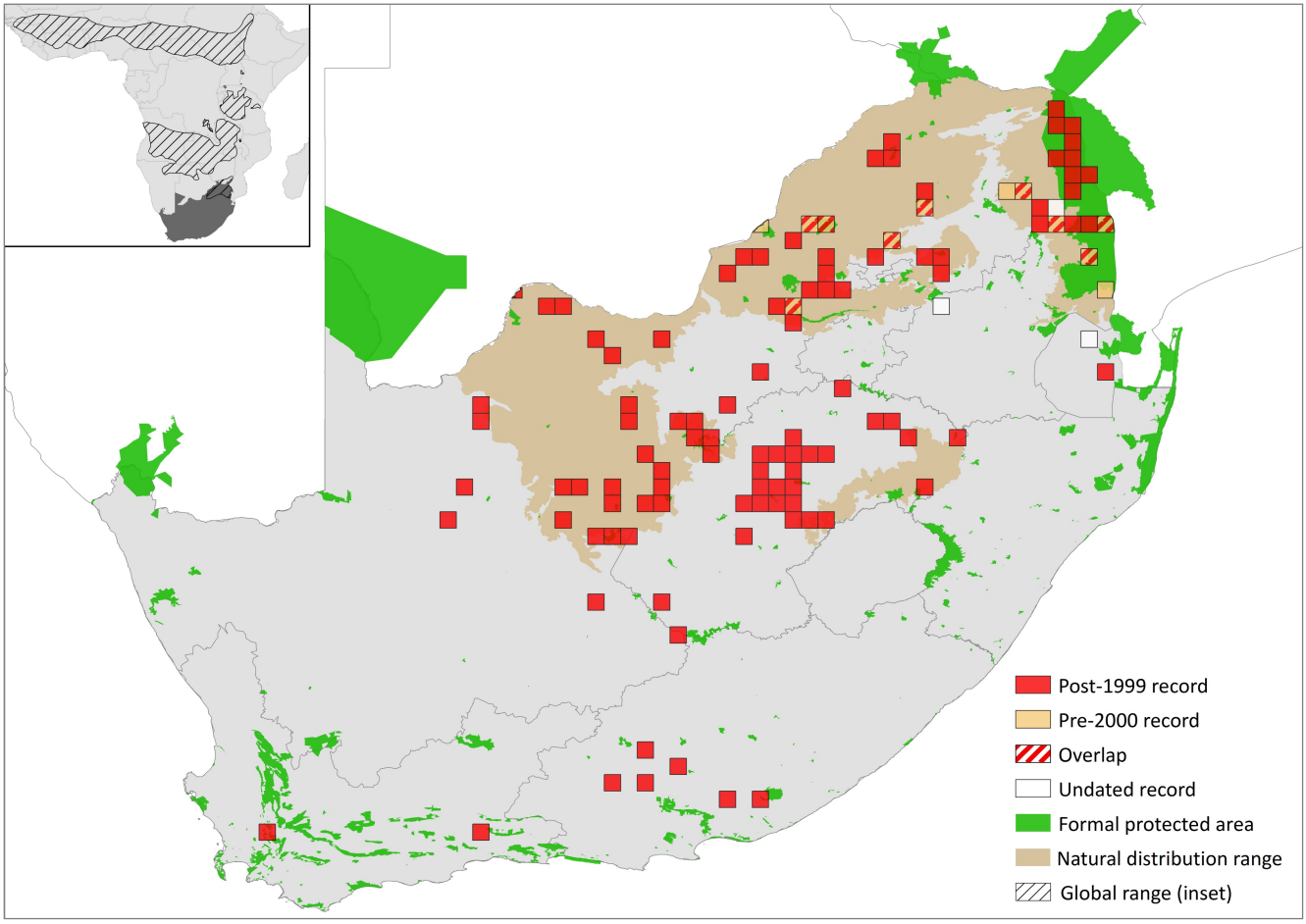

Figure 1. Distribution records for Roan Antelope (*Hippotragus equinus*) within the assessment region

Table 1. Countries of occurrence within southern Africa

Country	Presence	Origin
Botswana	Extant	Native
Lesotho	Absent	-
Mozambique	Possibly Extinct	Native
Namibia	Extant	Native
South Africa	Extant	Native
Swaziland	Extant	Reintroduced
Zimbabwe	Extant	Native

and Mozambique (the Greater Limpopo Transfrontier Park) and perhaps through Botswana, but Roan Antelope are mostly restricted to northern Botswana (C. Havemann pers. comm. 2015). Similarly, Roan Antelope have not been observed in either the 2010 or 2013 aerial census of the Limpopo National Park, suggesting they have declined or are locally extinct (Stephenson 2013). Thus, immigration appears to be negligible and there is no confirmation that it actually takes place, and so no rescue effect is possible.

Distribution

The Roan Antelope formerly occurred widely in the savannah woodlands and grasslands of sub-Saharan Africa, but has been eliminated from large parts of its former range (Havemann et al. 2016). For example, it has declined dramatically over the past two decades in Botswana, Namibia and Zimbabwe and has been almost entirely eradicated in Angola and Mozambique (summarised in Havemann et al. 2016). However, small remnant subpopulations may exist in Mozambique primarily for trophy hunters (K. Collins pers. obs. 2016). It was also eliminated from Swaziland and later reintroduced to the privately owned Mkhaya Nature Reserve (East 1999; Chardonnet & Crosmary 2013). Within South Africa, by the mid-twentieth century, Roan Antelope consisted of a subpopulation in KNP and a subpopulation in the New Belgium Block and its immediate environs in the Waterberg, Limpopo Province. In an attempt to save these last free roaming Roan Antelope from extinction, the former Transvaal Provincial Administration embarked on a mass capture operation during the period 1968–1972 to capture the last free roaming animals to provide formal protection in a proclaimed provincial nature reserve, Percy Fyfe.

Roan Antelope naturally occur in Limpopo (and marginally Mpumalanga) bushveld areas through to the open savannahs in certain areas of North West, Northern Cape and Free State provinces (Figure 1). Although the type specimen for this species is from the Northern Cape, this species was eradicated there historically (Skinner & Chimimba 2005). However, subpopulations have since been reintroduced in the Northern Cape Province and have bred successfully. Two subpopulations were introduced into KwaZulu-Natal Province at Ithala and Weenen Nature Reserves but were removed before 2000. Although Roan Antelope's area of occupancy has been declining in key protected areas, such as KNP (Harrington et al. 1999), its overall occupancy in South Africa is increasing due to it being considered a high value species

by private sector and its subsequent breeding and translocation by the wildlife industry. However, most subpopulations are intensively managed (within < 50 ha camps) with larger free-roaming herds found predominantly on formally protected areas.

Population

Roan Antelope have always been the scarcest of the antelope in the Lowveld, numbering just 100 in the former Transvaal (outside of KNP) in the early 1970s (Lambrechts 1974). By the mid-twentieth century, Roan Antelope in South Africa consisted of a small subpopulation in KNP and a subpopulation in the Waterberg. The former Transvaal Provincial Administration captured the last free roaming animals during 1968–1972 to provide formal protection in a proclaimed provincial nature reserve, Percy Fyfe Nature Reserve. This allowed the establishment of subpopulations in various Limpopo Province nature reserves while a number of animals have also been made available to private land owners.

Protected Areas: Currently (2013–2015), there are an observed (or estimated in KNP) 333 individuals on formally protected areas within the Roan Antelope natural distribution range (Table 2). Mature population structure is inferred to be 60–70% based on a 63% mature herd structure from Perrin and Taolo (1998). This yields a minimum mature population size of 210–233 individuals. Additionally, there are another 218 animals on private protected areas of which 155 individuals on five private protected areas in the Northern Cape Province are kept isolated from predators and receive supplementary feeding on a daily basis (C. Kraft pers. comm. 2015), while another 63 individuals are in Eastern Cape and Swaziland, outside the natural distribution range. These subpopulations therefor do not comply to the criteria for inclusion in the assessment.

Wildlife Ranches: There are at least another 1,756 individuals existing on 77 wildlife ranches and/or in breeding camps across the country (Figure 1), A preliminary analysis (based on a sample of 26 subpopulations nationwide; EWT unpubl. data) into the proportion of private subpopulations that can be considered wild and free-roaming indicates that only 0.8–5% of individuals (14–88 animals), are eligible for inclusion as most are kept in areas smaller than reported home range sizes and are managed intensively. This echoes an earlier estimate by East (1999) that, of ~1,200 individuals, only 300 were considered wild as 88% occurred in small subpopulations (Havemann et al. 2016). Including the estimated number of wild animals from the private sector, brings the total estimated population size to 218–294 mature individuals.

Thus, although the bulk of the Roan Antelope population exists on private land, most are kept in intensive or semi-intensive systems where intensive manipulation often includes daily supplementary feeding, consistent parasite control and exclusion of predators, impacting negatively on the adaptability of these animals when released into the wild. It is further unclear what percentage of these subpopulations are hybridised with West African Roan Antelope, a serious problem which damages the integrity of the southern African Roan Antelope population. The extent of hybridisation of private Roan Antelope populations with West African Roan Antelope is currently being investigated by the Department of Environmental Affairs. This mixing may be widespread and necessitates the continued enforcement of strict translocation protocols. Thus, although formally protected subpopulations can be augmented by private stock, the risks to genetic integrity of protected wild subpopulations should be considered. Increases in Roan Antelope numbers resulting from increases in auction prices may merely increase numbers of animals in breeding facilities that do not necessarily contribute to improvement of the conservation status of the species in the wild.

Generation length is calculated as 8.4 years (Pacifici et al. 2013), which yields a 25 year three generation period (1990–2015). The subpopulation in KNP declined from 450 to *c*. 45 individuals between 1986 and 1993, a 90% decline over one generation (Harrington et al. 1999). However, the subpopulation has since stabilised at around 50 (2012 count) individuals (Ferreira et al. 2013). Over three generations, based on available data for nine formally protected areas, there has been a net population reduction of *c*. 23%, which indicates an ongoing decline but not as severe as the historical reduction. While some subpopulations are thriving, others continue to struggle. For example, in Kgaswane Mountain Reserve, there is currently (2016) only one male left after the herd has fluctuated between three and five individuals since 1999 (Nel 2015). Similarly, the subpopulation on Mokala National Park was reintroduced in 2006 with a founder size of six and subsequent reintroductions of 37 animals (2007) and eight animals (2009/10), but is not thriving and currently (2016) comprises 60 individuals after some were lost to drought (C. Bissett unpubl. data). Conversely the subpopulation on Sandveld Nature Reserve is faring better, having doubled in size from 12 in 2001 to 25 in 2014 (E. Schulze unpubl. data).

Current population trend: Declining

Continuing decline in mature individuals: Yes

Number of mature individuals in population: 218–294

Number of mature individuals in largest subpopulation: 46–54 in Percy Fyfe Nature Reserve, Limpopo.

Number of subpopulations: Nine on formally protected areas.

Severely fragmented: Yes, as all subpopulations are fenced. Roan Antelope require large home ranges (60–100 km2) that are mostly not satisfied on small private properties where they occur. Small breeding camp systems and agricultural/livestock farming contribute to habitat fragmentation.

Habitats and Ecology

Roan Antelope inhabit savannah woodlands and grasslands within the bushveld and Lowveld of southern Africa and prefer habitats with a cover of high grasses and

Table 2. Summary of population size estimates for Roan Antelope (*Hippotragus equinus*). This is based on available data only and thus may underestimate total numbers.

Province	No of protected areas	Subpopulation total (2013–2015)
Free State	2	28
Limpopo	5	232
North West	1	1
Northern Cape	1	72
Total	**9**	**333**

woody plants (Dorgeloh 1998; Knoop & Owen-Smith 2006), which play an important role for both grazing and calving (Chardonnet & Crosmary 2013). As such, they may be especially sensitive to changes in grass height and composition, as Roan Antelope rely on grass to camouflage their young and for foraging (Havemann et al. 2016). Roan Antelope are most abundant in moist or dystrophic savannas and sandveld woodlands where soils are predominantly infertile (Heitkönig & Owen-Smith 1998), such as *Terminalia sericea* and *Philenoptera nelsii* woodlands. They are water-dependent grazer/browsers, foraging at the boundary between ephemeral wetland and savannahs (for example, in the northern plains of KNP, Kröger & Rogers 2005). They currently only occur in the northern plains of KNP (Owen-Smith et al. 2012), but previously occurred throughout the park. Vlei grasslands are a key resource area in certain areas like the KNP, where *Themeda triandra* and *Panicum maximum* are important key resource grasses used during the dry season (Knoop & Owen-Smith 2006). They also show a preference for sandveld woodlands with predominantly infertile soils (Heitönig & Owen-Smith 1998). Habitats that have low densities of competitor and predator species appear to be crucial for their survival (Havemann et al. 2016).

Ecosystem and cultural services: Roan Antelope is a flagship species in the Waterberg. It is also a valuable trophy hunting species.


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Use and Trade

Roan Antelope are commercially bred and traded in South Africa. Trade has resulted in the deleterious mixing of ecotypes and/or ESUs. Wild animals were taken and put into captive-breeding camps with selective breeding, often for certain traits (for example, horn length) and intensive manipulation such as consistent supplementary feeding and veterinary care. The scale and impact of wild harvest are unknown but it is suspected to be stable to decreasing because of the already large numbers of Roan Antelope in captive breeding camps and the decrease in availability of wild populations in Africa The utilisation of Roan Antelope is either through hunting of trophy animals or selling of breeding stock that is largely between private intensive breeding facilities. Currently only a few subpopulations in the assessment region are definitely *H. equinus equinus*/*cottoni* hybrids. The uncertainty of the genetic status of most subpopulations in private sector hands creates a problem for permit allocations. Permit requirements for translocation now include genetic testing to prove purity.

These are the following negative risks when keeping the animals in camp systems:

- Loss of genetic fitness because of hybridisation, inbreeding or selective breeding for certain traits.
- Altered social behaviour where animals are no longer fit to function in natural systems.
- Habitat fragmentation.
- Increased veterinary care that may reduce population fitness of animals destined for release into the wild.

Therefore these animals potentially contribute less to conservation as they are less suitable to be released back into a free ranging system. Additionally, the illegal importation of various Roan Antelope ESUs (such as *H. e. koba*) into the assessment region may result in a risk of out-breeding depression for native Roan Antelope herds.

Table 3. Use and trade summary for the Roan Antelope (*Hippotragus equinus*)

Category	Applicable?	Rationale	Proportion of total harvest	Trend
Subsistence use	No	Illegal poaching may be occurring on a small scale but is not a major threat.	Negligible	Stable
Commercial use	Yes	Trophy hunting and live animal sales.	Nearly all	Increasing
Harvest from wild population	Yes	Few animals nowadays are taken from wild subpopulations.	Very limited < 3%	Stable
Harvest from ranched population	Yes	The minority of private subpopulations are kept on extensive systems.	17%	Increasing
Harvest from captive population	Yes	Most private subpopulations are intensively managed and/or bred.	80%	Increasing

Threats

Throughout Africa, the Roan Antelope has been eliminated from large parts of its former range because of poaching and loss of habitat due to the expansion of human settlements, and now survives mainly in protected areas. Within the assessment region, all wild Roan Antelope subpopulations exist in fenced protected areas, with additional stock existing in private wildlife ranches. Habitat loss and degradation within the assessment region is the greatest ongoing threat to Roan Antelope. Natural habitat is fragmented by agricultural expansion, human settlements, small camp systems on private ranches and impermeable game fences.

Furthermore, there has been a loss of habitat quality due to overstocking and areas being much smaller than natural home ranges (including some formally protected areas). Roan Antelope are sensitive to competition and cannot co-exist with high densities of game or cattle. As game ranchers increase densities to be more profitable, free-roaming animals on many private ranches have started to perform poorly because of habitat degradation (J. Kruger unpubl. data). Their environment is either less suitable than large protected areas where Roan Antelope occurred in the wild, or the grazing pressure is too high.

In KNP, the construction of artificial water-points in semi-arid regions increased predation rates by Lions (*Panthera leo*), following the influx of Zebra (*Equus quagga*) and Blue Wildebeest (*Connochaetes taurinus*) (Harrington et al. 1999); and also due to the associated habitat degradation and competition with other herbivores (Harrington et al. 1999; Grant & van der Walt 2000; Grant et al. 2002). However, the closing of artificial water-points in these areas have not led to a recovery of the Roan Antelope numbers (Ferreira et al. 2013), possibly due to an Allee effect where reduced herd vigilance causes increased juvenile mortality from predation and declining population numbers (Owen-Smith et al. 2012). This demonstrates that correct long-term management of existing protected subpopulations are crucial in conserving Roan Antelope.

Hybridisation between extra-limital subspecies and ESUs also takes place within the private sector. Although this is not seen as a threat for *equinus*/*cottoni* hybrids as they are seen as one group by provincial conservation departments, hybridisation with West African Roan Antelope (*H. e. koba*) is a threat. The largest subpopulation of private Roan Antelope (c. 200 individuals) consists of West African Roan Antelope (EWT unpubl. data), which precludes this subpopulation from being included in the Red List as it is likely to contain a significant number of hybrid animals. The loss of genetic

Table 4. Threats to the Roan Antelope (*Hippotragus equinus*) ranked in order of severity with corresponding evidence (based on IUCN threat categories, with regional context)

Rank	Threat description	Evidence in the scientific literature	Data quality	Scale of study	Current trend
1	*2.3.3 Agro-industry Grazing, Ranching or Farming:* habitat loss from livestock agricultural expansion. Current stresses *1.2 Ecosystem Degradation* and *1.3 Indirect Ecosystem Effects*: habitat degradation from overgrazing and fragmentation of suitable habitat.	Havemann et al. 2016	Review	Continental	Stable
2	*2.3.2: Small-holder Grazing, Ranching or Farming:* habitat loss from livestock agricultural expansion. Current stresses *1.2 Ecosystem Degradation* and *1.3 Indirect Ecosystem Effects*: habitat degradation from overgrazing and fragmentation of suitable habitat.	Havemann et al. 2016	Review	International	Stable
3	*7.2.9 Natural Systems Modifications:* establishment of artificial water-points on protected areas and ranches. Current stresses *1.2 Ecosystem Degradation*, *2.1 Species Mortality* and *2.3.2 Competition:* habitat degradation around water-points and increased grazing competition/ predation.	Harrington et al. 1999 Grant et al. 2002 Owen-Smith et al. 2012	Empirical Empirical Empirical	Local Local Local	Water-points removed in northern KNP but present in other protected areas and ranches.
4	*11.2 Climate Change:* increased drought conditions and loss of ephemeral wetlands/grass leading to decreased habitat suitability.	Erasmus et al. 2002 Boko et al. 2007	Simulation Simulation	National Continental	Drought conditions expected to increase along the east-west aridity gradient.
5	*2.3.2: Livestock Farming & Ranching:* increasing intensification of Roan management. Current stresses *2.3.1 Hybridization* and *2.3.5 Inbreeding:* loss of genetic integrity through inbreeding and hybridisation.	Barry 2003	Empirical	National	Only 42% sampled Roan belonged to *H. e. equinus.*
6	*5.1.1 Biological Resource Use:* removal of animals from the wild for intensive breeding purposes; small-scale poaching.	-	Anecdotal	-	-
7	*8.1 Diseases:* periodic diseases outbreaks, such as anthrax.	-	Removal of animals from the wild.	-	-

integrity is a severe threat to Roan Antelope (Barry 2003). For example, in 2000, of the estimated 1,237 Roan Antelope in South Africa, only 520 belonged to the indigenous *H. equinus equinus* while the rest either belonged to exotic subspecies or were hybrids (Barry 2003). The current level of hybridisation in the population on private game ranchers is unknown. Hybridisation between depleted populations is of great concern for biodiversity due to potential outbreeding depression hindering recovery. For example, camera-trapping and molecular surveys recently documented introgressive hybridisation between Giant Sable Antelope (*Hippotragus niger variani*) and sympatric Roan Antelope in Angola following severe wartime poaching (Pinto et al. 2016).

Another threat to Roan Antelope is their removal from the wild and into captive-breeding systems. Given the expansion of private wildlife enterprises, this threat could become more severe in the future, especially as wild Roan Antelope dwindle in the assessment region and thus increase their financial value. Thus, one of the biggest challenges facing the species is the institutional capacity of the agencies involved with the translocation and management of Roan Antelope. Disease is also a minor threat facing wild Roan Antelope. For example, KNP lost 30 Roan Antelope from an anthrax outbreak in the Capricorn breeding enclosure in 2012 (SANParks unpubl. data).

The high financial value of Roan Antelope, make them a sought after species for game ranchers. To reduce risks of losing expensive animals to poaching or predators, they are often put into camps smaller than their home ranges and managed intensively. As a result of intensive manipulation of social structures and mating selection, ongoing supplementary feeding and parasite control, intensive and selective breeding may further impact on the genetic integrity of Roan Antelope populations and make them less suitable for reintroduction into lightly managed systems (Jule et al. 2008). At the other end, extensive game ranchers with wild Roan Antelope populations do not get incentives for the costs they incur in conserving wild, genetically fit subpopulations that contribute to conservation. This results in a shift in game ranching from extensive ranches to intensive breeding, with a reduced contribution of private sector to conservation.

Current habitat trend: Ongoing loss of habitat and habitat quality. Habitat suitability is declining in South Africa due to bush encroachment and overgrazing. Many Roan Antelope subpopulations exist on small parcels of private land or in captive breeding camps, which has increased population numbers but fragmented the natural habitat. Overgrazing reduces grass species composition and biomass and encourages bush encroachment in certain areas (bushveld). Fragmentation through fencing reduces the ability to move away from areas that become unsuitable. Climate change will most likely increase bush encroachment and dry up the ephemeral wetlands needed by this species in southern African savannahs (Erasmus et al. 2002; Boko et al. 2007).

Conservation

Conservationists should focus on conserving Roan Antelope (and Sable) *in situ* within provincial and national parks. The establishment of new protected areas (or expansion of existing protected areas) with suitable habitat and improved management of such protected areas are priorities. Conservation areas need to be large enough to support resilient subpopulations and provide a buffer to increasing human populations at reserve edges (Wittemyer et al. 2008; Newmark 2008). Additionally, climate change may ultimately undermine conservation efforts for this species, as it makes the western parts of the country drier (thus reducing the suitability of benign reintroduction sites), which makes *in situ* conservation more difficult (Sandler 2012). It must be remembered that this species exists at the edge of its range in the assessment region: it reaches its highest densities north of South Africa in high-rainfall (> 1000 mm / annum) dystrophic woodlands (Heitkönig & Owen-Smith 1998), so any drier areas are marginal habitats. Since southern Africa is expected to get drier as a consequence of global change (Boko et al. 2007), suitable natural habitats will decrease. Thus, we recommend intensifying conservation efforts for this species in parts of its core range to combat the effects of climate change. For this, conservationists need to know the amount and location of available habitat and hence work closely with private landowners (as above).

One mechanism to achieve protected area expansion is to coordinate with private landowners adjoining protected areas in forming conservancies and restoring key habitats through holistic management of the landscape, such as decreasing artificial water-point provision, reducing grazing pressure and implementing an ecological fire regime (Dorgeloh et al. 1996; Owen-Smith 1996; Dorgeloh 1998), as well as to implement correct harvest management to maintain effective social units (Caro et al. 2009). Reintroductions and augmentation will only assist in the long-term if well-managed and suitable habitat can be conserved. Mokala National Park in the Northern Cape and Percy Fyfe Nature Reserve in Limpopo are both Roan Antelope strongholds and can be used to supplement/ augment other formally protected subpopulations.

Translocations and reintroductions should follow the recommendations proposed by Alpers et al. (2004) to avoid cross-breeding between ESUs. Although translocations of animals between West and southern Africa is prohibited, it still happens illegally. Movement of animals around the remaining regions of the Roan Antelope's range is considered less of a conservation concern (Alpers et al. 2004), especially seeing as this species is at the edge of its range. What is required is a pragmatic workable management plan that maximizes the area and habitat suitability for free-roaming herds in the assessment region. There should be more cooperation between private and public bodies. For this to happen, however, the management on state-protected reserves needs to improve. Stricter regulations on translocations should be developed and enforced, especially if animals from captive-bred facilities enter the free-roaming population at any stage. For private lands to contribute to the conservation of this species, they must form conservancies and manage translocations in conjunction with the provincial conservation officials. There should also be incentives for game ranchers that contribute to conservation of the species and disincentives for practices that negatively impact on its survival.

Monitoring the population and trade within the private sector is a key management intervention necessary to inform other interventions. Currently, there is no coordinated monitoring system or management plan and there is a lack of capacity to survey the private sector, which should be addressed. The species cannot benefit from captive breeding programs but it can benefit from *ex*

situ management strategies. Most savannah habitat is suitable for Roan Antelope if the area is managed responsibly. For example, in the North West Province, Roan Antelope should be reintroduced in Molopo Nature Reserve, and at least one of the provincial protected areas should focus on Roan Antelope conservation management (Power 2014).

To achieve cooperation with the private sector, the correct incentives and legislation are required for land owners to manage Roan Antelope as free-roaming herds rather than captive animals and ensure the habitat is of good quality. This would also be lucrative for the trophy hunting industry as hunters would be ensured of quality animals rather than domesticated animals.

Recommendations for land managers and practitioners:

- A Biodiversity Management Plan (BMP) should be developed to inform a national translocation and reintroduction policy. A national translocation policy should then be implemented to iron out the inconsistencies caused by different provincial legislation. Currently, formal risk assessments are necessary in all provinces for permits to be issued, but should be coordinated on a national scale. The BMP should also include habitat assessments for properties where Roan Antelope are to be translocated. Roan Antelope should currently not be reintroduced to provincial reserves from private properties, due to risk of hybridisation with *H. e koba.* All translocations should be preceded by genetic testing.
- Immediate actions should be taken to limit further hybridisation with *H. e. koba*. This necessitates enforcement of existing translocation regulations.
- Provincial departments should work more closely with the Roan Advisory Group of the Wildlife Ranching South Africa to create a national database of Roan Antelope numbers, management practices and genetic origins. This should include registering private subpopulations, indicating levels of management and genetic status as a precondition to trade.
- Ranchers who wish to sustain wild and free-roaming herds should manage lightly (for example, no continual supplementary feeding or predator exclusion) and should form conservancies or own properties of at least 40–100 km^2 for Roan Antelope to create natural home ranges. To enable this, incentives should be designed to encourage the management of wild subpopulations.
- Protected area expansion should be achieved in collaboration with the private sectors and local communities to facilitate larger spaces for free-roaming Roan Antelope herds.

Research priorities:

- Field surveys to determine national population size and management practices for Roan Antelope on

Table 5. Conservation interventions for the Roan Antelope (*Hippotragus equinus*) ranked in order of effectiveness with corresponding evidence (based on IUCN action categories, with regional context)

Rank	Intervention description	Evidence in the scientific literature	Data quality	Scale of evidence	Demonstrated impact	Current conservation projects
1	*1.1 Site/Area Protection:* establish new protected areas or expand existing protected areas in core natural range to reduce fragmentation effects.	-	Anecdotal	-	-	Provincial conservation agencies and South African National Parks
2	*1.2 Resource & Habitat Protection:* encourage private landowners adjoining protected areas to form conservancies and incentivise key resource protection.	-	Anecdotal	-	-	-
3	*2.3 Habitat & Natural Process Restoration:* improve veld management practices on protected areas and private game farms in order to improve habitat quality,	-	Anecdotal	-	-	-
4	*2.1 Site/Area Management*: drop internal fences to form conservancies and reduce artificial-waterpoints.	Owen-Smith et al. 2012	Empirical	Local	Closure of water-points has not led to population recovery possibly due to Allee effect.	South African National Parks
5	*6.5 Livelihood, Economic and Other Incentives:* provide incentives to land owners to introduce roan as free roaming animals instead of keeping them in small camps.	-	Anecdotal	-	-	-
6	*3.3.1 Species Management:* coordinate translocations through a biodiversity management plan and avoid translocations that would result in mixing *H. equinus* and *H. e. koba.*	-	Anecdotal	-	-	-

private lands, including surveying potential suitable habitats for Roan Antelope conservation.

- Genetic studies are a priority to assess to what degree hybridisation between the different subspecies has already taken place.
- Research also needs to document the survival of captive-bred individuals when released into wild systems and provide best practice guidelines.
- Understanding ecological aspects (home range, habitat utilization, feeding behaviour) of Roan Antelope in areas where they appear to be thriving. Studies on Roan Antelope subpopulations that appear to be stable or increasing are vital for providing important information for use in management and mitigation plans in areas where they appear to be declining.

Encouraged citizen actions:

- Landowners can drop internal fences to create conservancies and sustain wild and free-roaming Roan Antelope herds.

Data Sources and Quality

Table 6. Information and interpretation qualifiers for the Roan Antelope (*Hippotragus equinus*) assessment

Data sources	Census (unpublished), field survey (unpublished)
Data quality (max)	Observed
Data quality (min)	Inferred
Uncertainty resolution	Total count/best estimate
Risk tolerance	Precautionary

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Details of the methods used to make this assessment can be found in *Mammal Red List 2016: Introduction and Methodology.*