

The viability of legalising trade in rhino horn in South Africa



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1. ACRONYMS AND GLOSSARY

| | |
|---------------------|---|
| AfRSG | African Rhino Specialist Group |
| CITES | Convention on International Trade in Endangered Species of Wild Fauna and Flora |
| DEA | Department of Environmental Affairs |
| DRC | Democratic Republic of Congo |
| EWT | Endangered Wildlife Trust |
| FSDTEA | Free State Department of Economic Development, Tourism & Environmental Affairs |
| IUCN | International Union for Conservation of Nature |
| MTPA | Mpumalanga Tourism and Parks Agency |
| NEMBA | National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) |
| PHASA | Professional Hunters Association of South Africa |
| Price elasticity | Price elasticity of demand is a measure of the extent to which the quantity of a product demanded responds to changes in price, and is determined by the ability and willingness of consumers to buy substitutes. When consumers are sensitive to changes in price and switch to alternative products easily, the demand is considered price-elastic. In contrast, a product that is price-inelastic is one that consumers will not, or cannot substitute, and will continue buying even when prices become very high |
| PROA | Private Rhino Owners Association |
| Pseudo-hunting | The hunting of a rhino for purposes other than obtaining a memento of the hunt as part of a personal sport hunted trophy, achieved through the abuse of the regulatory system |
| Put and take animal | A live specimen of a captive bred <i>Ceratotherium simum</i> (White rhinoceros) or <i>Diceros bicornis</i> (Black rhinoceros) that is released on a property irrespective of the size of the property for the purpose of hunting the animal within a period of 24 months after its release from a captive environment |
| RhODIS™ | Rhino DNA Index System |
| RMG | Rhino Management Group |
| SANParks | South African National Parks |
| TOPS | Threatened or Protected Species (commonly refers to the regulations issued in terms of NEMBA) |
| TRAFFIC | The Wildlife Trade Monitoring Network |
| Translocate | The capture, transport and release of a rhino from one location to another |
| WRSA | Wildlife Ranching South Africa |
| WWF | World Wide Fund For Nature |

2. EXECUTIVE SUMMARY

South Africa is facing a major rhino-poaching crisis. In 2011, 448 rhinos were killed by poachers, of which 429 were white rhinos (representing approximately 2.2% of the national population) and 19 were black rhinos (approximately 0.9% of the population). During the first 6 months of 2012, 254 rhinos were killed by poachers: if this rate continues, as many as 508 rhinos may be killed by the end of the year, representing approximately 2.4% of the combined national herd of white and black rhinos. South Africa can currently sustain this rate of poaching because the population growth rate (approximately 6.5% for white rhinos and 5% for black rhinos) is higher than the off-take (legal and illegal), but if poaching continues to escalate, a tipping point may eventually be reached forcing the population into decline for the first time in 50-100 years. This would reverse the hard won achievements of South African conservationists responsible for one of the greatest conservation success stories ever seen in large mammals.

The driver for the illegal killing is a persistent demand for rhino horn from Asia, where it is used mainly for medicinal purposes. This demand cannot be met by legal supplies because international trade in rhino horn was banned by CITES in 1977 in response to long-term, high levels of rhino poaching that were threatening to push all rhino species to extinction. Although South Africa continued to allow legal trade of rhino horn within its borders after the international ban, this did not allow for the legal export of horn. Sometime after the year 2000, however, it is alleged that Asian nationals bought rhino horn through the legal internal permitting system, either directly from private rhino owners or indirectly through intermediaries, and then exported the horn illegally out of the country. When this fraudulent activity was suspected, the South African government placed a national moratorium on trade in rhino horn (Government Gazette No. 31899, Notice No. 148, 13 February 2009) in an attempt to stop it.

The timing of the implementation of the national moratorium coincided with the on-going surge in the rhino poaching in South Africa, leading some observers to suggest that the moratorium had contributed towards, or even caused, the crisis. At a Rhino Summit in October 2010, hosted by the then Minister of Water and Environmental Affairs, the Department of Environmental Affairs agreed to commission a feasibility study to determine the viability of the legalisation of the trade in rhino horn in South Africa. The study had to do the following: a) Analyse trends in local (national) trade in rhino horn prior to the moratorium that came into effect in February 2009; b) Analyse trends in incidences of illegal killing prior to and subsequent to the national moratorium; c) Assess the potential national market for rhino horn; d) Determine security risks relating to the lifting of the moratorium; e) Identify measures to be put in place to address the risks identified above, including a response strategy; f) Recommend systems to be developed and implemented to regulate national trade in rhino horn, including a tracking and monitoring system; g) Identify the legal requirements to be addressed in terms of a national trade system; h) Identify means to ensure rhino horn traded nationally does not enter international trade; i) Analyse similar situations in other countries and advice on best practices and interventions made in those countries.

Methods

Data used in the report were obtained from the following sources: DEA, SANParks, Provincial Parks, Provincial permit offices, IUCN AfRSG, TRAFFIC, the CITES trade database, and survey questionnaires to 66 rhino experts and 54 private rhino owners. Sixteen private rhino owner surveys overlapped with rhino expert surveys; the total number of survey questionnaires = 104. Opinions on trade were also obtained from the surveys. Risks of lifting and not lifting the moratorium, as well as potential measures to mitigate these risks were identified during a workshop of expert rhino stakeholders.

Results

2.1. Rhino populations

- The national population of white rhinos at the end of 2011 was estimated at 19,570 animals, with an estimated 4,971 (25%) of these being protected on private land.
- The national population of black rhinos at the end of 2011 was estimated at 2,011 animals, with an estimated 468 (23%) of these being protected on private land.
- National populations of both species continue to increase, although the white rhinos in Kruger National Park appear to have levelled off at approximately 10,600 animals.

2.2. Rhino poaching and the impact of the national trade moratorium

- South Africa experienced very little rhino poaching before 1980, after which there was a gradual increase leading up to 2007 that coincided with an increase in rhino populations. In 2008, there was a sudden and very large increase in poaching in South Africa, which has continued to escalate until the present time.
- Rhino poaching rates in most other African range states were very high before 1980, and continued into the 1990's when many rhino populations outside southern Africa were approaching extinction. As rhinos were extirpated from countries in north and central Africa, the poaching moved south through Zambia, Zimbabwe and Swaziland, and was expected to hit South Africa in the 1990's. This did not happen, however, for a number of potential reasons, including South Africa's strong anti-poaching capability and a lull in demand for horn caused by the implementation of domestic bans in Asia and the availability of large stockpiles of horns in Asia.
- Rhino poaching in Zimbabwe and Swaziland was brought under control, and a decade long reduction of poaching in southern Africa followed until 2003, when poaching in Zimbabwe escalated again, possibly coinciding with the depletion of rhino horn stockpiles in Asia.
- Although rhino poaching in South Africa did not increase in 2003, other illicit ways of obtaining rhino horn allegedly started being exploited by Asian nationals (primarily from Viet Nam) around this time. The first was *pseudo-hunting*, which started out on a small scale, but then escalated dramatically every year, peaking in 2010 and 2011 when 116 applications came from Vietnamese nationals in both years. It is unknown how many of these applications were for pseudo-hunts. Threatened or Protected Species (TOPS) regulations under the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) (Government Gazette No. 29657, Notice No. 150, 23 February 2007) were introduced in 2007; these placed stricter controls on trophy hunting but did not specifically target pseudo-hunting. To prevent pseudo-hunting, norms and standards were introduced in 2009 (Schedule 2: Management of the hunting

of white rhino; Government Gazette No. 32426, Notice No. 756, 20 July 2009), but by 2011 these measures had not yet been very effective because pseudo-hunting continued. The norms and standards were amended in 2012 (Schedule 3: Management of the hunting of rhinoceros; Government Gazette No. 35248, Notice No. 304, 10 April 2012), with the result that the total number of applications for hunting white rhinos in 2012 dropped to 66, and included only eight applications from Vietnamese nationals.

- The second illicit method of obtaining rhino horn involved Asian nationals buying horn directly from private rhino owners. In some instances, rhino horns were bought with the necessary permits issued in terms of provincial legislation, but rhino horns were also allegedly bought directly from private rhino owners without any permits. It is suspected that many of these horns were subsequently exported illegally out of the country. In the case of the horn sales conducted with provincial permits, an estimated 100 kg of horn were traded within South Africa during 2008, at a price of roughly R35,000/kg (USD 4,375/kg at an average exchange rate of 1 USD for 8 ZAR in 2008) and an approximate market value of R3.5 million (USD 437,500). It is not known what percentage of these horns were bought with the intention of illegal export, but such illicit activities led to the implementation of the national moratorium on trade in rhino horn in South Africa in 2009 (Government Gazette No.31899 , Notice No. 148, 13 February 2009).
- The amount of illegal trade in rhino horn that occurred without provincial permits before the moratorium could not be established with any accuracy, but by 2008 there was a potential shortfall of 1,800 kg (estimated from expected mortality rates) between the amount of rhino horn that should have been in registered private stockpiles and the amount that was officially recorded in private stockpiles.
- Around the time of the implementation of TOPS regulations under NEMBA (2007), the norms and standards (2009) and the national trade ban on trade in rhino horn (2009), poaching of rhinos in South Africa escalated. The restrictions on pseudo-hunting in 2009 (norms and standards) did not initially reduce the number of rhinos killed by Vietnamese hunters, but the psychological impact of the regulations may have led to an increase in demand from speculators and a subsequent spike in price. Similarly, the national moratorium may have led to further speculation because it restricted the illegal international trade in rhino horn (perhaps by as much as 100 kg per year), and signalled that horn supplies were going to be harder to obtain in future.
- The rhino-poaching crisis is being driven by a persistent demand for rhino horn that cannot be supplied through legal channels because of the national and international trade bans. The ensuing high price of horn has encouraged the involvement of criminal syndicates and provided strong incentives for poachers to risk their lives to acquire horns through poaching.
- Viet Nam is currently thought to be the main international market for rhino horns, with newly wealthy consumers allegedly using horn as a detoxifying beverage, or desperate individuals using horn in an attempt to cure life threatening illnesses like cancer. These non-traditional markets appear to be new and may be playing a major role in the current upsurge in rhino poaching.
- Live sale prices of white rhinos dropped between R35,000 and R60,000 per animal (USD 4,070 – 7,000 at an average exchange rate of 1 USD for 8.6 ZAR in 2009) in 2009,

the year in which the national moratorium on trade in rhino horn was implemented and the year after the surge in rhino poaching started. The majority of expert opinion was that if the moratorium remains in place, live rhino prices would further decrease; if the moratorium was lifted nationally, the effect on the live sales price would be unpredictable; if international trade was legalised, the price of live rhinos would increase significantly.

- Private rhino owners are spending a median of R85/ha/year (USD 10/ha/year at an exchange rate of 1 USD for 8.5 ZAR in June 2012) to protect their rhinos, and a median of R310,500/year/property (USD 36,500/year/property). In comparison, Ezemvelo KwaZulu-Natal Wildlife currently spends about R250/ha/year (USD 30/ha/year).

2.3. The potential market for trading rhino horn

- Future annual rhino horn supplies from natural mortalities and dehorning were estimated. The minimum quantity of horn that could be harvested from South African rhinos in 2012 from both natural mortalities and dehorning would be 2,339 kg, while the maximum quantity harvested could be 3,606 kg. The minimum quantity was estimated using an assumed carcass recovery rate of 25% for white and black rhinos dying naturally on state land, a carcass recovery rate of 75% on private land, and that 51% of private rhino owners would dehorn their rhinos (which was the percentage that stated they might dehorn rhinos if domestic trade were legalised). The maximum quantity was estimated using an assumed carcass recovery rate of 75% for white and black rhinos dying naturally on state land and private land, and that 65% of private rhino owners would dehorn their rhinos (which was the percentage that stated they might dehorn rhinos if international trade were legalised). The potential market value for the minimum amount, given a price of R35,000/kg would be R83,720,000 (the price for 2008 was used because there has been no legal trade since then). However, given that only 100 kg of rhino horn were traded legally within South Africa before the moratorium, and that only two out of 54 private rhino owners indicated an interest in *buying* horn if national trade was legalised, there would not be sufficient demand to buy this amount of rhino horn in South Africa if the domestic moratorium was lifted nationally only.
- 60% of rhino experts *did not agree* with the idea of lifting the national moratorium if international trade was not also legalised. The main reasons/options given were: 1) There is no end-user market in South Africa, so this would not deal with the core issue of demand in Asia, nor would it do anything to curb poaching; 2) Permitting controls are not currently sufficient to prevent laundering of horn and leakage of horn out of South Africa; 3) There is insufficient capacity to regulate national trade due to enforcement capacity shortages; 4) Illegal activities could tarnish South Africa's international reputation, might be detrimental to future chances of negotiating international trade, and might result in CITES implementing stricter controls on trophy hunting; 5) Will send mixed messages to the world and to end-user markets.
- 62% of rhino experts *agreed* with the idea of legalising international trade. The main reasons/options given were: 1) South Africa would control the supply for rhino horn, economic forces would take effect, horn prices would drop, and the incentive to poach would decrease; 2) International trade would generate funds to pay for anti-poaching and incentivise private owners; 3) The current situation is not working and legal trade

cannot be worse; 4) It is the only option that is financially sustainable; 5) Rhino horn is renewable and a legal supply can provide more horn to the end-user than is provided by current levels of poaching; 6) There are other examples of threatened species recovering under legal trade (e.g. vicuña *Vicugna vicugna*); 7) International trade gets rid of stockpiled horn, which reduces security risks of theft; 8) Anti-poaching and protectionism cannot stop poaching on their own; 9) International trade in rhino horn would make live rhinos more valuable than dead rhinos (which would be the opposite to the current situation) – rhinos must have a value to survive; 10) It is not feasible to pretend that the trends of the last 4 decades will be reversed by persisting with failed trade ban policies.

2.4. Implications of lifting the national moratorium (with the international trade ban in place)

- May lead to laundering of illegal rhino horn into legal national trade, and leakage of rhino horn into the illegal international market.
- May tarnish South Africa's international conservation reputation.
- May lead to problems with compliance and enforcement.
- May send conflicting messages to the international community about South Africa's position on trade.
- May not reduce rhino poaching.

2.5. Implications of *NOT* lifting the national moratorium

- The incentive to poach rhinos will remain high.
- May cause some private rhino owners to de-stock if protecting rhinos becomes financially unsustainable.
- May lead to a decrease in live-sale prices of rhinos and reduce the incentive to protect them.
- Storing rhino horns will become an increasing security risk for private owners.
- A small proportion of private rhino owners may consider taking legal action against the South African government.
- Illegal activities might be perversely stimulated rather than reduced.

2.6. Main mitigation measures and recommendations

- Set up a secure, national, electronic rhino permitting system and database for live rhinos and rhino horn stockpiles.
- Encourage non-compliant private rhino owners to register their horn stockpiles by providing guidance and assistance with security, and by convincing them that their personal information will be stored securely. Issue DNA certificates with each possession permit for each rhino and each rhino horn.
- Conduct regular audits of horn stockpiles to discourage illegal sales.
- Only issue possession permits for rhino horns when sufficient proof of legal ownership or acquisition is provided.
- Increase capacity at ports of entry/exit to detect illegal wildlife products.

2.7. Conclusion

- South Africa should not lift the national moratorium at the present time. However, it should immediately start developing a secure national electronic permitting system to

bring non-compliance issues under control. This must be linked to a rhino database that includes horn stockpile and DNA profile information. Private rhino owners must be incentivised to continue protecting rhinos during this period. South Africa must continue to show that it is complying with CITES Resolution Conference 9.14 (Rev. CoP15) to avoid potential punitive measures from Parties and, if a proposal for legalising international trade is to be submitted, South Africa should be prepared before the deadline for submissions for CoP17 in 2016.

3. INTRODUCTION

3.1. African rhinoceros species

There are five living species of rhinoceros worldwide, with two occurring in Africa and three in Asia. Both African species have been split into subspecies: the white rhinoceros (*Ceratotherium simum*) is divided into two subspecies, the southern white rhino (*C. s. simum*) and northern white rhino (*C. s. cottoni*) (Emslie, 2011a); the black rhinoceros (*Diceros bicornis*) is divided into four subspecies, the south-central black rhino (*D. b. minor*), the south-western black rhino, (*D. b. bicornis*), the eastern black rhino (*D. b. michaeli*), and the western black rhino (*D. b. longipes*). The western subspecies is now thought to be extinct (Emslie, 2011b).

South Africa is home to the southern white rhino (*C. s. simum*) and two subspecies of black rhino, *D. b. minor* and *D. b. bicornis*. A single population of *D. b. michaeli* occurs on private land within South Africa, but this is outside its natural range and is kept separate from the other two subspecies. Historically, both white and black rhinos were widespread in South Africa, but both have come perilously close to local extinction.

3.1.1. The white rhinoceros

Before the colonisation of southern Africa, the southern white rhino was abundant in the region (Wilson & Mittermeier, 2011), but at the beginning of the twentieth century its' total world population had been reduced to <100 individuals as a result of relentless hunting, and it was confined to a single relict population in what is now the Hluhluwe-iMfolozi Game Reserve in KwaZulu-Natal (Skinner & Chimimba, 2005). Fortunately, forward thinking conservationists at the time took action to preserve the remaining animals, and their numbers slowly recovered.

In 1961, when the southern white rhino population had grown to about 700 individuals, the first rhino translocations out of KwaZulu-Natal were conducted, and the species was reintroduced to the Kruger National Park for the first time in more than 60 years. Since then, a combination of frequent reintroductions to protected areas within southern Africa and intensive conservation measures has resulted in high population growth rates, and the current global population size is now greater than 20,000 rhinos (Emslie, 2011a) (Figure 1a). This ranks as one of the greatest conservation success stories ever seen in large mammals.

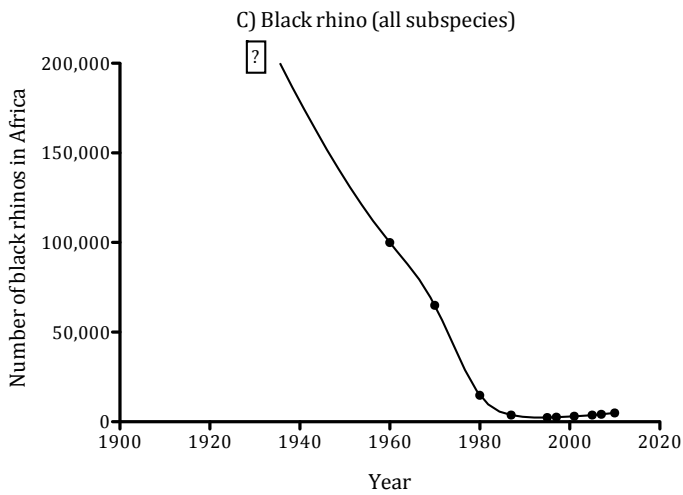
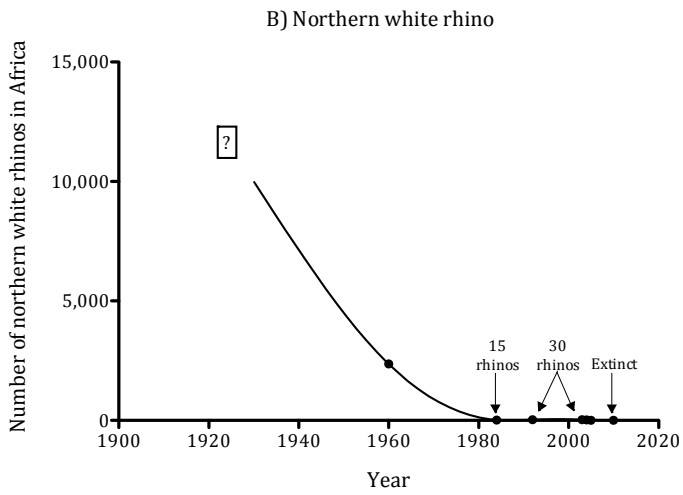
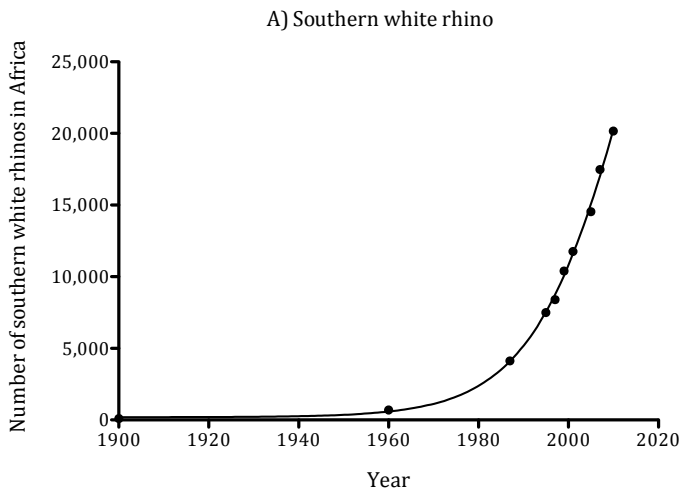


Figure 1. Population trends in white and black rhinos across Africa since 1900.

In addition to reintroductions to state protected areas, southern white rhinos were also sold to private landowners with suitable habitat. When this started in the late 1960's, there was a strict policy that rhinos would only be allocated to farms that met certain criteria, but in the early 1980's these criteria were relaxed, leading to concern in the conservation community that private owners had become complacent with their rhinos (Buijs, 1999). Rhinos had been sold cheaply, and many died due to poor translocation techniques, unsuitable introduction conditions, insufficient food, or hunting (Buijs, 1988). In 1986, the then Natal Parks Board started auctioning rhinos and, as a result, rhino values increased and private owners started showing greater responsibility in management ('t Sas-Rolfes, 1990). While expanding the range of white rhinos outside formally protected areas, translocations to private land have additionally helped keep state owned rhino populations at sustainable levels, thus preventing over-utilisation of food resources and maintaining high birth rates (Tony Conway, Ezemvelo, pers. comm.). Moreover, sales to private owners have contributed significant funds to be fed back into conservation in state owned parks and game reserves.

The Rhino and Elephant Foundation conducted the first comprehensive survey on the status of white rhinos on private land in South Africa in 1987 (Buijs, 1988). At that time there were 824 privately owned white rhinos on 187 properties, and these constituted about 20% of the national herd. There have been eight additional surveys of white rhinos on private land since 1987 (Buijs & Papenfus, 1996; Buijs, 1998; Buijs, 1999; Castley & Hall-Martin, 2003a,b; Castley & Hall-Martin, 2005; Hall-Martin *et al.*, 2009), including the not-yet completed census currently being conducted by TRAFFIC/WWF/PROA/WRSA (Shaw *et al.*, in prep.). The most recent estimate of numbers of white rhinos on private land was 4,174 (on 395 properties) in 2008 (Hall-Martin *et al.*, 2009). Extrapolating from this using three years of population growth (which has been approximately 6% per year on private land) gives the following estimate: $4,174 \times 1.06^3 \approx 4,971$ animals (Table 1), or approximately 25% of the national herd (Figure 2).

Table 1. Estimated numbers of white rhinos on state, provincial and private land within South Africa at the end of 2011. Provincial numbers were estimated indirectly as the difference between total counts and counts on private land and Kruger National Park.

| | Estimated number of white rhinos | % of total |
|---|-------------------------------------|---------------|
| Parks and provincial reserves (excluding Kruger NP) | 3,978 | 20.3 |
| Private land | 4,971 | 25.4 |
| Kruger National Park | 10,621 | 54.3 |
| Total in South Africa | 19,570 | |

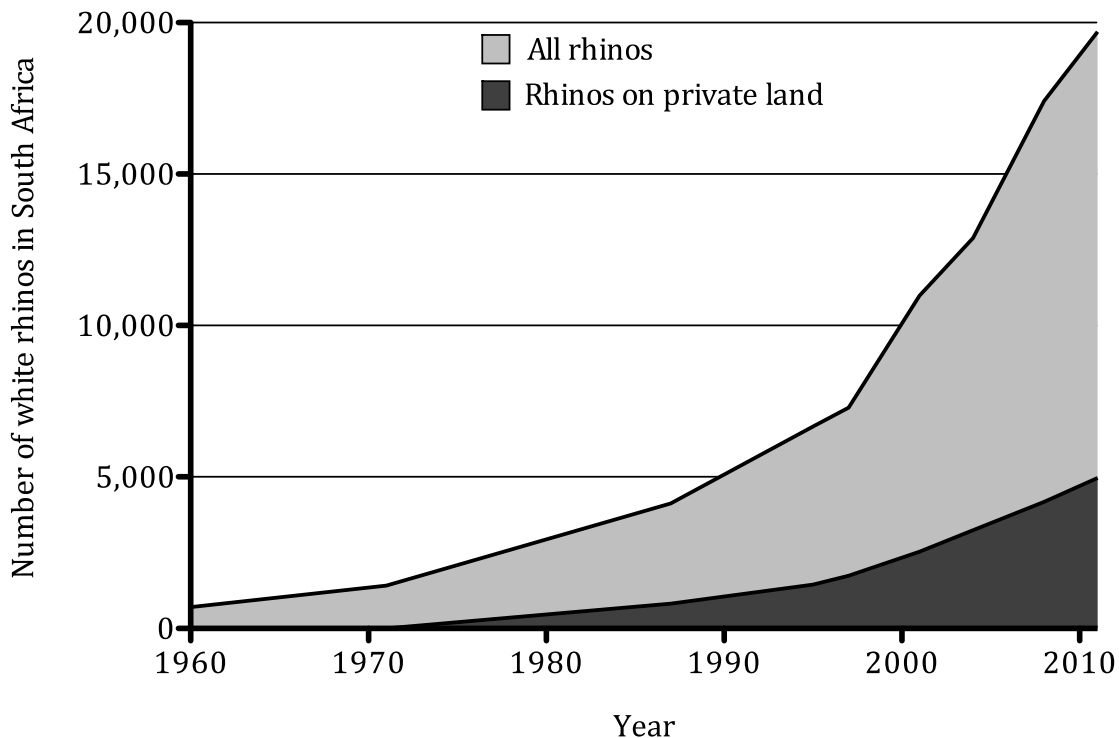


Figure 2. The concurrent population growth rates of white rhinos on private land and white rhinos on all land (State and private) in South Africa between 1960 and 2011. (Sources: IUCN AfRSG reports; Hall-Martin *et al.*, 2009.)

According to AfRSG data, the total population of southern white rhinos in South Africa was 18,796 in December 2010 (Emslie, 2011a). Assuming an average national population growth rate of 6.5% (estimated from AfRSG population estimates over the last 10 years) for one additional year, and subtracting the number of rhinos poached in 2011 (448), the number of white rhinos currently in South Africa is $(18,796 \times 1.065) - 448 \approx 19,570$ (Table 1). It should be noted that this could be an overestimate because the population in the Kruger National Park, which comprises half the national herd, is not growing (Sam Ferreira, SANParks, pers. comm.).

The southern white rhino is now the most numerous of all rhino taxa (Emslie, 2011a), with 93% of the global population occurring in South Africa. In 1977, soon after CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) entered into force, the white rhino was placed on Appendix I, meaning that all international commercial trade in rhinos and their products (including their horns) was prohibited (although limited trophy hunting was still allowed). As a result of the great conservation successes described above, the South African population was downlisted to Appendix II in 1994, which allowed limited live export of animals to appropriate and acceptable destinations, as well as the (continued) export of hunting trophies (although international commercial trade in rhino horn was still banned). In 2004, Swaziland's white rhinos were

also down-listed to Appendix II. The southern white rhino is currently listed as Near-Threatened under the international IUCN Red List of Threatened Species (Emslie, 2011a). Within South Africa, white rhinos are listed as a protected species according to the South African list of Threatened or Protected species (TOPS) in terms of section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA).

The success of the southern white rhino runs in stark contrast to the plight of the northern white rhino (*C. s. cottoni*), which was abundant at the beginning of the twentieth century in its natural range (north-central Africa south of the Sahara) but is now thought to be extinct in the wild (Figure 1b) (Milliken *et al.*, 2009). The last confirmed wild population of this subspecies occurred in the Democratic Republic of Congo (DRC), but there have been no reported live sightings since 2006 (Emslie, 2011a), indicating that this tiny remaining population has most likely been extirpated. There are four potentially breeding northern white rhinos in a private sanctuary in Kenya (that were translocated from the Dvur Kralove Zoo in the Czech Republic), but due to a small effective founder number and inter-relatedness of these animals, this subspecies is highly unlikely to be viable in the long term unless more rhinos are found in the wild (Emslie, 2011a).

3.1.2. The black rhinoceros

Black rhinos were also once abundant across sub-Saharan Africa, with numbers of approximately 800,000 animals occurring historically (Richard Emslie, IUCN AfRSG, pers. comm.). By 1900, however, this species mostly occurred outside South Africa, having been hunted to near extinction south of the border. Although once recorded as far south as Table Mountain in the Western Cape, by the early 1900's black rhinos were confined to protected areas in KwaZulu-Natal and Kruger National Park (Skinner & Chimimba, 2005), while their main populations occurred in countries to the north. In 1933 numbers in South Africa were thought to be 95-115, and by 1936, they were confined to Hluhluwe-iMfolozi Game Reserve and Mkhuze Game Reserves (Richard Emslie, IUCN AfRSG, pers. comm.) after finally disappearing from Kruger National Park (Ferreira *et al.*, 2011).

The recovery of the black rhino in South Africa has been slower than that of the white rhino (Figure 3). The first reintroductions of *D. b. minor* from KwaZulu-Natal to the Kruger National Park started in 1971, and by 1990, 81 individuals had been introduced. This population has been growing at about 6.75% per annum since 1988 (Ferreira *et al.* 2011). In October 2009, aerial block counts south of the Olifants River estimated 627 black rhinos (95% CI: 588-666). At the given population increase of 6.75%, the black rhino population may now be 715, depending on the impact of poaching. Black rhinos also occur north of the Olifants River, but there has been no recent formal survey in the area and their population density is lower (Sam Ferreira, SANParks, pers. comm.).

Black rhino reintroductions onto private land started at the end of 1990, with an initial translocation of 5 individuals of the *D. b. minor* subspecies (Richard Emslie, IUCN AfRSG, pers. comm.). The first reintroductions of *D. b. bicornis* onto private land took place in 1995. Due to the later start and smaller scale of these black rhino reintroductions, the effort

required to census them on private land is lower than for white rhino. In 2001 there were 118 animals on 15 properties (Hall-Martin & Castley, 2003), and at the end of 2010, there were 334 on private properties (Knight *et al.*, in prep.).

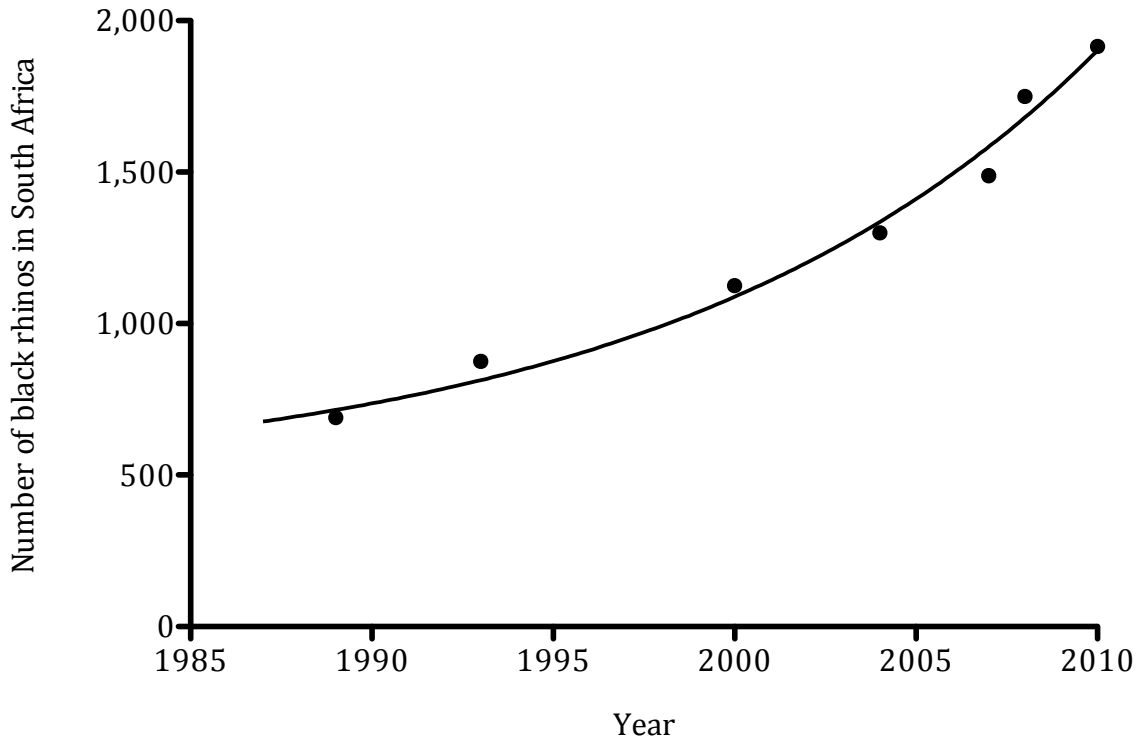


Figure 3. Black rhino population growth in South Africa (Source: IUCN AfRSG reports).

In 2003, the WWF-SA Black Rhino Range Expansion Project (BRREP) was started. This is a partnership between WWF-SA, Ezemvelo KwaZulu-Natal Wildlife (hereafter Ezemvelo), Eastern Cape Parks and Tourism Board, and private landowners, in which ownership of founder rhino remains with the donor conservation agency, but with private custodians and the donor agency equally sharing the benefits of rhinos born in these populations. Since the project began, seven new black rhino populations have been created in South Africa on more than 150,000ha of land, and at the end of 2010, there were 111 individuals being managed this way on private land (Knight *et al.*, in prep.).

The most recent estimate of the total population of black rhinos in South Africa was made in December 2010, when there were 1,915 animals, with 23% of these occurring on private land (17% privately owned, 6% on BRREP custodian land) (Knight *et al.*, in prep.) (Table 2). At an estimated annual population growth rate of 5%, the number of black rhinos at the end of 2011 would have been approximately 2,011 animals.

Table 2. Estimated numbers of black rhinos on state, provincial and private land within South Africa at the end of 2011. Data extrapolated from Knight *et al.* (in prep.) using an annual population growth rate of 5%.

| | Estimated number of black rhinos (2011) | % of total |
|--|--|-----------------------|
| Black Rhino Range Expansion Project custodian land | 117 | 5.8 |
| Privately owned land | 351 | 17.5 |
| Provincial reserves | 721 | 35.8 |
| SANParks (including Kruger National Park) | 822 | 40.9 |
| Total in South Africa | 2,011 | |

Outside South Africa, the first scientifically-based estimate of black rhino numbers across Africa was 14,800 animals in 1980 (Hillman, 1981), while earlier estimates for continental population sizes were based on imprecise techniques. Nevertheless, black rhinos clearly went through a major population decline over the last century, initially due to hunting and a progressive fragmentation of their habitat, but then as a result of poaching. By 1960, the total African population was estimated to be about 100,000 individuals, from where it declined to 65,000 in 1970, 14,800 in 1980, 3,780 in 1987 and eventually 2,410 animals by 1995 (Figure 1c). This was probably the fastest rate of decline of any large land mammal in recent times (Milliken *et al.*, 1993) but, since the nadir in the mid-nineties, there has been a turnaround in fortunes, and the species has recovered to approximately 4,880 animals (as of 31 December 2010: Emslie, 2011b). This has been thanks to the conservation efforts of certain African range states, particularly South Africa and Namibia, demonstrated by the fact that the two southern African subspecies are the most numerous. The black rhino is currently listed as Critically Endangered under the international IUCN Red List of Threatened Species (Emslie, 2011b) and, like the white rhino, was placed on CITES Appendix I in 1977. It remains on Appendix I today, with all international commercial trade in live animals and their products prohibited – other than the 2004 approval by the CITES Conference of Parties allowing limited sport hunting quotas of up to five surplus males for non-commercial export purposes from South Africa and Namibia. Within South Africa, black rhinos are listed as an endangered species according to the South African list of Threatened or Protected Species in terms of section 56(1) of NEMBA.

3.2. The resurgence of illegal killing of rhino in South Africa

3.2.1. Rhino poaching

Whilst rhino poaching in many African range states remained a major problem between 1960 and 1995, particularly for the black rhino and northern white rhino, rhino poaching within South Africa was low. Between 1960 and 1980, numbers of rhinos poached were negligible, whilst between 1980 and 2007 the average rate of rhino poaching was nine animals per year. In 2008, however, a significant upsurge in rhino poaching took place in South Africa, with a reported 83 animals being killed illegally, and this trend has been escalating ever since (Figure 4). In 2009, the official figure climbed to 122 rhinos poached;

then to 333 in 2010; and 448 in 2011. If the first six months of 2012 are representative of the entire year, there may be as many as 508 rhinos poached in South Africa by the end of the year. While this rate of poaching does not yet exceed the population growth rate (meaning that the rhino population should continue to grow), should the rate of poaching continue to increase, it may eventually exceed the population growth, which would see South Africa's rhino populations go into decline. See section 6.2 for a more detailed analysis of the poaching situation.

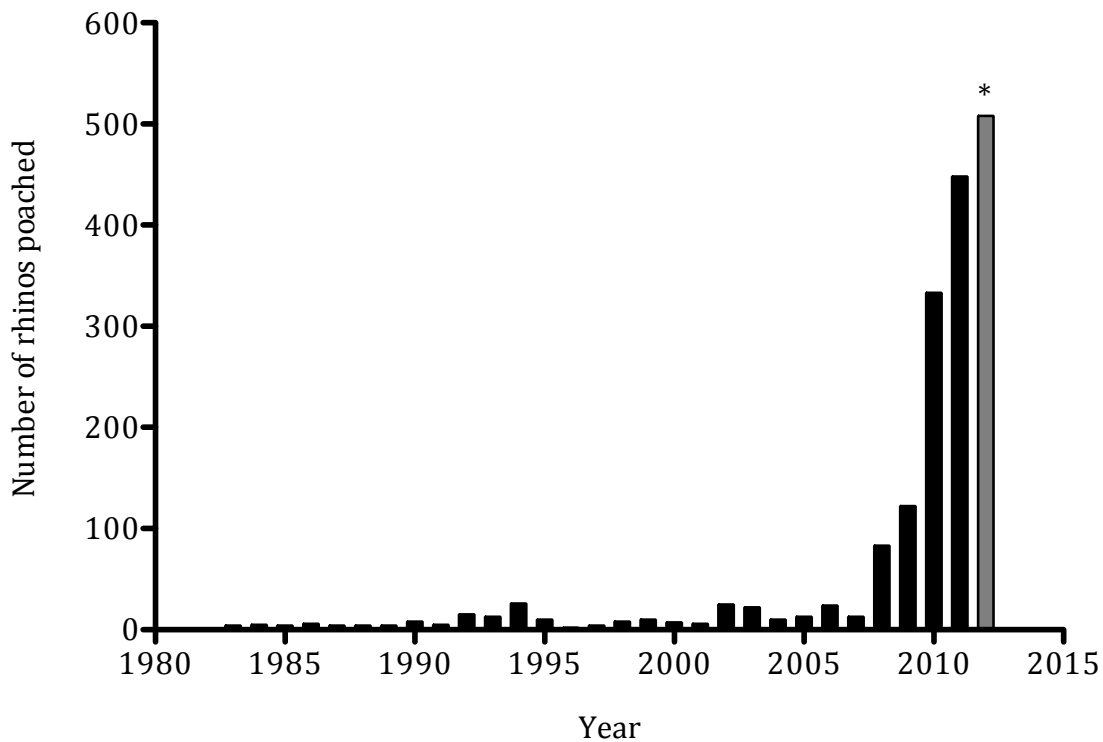


Figure 4. The total numbers of rhinos poached annually in South Africa since 1980. Poaching in 2012 is predicted (*) from the first six months of year (Source: SANParks).

In addition to the alarming increase in numbers of poached rhinos, a second cause for concern has been the methods used by poachers to catch rhinos and remove their horns. There have been incidents of drugged or wounded animals having their horns chopped off while still alive, then being left to bleed to death in the most inhumane way. In other cases, highly sophisticated poaching techniques have arisen, with well organised crews using game capture techniques to dart rhinos from helicopters in order to enter and leave protected areas quickly without being detected. Such crimes have been made possible by the rise of international criminal syndicates becoming involved in rhino poaching and the large sums of money being paid for rhino horn on the black market

(http://www.cites.org/eng/news/sundry/2011/20110421_res_UNCCPCJ.php). In recent hearings of the U.S. Senate Committee on Foreign Relations (24 May 2012: Ivory and insecurity: the global implications of poaching in Africa), Tom Cardamone (Managing Director, Global Financial Integrity) made the following statement: “In comparison to other forms of transnational crime, the risks and penalties associated with the illegal poaching and trafficking of wildlife are small. In many countries, poachers and traffickers face little more than a small fine and a couple of months in prison if caught, while penalties for drug trafficking can result in the death penalty. On the other hand, rhino horn can now rival cocaine and gold in value by weight, making it an extremely lucrative business in which to engage”.

3.2.2. “Pseudo-hunting” of white rhinos

South Africa’s successful track record and reputation in rhino conservation have been undermined in the last 10 years by the exploitation of loopholes in the laws pertaining to the export of white rhino trophies. CITES allows for the export of hunting trophies as long as they are intended for personal use (commercial reasons are prohibited), but in 2003, it is alleged that this legitimate means of limited harvest of white rhinos started being abused by Vietnamese nationals as a way to obtain rhino horn for commercial purposes (Hall-Martin *et al.*, 2009; Milliken *et al.*, 2009). This rhino horn was legally obtained with the required CITES and NEMBA (TOPS) permits under the guise of trophy hunting, but it is suspected that the true intention was to sell horn onto the black market in Asia. This alleged deception has been termed “pseudo-hunting”, although it has yet to be officially verified. There have also allegedly been cases of pseudo-hunters killing multiple rhinos and exporting the trophies illegally on a single permit (Milliken *et al.*, 2009). See section 6.2 for a more detailed analysis of the pseudo-hunting situation.

The South African Government issued norms and standards that address trophy hunting of white rhino (Government Gazette No. 32426, Notice No. 756, 20 July 2009), in terms of which all white rhino hunts were to be strictly controlled by means of individual NEMBA (TOPS) hunting permits, and by limiting individual hunters to one rhino hunt per year, to combat the exploitation of these loopholes. Illegitimate hunters initially got around this latter restriction by bringing additional people along to a hunt, so that each person could shoot a different rhino and remain within the law. In many instances, such individuals could not shoot a rifle competently, and in some cases the professional hunter actually performed the killing. The norms and standards were amended (Government Gazette No. 35248, Notice No. 304, 10 April 2012) when the exploitation of the system was detected, placing stricter controls on hunting and making it obligatory that a conservation official be present at every rhino hunt (under the first norms and standards it was stated that “rhino hunts should, where possible, take place under the supervision of a conservation official from the province concerned”). It is also a requirement now that the hunting clients prove their legitimacy as hunters by proof of membership of a hunting association in the country of normal residence, or proof of previous experience of hunting African species, or a CV indicating hunting experience. In addition, the permit issuing authority must also consider whether the country of usual residence of the hunting client has adequate legislation to ensure the rhino horns will be used for the purpose as indicated on the CITES export

permit. Furthermore, the South African government informed Viet Nam that permits for the hunting of white rhino will not be issued to Vietnamese citizens, until the CITES Management Authority in Viet Nam confirmed, in writing, that the rhino trophies exported to Viet Nam since 2010 are still in the possession of the hunters. Viet Nam agreed to conduct inspections in this regard during 2012. So far, these amended norms and standards appear to have been effective because the total number of applications to hunt white rhinos in 2012 (66) is much lower than the total number of applications in 2011 (226), with only 8 applications from Vietnamese nationals in 2012. It remains to be seen if the measures implemented will continue to prevent pseudo-hunting in South Africa.

3.3. The National Moratorium on trade in rhino horn

Although international trade in rhino horn has been prohibited under CITES regulations since 1977, it remained legal for South African citizens to sell and exchange rhino horn within South Africa as long as permits were acquired. At some unknown period in the early 2000's, however, it is alleged that this legal trade started being exploited for illegal purposes, and horns were being sold to foreign nationals, mostly Asians from countries such as Viet Nam, who were then smuggling the horns out of the country to sell on the black market. After consulting with various rhino stakeholders, the South African Government placed a national moratorium on the sale of individual rhinoceros horns and any derivatives or products within South Africa to ensure that no legally obtained horns ended up in the illegal trade. The moratorium was officially published in February 2009 (Government Gazette No.31899, Notice No. 148, 13 February 2009) and, although it was intended to be a temporary measure until such time that the illegal trade was under control, it remains in place today (July 2012).

The moratorium was well received by CITES and, by implementing it, South Africa was seen to be taking a positive step towards gaining control of increasingly prevalent illicit activities involving rhino horn. However, the rhino-poaching surge that started in South Africa during 2008 has continued to escalate despite the moratorium, and there have been concerns raised among some sections of the rhino stakeholder community that the local trade ban has exacerbated the poaching crisis rather than alleviate it.

3.4. Potential solutions to address rhino poaching

In October 2010, a recommendation was made at a rhino summit hosted by the Ministry of Water and Environmental Affairs, that the South African government commission three studies to investigate possible solutions to the poaching crisis. The first was an impact study to determine the viability of dehorning rhinos as a means of reducing poaching, and this was released in July 2012 (Lindsey & Taylor, http://www.environment.gov.za/sites/default/files/docs/studyon_dehorning_african_rhinoceros.pdf). The second was a feasibility study to determine the viability of the legalisation of the trade in rhino horn within South Africa, which is the subject of this report. The third was a global competitive market research project on market intelligence regarding international rhino horn trade, but this has not yet been initiated

Legalising international trade in rhino horn as a possible means of reducing poaching is not a new idea. South Africa and Zimbabwe approached CITES in 1992 (8th Conference of Parties) to establish a quota for commercial export of horn (Milliken *et al.*, 1993) and, although this was unsuccessful, the idea has not disappeared. There are two main theoretical reasons why a well-controlled international trade in rhino horn has potential to reduce poaching: 1) it would allow rhino owners (SANParks, provincial parks and private owners) to generate income to pay for increased rhino protection; and 2) it would increase the total supply of horn to the market, thereby most likely reducing the profitability of illegal activity and, therefore, incentives for illegal killing. Furthermore, providing a stable, legal supply of horn would remove incentives for illegal speculative stockpiling and bringing prices into the open would allow for effective monitoring of, and adaptation to, changing market conditions. International trade, however, is a controversial idea with many skeptics. It is a highly complex issue, and many factors need to be considered when deciding whether it might alleviate poaching.

4. AIMS OF THE FEASIBILITY STUDY

As a result of concerns raised about the possible contribution of the national moratorium towards rhino poaching, DEA is considering (*as one option*) the possibility of legalising national trade in rhino horn, i.e. within South Africa, via the lifting of the temporary national moratorium. The focus of the current feasibility study was to investigate this option, and to answer the following question: Should the national moratorium on trade in rhino horn be lifted?

In order to do this, the following aims were set:

- A) Analyse the impact of the trade moratorium on poaching in South Africa. This was broken down into the following factors identified in the terms of references for the study:
 - i. Analyse trends in local (national) trade in rhino horn prior to the moratorium that came into effect in February 2009;
 - ii. Analyse trends in incidences of illegal killing prior to and subsequent to the national moratorium.
- B) Determine the viability of lifting the moratorium (i.e. legalising trade in rhino horn in South Africa). This was broken down into the following factors identified in the terms of references for the study:
 - i. Assess the potential national market for rhino horn;
 - ii. Determine security risks relating to the lifting of the moratorium;
 - iii. Identify measures to be put in place to address the risks identified above, including a response strategy.
- C) Make recommendations to DEA regarding whether the national moratorium on rhino horn trade should be lifted and stipulate what actions would be necessary for this to take place within designated time frames. This was broken down into the following factors identified in the terms of references for the study:

- i. Recommend systems to be developed and implemented to regulate national trade in rhino horn, including a tracking and monitoring system;
- ii. Identify the legal requirements to be addressed in terms of a national trade system;
- iii. Identify means to ensure rhino horn traded nationally does not enter international trade;
- iv. Analyse similar situations in other countries and advice on best practices and interventions made in those countries.

While the focus of this report is on the viability of legalising national trade, there are two other trade scenarios that need to be considered in parallel with this in order to make informed decisions on the best way forward. The first of these other scenarios is *no* trade at all, and the question asked would be: what would happen to poaching levels in South Africa if the moratorium was *not* lifted? This is a crucial comparison because, although lifting the moratorium has many implications and potentially creates new risks, leaving the moratorium in place retains an ongoing situation that is not preventing illegal killing of rhinos. If the moratorium stays, new or improved anti-poaching methods will need to be identified, otherwise rhinos will continue to be poached, possibly at escalating and eventually unsustainable rates.

The second scenario is the legalisation of international trade. The feasibility of this scenario is not under investigation here, but the decisions taken now on legalising national trade could have important repercussions if South Africa decides to apply to CITES for international trade in the future.

As the conservation of South African rhinos was the primary goal of the current feasibility study, the aims listed above were always addressed in terms of the following underlying rhino conservation objectives (as listed by IUCN/SSC AfRSG):

- To reduce illegal killing of rhinos, including poaching and pseudo-hunting;
- To reduce the illegal supply of horn to end user-markets;
- To reduce black market prices of rhino horn;
- To reduce illegal demand for horn;
- To create and maintain an enabling environment that will lead to continued expansion of rhino range and numbers (by incentivising the private sector and communities to invest in rhino conservation);
- To achieve rapid population growth rates and conservation of genetic diversity through appropriate biological management;
- To enhance law enforcement and rhino protection and in particular to stop more poachers *before* they kill rhinos;
- To be able to sustainably fund effective conservation measures.

5. METHODS

5.1. Data collection

Regulatory provisions relating to the moratorium and trophy hunting were obtained from Government Gazettes and from discussions with DEA personnel. Rhino population numbers were obtained from IUCN/SSC AfRSG and WWF Africa Rhino Programme reports (see specific sections for references), from staff of the IUCN/SSC AfRSG and TRAFFIC, from the scientific literature, and from questionnaire surveys of senior SANParks personnel, provincial experts, specialist rhino experts and private rhino owners (see below).

Data on national and international poaching were obtained from DEA, SANParks and AfRSG reports, while data for trophy hunting were obtained from DEA and the CITES trade database (<http://www.unep-wcmc-apps.org/citestrade/trade.cfm>). Trends in legal trade of horn were determined from permit information obtained from provincial permit offices and from direct feedback from private rhino owners (see below). Live sale prices were kindly provided by Dr. Flippie Cloete (North West University) and from Tony Conway (Ezemvelo). The economic costs of protecting rhinos were obtained from interviews with private rhino owners, provincial experts and managers of private reserves.

Horn stockpile figures were obtained from IUCN/SSC AfRSG and SANParks. Projected future horn supplies were modelled using estimates of rhino numbers, population growth rates, mortality rates and de-horning statistics. The models accounted for differences between private and state owned rhinos, including differences in population structures, population growth rates, mortality rates and de-horning methods (state owners may de-horn for security reasons but are unlikely to do so for commercial reasons, while some private owners will de-horn for trade purposes). De-horning statistics (including growth rates) were obtained from questionnaire surveys of experts and private owners with experience in de-horning rhinos.

The risks and other implications of lifting (and *not* lifting) the national moratorium, as well as the mitigation measures required to address these risks, were assessed during a workshop of rhino expert stakeholders held on 12 April 2012 at the EWT premises, Johannesburg. This workshop included representatives from DEA, SANParks, Ezemvelo, MPTA, IUCN/SSC AfRSG, SADC RMG, South African Veterinary Council, Lowveld Rhino Trust (Zimbabwe), Veterinary Genetics Laboratory (Onderstepoort), PROA, TRAFFIC and EWT. It also included three independent economists, two private rhino owners and an expert on rhino rescue and rehabilitation. Rhino experts who participated in the survey questionnaires, but that were not involved in the workshop, also contributed to these risks and mitigation measures as part of the survey.

5.2. Survey questionnaires

The contents of the surveys were built around the terms of reference for the feasibility study, and the questions compiled by the EWT project team. The selection of participants was based on one of the following two criteria: 1) they were either considered to have expertise pertinent to the study (and are hereafter referred to as “rhino experts”, see below

for more detailed selection criteria); or 2) they owned rhinos or represented people who owned rhinos (hereafter referred to as “private rhino owners”).

5.2.1. Expert surveys

In order to thoroughly cover all the points in the terms of reference, it was necessary to cover wide-ranging topics related to rhino conservation in the expert surveys. Relevant topics included current and historical trends in rhino populations, trends in poaching, trends in trophy hunting, methods of anti-poaching, security and law-enforcement, rhino horn growth rates, game farming, animal welfare, and resource economics. As few people have sufficient expertise in all these issues, it was necessary to approach experts in varying fields, and these are categorised in Table 3. An attempt was made to survey a minimum of six suitably qualified people in each category, and this was achieved in all but two areas.

Table 3. Categories of rhino experts surveyed

| Category of expertise | Sample size |
|---|-------------|
| <i>Rhino specialists</i> : Includes scientists, ecologists, conservation biologists, rhino rescue and rehabilitation, SANParks management personnel, members of regional and international rhino conservation groups (IUCN AfRSG, SADC RMG etc.), and staff of TRAFFIC. | 16 |
| <i>Provincial rhino experts</i> : Senior conservation staff responsible for rhino conservation in their province and with significant experience with rhino issues. | 11 |
| <i>Provincial law enforcement</i> : Included representation from Limpopo, Mpumalanga and Free State | 5 |
| <i>Economists</i> : Resource economists | 8 |
| <i>Veterinarians</i> : Experienced in capture and translocation of rhinos | 6 |
| <i>Private/Provincial reserve managers</i> | 10 |
| <i>Private owners/PROA/WRSA</i> | 6 |
| <i>Professional hunters</i> : Connections with PHASA, or long time experience in professional hunting industry with extensive rhino trophy hunting experience | 4 |
| Total | 66 |

Sixty-six (66) rhino experts were surveyed overall between January and May 2012. In the majority of cases, the opinions of the experts regarding the potential for future national trade in rhino horn was not known before they were requested to participate. Seven experts were based outside South Africa, including regional rhino experts from Swaziland,

Zimbabwe and Namibia, one expert in trade in wildlife products from Zimbabwe, and resource economists based in Namibia, New Zealand and USA. Five senior members of SANParks were interviewed, as well as senior provincial personnel responsible for rhino conservation from all provinces except Gauteng and Northern Cape. Ten rhino experts that were approached to participate in the study did not complete the survey for various reasons.

Where possible, the rhino experts were first contacted telephonically to explain the purpose of the survey and to request their participation. They were given the option to answer the questions over the phone or to complete the questionnaire themselves (with preference given to the former to keep the survey as consistent as possible). Nearly half the experts expressed a preference to complete the survey themselves, in which case the questionnaires were sent to them via email. Many of the participants who gave answers over the phone were sent the questionnaire in advance, giving them time to consider their answers. Thirty-four (34) answered the survey over the phone, while 32 completed the survey themselves.

Technical details about the Rhino DNA Index System (RhODIS™) were kindly provided by the Director of the Veterinary Genetics Laboratory (VGL), Faculty of Veterinary Science, University of Pretoria. The Trade Policy Analyst for WWF International answered informal questions relating to the likely response of CITES and the international conservation community to the possibility of lifting the moratorium.

5.2.2. Private owner surveys

Private rhino owners are a very important group of stakeholders in rhino conservation in South Africa. They have made significant financial contributions to national parks and provinces for over 40 years as a result of buying rhinos and have allowed many of these parks to maintain high levels of population growth (Tony Conway, Ezemvelo, pers. comm.). Wildlife ranchers in South Africa currently own about 25% of the national rhino herd, have presided over a huge distribution range increase for rhinos (2,227,346 ha by 2008, which is an area larger than the Kruger National Park [Hall-Martin *et al.*, 2009]), and have assumed responsibility for protecting and conserving these animals. Despite their major contribution, private rhino owners are viewed quite negatively by some segments of the formal conservation sector because of the involvement of some of their sector in illegal activities. While the extent of involvement of private owners in unethical practices is unknown, it is likely that only a minority are involved, and so generalisations are unjustified and possibly even detrimental to the future of rhinos. Rhino owners were included in the survey for two major reasons: 1) they represent 25% of rhinos in South Africa; and 2) if trade in rhino horn is legalised in future, they may contribute large amounts of horn to be marketed.

The private owner surveys had two main sections. The first was based on the personal experiences of owners with rhino issues such as trading horn, poaching, costs of protecting rhinos, and trophy hunting. The second section overlapped with the expert surveys, and asked opinions on the viability and potential outcomes of legalising trade.

Unlike the participants in the expert survey, who were selected on the basis of relevant expertise, we endeavoured to select private owners randomly. Due to the sensitivities and security issues associated with the poaching crisis, organisations like the SADC RMG, PROA, WRSA and the provinces are obliged to keep private owner contact details confidential. It was not possible, therefore, to make contact with private owners directly, which would have allowed selection of participants to be truly random. Instead, private owners were initially contacted via the SADC RMG and PROA, who were conducting a survey of white rhinos on private land within South Africa at the time. In this way, owners were encouraged to participate and to either complete the survey themselves, or to contact the EWT to arrange an interview. To widen the exposure of the survey to as many private owners as possible, all provinces and WRSA were requested to distribute the surveys to their contact lists of private rhino owners. Additionally, a notice was placed in the Farmers Weekly magazine to request participation of private owners. It is acknowledged that relying on private rhino owners to make the first contact is not random and may exclude those owners that are especially cautious and do not want their confidentiality compromised at all, and may bias the sample in the direction of those who have strong views on trade. However, due to the prevailing security concerns associated with the contact details of private rhino owners, the above approach was the only practical option.

A total of 54 private owner surveys were included, with at least 27 of these being completed by private reserve managers who were not necessarily the rhino owners. These managers represented the owners, but the exact proportion of surveys that were completed by non-owner managers was not known because the survey did not explicitly ask this question. However, 56% of private owner surveys indicated that ecotourism was one of the primary land uses, suggesting that their land was used to some extent as private game reserves (this was sometimes confirmed during correspondence, but as the survey was confidential, owners were not explicitly asked if this was the case). Sixteen of the private owner surveys overlapped with the expert surveys, and in most cases this was because the respondents were private reserve managers with extensive rhino and other conservation management experience, who were responsible for rhino populations of > 20 animals. Eighty-nine percent of private owner surveys were completed via email, while 11% were conducted telephonically. The response rate to the survey was unknown because the number of private owners who received the request to participate was unknown.

6. THE IMPACT OF THE TRADE MORATORIUM

6.1. Domestic trade in rhino horn before the implementation of the national moratorium in February 2009

6.1.1. Data limitations

6.1.1.1. Provincial trade permits for rhino horn

Although international trade in rhino horn has been prohibited by CITES since 1977, it was legal for South African citizens to buy, sell or donate their legally owned rhino horns domestically until February 2009, at which time the national moratorium was published for implementation (Government Gazette No.31899, Notice No. 148, 13 February 2009). TOPS regulations under NEMBA promulgated in 2007 required all persons in possession of rhino horn to have their horns permitted, marked and registered on the national database, and also required permits to be issued for trading horns (until 2009 when trade became illegal). Provincial conservation permit offices issued these permits, and it was from these sources that permit data for the current study were requested.

In most provinces, permit records are stored in archives that are not easy to access and, in two cases, some of the relevant information was provided on the basis of the permit officers' memory. Although this information is considered reliable in terms of the number of permits issued (because the permit officers in the respective provinces had been in their positions for many years and the number of permits issued was low), this suggests that if trade was to be legalised again, the existing permit system would be slow, difficult to audit and potentially ineffective at preventing illegal export of rhino horn (see sections 8 & 9 for more detailed discussion of this issue). It would need to be reviewed and improved to successfully monitor and manage trade.

Permit data for rhino horns traded legally within South Africa before February 2009 (dating back to 1994) were obtained from eight provinces (Limpopo, Mpumalanga, Gauteng, KwaZulu-Natal, Free State, Northern Cape, Western Cape and Eastern Cape), of which five included information on whether the horns remained within the province or were exported to other provinces. North West Province, which had 13% of rhinos on private land in 2008 (Hall-Martin *et al.*, 2009), did not provide any permit information. This created some limitations in the data analyses (discussed in the text at relevant sections), because estimates of horn traded were subsequently based on extrapolations and assumptions. The implication of this is that the accuracy of the estimate of the number of horns traded legally before the moratorium is unknown.

6.1.1.2. Private owner surveys

The number of private rhino owner surveys returned (n=54) represents approximately 13% of all private rhino owners in South Africa and a minimum of 34% of rhinos occurring on private land (>1,800 rhinos). While this provides a reasonable sample size for many issues dealt with in this report, only seven respondents indicated that they had legally traded horn before 2009, which is a small sample size to base extrapolations on. As with the permit calculations, a few assumptions had to be made in the analyses, and these are discussed in the relevant sections of text. The implication of this small sample size is that

all calculations for legal trade before 2009, which are based on data provided by the private owner surveys, are potentially inaccurate.

6.1.2. Buyers and sellers of rhino horn before the moratorium

Due to confidentiality issues, provincial permit information provided by the provinces was restricted to the number of permits issued, the years they were issued and (sometimes) the destination province of the horns. It was not possible for the current study to determine what subsequently happened to the horns. There is, however, evidence that some of the horns sold on valid permits were then illegally exported out of South Africa, probably to countries in Asia, including Viet Nam (Milliken *et al.*, 2009). For example, authorities in the Free State discovered that rhino horns were being sent to an address in Pretoria that was linked to Vietnamese nationals, and from there the horns were thought to be leaving the country (Werner Boing, FSDETEA, pers. comm.). Once this scam was discovered, applications for permits to move horns to this address were refused, but this type of situation was a major reason for the enactment of the moratorium.

Regulations 19(1i: iii) & 19(1i: iv) of the TOPS regulations under NEMBA (Government Gazette No. 29657, 23 February 2007, Government Notice No. 150) state that a permit must include the name and physical addresses of the seller or supplier (in the case of a permit authorising the purchase or acquisition of a specimen of a listed threatened or protected species) and the name and physical address of the person purchasing or acquiring the specimen of a listed threatened or protected species (in the case of a permit authorising the sale or supply of such a species). It should have been possible, therefore, for conservation authorities to follow up with owners of horn to verify the whereabouts of any horns, based on the information on the permits that authorised the selling or buying of rhino horns. However, the auditing process has been (and still is) insufficient and incomplete (Milliken *et al.*, 2009). In cases where audits were conducted before the moratorium and owners could not verify the whereabouts of their horn, successful prosecution would have been difficult anyway. For example, there is nothing in the Mpumalanga Act to charge someone with if horns were reported lost or if a theft case had been opened (Juan de Beer, MTPA, pers. comm.).

In the private rhino owner survey, respondents were asked if they traded horn legally before the moratorium. Seven of the 54 private rhino owners (13%) indicated that they had sold rhino horn between 2005 and 2008, while one owner stated he was in the process of organising a sale when the moratorium was enacted (Table 4). When asked what they thought happened to the horn after it was sold, one of the owners stated that the buyers were Chinese and suspected that they took the horns to China, three indicated that they suspected their horn had been smuggled out of the country and traded on the black market, while the remaining three were unsure what happened to it. None of the 54 private owners indicated that they had bought rhino horn.

Table 4. Horn sales information provided by the private owner survey.

| Rhino owner | Year | Number of rhinos owned | Mass of horn sold | Price | % from Natural deaths | % from breakages | % from dehorning |
|-------------|------|------------------------|-------------------|------------|-----------------------|------------------|------------------|
| 1 | ? | >5 | 20 kg | ? | 90 | 0 | 10 |
| 2 | ? | ? | ? | ? | 100 | 0 | 0 |
| 3 | 2005 | >20 | ? | R15,000/kg | 5 | 10 | 85 |
| 4 | 2006 | >50 | 84 kg | R8,000/kg | 67 | 23 | 10 |
| 5 | 2007 | >20 | ? | R18,000/kg | 80 | 20 | 0 |
| 6 | 2007 | >5 | 7 kg | R18,000/kg | 75 | 25 | 0 |
| 7 | 2008 | >5 | 38 kg | R36,000/kg | 20 | 80 | 0 |
| 8 | 2009 | 5 | Cancelled | R35,000/kg | - | - | - |
| Ave. | | | | | 60% | 27.5% | 12.5% |

6.1.3. The quantity and value of legal rhino horn trade before the moratorium

6.1.3.1. Permit data

Thirty-nine (39) rhino horn trade permits were issued by eight provinces between 2000 and 2009, representing 169 horns, with the majority of horns being traded between 2006 and 2008 (Figure 5). One permit in 2007 was issued for 219 pieces of horn, but these were excluded from the total count because it was impossible to determine the actual number of horns represented by the number of pieces. All provinces stipulated the number of horns traded on each permit, but only Mpumalanga provided the corresponding mass of those horns (77 horns with a total mass of 120 kg; average = 1.56 kg/horn). If it were assumed that this average mass was representative of the other provinces, the mass of rhino horn traded legally in the eight provinces between 2000 and 2009 would have been approximately 264 kg (plus the unknown mass of the 219 horn pieces).

The number of horns sold per year increased over time, with a peak of 55 horns traded in 2008 in the eight provinces (Figure 5). Assuming the same average horn mass of 1.56 kg, this extrapolates to 86 kg traded in one year. Because this figure excludes any horns traded in North West Province, which represents approximately 13% of rhinos on private land, it is possible that the mass of horn traded in all provinces in 2008 was approximately 100 kg (Table 5). This estimate contains another potential source of error, however, because it assumes that the number of rhino horns traded in North West Province was proportional to the numbers traded in the other eight provinces relative to the numbers of rhinos occurring on private land in those provinces. This assumption is invalid because the numbers of rhino horns traded in each of the other eight provinces did not correlate positively with the numbers of rhinos on private land in those provinces (Spearman $r=0.42$, $P=0.29$) (Figure 6).

One additional anomaly is worth mentioning here. Limpopo Province reported no horn trade before the moratorium, yet during the private rhino owner surveys, four respondents

from Limpopo (out of a sample of 18 private owners from the province) indicated they had traded rhino horn legally before the moratorium. At the time of submission of this report, the reason for this inconsistency is unclear, but it highlights the need for an improved permitting system.

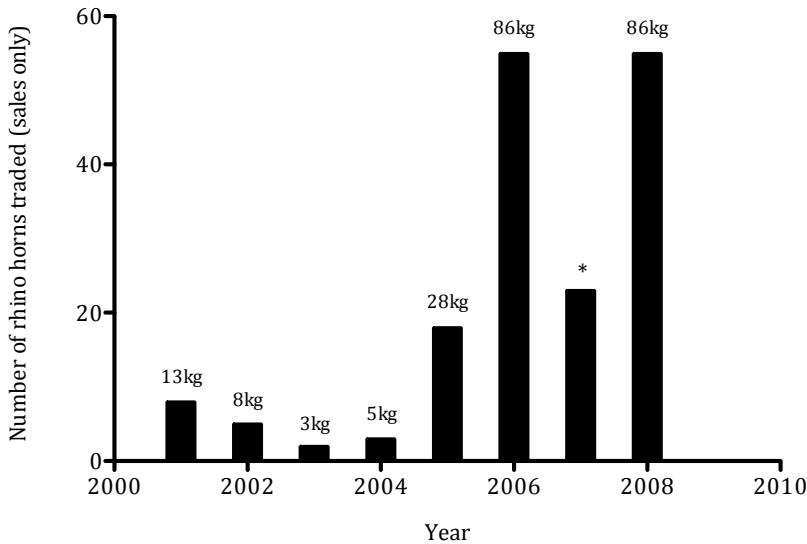


Figure 5. The number and mass of rhino horns traded on legitimate permits in eight provinces (excluding North West Province) between 2000 and 2009. The quantities traded in 2007 (*) are an underestimate because one permit was issued for 219 pieces of horn, but the size or mass of those horns was not provided (Source: provincial permit offices).

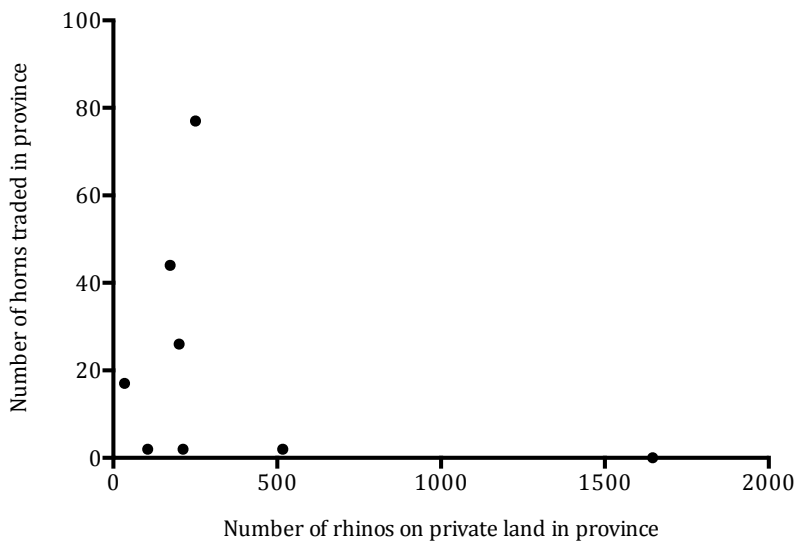


Figure 6. The number of rhinos on private land per province compared to the number of rhino horns traded in those provinces (Sources: provincial permit offices; Hall-Martin *et al.*, 2009).

Table 5. Independent estimates for the quantity and mass of white rhino horns sold legally in 2008. Each estimate is based on at least 2 assumptions that are listed in the table.

| | Trade permit data | Private owner survey data |
|---------------------|--|---|
| <i>Assumption 1</i> | <i>The mean mass of each rhino horn traded in Mpumalanga is representative of the mean mass of horn traded in all the provinces. This is probably an underestimate because the mean mass of a single horn obtained from natural deaths in Kruger National Park was 2.95 kg (taken from Pienaar et al., 1991, where the mean mass of two horns, anterior and posterior, from a random sample of white rhinos was 5.9 kg)</i> | <i>A reasonable estimate of the average mass of horn traded per permit can be derived from the median of the combined Mpumalanga permit data and private owner survey data (to avoid the disproportionate effect of one unusually large sale that would have skewed the average).</i> |
| Calculation 1 | 2008: 8 provinces traded 55 horns; Average horn mass from Mpumalanga data 1.56 kg; Mass of horn traded: $55 \times 1.56 = 86 \text{ kg}$ | The median mass of horn traded between 2005 and 2008 was 7 kg on 9 permits. |
| <i>Assumption 2</i> | <i>The numbers of rhino horns traded in North West Province were proportional to the numbers traded in the other eight provinces relative to the number of rhinos on private land in those provinces. This is unlikely to be true because the number of horns traded per province in the eight provinces for which data were available, did not correlate with the number of rhinos on private land in those provinces. Whether this assumption will produce an over- or underestimate is unknown.</i> | <i>The average mass of rhino horn traded per permit (above) is typical for all the provinces.</i> <i>The % of survey participants that traded horn is representative for all private rhino owners.</i> |
| Calculation 2 | Estimated mass of horn traded by North West Province: $86 \times (13/87) = 13 \text{ kg}$ | 13% of 395 private rhino owners traded an average of 7 kg of rhino horns over 4 years: $(395 \times 0.13 \times 7)/4 = 90 \text{ kg}$ |
| Calculation 3 | Estimated total mass of horn traded legally in South Africa in 2008 $86 + 13 = 99 \text{ kg}$ | |
| Totals | 99 kg | 90 kg |

6.1.3.2. Private rhino owner survey trade data

A small amount of data relating to rhino horn traded by private rhino owners were obtained from the private owner survey questionnaire (Table 4). The mean mass of all horns sold by four owners was 37 kg (range 7-84 kg), but this estimate was probably skewed by the contribution of one individual who owned a large number of rhinos. The small sample size of available trade mass data meant that this one large sale had a very big influence on the average. A more representative estimate of the average mass of horn traded per permit can be derived from the median of the combined Mpumalanga permit data and private owner survey data. The median mass of horn traded per permit was approximately 7 kg. If it is assumed that 13% of all private rhino owners (n=395 in 2008 [Hall-Martin *et al.*, 2009]) sold an average of 7 kg of horn between 2005 and 2008, a total of 360 kg of horn were traded, at a rate of 90 kg per year (Table 5).

6.1.3.3. Market size of rhino horn traded legally before the moratorium

The two independent estimates for the mass of rhino horn sold per year immediately before the moratorium were based on a number of assumptions (Table 5), but they returned similar values of approximately 100 kg. Given that the assumptions were mostly for underestimates of mean horn mass, this value of 100 kg is likely an underestimate as well. At a price of R35,000/kg in 2008 (Table 4), the annual market value of horn traded legally within South Africa would have been approximately R3.5 million.

6.1.4. The destination of traded rhino horn before the moratorium

Between 2000 and 2009, 160 horns were exported to different provinces on 36 permits, while 9 horns (3 permits) remained within the province in which they were purchased (Table 6). The final destinations of all these horns are unknown.

Table 6. Destination provinces of horns exported

| Destination Province | Number of permits | Number of horns sold | Percentage of horns sold |
|-------------------------|-------------------|----------------------|--------------------------|
| Mpumalanga | 1 | 6 | 3.6 |
| Limpopo | 2 | 4 | 2.4 |
| Eastern Cape | 2 | 8 | 4.7 |
| North West | 3 | 7 | 4.1 |
| Remain within province | 3 | 9 | 5.3 |
| Gauteng | 5 | 22 | 13.0 |
| Unspecified destination | 23 | 113 | 66.9 |
| Total | 39 | 169 | |

6.1.5. Illegal trade in rhino horn from private stocks

This trade generally involves rhino horn that has not been declared or permitted. The horns may have been collected from carcasses of rhinos that died of natural causes, from hunted animals, or they may have been obtained from dehorning exercises. The common

element is that the horn does not have a NEMBA permit and is difficult to trace. While the amount of horn sold illegally from these sources in South Africa cannot be determined precisely, there are indicators that may be used to derive a rough estimate.

Estimates have been made of the amount of rhino horn that *should* be in private stocks, given the number of rhinos on private land and the predicted rate of horn accumulation, and these can be compared to the amount of horn that is officially registered with NEMBA (TOPS) permits. Hall-Martin *et al.* (2009) made two estimates of how many horns should be in private stocks in 2008, one based on answers given by a sample of private owners to survey questions specifically about their horn stockpiles, the other based on estimated mortality rates of rhinos on private land (also derived from their own survey questionnaires) combined with a previous estimate of horn stockpiles. The two estimates derived were 3,361 kg and 2,508 kg respectively. During this same period, Richard Emslie (IUCN AfRSG, pers. comm.) estimated that there should have been approximately 4,750 kg of rhino horn in private stockpiles based on estimated numbers of rhinos on private land, estimated mortality rates, and horn masses based on data from Pienaar *et al.* (1991).

Using the average of these three estimates gives a figure of approximately 3,500 kg of rhino horn that *should* have been in private rhino horn stockpiles in South Africa in 2008. At the time 1,428 kg were officially reported from four provinces representing approximately 81% of rhinos on private land (Milliken *et al.*, 2009). If this is extrapolated to include the provinces that did not report private stockpiles, 1,700 kg of horn were registered in private stocks in 2008. This leaves a shortfall of 1,800 kg of horns unaccounted for, and suggests that about half the private rhino owners did not register their horn stocks (although, without knowing which owners were non-compliant, this proportion is highly speculative). It is possible that some of these horns were never recovered from dead animals, while others may not have been registered due to a mistrust of permitting authorities, but it is also possible that some of them were sold clandestinely and exported to Asia (Hall-Martin *et al.*, 2009).

The time period over which these privately owned horn stockpiles would have been accumulated was not specified, but it would have taken more than a decade given the rhino population size on private land and an assumed mortality rate of 2%. However, given that pseudo-hunting and illegal horn trading started around 2003, it is probably safe to assume that illegal sales of this 'unaccounted for' rhino horn started about the same time. If it were assumed that half this horn was sold illegally, 900 kg would have been exported over a 6-year period (between 2003 and 2008), probably at an increasing rate through time. Additionally, if any private owners dehorned their rhinos without permits during this period, the discrepancy between registered horn and expected horn would be even greater.

6.2. Legal and illegal killing of rhinos before and after implementation of the national moratorium

6.2.1. Data limitations

The key limitation of the poaching data obtained from SANParks and IUCN AfRSG reports is that it is impossible to keep track of every rhino in large conservation areas such as the Kruger National Park, so some poaching incidents will inevitably have gone undetected. However, such errors should be consistent across years, so trends in poaching identified by these data are reliable.

The trophy hunting data obtained from the CITES trade database does have limitations that affect accuracy. Each Party to CITES designates a management authority to issue permits and compile annual reports that are entered into the database (CITES, 2010). Although there are guidelines for preparation of these reports, many Parties do not follow them completely, resulting in inconsistencies. The main departure from the guidelines that is of relevance to this study is that many annual reports do not clearly state whether the data were derived from the actual number of specimens traded (exported) or from the number of permits issued. In addition, export permits are valid for six months while import permits are valid for 12 months. This creates anomalies between export and import data. As a result, the information relating to exports from one country, whether based on permits or actual exports, rarely matches the number of import permits issued by the importing country or the actual imports reported by that same country. While some Parties (e.g. USA) report imports accurately, many do not, and some do not report them at all because importing countries are not required to do so for trade in Appendix II species in terms of the Convention. This problem has been further confounded by allegations that some used permits are not surrendered after a trophy has been exported and are subsequently reused, allowing two or more trophies to be shipped on one export permit.

As a result of these limitations, when import and export permit counts for rhino trophies do not match up on the CITES database (which is the case in all years for which data were used in this study), it is impossible to determine exactly how many trophies were actually exported legally out of South Africa.

The trophy hunting data obtained from the annual reports compiled by provincial conservation authorities and consolidated by DEA also have some limitations that affect accuracy. Trophy hunting figures indicate actual hunts that took place and were compiled by using professional hunting registers. However, provincial conservation authorities do not necessarily capture a record of the hunt at the time when the hunt took place, but rather at the time that the copy of the professional hunting register was received by the provincial official (Magdel Boshoff, DEA, pers. comm.). This could be in the following year, depending on how long it takes for the taxidermist to prepare the specimen for export. Additionally, the nationalities of the rhino hunting clients were not recorded in the DEA annual reports prior to 2009, which meant that the potential number of pseudo-hunts before that year could not be determined accurately.

6.2.2. Rhino poaching

6.2.2.1. Trends in rhino poaching in South Africa

Between 1900 (when both white and black rhinos started being formally protected in KwaZulu-Natal) and 1982, rhino poaching in South Africa was negligible, with many years experiencing zero poaching. Between 1983 and 2007 there was rhino poaching in every year (Figure 7), with a trend of increased poaching with time correlating with a concurrent increase in the rhino population ($r=0.72$, $P<0.001$). There were two small peaks in poaching during this time, with one occurring around 1994 (26 rhinos killed) and the other around 2002 (25 rhinos killed). The peak in 1994 coincided with the end of a poaching surge in Zimbabwe at a time when the poaching was expected to continue moving south into South Africa (see sections 6.2.2.3 and 6.3.2), while the peak in 2002 occurred a year before the second spike in poaching in Zimbabwe.

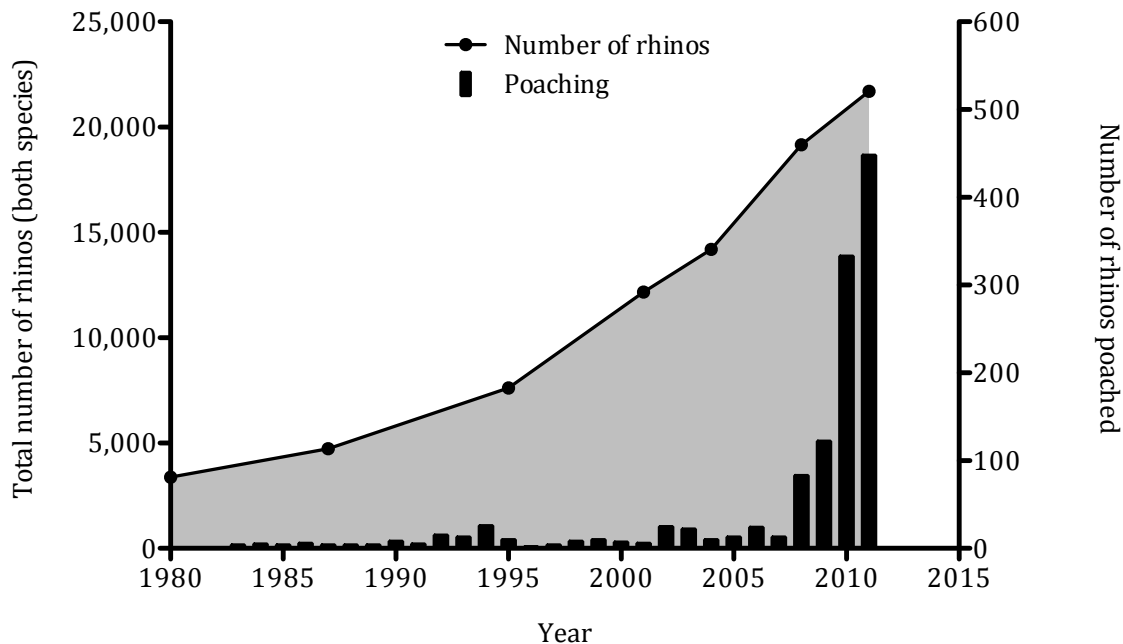


Figure 7. Concurrent changes in population size and level of poaching in all rhinos within South Africa between 1980 and 2011 (Sources: AfRSG data; SANParks).

Poaching levels increased dramatically in 2008 (Figure 7), however, when 83 animals were poached in one year, an increase of 453% from the mean of 15 rhinos poached per year during the previous 8 years. In 2009, 122 rhinos were poached (which was a 47% increase from 2008), in 2010 333 were poached (a 173% increase), and in 2011 448 rhinos were poached (a 35% increase). The breakdown for poaching by species in 2011 was 429 white rhinos and 19 black rhinos, representing 2.2% and 0.9% of the national populations respectively. During the first 6 months of 2012, poachers in South Africa killed 254 rhinos, which extrapolates to ~508 rhinos if the same rate continues for the remaining 6 months. While this rate of rhino poaching is currently sustainable because the national population

growth rate remains higher than the death rate (i.e. the rhino population of South Africa would still increase), if the annual poaching rate continues to increase, it will eventually exceed population growth. In 2011, 57.5% of poached rhinos came from National Parks, 27.9% came from private land and 14.6% came from provincial parks (Figure 8). It is noteworthy that rhinos in SANParks and on private land were poached at a disproportionately high level relative to their population size in 2011, while rhinos in provincial parks were poached at a low level relative to their population size.

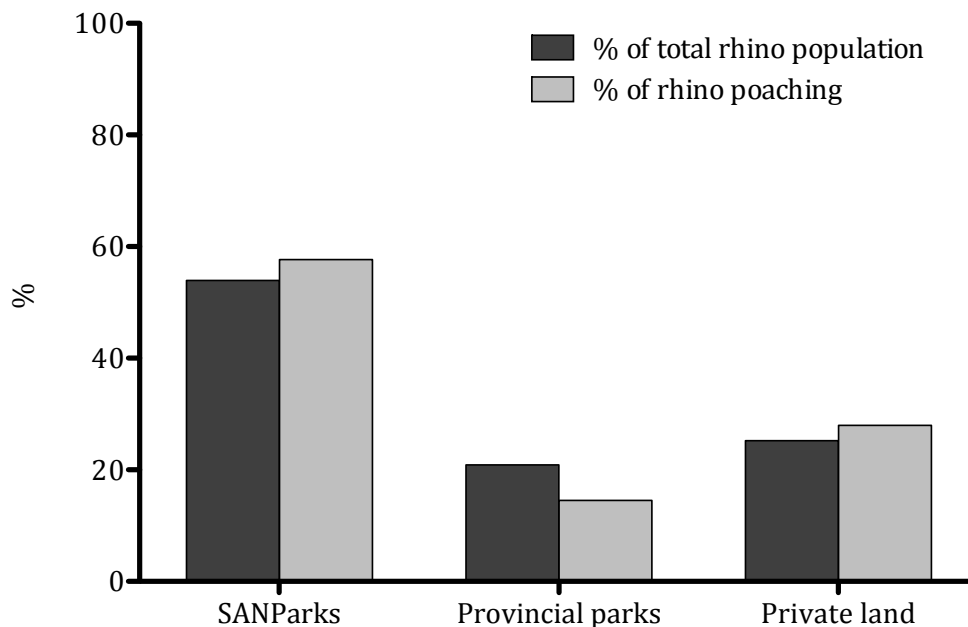


Figure 8. Percentage of poaching on private land and state land in 2011 relative to the percentage breakdown of the total rhino population (Sources: AfRSG data; SANParks; Hall-Martin *et al.*, 2009).

6.2.2.2. Potential quantity of rhino horn supplied to the illegal international market through poaching in South Africa

The large increase in number of rhinos poached in South Africa since 2008 would have resulted in a correspondingly large increase in the quantity of rhino horn reaching the illegal international market. If it is assumed that all the horns extracted from poached rhinos were successfully exported to the intended end-user markets, and if the average mass of horns taken was 5.9 kg for white rhinos and 2.65 kg for black rhinos (for both species assuming that poachers target adult or sub-adult animals of either sex [Pienaar *et al.*, 1991]), the annual mass of rhino horn that was exported illegally out of South Africa due to poaching can be estimated (Table 7).

Table 7. Potential annual mass of illegally exported white and black rhino horn obtained from poaching in South Africa

| Year | Number of white rhinos poached | Mass (kg) of white rhino horn obtained | Number of black rhinos poached | Mass (kg) of black rhino horn obtained | Total mass (kg) of rhino horn obtained from poaching |
|-------------|---------------------------------------|---|---------------------------------------|---|---|
| 2002 | 22 | 130 | 3 | 8 | 138 |
| 2003 | 19 | 112 | 3 | 8 | 120 |
| 2004 | 8 | 47 | 2 | 5 | 53 |
| 2005 | 13 | 77 | 0 | 0 | 77 |
| 2006 | 24 | 142 | 0 | 0 | 142 |
| 2007 | 13 | 77 | 0 | 0 | 77 |
| 2008 | 80 | 472 | 3 | 8 | 480 |
| 2009 | 118 | 696 | 4 | 11 | 707 |
| 2010 | 330 | 1947 | 3 | 8 | 1955 |
| 2011 | 429 | 2531 | 19 | 50 | 2581 |

Assumptions: 1) All horns taken from poached rhinos were illegally exported to end-user markets; 2) All rhinos poached were adults or sub-adults of either sex; 3) The average mass of horns taken from each poached white rhino was 5.9 kg (Pienaar *et al.*, 1991); 4) The average mass of horns taken from each poached black rhino was 2.65 kg (Pienaar *et al.*, 1991).

6.2.2.3. Rhino poaching in other African range states

When the southern white rhino was almost exterminated from Africa around 1900, South Africa was its last refuge, and there were no wild members of the subspecies living outside the country. This left only the northern white subspecies representing white rhinos in the rest of Africa, but there are few data on numbers. *C. s. cottoni* was still abundant in countries such as Sudan and DRC around 1900 (Wilson & Mittermeier, 2011), but by 1960 their numbers had been reduced to only 2,360 animals for the entire continent (Emslie, 2011a). In 1984, the last remaining northern white rhinos, totalling 15 animals, were located in Garamba National Park in the DRC (Emslie *et al.*, 2006). Although protection helped this small population recover slightly to 30 animals by 1992, population growth was increasingly suppressed by the nearby civil war in southern Sudan, and the northern white rhino was eventually extirpated sometime after 2006, when the last confirmed live sighting in Garamba occurred (Emslie, 2011a). This subspecies is most likely extinct in the wild. Due to the dearth of direct observations, poaching levels can only be estimated from limited population counts. In total, the number of northern white rhino poached between 1960 and 2006 was approximately 3400 animals, but the vast majority of these were killed before 1980. It is difficult, therefore, to link poaching of this subspecies to the current poaching in South Africa.

As discussed previously, the black rhino also underwent a massive population decline throughout Africa in the twentieth century. From a population of >800,000 individuals in 1900, it dropped to 100,000 by 1960, 65,000 by 1970, 14,800 by 1980, and eventually 2,410 animals by 1995, which was the lowest historical point in global black rhino

population size. Virtually all this took place outside South Africa, where black rhinos had already been pushed close to extinction by 1900. Due to the vast areas involved and the lack of capacity in many African countries, black rhino poaching statistics have not been well documented, but numbers of animals poached can be inferred from the known population declines. Taking into account natural population growth (assumed to be 5%), it can be estimated that more than 7,000 black rhinos were poached every year between 1960 and 1975 (Figure 9). After 1975, poaching levels started to decline, but this was probably because the number of rhinos left alive was decreasing dramatically, resulting in them being harder to locate. Sometime around 1993, annual continental black rhino poaching dropped below 100 animals per year, at which point there were only about 2,500 individuals left alive. Total numbers of black rhinos across Africa have recovered to 4,880 (as of 31 December 2010) (Emslie, 2011b).

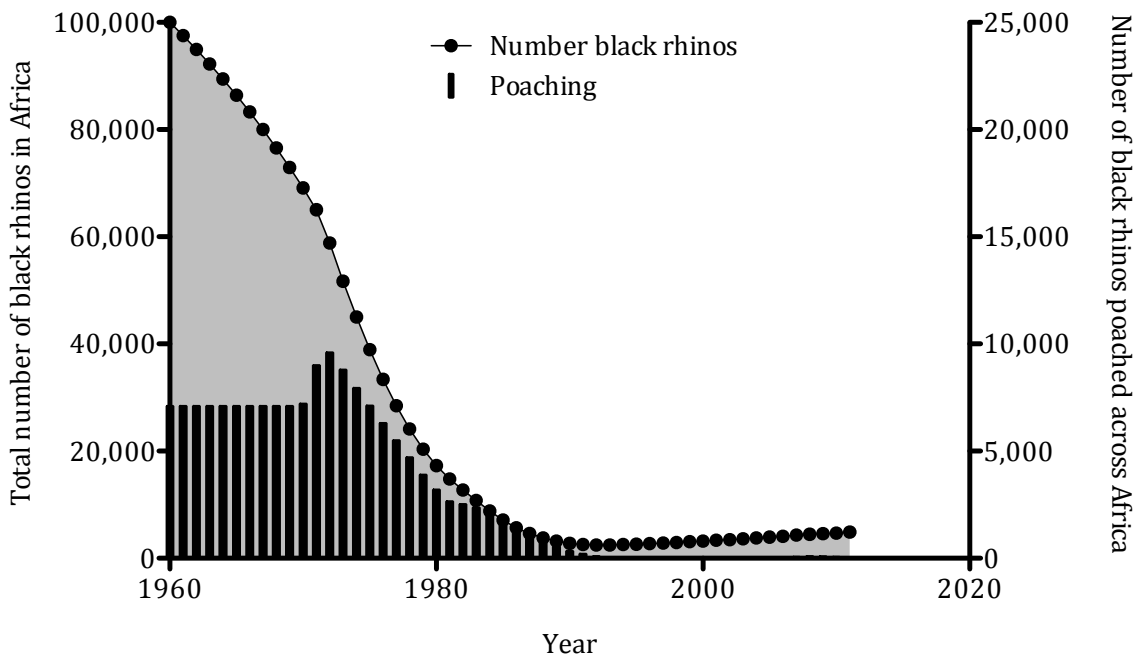


Figure 9. Concurrent changes in population size and level of poaching in black rhinos across Africa between 1960 and 2011. Note different scales for left and right Y-axes. (Source: AfRSG data.)

Namibia, Zimbabwe and Kenya are the three other range states outside South Africa that still maintain populations of >500 black rhinos (Milliken *et al.*, 2009), while the 5th largest population occurs in Tanzania, where there are <150 black rhinos. Namibia has experienced very low levels of rhino poaching since 1989 (Pierre du Preez, Ministry of Environment and Tourism, Namibia, pers. comm.), even during the recent upsurge in South Africa, while Kenya has seen a small increase since 2008. Zimbabwe has suffered significant poaching since 2003, the second worst in Africa (after DRC) when considered in terms of the percentage of the total rhino population killed (Milledge, 2007). This was the first major upsurge in the country for 10 years. A comparison of poaching in South Africa and

Zimbabwe since 2000 shows that the numbers of rhinos poached in the two countries were quite similar until 2008 (Figure 10a), when the first signs of the surge in South Africa was accompanied by an even larger surge in Zimbabwe.

After 2008, however, poaching in Zimbabwe started to decline, while in South Africa it continued increasing at a rapid rate. A higher proportion of the Zimbabwean rhino population was poached (Figure 10b), with Zimbabwe suffering a level of poaching that removed 3% or more of its rhino population annually (peaking at 17% in 2008). By 2011, the percentage of national rhinos poached in South Africa exceeded 2% and was approaching the figure for Zimbabwe, which had dropped to 4%. As the rhino populations in Zimbabwe declined and the easier targets were reduced, the remaining rhino populations were harder to access because they were protected by stronger anti-poaching security, so the poaching pressure switched more and more to South Africa.

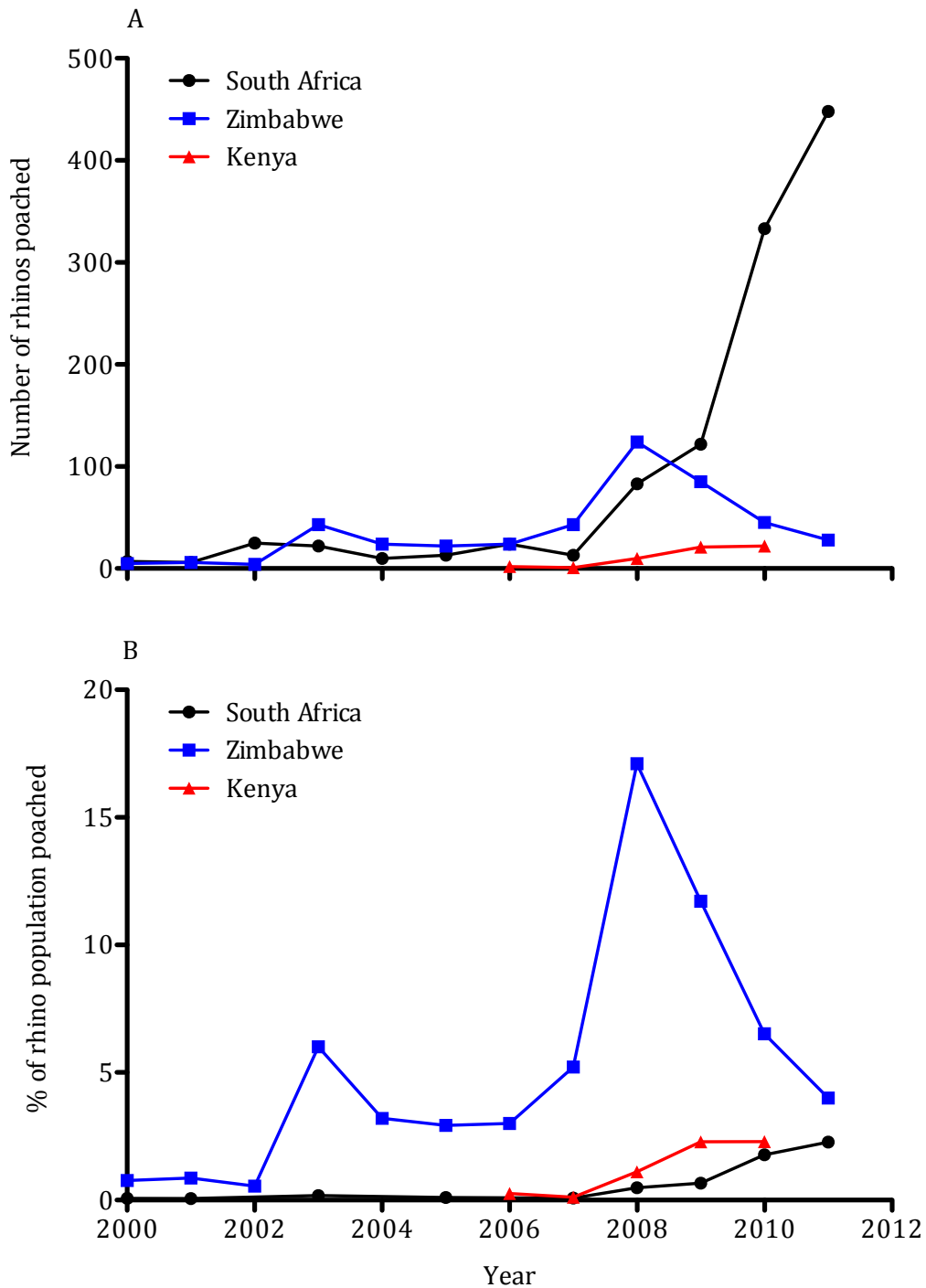


Figure 10. Annual rhino poaching in the main range states since 2000: South Africa, Zimbabwe and Kenya (Namibia is not shown because it has had very low levels of poaching). A) Numbers of rhinos poached; B) Percentage of rhino population poached. (Sources: SANParks; Lowveld Rhino Trust; IUCN AfRSG data).

6.2.2.4. *The influence of the national moratorium on losses of rhinos to poaching*

Some people have blamed the national moratorium on trade in rhino horn for causing or exacerbating the recent rise in poaching. The timing of the implementation of the national moratorium appears to rule it out as the initial cause of the poaching upsurge because the poaching increase started in 2008, while the national moratorium was only implemented in February 2009 (Figure 11). However, the notice for public participation with regards the national moratorium for trade in rhino horn was published in August 2008, suggesting that potential horn traders had prior warning that trade of rhino horn within South Africa was going to be prohibited. This may have led to speculative buying, an increase in horn prices, and an increase in poaching. A direct causal role for the national moratorium is difficult to establish, however, as there were many potentially confounding factors that could have contributed to the poaching surge (see section 6.3).

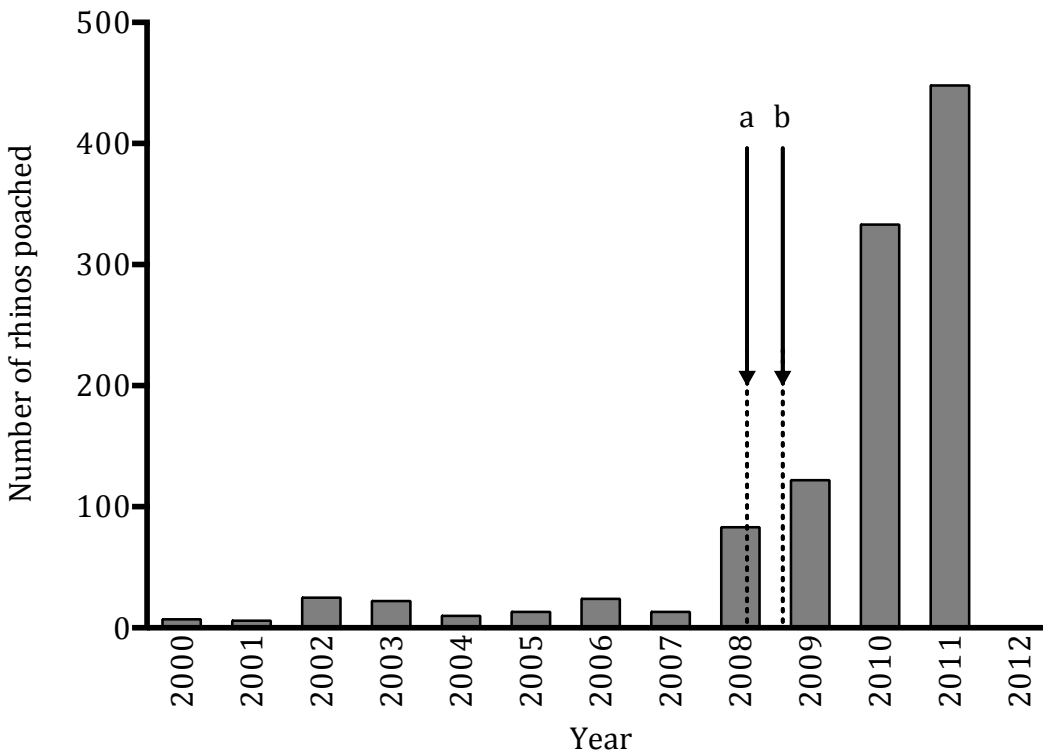


Figure 11. The timing of the implementation of the national moratorium on trade in rhino horn relative to the timing of the poaching spike: a) August 2008: notice for public participation with regards the national moratorium; b) February 2009: Implementation of the national moratorium (Sources: SANParks; Government Gazette No.31899, Notice No. 148, 13 February 2009)

Given the proximity in the timing of the notice of public participation, the timing of the implementation of the national moratorium, and the timing of the upsurge in poaching, it is reasonable to consider a possible link between them. In section 6.1.3, it was estimated that

approximately 100 kg of horns were being sold legally every year within South Africa, but the amount of this legally obtained horn that was leaking onto the black market was unknown because the horns were not sufficiently monitored after being sold to ascertain whether they remained in the possession of the purchasers. Although we do not know the actual figure, it can be estimated that the maximum amount of horn reaching Asia via this route and, therefore, the maximum amount cut off by the moratorium, was approximately 100 kg per year. Whilst this is not a particularly large quantity of horn, the major effect of the national moratorium may have been psychological, and it may have led to an increase in demand from speculators and a subsequent spike in price. See section 6.3.2 for further discussion on this possibility.

When rhino experts were asked their opinion on the causes of the spike in rhino poaching in South Africa in the last 4 years (see section 6.3.4 below for further discussion on this), they were also specifically asked if they thought the moratorium on local trade in horn had influenced the extent of poaching. Out of 63 respondents that answered this question, 49% believed that the moratorium had *not* influenced the poaching spike, 30% thought it *had* influenced the poaching spike (all of whom thought it caused an increase in poaching), while 21% were unsure (Table 8).

Table 8. Expert responses to the question: Do you think the moratorium on local trade in rhino horn influenced the extent of poaching? (n=63)

| Responses | Reasons given |
|-------------|---|
| No: 49% | <ul style="list-style-type: none"> • The increase in poaching started in 2008, which was before the moratorium was enacted in February 2009. • Many factors contributed to the increase in poaching, the moratorium cannot be blamed alone. This reason does not necessarily preclude the moratorium from playing a role in the poaching spike, but it suggests that the poaching spike would have occurred anyway, regardless of whether or not the moratorium had been implemented. |
| Yes: 30% | <ul style="list-style-type: none"> • Banning local trade cut off a supply route for horn to get to Asia. Although this was illegal, it provided horn to Asia from animals that were either dehorned or died of natural causes, and did not require rhinos to be poached. When this supply was cut off because of the moratorium, rhino horn became harder to acquire, which resulted in an increase in the price of horn and a subsequent increase in the incentive to poach rhinos. • The timing of the poaching increase and the implementation of the moratorium were similar. |
| Unsure: 21% | |

6.2.2.5. The influence of trophy hunting restrictions on losses of rhinos to poaching

The TOPS regulations under NEMBA came into effect on 1 June 2007 (Government Gazette, No. 29657, 23 February 2007, Government Notice No. 150), less than one year before the surge in poaching started (Figure 12). These regulations included the prohibition of “put and take” hunting (Regulation 24(1a)). In July 2009, soon after the national moratorium was placed on trade in rhino horn, the government implemented norms and standards for marking rhino horn and hunting white rhinos (Government Gazette No. 32426, Notice No. 756, 20 July 2009). Paragraph 2.2 of the norms and standards stipulated that all rhino hunts had to be strictly controlled by means of individual NEMBA (TOPS) hunting permits dispensed by the issuing authority and could not be included on NEMBA (TOPS) standing permits or game farm hunting permits. This was done to ensure that all rhino horn could be traced to the property where the hunt took place. Paragraph 2.3 of the norms and standards stipulated that all applications for hunting of rhino received by the issuing authorities had to be referred to DEA for recommendation and that hunters were not allowed to kill more than one rhino per year (Paragraph 2.5). The rate of poaching increased soon after the norms and standards were implemented.

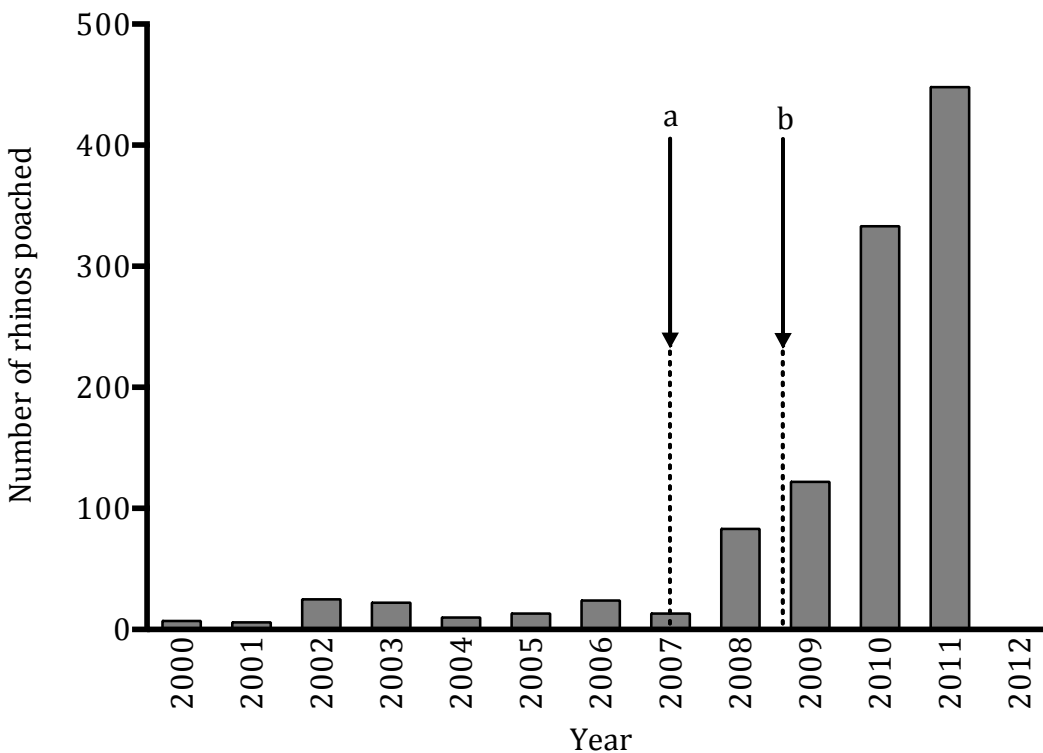


Figure 12. The timing of national legislation on trophy hunting in relation to rhino poaching in South Africa: a) June 2007: TOPS regulations under NEMBA implemented; b) February 2009: Announcement of norms and standards for the marking of rhinoceros horn and the hunting of white rhinoceros for trophy hunting purposes, as well as the national moratorium on trade in rhino horns.

The timing of the surge in poaching after implementation of TOPS Regulations in 2007 and a second poaching spike after the 2009 norms and standards were implemented, suggests a relationship between the hunting restrictions and increase in poaching (Milliken *et al.*, 2009). Cause and effect have not yet been demonstrated, however. See section 6.3.2 for further discussion on this.

When rhino experts were asked if they thought the recent restrictions on trophy hunting had influenced the extent of poaching, 47% thought that the restrictions had influenced the poaching, primarily because they reduced pseudo-hunting and cut off a supply of horn to Viet Nam. 41% of respondents thought the restrictions had not influenced the poaching, primarily because it was unclear if the restrictions had actually had any effect on the amount of pseudo-hunting taking place. The remaining 12% were unsure.

6.2.3. Trophy hunting of rhinos

6.2.3.1. Legitimate trophy hunting

The first trophy hunt for a southern white rhino occurred in South Africa in 1968 (Richard Emslie, IUCN AfRSG, pers. comm.), after the first reintroductions onto private land had taken place, and at a time when the national population was <1,800 individuals. Although rhinos were included in Appendix I of CITES in 1977, which meant that all international commercial trade in rhinos and their products was prohibited, export of hunting trophies for personal use was still permitted. One advantage that arose from the restrictions imposed by CITES was that all hunting export permits issued from South Africa had to be recorded on the CITES trade database, and this allowed a more consistent monitoring system for rhino trophy shipments out of South Africa.

Between 1985 and 1990, the mean annual number of white rhino trophy hunts was 47; between 2005 and 2010, the mean annual number of white rhino trophy hunts was 105 (Figure 13). Hunters from the United States exported more white rhino trophies than any other nation, and in most of those years they were responsible for more than 50% of the hunts. Other nations that regularly trophy hunted white rhinos in South Africa were Spain, Germany, Italy, Austria and Canada.

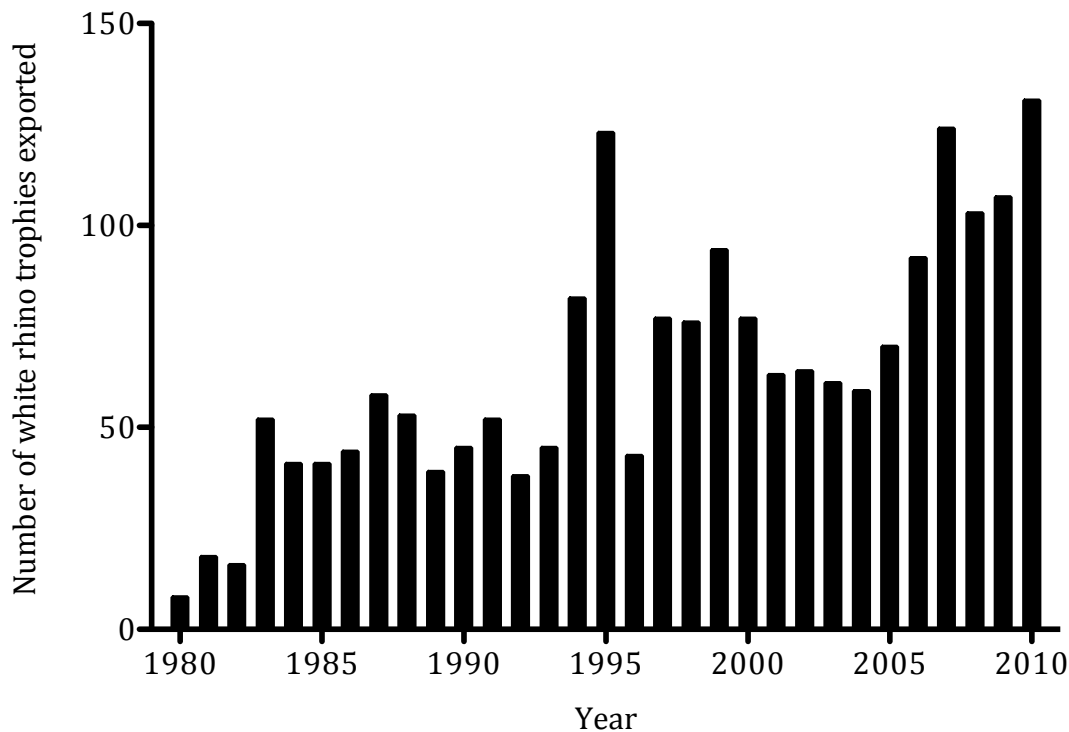


Figure 13. Total annual white rhino trophy hunts in South Africa since 1980. Data were amalgamated from the CITES trade database and DEA annual reports. Note that the 2009 national moratorium on trade in rhino horn did not prohibit the export of rhino trophies. (Sources: CITES trade database; DEA.)

6.2.3.2. Pseudo-hunting rhinos for horn

In 2003, Vietnamese nationals started hunting white rhinos in South Africa and exporting the trophies on CITES permits to Viet Nam, where it is suspected they ended up being traded commercially rather than being used for personal use (Milliken *et al.*, 2009). It is not possible to accurately estimate the number of white rhino trophies exported to Viet Nam from South Africa from the CITES database because the export permits from South Africa do not match the import permits from Viet Nam, and it is not possible to determine whether this was because some export permits issued were not actually used, or whether Viet Nam under-reported their imports. There have also been allegations that some export permits have been used more than once in South Africa, while import controls for wildlife trade are currently very poorly regulated in Viet Nam (Milliken & Shaw, 2012). Regardless of the accuracy of the permit data, there was a clear trend of increased exports of rhino trophies to Viet Nam between 2003 and 2010 (Figure 14). DEA data from 2009 indicate that the number of applications by Vietnamese nationals to hunt white rhinos in South Africa peaked in 2010 and 2011, when 116 applications were made in both years (these were applications only, not necessarily actual hunts, so are not included in Figure 14). The number of hunting applications has dropped dramatically in 2012, however, since the

implementation of the amended norms and standards, with only 8 applications from Vietnamese nationals.

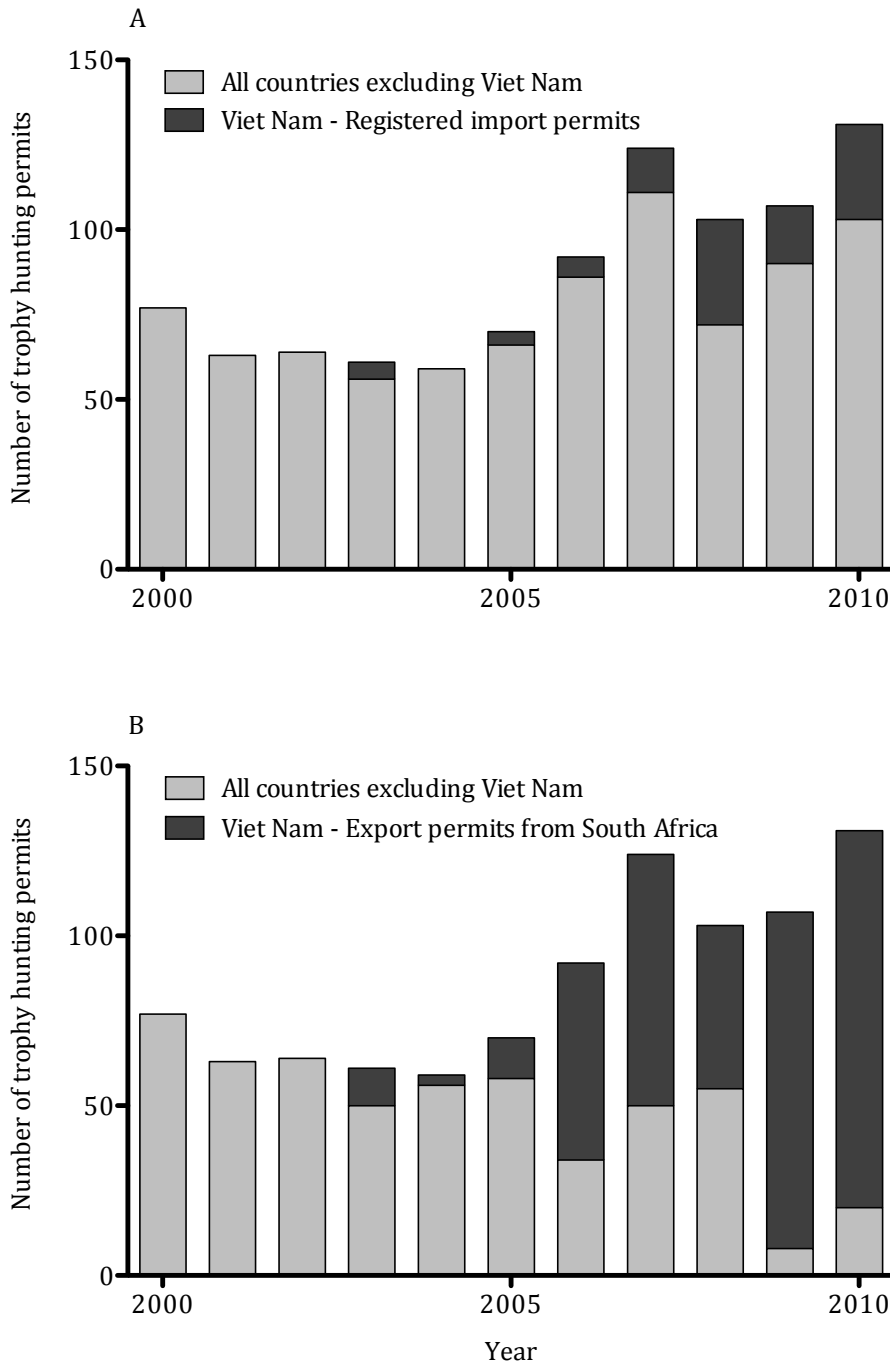


Figure 14. Annual white rhino trophy hunts in South Africa. A) Proportion going to Viet Nam according to Vietnamese import permits; B) Proportion going to Viet Nam according to export permits from South Africa (Sources: CITES trade database; DEA annual reports).

6.2.3.3. *The potential quantity of horn supplied to the illegal international market through pseudo-hunting*

The increase in number of annual pseudo-hunts leading up to 2010 would have resulted in a corresponding increase in the quantity of rhino horn reaching Viet Nam for illicit commercial purposes. If it is assumed that the actual number of pseudo-hunts that occurred was an average of the minimum and maximum estimates from the CITES trade database (Figure 14), and if the average mass of horns of rhinos killed was 8.3 kg (taken from the average horn mass of adult male white rhinos [Pienaar *et al.*, 1991]), the annual average mass of rhino horn that reached Viet Nam in 2010 via pseudo-hunting can be estimated (Table 9).

Table 9. Potential mass of white rhino horn exported with CITES permits from South Africa to Viet Nam as a result of pseudo-hunting

| Year | Minimum number of pseudo-hunts | Maximum number of Pseudo-hunts | Average number of pseudo-hunts | Potential mass (kg) of horn acquired from average pseudo-hunts |
|------|--------------------------------|--------------------------------|--------------------------------|--|
| 2002 | 0 | 0 | 0 | 0 |
| 2003 | 5 | 11 | 8 | 66 |
| 2004 | 0 | 3 | 2 | 17 |
| 2005 | 4 | 12 | 8 | 66 |
| 2006 | 6 | 58 | 32 | 266 |
| 2007 | 13 | 74 | 44 | 365 |
| 2008 | 31 | 48 | 40 | 332 |
| 2009 | 17 | 99 | 58 | 481 |
| 2010 | 28 | 111 | 70 | 581 |

Assumptions: 1) The number of white rhino trophies exported to Viet Nam was an average of the minimum and maximum number of permits listed on the CITES trade database (import permits recorded by Viet Nam = minimum; export permits recorded by South Africa = maximum); 2) All white rhinos pseudo-hunted were adult males with an average horn mass of 8.3 kg (Pienaar *et al.*, 1991).

6.2.3.4. *The influence of the national moratorium on trophy hunting of rhinos*

It is difficult to assess the influence of the national moratorium on trophy hunting of rhinos from the available trophy hunting data because both the CITES trade database and the DEA annual reports only extend to 2010, one year after the moratorium was implemented, so there is insufficient time post-moratorium to detect any trends. Additionally, there are uncertainties regarding how many of these hunts were genuine trophy hunts and how many were pseudo-hunts, which confounds any possible analysis. Furthermore, norms and standards for hunting white rhinos were implemented soon after the national moratorium (Government Gazette No. 32426, Notice No. 756, 20 July 2009) and these would have confounded any possible effect of the moratorium. These norms and standards stopped the

use of NEMBA (TOPS) standing permits or game farm hunting permits for hunting rhinos, and required instead a NEMBA (TOPS) hunting permit. They also stipulated that all permit applications were to go through the Directorate (Regulation and Monitoring Services at DEA) for recommendation, which helped ensure that a hunter could not hunt more than one rhino per year by covertly hunting in different provinces.

The overall number of recorded trophy hunts increased after the national moratorium was implemented (Figure 13), but this may have been the result of an increase in pseudo-hunting (Figure 14) rather than genuine trophy hunting (although, as mentioned above, the actual number of pseudo-hunts is unknown). The national moratorium on trade in rhino horn may, therefore, have contributed to the increase in pseudo-hunts because it cut off a supply of rhino horn for illegal export.

Rhino experts were asked what they thought would happen to the demand for trophy hunting if the national moratorium remained in place or if trade in rhino horn was legalised nationally and internationally. Overall, respondents thought that there would be no change in the demand for trophy hunting, irrespective of whether the moratorium was lifted or not, with the main reason given being that genuine trophy hunters hunt rhinos for the experience, not for commercial trade purposes (Table 10).

Table 10. Expert responses to the question: What do you think would happen to the demand for trophy hunting if the moratorium was: a) NOT lifted? (n=31); b) lifted nationally (n=35); c) lifted internationally (n=35).

| Trade scenario | Responses | Reasons given |
|---|------------------|--|
| <i>A) Moratorium NOT lifted</i> | No change: 66% | <ul style="list-style-type: none"> Genuine trophy hunters hunt rhinos for the experience, not for commercial trade purposes. (A common caveat given here was it would remain unchanged <i>if</i> pseudo-hunting was prevented). |
| | Increase: 21% | <ul style="list-style-type: none"> Pseudo-hunting will increase (these respondents may have answered differently if they had considered only genuine trophy hunting). |
| | Decrease: 13% | <ul style="list-style-type: none"> These respondents thought poaching would increase if the moratorium were not lifted, which would decrease the number of rhinos available to hunt. |
| <i>B) Moratorium lifted nationally</i> | No change: 69% | <ul style="list-style-type: none"> Genuine trophy hunters hunt rhinos for the experience, not for commercial trade purposes. |
| | Increase: 25% | <ul style="list-style-type: none"> Pseudo-hunting will increase (these respondents may have answered differently if they had considered only genuine trophy hunting). |
| | Decrease: 6% | <ul style="list-style-type: none"> Private owners would dehorn their rhinos for commercial reasons, so there might be fewer trophy animals available for sport hunting. |
| <i>C) International trade legalised</i> | No change: 46% | <ul style="list-style-type: none"> Genuine trophy hunters hunt rhinos for the experience, not for commercial trade purposes. |
| | Decrease: 26% | <ul style="list-style-type: none"> Rhinos will be worth more if kept alive to harvest horn rather than sold to sport hunters. Fewer trophy animals will be available to hunt. Demand for pseudo-hunting will drop because other sources of horn will be available. |
| | Increase: 22% | <ul style="list-style-type: none"> Rhino populations will grow and there will be less red tape associated with selling trophy hunts. |
| | Depends: 6% | <ul style="list-style-type: none"> Depends on how hunting regulations change. Depends on price of horn. |

6.2.4. Live sale prices of rhinos

6.2.4.1. The influence of the moratorium on live sale prices of rhinos

Average live sale prices of white rhinos at SANParks and provincial auctions in South Africa increased six-fold over ten years between 1992 (R29,375 per rhino, n=56) and 2002 (R192,382 per rhino, n=106), with an average annual increase of approximately 20% (Figure 15). This occurred while international trade in rhino horn was prohibited, suggesting that private rhino owners had alternative incentives for buying rhinos during this period other than trading horn (such as breeding, trophy hunting, and ecotourism). This period of price increases was followed by a decline to R95,000 per rhino in 2005 (n=137), before the price increased again to a high point of R275,862 per rhino in 2008 (n=119). In 2009, the year of the implementation of the national moratorium on trade in rhino horn, and the year after which the upsurge in poaching started, the live sales price of white rhino dropped again to R212,448 (n=87), and remained at this relatively low level until 2011 (R216,226, n=116). The average live sale prices for white rhino in Ezemvelo KZN Wildlife have closely tracked the national sales prices since 2004, showing a similar low in 2005, high in 2008, and current slightly reduced price around R190,000 per rhino (Figure 15).

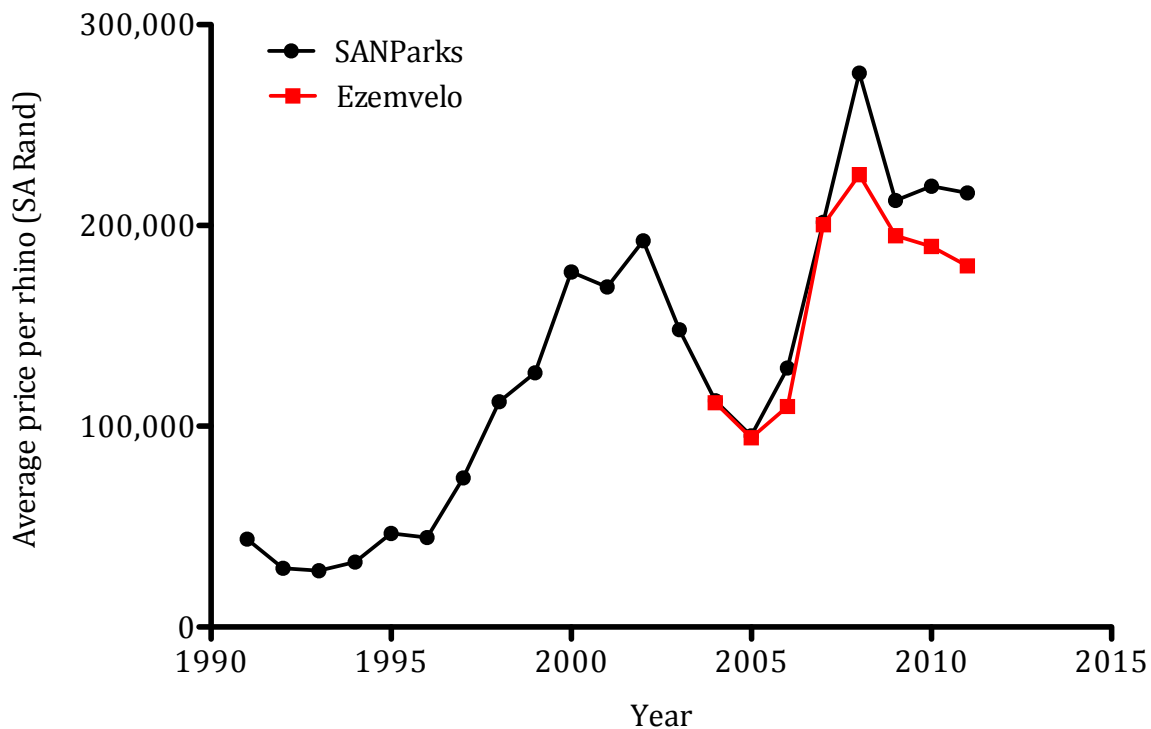


Figure 15. Annual trends in white rhino live sales prices in South Africa (Sources: SANParks and provincial prices supplied by Dr. Flippie Cloete, North West University; Ezemvelo prices supplied by Tony Conway).

This decline in live rhino sale prices of between R35,000 and R63,000 in 2009 may have been the combined result of the increase in poaching in 2008 and the implementation of the national moratorium in 2009. As mentioned above, the price of live rhinos increased considerably between 1992 and 2002 even though international trade in rhino horn was prohibited, so the incentive for private owners to buy rhinos during this time was unlikely to have been trading rhino horn (although they were legally able to sell horn within South Africa). This was also a period of low poaching, however, so private owners did not have to pay high costs to protect their rhinos. After the poaching increase in 2008, costs of protecting rhinos increased for private owners, and many may have needed to find alternative sources of income to compensate. Trading rhino horn legally within South Africa was one such way to obtain funds (regardless of what happened to the horns after they were sold), but the national moratorium put a stop to this. The incentive for private owners to buy more rhinos would then have been relatively low, and this may have led to the decline in live sale rhino prices.

At an Ezemvelo KZN Wildlife game auction in April 2012, live sale prices of white rhinos had increased by an average of R30,000 per rhino compared to the same time the previous year (Zululand Observer, 29 May 2012). This may have been partly a result of the governments' renewed commitment to security but also a positive attitude countrywide towards horn trade (Tony Conway, Ezemvelo, pers. comm.).

Expert respondents were asked what they thought would happen to the price of live rhinos at auctions under three different trade scenarios: a) if the moratorium remained in place; b) if the moratorium was lifted nationally; and c) if international trade was legalised (Table 11). With regards the scenario of lifting the national moratorium, there was no real consensus as to what would happen to the price of live rhinos. However, if the international ban on rhino horn trade was lifted, the large majority of respondents thought this would result in an increased demand for rhinos among private landowners (Table 11).

As this is a financial question, the opinions of the economists were considered particularly valuable here. If the moratorium were to remain in place, six of the eight economists predicted that prices and demand for live rhinos would decline, with the main reason being that incentives to buy rhinos would remain low. If the risks of poaching stay high or increase, the costs of protection will become unsustainable because there are few ways to recuperate money spent on security. Rhinos not only lose their value, but become a financial liability. Under the scenario of the moratorium being lifted nationally, there was no consensus as to what would happen to demand for- and price of live rhinos. Three of the economists were unsure what would happen, two thought prices would stay the same, two thought they would decrease, while one thought prices might increase slightly. As was the case with the response from all the experts, this indicates uncertainty as to what would happen to demand for rhinos if the national moratorium was lifted without international trade. If international trade were legalised as well, however, six of eight economists thought prices and demand would increase substantially because of the renewed financial incentives for private owners to recuperate their investment in rhino conservation and anti-poaching.

Table 11. Expert responses to the question: What do you think would happen to the price of live rhinos at auctions if the moratorium was: a) NOT lifted? (n=48); b) lifted nationally (n=56); c) lifted internationally (n=55).

| Trade scenario | Responses | Reasons given |
|---|----------------|--|
| <i>A) Moratorium NOT lifted</i> | Decrease: 77% | <ul style="list-style-type: none"> The threat of poaching will continue and rhino owners will have to continue paying for anti-poaching. With no means of recuperating costs, this becomes unsustainable. There will be few incentives to keep rhinos and demand will drop. |
| | Unchanged: 15% | <ul style="list-style-type: none"> There are other reasons to keep rhinos (such as ecotourism). |
| | Depends: 6% | <ul style="list-style-type: none"> Depends how effective anti-poaching is. Depends on whether trophy hunting is allowed to continue. |
| | Increase: 2% | <ul style="list-style-type: none"> As rhinos become rarer (due to poaching), they will become more valuable. |
| <i>B) Moratorium lifted nationally</i> | Increase: 41% | <ul style="list-style-type: none"> Private owners would be optimistic at the positive intent shown in the market and by the possibility of international trade in the future. The opportunity to trade illegally might encourage some people to invest more in rhinos. |
| | Decrease: 23% | <ul style="list-style-type: none"> Lifting the moratorium will do nothing to curb poaching. |
| | Unchanged: 20% | <ul style="list-style-type: none"> Little opportunity for trading horn locally, so little will change. |
| | Depends: 9% | <ul style="list-style-type: none"> Depends on price of horn. Depends on state of market. Depends on whether trophy hunting is allowed to continue. |
| | Unsure: 7% | |
| <i>C) International trade legalised</i> | Increase: 89% | <ul style="list-style-type: none"> International trade would incentivise private rhino owners to buy more rhinos. The legal international outlet for horn would create opportunities for owners to make back their money invested in security. |
| | Depends: 7% | <ul style="list-style-type: none"> Depends on how the trade would work. Depends on if rhinos were dehorned. Depends on whether the reward outweighs the risk. |
| | Unsure: 4% | |

6.2.5. Total quantities of rhino horn that have exited South Africa illegally

The total estimated annual mass of rhino horn that exited South Africa in 2011 was nearly 12 times greater than in 2003 (Table 12). The two main reasons for this increase were horns derived from poaching and pseudo-hunting. In 2008, the final year in which legal trade in rhino horn occurred before the implementation of the national moratorium, the maximum possible mass of horn derived from legal domestic trade (i.e. permitted horn that could have been illegally exported) was 99 kg. This was 8% of the total estimated mass of horn that could have been illegally exported through all sources, suggesting that the proportion of the supply of rhino horn that was cut off by the implementation of the moratorium was quite low. However, this does not necessarily mean that the impact of the moratorium on the poaching surge was minor (see section 6.3.2 below for further explanation).

Table 12. Estimates of the mass of horn exiting South Africa from different illegal sources since 2003.

| Year | Horn mass (kg) from permit sales (a) | Horn mass (kg) from illegal sales (b) | Horn mass (kg) from museum thefts (c) | Horn mass (kg) from pseudo-hunting (d) | Horn mass (kg) from poached white rhino (e) | Horn mass (kg) from poached black rhino (e) | Total horn mass (kg) leaving SA |
|------|--------------------------------------|---------------------------------------|---------------------------------------|--|---|---|---------------------------------|
| 2003 | 4 | 25 | 6 | 66 | 112 | 8 | 221 |
| 2004 | 6 | 50 | 12 | 17 | 47 | 5 | 137 |
| 2005 | 32 | 100 | 12 | 66 | 77 | 0 | 287 |
| 2006 | 99 | 175 | 17 | 266 | 142 | 0 | 699 |
| 2007 | 46 | 250 | 29 | 365 | 77 | 0 | 767 |
| 2008 | 99 | 300 | 29 | 332 | 472 | 8 | 1240 |
| 2009 | 0 | ? | 104 | 481 | 696 | 11 | >1292 |
| 2010 | 0 | ? | 145 | 581 | 1947 | 8 | >2681 |
| 2011 | 0 | ? | 58 | ? | 2531 | 50 | >2639 |

Sources: a) extrapolated from Figure 5; b) estimated from section 6.1.5; c) TRAFFIC report; d) Table 9; e) Table 7.

6.3. What has caused the current rhino poaching crisis in South Africa?

6.3.1. The underlying reasons for rhino poaching

The ultimate reason why rhinos have been, and still are being killed is the historically entrenched and persistent demand for rhino horn in Asia. Traditional medicine practices in China that use rhino horn can be clearly dated back to the first century B.C., possibly even

as far back as 2,600 B.C. (Milliken *et al.*, 1993), and these practices are likely to continue to some extent in the future regardless of Western society's attitudes towards them. Before 1993, there were two avenues for trade of rhino horn in China for medicinal purposes (Milliken, 2012). The first was factory produced traditional medicines that were marketed under brand names much like western pharmaceuticals. This trade, which was the larger of the two avenues, appears to have ceased since 1993, after China removed rhino horn from the official pharmacopeia and placed a domestic trade ban on its use (Nowell, 2012). The second was through traditional medicine practitioners who treated patients directly and prescribed rhino horn as a remedy in combination with other natural medicines. This kind of trade continues today, although it is difficult to observe and regulate because it is prohibited, and is thought to be on the decrease (Nowell, 2012). Moreover, it occurred on a smaller scale than the factory manufacture of rhino horn products and may not be very widespread (Tom Milliken, TRAFFIC, pers. comm.). Other Asian countries, including Taiwan, South Korea and, more recently, Viet Nam, also use rhino horn for medicinal purposes, and have at times been major consumers. Currently, Viet Nam appears to be the major illegal importer of rhino horn and is primarily responsible for driving the surge in poaching (Milliken & Shaw, 2012).

Another critical fact is that this demand cannot currently be supplied by any legal sources of rhino horn because of the international trade ban implemented by CITES in 1977. While this ban cannot be blamed for the demand for rhino horn in Asia or for the rhino poaching across Africa that had already extirpated 90% of African rhinos before 1977, it did little to help prevent or even reduce the poaching and, by 1993, had been a failure in safeguarding the survival of rhinos (Milliken *et al.*, 1993). Instead, it forced trade in rhino horn underground, drove the price of horn up sharply (Milliken *et al.*, 1993), and encouraged the involvement of criminal syndicates. Given that consumers in Asia appear willing to pay extremely high prices for rhino horn, these factors may all have contributed to the high levels of rhino poaching.

6.3.2. Why did South Africa not experience increased poaching before 2008?

In attempting to explain why rhino poaching increased in South Africa in 2008, it is first necessary to consider why it did not increase earlier. Between 1960 and 1990, African rhinos were progressively extirpated from range states that once held large populations. In 1981, countries like DRC, Sudan and Uganda had already been mostly poached out, with each having fewer than 300 black rhinos left (and almost no northern white rhinos - Emslie *et al.*, 2006), while Kenya, Tanzania and Zambia were under severe poaching pressure (Milliken *et al.*, 1993). By 1987, all three of the latter countries had <1,000 black rhinos and virtually no white rhinos. Once a major contributor to Africa's black rhino population, Zambia became a centre for rhino poaching in the 1980's (Milliken *et al.*, 1993), and it was from here that poaching incursions into the Zambezi Valley of Zimbabwe started. By 1992 the black rhino population in Zimbabwe had been reduced to <500 animals, the result of the continued trend of poaching moving south, while South Africa was the only range state with >500 black rhinos (although Namibia had a growing population approaching 500). At this time there was concern that South Africa and Namibia might be the next targets for the rhino-poaching onslaught (Milliken *et al.*, 1993) and, given that South Africa had about

6,000 white rhinos at the time, more than the remaining rhinos in the rest of Africa, it is perhaps surprising that this poaching did not transpire as expected.

South Africa did not have large rhino populations before 1980 (<3,000 animals), rendering it unattractive as a potential rhino poaching country simply because rhinos were rare. However, as rhino numbers outside South Africa dropped below 10,000 during the 1980's, they would have become increasingly hard to locate, while the growing rhino population in South Africa would have made rhinos easier to find. Sometime around 1987 the size of the rhino population of South Africa overtook that of the rest of Africa combined.

One likely reason that South Africa avoided the predicted poaching surge in the 1990's was the relatively strong anti-poaching measures in place in areas where rhinos were formally protected. Unlike many other African countries, South Africa had a structured conservation programme that was well funded from ecotourism revenues and government funds and this, along with a strong history of military and conservation expertise, resulted in anti-poaching deterrents that were more effective than anywhere else in Africa. In fact, the South African government used to spend more on rhino conservation than the other African governments combined (Milliken *et al.*, 1993). Many former African rhino range states, including Angola, Chad, Sudan, Uganda, DRC, and Mozambique, had few structured anti-poaching deterrents and limited governmental expenditure on conservation (Emslie, 2011a,b). Many were also exposed to extended periods of civil unrest or civil war, with the concomitant free-flow of automatic weapons, and these periods proved particularly destructive for rhinos, whose horns (along with elephant ivory) were traded for weapons. African range states that still have small rhino populations, including Zimbabwe, Malawi, Tanzania and Kenya, have had, or still have, the basic conservation structures in place for rhino conservation and anti-poaching, but have not implemented them as successfully as South Africa. They have, however, mostly escaped the same level of exposure to civil unrest and free-flow of automatic weapons that were so devastating in many of the previously mentioned countries.

A second possible reason why South Africa avoided the increased poaching was that key consumer markets in Asia, including China and Taiwan, took measures in the 1990's to restrict domestic sales in rhino horn medicines because the USA threatened to apply trade sanctions (via the Pelly Amendment). This may have had a temporary demand-reduction effect for rhino horn and a subsequent decrease in the need for poaching.

A third contributing factor is the possibility that consumer nations in Asia, particularly China, had large stockpiles of rhino horn throughout the 1990's and may have been able to meet their needs without obtaining new horns. In 1989, China had 9,875 kg of rhino horn stocks registered with import/export corporations and drug factories (Martin, 1990); this would have been a minimum figure that excluded unregistered stocks from medicine shops and private collections. At an annual rate of use of 700 kg per year (Martin, 1990), these supplies would have lasted about 14 years, or until 2003. As these horn stockpiles were acquired before China banned the trade in rhino horn, there would have been few restrictions on their use, but if they started running out around 2003, a new supply of rhino horn would have been required. If other consumer nations had equivalent horn supplies, or

were supplied by China, they may also have started seeking new supplies at this time. This period roughly coincided with the upsurge in poaching seen in Zimbabwe in 2003 (see section 6.2.2.3), but after the more vulnerable rhino populations in that country were mostly extirpated by poaching, the threat should have also moved to South Africa.

This did not happen immediately, however, possibly because Asian nationals (particularly Vietnamese) started acquiring rhino horn by purchasing it from private rhino owners, with or without permits (which they then allegedly exported illegally), or by pseudo-hunting white rhinos and exporting the horns on CITES permits (see sections 6.1 and 6.2). In 2003, the mass of horn accumulated from these sources would have only been approximately 100 kg (Table 12), but by 2007, the annual amount obtained might have been as high as 650 kg because pseudo-hunting and purchases of horn from private owners had both escalated. At that time, these supplies may have satisfied the consumer needs in Viet Nam, which had become the major importer of rhino horn (Milliken & Shaw, 2012), because few rhinos were being poached in South Africa.

In June 2007, TOPS regulations under NEMBA (Government Gazette No. 29657, Notice No. 150, 23 February 2007) placed stricter provisions on hunting in South Africa. These restrictions nationalised hunting requirements involving listed threatened or protected species, by requiring a permit to hunt a rhino, as well as prohibiting put and take hunting of rhinos and hunting of rhinos in a controlled (captive) environment, but had limited impact on pseudo-hunting. The poaching surge started in the following year (Figure 12). In 2009, the norms and standards for trophy hunting were implemented (Government Gazette No. 32426, Notice No. 756, 20 July 2009), placing restrictions on trophy hunting and making it harder to obtain horns from pseudo-hunts; the following year witnessed another very large spike in poaching. Although these restrictions appeared ineffective because pseudo-hunting continued to escalate after the regulations were implemented, their effect may have had more to do with a psychological impact than a real supply effect. If the legal restrictions signalled that future horn supplies would be harder to come by, this may have led to an immediate increase in demand from speculators and a subsequent spike in price.

In addition to these hunting restrictions, access to rhino horn by illegal horn traders was further reduced by the implementation of the national moratorium on trade in rhino horn (Government Gazette No.31899, Notice No. 148, 13 February 2009), which would have been another indicator to illegal horn dealers that future supplies would be restricted.

6.3.3. Has there been an increase in demand for rhino horn?

This is a highly contentious question. Demand appears to be a poorly understood concept for at least two reasons. The first is an issue of definition: for many people unfamiliar with economic principles, the term 'demand' for rhino horn is interpreted as the number of people who want to acquire it, i.e. the quantity of horn being sought. But this is just one dimension of demand and fails to account for price, which is the second dimension of demand. Both quantity and price are variable and both fluctuate according to what the other is doing. For example, at low prices, the quantities of rhino horn sought may be high, but as prices increase, the quantities sought decline. Demand should, therefore, be viewed

in terms of market size or value (which is the quantity traded multiplied by the price), rather than just the quantity traded. This common misunderstanding often leads to concerns that the quantities sought will be too large for the supply. For example, the following question is often raised by trade sceptics: *if there are millions of potential consumers of rhino horn in Asia, how can South Africa possibly supply enough horn when there are only 20,000 rhinos available to produce it?* The answer to this question is: *that although there may be millions of 'potential' consumers in Asia, the price of rhino horn will determine how many actually try to buy it.*

A second misunderstanding of demand is the common idea that increasing the supply to a consumer market will stimulate increased demand. There is no empirical evidence to support this concept, however, and, to the best of our knowledge, there are no examples of this happening in the economic literature. If we consider demand in terms of market size, economic principles suggest that it would not change significantly if the supply of rhino horn increased. Although the quantity of horn traded might increase if trade was legalised (because as the supply increases, the price might decrease – but see Annexure 1), it would only do so in proportion to the change in price. So if the price did not decrease too much, the quantity sought would not outstrip the supply. Additionally, even if the price of horn decreased and the quantity traded increased, this would not necessarily lead to an increase in poaching because illegal trade in rhino horn would be less profitable. It should be noted here that it is not impossible for the market size to expand if trade were legalised, but any such expansion would not be due to changes in supply. The only way to find out what would happen would be to legalise trade; currently this has not been studied because trade is illegal.

An important contributing factor to this debate is the issue of price elasticity of rhino horn. Although there has been no direct research on the price elasticity of rhino horn (it is difficult to study because trade is illegal), it can be inferred to be price inelastic because certain consumers are willing to pay increasingly high prices to obtain it. As an example, an important traditional use for rhino horn is to treat fever (Milliken *et al.*, 1993); users of rhino horn for this ailment could switch to a cheaper, modern pharmaceutical product such as paracetamol (acetaminophen) to treat the fever, but they do not. Rather, they continue using the more expensive rhino horn. (See Annexure 1 for alternative potential elasticity's for rhino horn.)

When trade in a product is legal, an increase in price usually leads to a decrease in quantity demanded, with little change in market size. However, when trade in a price-inelastic product is made illegal (by placing a trade ban on that product), the resulting price increase may be disproportionately large relative to the decrease in quantity demanded, which would have the perverse effect of increasing market size. This would be counter-productive to the aims of the ban. A commonly used example of this kind of perverse effect is the alcohol prohibition enacted in the USA in the 1920's that had the aim of reducing alcohol consumption. The outcome was an increase in market size and concomitant upsurge in criminal involvement.

This still leaves the question, however, of whether the market size for rhino horn has increased for other reasons. Two lines of evidence have been proposed as indicators that it might have increased. The first is the surge in poaching: the quantity of illegally exported rhino horn derived from poaching and pseudo-hunting in South Africa has increased considerably since 2008 (Table 12), but the price of horn in the end-user market has not declined. As there was relatively little rhino poaching in the rest of Africa in the 15 years before this (even if the increase poaching that started in 2003 in Zimbabwe is considered), this could lead to the conclusion that there must have been an increase in market size. However, this conclusion is potentially spurious for reasons described in section 6.3.2. First, there was a potential lull in horn trade in the 1990's brought about by the trade restrictions imposed by Asian countries at the time, and these might have temporarily decreased the market size for legal reasons. Desire for rhino horn is unlikely to have decreased given the historical use that has been around for thousands of years. Second, Asian countries are known to have had large stockpiles of rhino horn in the 1990's, and could have been using those up during the period immediately after domestic restrictions were implemented. So the increase in horn requirements that led to the current poaching surge may have simply been old markets resurfacing and requiring a new supply of horn, rather than additional markets emerging.

A second line of evidence for an increase in market size in the last decade, and one that is considerably more compelling, is the upsurge in use of rhino horn in Viet Nam. Viet Nam has experienced considerable economic growth over the last decade, and this has increased the disposable income of many potential end-users who could not previously afford to buy rhino horn. This has led to the expansion of old traditional medicine markets (similar to Traditional Chinese Medicine) as well as the opening up of new, non-traditional markets (Milliken & Shaw, 2012). Among the newer, non-traditional users are wealthy individuals using horn as a rejuvenating, detoxifying beverage (Milliken, 2012). These horn users are status seekers that measure social self-worth against the consumptive habits of their peers; in sociological terms, this is known as "face consumption". Another non-traditional medicine use that has arisen within the last decade is the treatment of life threatening illnesses like cancer (Milliken, 2012). Desperate individuals that believe rhino horn may cure cancer will obviously be willing to pay high prices to obtain it. These new markets for rhino horn and the overall upsurge in use in Viet Nam are likely to be playing some role in the recent surge in rhino poaching in South Africa (Milliken & Shaw, 2012), but the relative contribution of this demand to the poaching increase is not yet known.

(As an aside, it is worth noting that if *international* trade were legalised and rhino horn became cheaper and more accessible in Viet Nam, the face consumption described above (which is similar to conspicuous consumption) might decrease or disappear completely because rhino horn would no longer be considered a luxury item. However, legalising *national* trade in rhino horn would have minimal effect on horn price (because it would still be difficult to obtain), so face consumption would likely continue.)

6.3.4. Expert opinion on the causes of the poaching surge

When rhino experts were asked their opinion on the causes of the spike in rhino poaching within South Africa, 73% of 59 respondents provided at least three factors that they thought had played a role, and many directly stated that there were multiple causes or contributing reasons involved. The most commonly cited factors included the following: the norms and standards for trophy hunting closed the loopholes for pseudo-hunting and restricted the supply of horn to Asia through CITES export permits; the high demand for rhino horn in Asia; the high price of rhino horn; the strengthening Asian economies and increased disposable incomes of Asians and; the increasing involvement of criminal syndicates in illegal international trade (Table 13). All respondents were asked their opinion on whether the poaching had been influenced by the implementation of the national moratorium or the restrictions on trophy hunting imposed by TOPS regulations under NEMBA and norms and standards, but all the other answers provided by the respondents were unprompted by the interviewer.

Table 13. Expert responses to the question: What has caused the increase in poaching observed during the last 4 years in South Africa?

| Percentage of respondents | Explanation given by rhino experts for the surge in poaching |
|----------------------------------|---|
| 47 | The norms and standards for trophy hunting closed the loopholes for pseudo-hunting and restricted the supply of horn to Asia through CITES export permits. To make up the shortfall in supply rhinos were illegally killed for their horns. |
| 44 | There was a higher demand for rhino horn in Asia. |
| 44 | The price of horn was very high and created large incentives for poachers. |
| 42 | There was an increase in disposable income for many Asians, making rhino horn affordable to more potential end-users. |
| 34 | Criminal syndicates became involved, recruited more poachers and decreased the trafficking time for illegal horn to reach Asia. |
| 30 | The national moratorium cut off a supply route for rhino horn to get to Asia and made horn harder to acquire (horn that was legally bought in South Africa but then illegally exported). To make up the shortfall in supply rhinos were illegally killed for their horns. |
| 24 | Anti-poaching tactics and law enforcement were inadequate to catch, prosecute or deter poachers. |
| 17 | There were few rhinos left in other African rhino range states, so poaching shifted to South Africa where rhino numbers were relatively high. |
| 15 | Stockpiles of rhino horn in Asia were depleted, so new sources of horn were required. |
| 15 | Corruption in both government and private owner sectors allowed information on the whereabouts of rhinos to be leaked to criminal syndicates. |
| 12 | Poverty in Africa resulted in many desperate people willing to risk their lives to make money selling poached horns. |
| 12 | International ports were inadequately monitored to prevent smuggling and made it easy to export horns illegally. |
| 10 | There were insufficient government resources to pay for enough anti-poaching rangers and law-enforcement officials to protect rhinos. |
| 7 | There were growing numbers of Asians living in Africa, providing relatively easy access to protected areas. |

Seventy-three percent of respondents indicated that there were multiple reasons for the surge in poaching and offered at least three potential causes. Percentages in the table do not, therefore, add up to 100. Note: respondents were asked if the national moratorium and restrictions on trophy hunting (NEMBA, norms and standards) influenced the poaching, but all other answers were unprompted.

6.5. The financial costs of protecting rhinos

6.5.1. The costs of protecting rhinos on private land

To get a measure of anti-poaching effort on farms, private rhino owners were asked to provide an annual protection cost per unit area: 30 out of 54 respondents provided figures. The mean annual cost of protecting rhinos on private land was R257/ha/year (SE \pm R128/ha/year; range R10 - R3,840/ha/year), while the median cost was R85/ha/year (Table 14). The median is a better measure in this case because the data are highly skewed, with a small number of properties with high costs per hectare having a large impact on the mean. The lowest annual cost of R10/ha/year was for a very large property that uses basic anti-poaching methods, while the highest cost of R3,840/ha/year was for a very small property that acts as a holding facility and quarantine area for multiple rhino owners. The latter property employed a security company to protect its rhinos and constituted an extreme outlier in terms of costs per hectare. The property with the second highest protection costs per hectare (R857/ha/year) was also a very small property functioning as a breeding facility. In general, properties with the highest costs per hectare either employed security companies to protect their rhinos or had full-time armed guards patrolling 24 hours a day. Protection costs in Ezemvelo reserves were R250-300/ha/year (R25,000-30,000/km²/year) in early 2012 (Tony Conway, Ezemvelo, pers. comm.), which is very similar to the mean cost to private owners.

Table 14. The costs of protecting rhinos on private land in South Africa. (Note that the mean and median protection costs per property were derived from the raw data, not from the means and medians of protection costs per ha and property size presented below.)

| | Cost (Rand) |
|---|-------------|
| <i>Mean</i> annual protection cost per ha | R 257 |
| <i>Mean</i> annual protection cost per property | R 820,066 |
| <i>Mean</i> property size | 13,654 ha |
| <i>Median</i> annual protection cost per ha | R 85 |
| <i>Median</i> annual protection cost per property | R 310,500 |
| <i>Median</i> property size | 6,350 ha |

There was a trend for larger properties to have lower protection costs per hectare than smaller properties (Pearson $r = -0.54$, $P = 0.002$) (Figure 16a), but there was no relationship between the costs per hectare and the number of rhinos owned (Kruskal-Wallis $H = 2.39$, $P = 0.495$) (Figure 16b).

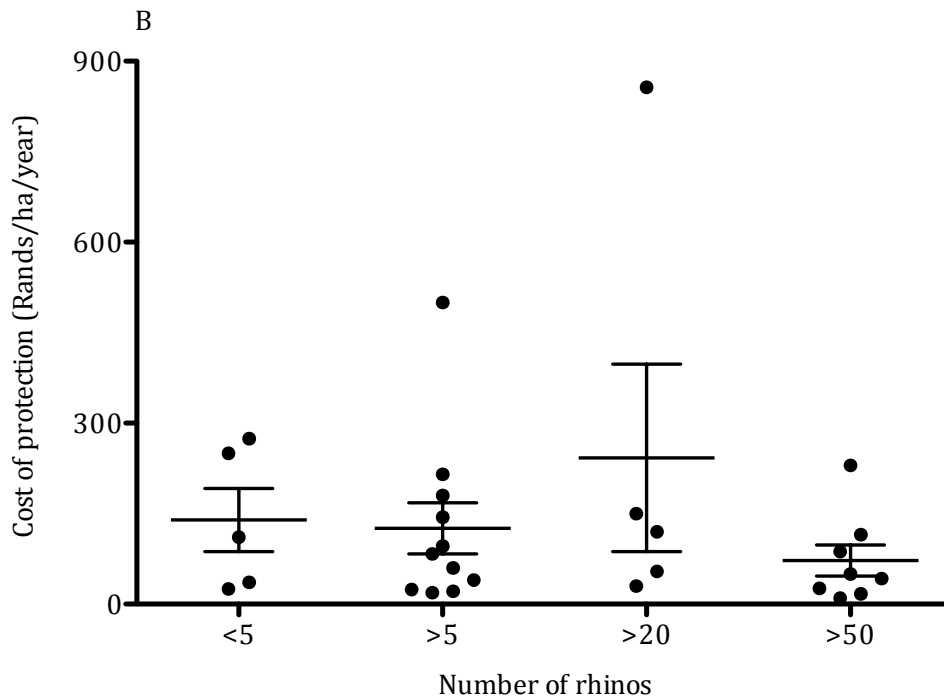
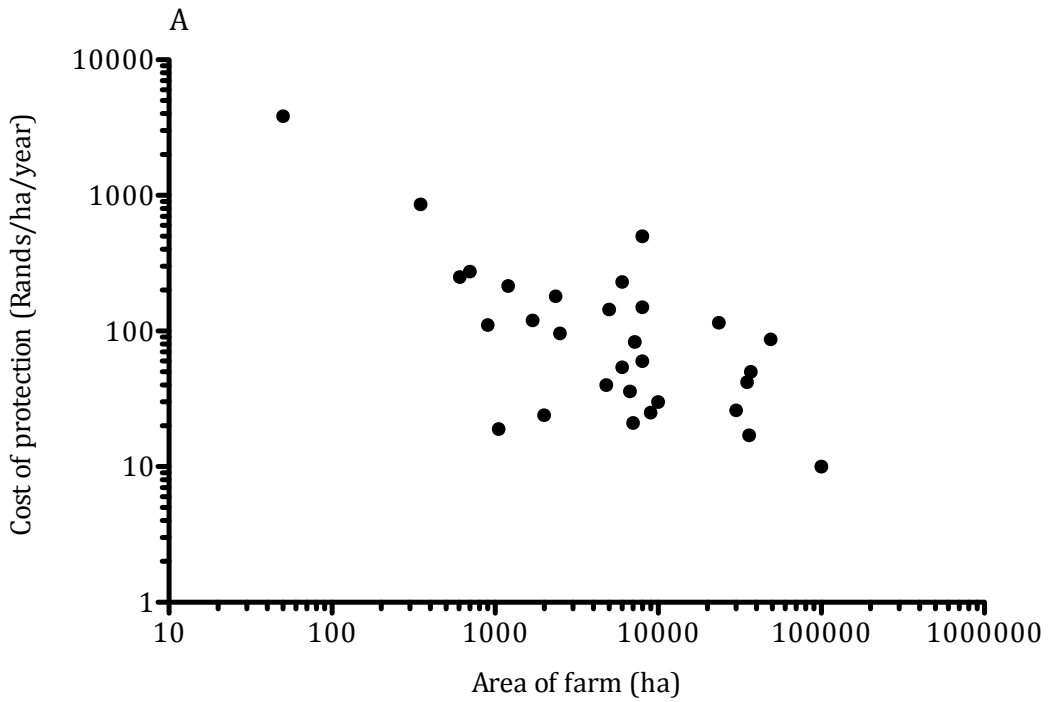


Figure 16. Annual costs of anti-poaching security on private land: a) costs vs. the area used for rhinos on private land (note Log_{10} axes); b) costs vs. the number of rhinos owned (error bars represent mean and SEM) (note that figure b excludes the property with the highest costs per hectare to make the graph legible). (Source: private rhino owner surveys.)

The median annual expenditure for protecting rhinos on the 30 private properties was R310,500 (range R20,000 to R4,245,360). Although these costs cover general anti-poaching for all species on game farms and private reserves, the majority of anti-poaching costs are incurred due to the threat of rhino poachers. During the survey, private owners were asked if their anti-poaching effort had remained constant over the last 10 years. Eighty-one percent of the 48 owners that answered this question indicated that their anti-poaching costs had escalated in the last four years due to the spike in poaching and, in 19% of cases (nine owners), anti-poaching started as a direct result of the poaching spike (having not viewed it as necessary before 2008).

7. THE POTENTIAL MARKET FOR RHINO HORN IN SOUTH AFRICA

7.1 Assessment of the potential national supply of rhino horn

7.1.1. Data limitations

Rhino horn stockpile information is currently considered very sensitive in South Africa due to the high risk of theft. In addition to the strong incentives to poach rhinos, the high value of horn makes stealing rhino horns from other sources very lucrative. Many museums around the world have had their rhino horn exhibits stolen, and there have been cases of private rhino owners having their horn stocks stolen by armed criminals. This makes storing rhino horn a serious security risk, so managers of such stockpiles try to keep information about the quantity and whereabouts of their stocks as secret as possible.

The most recent rhino horn stockpile information for South Africa was obtained from IUCN AfRSG data (Knight, 2010). This includes an estimate of privately owned stockpile figures, which are only accurate for registered horns. Estimates of the number of horns that *should* have accumulated in private stockpiles suggest that some rhino owners have not registered their horns (although they are legally obliged to do so in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004)).

7.1.2. Current horn stockpiles

The most recent estimate available for the total weight of rhino horn kept in registered stockpiles in South Africa (state and private) was 15,152kg, as of 31 December 2010 (Knight, 2010). This was an increase of 1,444 kg from the previous estimate of 13,708 kg in 2009 (Milliken *et al.*, 2009). If this increase is extrapolated for one extra year, there should have been approximately 16,596 kg of rhino horn in stockpiles in South Africa at the end of 2011. In early 2012, SANParks had a total of 4,707 kg of horn stockpiled (Peter Novellie, SANParks, pers. comm.), which is approximately 28% of the total.

Estimates have been made of the amount of rhino horn that *should* be in private stocks, given the number of rhinos on private land and the predicted rate of horn accumulation (See section 6.1.5), and these can be compared to the amount of horn that is officially registered with NEMBA (TOPS) permits. In 2008, the amount in private stockpiles should have been approximately 3,500 kg, an estimate that does not include any accumulation

from dehorning (see section 6.1.5 for the explanation for this estimate). Extrapolating from this figure using the numbers of rhinos on private land and the expected rate of natural mortality (2%), at the end of 2010 there should have been 4,008 kg in private stocks (Table 15). The quantity reported at this time from four provinces, representing ~80% of rhinos on private land, was 1,805 kg (Knight, 2010). This extrapolates to 2,166 kg of horn registered in private stockpiles in all provinces, leaving a shortfall of 1,842 kg.

Table 15. Estimation of white rhino horn accumulation in private stockpiles.

| Year | White rhino population size | Natural mortality rate | Horn accumulation |
|-------------|------------------------------------|-------------------------------|---|
| 2008 | 4,174 | | 3,500kg |
| 2009 | $4,174 \times 1.06 = 4,424$ | $4,424 \times 0.02 = 88$ | $3,500 + (88 \times 2.79) =$ 3,746 kg |
| 2010 | $4,424 \times 1.06 = 4,690$ | $4,690 \times 0.02 = 94$ | $3,746 + (94 \times 2.79) =$ 4,008 kg |
| 2011 | $4,690 \times 1.06 = 4,971$ | $4,971 \times 0.02 = 99$ | $4,008 + (99 \times 2.79) =$ 4,284 kg |

Assumptions: population growth = 6%; The average mass of horn collected from natural mortalities on private land = 2.79kg (both horns), (estimated from Table 16 and taking into account mortality rates of different age groups. Data from Owen-Smith, 1988 and Pienaar *et al.*, 1991).

These estimates do not account for any horn accumulated as a result of dehorning rhinos. When asked if they dehorned their rhinos, 37% of 52 private owners indicated that they *did* dehorn. If this percentage is extrapolated out to all owners, as many as 148 private rhino owners might have dehorned rhinos over the last few years. The estimates of horn masses given in Table 15 are, therefore, minimum amounts.

7.1.3. Potential future horn supplies

7.1.3.1 Natural mortalities

To estimate the quantity of horn that might be collected from rhinos that die naturally, four estimates are ideally needed:

1. Population size. This has to take into account population growth rates. For white rhinos, the national growth rate has been approximately 6.5% over the last 10 years (estimated from IUCN AfRSG past population estimates). However, the population of white rhinos in the Kruger National Park is currently fluctuating around 10,500 animals and does not appear to be growing (Sam Ferreira, SANParks, pers. comm.). As these rhinos represent more than half the current national population of white rhinos, 6.5% growth may be an overestimate. The population growth in the Kruger National Park is affected by a number of factors, including off-take for management

reasons (which has been approximately 1.6% of the population since the 1990's, but has been reduced to almost zero due to the recent poaching increase) and poaching. If the rate of poaching continues to escalate in Kruger, the point may soon be reached where the population starts to decline (Sam Ferreira, SANParks, pers. comm.). For the purposes of estimating future horn supplies in this report, it was assumed that the population of white rhinos in Kruger would not grow over the next 10 years, while the remaining population (both provincial and private) would grow at 6% per year. For black rhinos, a conservative overall population growth rate of 5% was assumed.

2. The percentage breakdown of deaths among different age groups (no distinction was made between sexes) (Table 16). For both state and privately owned populations of white rhinos, this was estimated using natural mortality rates determined by Owen-Smith (1988). For black rhinos, these figures are unknown, so were assumed to be similar to white rhinos;
3. The average mass of horn expected from these categories (Table 16). These have been estimated by Pienaar *et al.* (1991) for Kruger National Park and Hluhluwe-iMfolozi Game Reserve;
4. The recovery rate of carcasses (Table 16). Little work has been done on quantifying the recovery rate of rhino carcasses for large conservation areas such as Kruger National Park, although a project is currently underway in Kruger National Park to provide some of these insights (Danie Pienaar, SANParks, pers. comm.). On private land and small reserves where many rhinos are monitored individually, recovery rates are likely to be very high (assumed to be 75% for this study).

Potential annual future horn accumulation from natural mortalities of white rhino on state and provincial land is shown in Table 17. As carcass recovery rates are unknown, three horn mass recovery rates were estimated. Potential annual future horn accumulation from natural mortalities of white rhino on private land is shown in Table 18. As carcass recovery rates are expected to be higher on private than on state land, a 75% recovery rate was estimated. Potential annual future horn accumulation from natural mortalities of black rhino on all land is shown in Table 19.

Table 16. Factors used to estimate potential future rhino horn accumulation from natural mortalities in both white and black rhinos.

| Category | Annual mortality estimates | % of total population | % of natural mortalities | Average horn mass (kg) |
|------------------------|-----------------------------------|------------------------------|---------------------------------|-------------------------------|
| White rhinos | | | | |
| Adults | 2.1% | 46% | 26% | 5.9 |
| Sub-adults | 3.0% | 32% | 25% | 4.0 |
| Calves | 8.3% | 22% | 49% | 0.5 |
| Average carcass | | | | 2.79 |
| Black rhinos | | | | |
| > 2 years age | 2.5% | 78% | 55% | 2.65 |
| Calves | 8.3% | 22% | 45% | 0.5 |
| Average carcass | | | | 1.61 |

White rhino estimates were taken from Owen-Smith (1988) and Pienaar *et al.* (1991). Black rhino estimates were taken from Conway & Goodman (1989) and Pienaar *et al.* (1991). Black rhino mortality rates were assumed to be similar to white rhinos. The horn mass per average carcass estimates were based on the % of natural mortalities and the average horn mass for each age category.

Table 17. Potential future annual horn accumulation from natural mortalities of white rhinos on state and provincial reserves (excluding privately owned rhinos).

| Year | Total number of rhinos | Natural deaths per year | Total horn mass per year (kg) | Horn mass (kg) 25% recovery | Horn mass (kg) 50% recovery | Horn mass (kg) 75% recovery |
|-------------|-------------------------------|--------------------------------|--------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| 2011 | 14,599 | 547 | 1,525 | 381 | 763 | 1,144 |
| 2012 | 14,838 | 556 | 1,550 | 388 | 775 | 1,163 |
| 2013 | 15,091 | 566 | 1,577 | 394 | 788 | 1,182 |
| 2014 | 15,359 | 576 | 1,605 | 401 | 802 | 1,203 |
| 2015 | 15,643 | 587 | 1,634 | 409 | 817 | 1,226 |
| 2016 | 15,944 | 598 | 1,666 | 416 | 833 | 1,249 |
| 2017 | 16,264 | 610 | 1,699 | 425 | 850 | 1,274 |
| 2018 | 16,602 | 623 | 1,735 | 434 | 867 | 1,301 |
| 2019 | 16,961 | 636 | 1,772 | 443 | 886 | 1,329 |
| 2020 | 17,342 | 650 | 1,812 | 453 | 906 | 1,359 |

Assumptions: 1) Population growth rate for the Kruger National Park = zero, population growth rate for other state parks = 6%; 2) Mortality rate = 3.75% (estimated from Table 16 using data from Owen-Smith, 1988); 3) Average horn mass per rhino carcass = 2.79kg (estimated from Table 16 and taking into account mortality rates of different age groups. Data from Owen-Smith, 1988). The recovery rate of carcasses in large Parks is unknown, so low medium and high rates are estimated.

Table 18. Potential future annual horn accumulation from natural mortalities of white rhinos on private land.

| Year | Total number of rhinos | Natural deaths per year | Total horn mass per year (kg) | Horn mass (kg) 75% recovery |
|-------------|-------------------------------|--------------------------------|--------------------------------------|------------------------------------|
| 2011 | 4,971 | 99 | 277 | 208 |
| 2012 | 5,269 | 105 | 294 | 221 |
| 2013 | 5,585 | 112 | 312 | 234 |
| 2014 | 5,921 | 118 | 330 | 248 |
| 2015 | 6,276 | 126 | 350 | 263 |
| 2016 | 6,652 | 133 | 371 | 278 |
| 2017 | 7,051 | 141 | 393 | 295 |
| 2018 | 7,475 | 149 | 417 | 313 |
| 2019 | 7,923 | 158 | 442 | 332 |
| 2020 | 8,398 | 168 | 469 | 351 |

Assumptions: 1) Population growth rate = 6%; 2) Mortality rate = 2% (Hall-Martinet *al.*, 2009); 3) Average horn mass per rhino carcass = 2.79kg (estimated from Table 16 and taking into account mortality rates of different age groups. Data from Owen-Smith, 1988). The recovery rate of carcasses is assumed to be higher than in large Parks, so only high rates are estimated.

Table 19. Potential future annual horn accumulation from natural mortalities of black rhinos on all land.

| Year | Total number of rhinos | Natural deaths per year | Total horn mass per year (kg) | Horn mass (kg) 25% recovery | Horn mass (kg) 50% recovery | Horn mass (kg) 75% recovery |
|-------------|-------------------------------|--------------------------------|--------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| 2011 | 2,011 | 40 | 60 | 15 | 30 | 45 |
| 2012 | 2,112 | 42 | 63 | 16 | 32 | 48 |
| 2013 | 2,217 | 44 | 67 | 17 | 33 | 50 |
| 2014 | 2,328 | 47 | 70 | 17 | 35 | 52 |
| 2015 | 2,444 | 49 | 73 | 18 | 37 | 55 |
| 2016 | 2,567 | 51 | 77 | 19 | 38 | 58 |
| 2017 | 2,695 | 54 | 81 | 20 | 40 | 61 |
| 2018 | 2,830 | 57 | 85 | 21 | 42 | 64 |
| 2019 | 2,971 | 59 | 89 | 22 | 45 | 67 |
| 2020 | 3,120 | 62 | 94 | 23 | 47 | 70 |

Assumptions: 1) Population growth rate = 5%; 2) Mortality rate = 2%; 3) Average horn mass per rhino carcass = 1.61kg (mortality rates of black rhinos in wild populations were assumed to be the same as for white rhinos).

7.1.3.2. Break-offs

Horn break-offs sometimes occur when rhinos knock or press their horns against hard surfaces or heavy objects, such as metal crates during translocations or other rhinos during fights (Chap Masterson, Lowveld Rhino Trust, pers. comm.). In cases where animals knock the side of a transport crate in irritation, it is most commonly splinters or shards of horn that break-off from the tip, leaving the main horn section behind. A more common circumstance occurs when the animal is a little over-sedated during transport, causing it to lean much of its weight against the side of the crate. If the animal leans on its horn during this time, it may damage the subjacent tissue attachments and lever the entire horn off at the base. In most instances when this occurs, the horn will be found inside the crate, but occasionally the horn does not fall off until after the rhino is off-loaded, and in these cases it may not be found. Although there is no substantiated incidence-data, the probable frequency with which horn loss occurs during translocation varies between about 0.25% and 3% and is partly dependent on the diligence of veterinary care during capture and transit. It is also dependent on the species, age and condition of the animal, which affects how “loose” or “firm” a horn may be attached in the first place. Pre-pubescent or very old animals in poor body condition tend to have looser horns than prime adult animals in good condition, while black rhino horns tend to be more firmly attached and stronger/harder in substance than white rhino horns.

Potential annual future horn accumulation from break-offs can be estimated from the expected number of translocations that would take place every year and the likely proportion of these resulting in break-off incidents. Kruger National Park sold approximately 100 white rhinos every year before the poaching crisis started (in some years they sold more, but an average of 100 will be assumed here) (Peter Novellie, SANParks, pers. comm.), while Ezemvelo sold an average of 72 rhinos per year over the last 5 years (Tony Conway, Ezemvelo, pers. comm.). The other eight provinces sold or donated about 60 rhinos in 2011, while large private reserves sold 40 – 50. This makes a total of approximately 280 white rhinos translocated every year, excluding private owners with smaller herds. If these rhinos were transported twice before reaching their final destination, this makes 560 translocation events per year. If break-offs occur on average in 1.5% of these cases, then 8 horns would become available every year. If an average anterior horn for white rhinos weighs 4.3 kg (Pienaar *et al.*, 1991), this would produce 34 kg of horn per year.

If 100 black rhinos are translocated every year, with an average of 1.5% of these resulting in whole-horn break-offs, and an average black rhino anterior horn weighs 1.72 kg (Pienaar *et al.*, 1991), break-offs for black rhinos would produce about 3 kg of horn per year.

7.1.3.3. De-horning wild rhinos

Kruger National Park will only dehorn rhinos in extreme circumstances, such as for translocation or for biological reasons (e.g. when there is an aggressive bull that regularly kills other rhinos). The Park does not dehorn rhinos for anti-poaching purposes and will never do so for commercial gain (Peter Novellie, SANParks, pers. comm.). Out of the seven provinces that have rhinos in state reserves, five do *not* dehorn rhinos (KwaZulu-Natal,

Limpopo, North West, Eastern Cape, and Free State), while one (Mpumalanga) dehorn all its rhinos in reserves that are not in an open system with Kruger National Park. Northern Cape did not participate in the survey, while Western Cape and Gauteng do not have any rhinos in provincial reserves.

None of the expert respondents were in favour of dehorning wild rhinos in state game reserves for the purposes of commercial sale of horn, although many conceded that dehorning could be a tool for reducing incentives for poaching. The possibility of acquiring rhino horn for future commercial trade through dehorning wild rhinos on state owned land has, therefore, not been considered in this report.

While many of the large private reserves can also be considered “wild”, they have been included in the farming section below because the management goals of these private reserves are often different to the management goals of state reserves and because some private reserves regularly dehorn their rhinos for security reasons.

7.1.3.4. Farming rhino for de-horning

In 2008, there were 395 private rhino owners in South Africa (Hall-Martin *et al.*, 2009), holding nearly 4,200 white rhinos. These private rhino owners, along with their rhinos, are the most likely source of a renewable horn supply if dehorning is ever to be used commercially. As mentioned previously, 37% of 52 private owners surveyed indicated that they dehorned their rhinos to some extent. This extrapolates to a total of 148 private rhino owners in South Africa who may have dehorned rhinos over the last few years.

Private owners were also asked the following two questions:

- 1) If trade were legalised (either nationally or internationally), would you buy or sell horn?
- 2) If trade were legalised (either nationally or internationally), would you consider dehorning rhinos on a regular basis to sell horn?

Overall, 51% of private owners said they would consider dehorning rhinos for commercial trade if the moratorium were lifted, while 65% said they would dehorn if international trade were legalised (Table 20). The difference stems from some owners believing national trade (when the moratorium is lifted locally only) is not the right thing to do or would not solve the poaching crisis. When the large private owners were considered alone (owners with >50 rhinos), the number that would dehorn rhinos for commercial purposes did not change even if international trade was legalised. This was because these large owners/managers represented large ecotourism ventures for which a dehorned rhino would be counterproductive to attracting clients. Note, however, that all seven private owners with >50 rhinos would consider selling horn if *international* trade were legalised, although they would only sell horns derived from natural deaths.

Table 20. Percentages of private rhino owners that currently dehorn, that would consider dehorning on a regular basis for commercial purposes, and that would sell horn.

| Number of rhinos owned | % that currently dehorn (n=49) | % that would consider dehorning for commercial purposes if national moratorium lifted (n=43) | % that would sell horn if national moratorium lifted (n=44) | % that would consider dehorning for commercial purposes if international trade was legal (n=46) | % that would sell horn if international trade was legalised (n=44) |
|-------------------------------|---------------------------------------|---|--|--|---|
| < 5 | 33 | 57 | 88 | 71 | 88 |
| > 5 | 25 | 50 | 48 | 65 | 76 |
| > 20 | 78 | 67 | 63 | 89 | 100 |
| > 50 | 29 | 29 | 86 | 29 | 100 |
| Average | 37 | 51 | 64 | 65 | 86 |

The potential horn accumulation that could be acquired from dehorning live white rhinos on private land in 2012 would be 1,677 kg if domestic trade were legalised and 2,137 kg if international trade were legalised (Table 21). Peer-reviewed publications generally only provide horn growth rates in terms of horn length (Pienaar *et al.*, 1991; Morkel & Geldenhuys, 1993; Kock & Atkinson, 1994; Rachlow & Berger 1997). A general pattern found by all these authors was that, in terms of length, horns grow faster in young animals, but in terms of mass (when the circumference of the base of the horn was taken into account), adult horns grow faster. Male horns grow faster than females (adult male minimum growth = 1 kg per year; adult female minimum growth = 0.6 kg per year; John Hume, private rhino owners, pers. comm.). This was taken into account in the growth estimates by using an average of 0.8 kg per rhino. Diet may play a minor, but insignificant role in wild populations, while the effect of supplementary feeding is unknown. Habitat plays a role in horn length in terms of how often a rhino “rubs” its horns: in arid areas or areas with few suitable objects to rub horns on (e.g. trees, logs, poles etc.), rhino horns (especially posterior horns) tend to grow longer (Danie Pienaar, SANParks, pers. comm.). Rhinos in captivity appear to get bored and have a tendency to rub their horns more frequently on objects within their pens, and this behaviour sometimes leads to captive rhinos showing atypical or deformed horns.

Table 21. Potential future annual horn accumulation from dehorning live white rhinos on private land.

| Year | Number of white rhino | National trade | | | International trade | | |
|------|-----------------------|---------------------------|-------------------------|----------------------|---------------------------|-------------------------|----------------------|
| | | Maximum available numbers | Maximum number dehorned | Total horn mass (kg) | Maximum available numbers | Maximum number dehorned | Total horn mass (kg) |
| 2012 | 5,269 | 2,687 | 2,096 | 1,677 | 3,425 | 2,672 | 2,137 |
| 2013 | 5,585 | 2,849 | 2,222 | 1,778 | 3,631 | 2,832 | 2,265 |
| 2014 | 5,921 | 3,019 | 2,355 | 1,884 | 3,848 | 3,002 | 2,401 |
| 2015 | 6,276 | 3,201 | 2,497 | 1,997 | 4,079 | 3,182 | 2,545 |
| 2016 | 6,652 | 3,393 | 2,646 | 2,117 | 4,324 | 3,373 | 2,698 |
| 2017 | 7,051 | 3,596 | 2,805 | 2,244 | 4,583 | 3,575 | 2,860 |
| 2018 | 7,475 | 3,812 | 2,973 | 2,379 | 4,858 | 3,790 | 3,032 |
| 2019 | 7,923 | 4,041 | 3,152 | 2,521 | 5,150 | 4,017 | 3,214 |
| 2020 | 8,398 | 4,283 | 3,341 | 2,673 | 5,459 | 4,258 | 3,406 |

Assumptions: 1) Population growth rate = 6% (this will be heavily dependent on poaching because if the poaching continues at the current rate or higher, Kruger will not sell any rhinos and private owners may be less inclined to buy); 2) Maximum available numbers = total number of rhinos on private land multiplied by the average % of private owners that would consider dehorning for commercial purposes; 3) Maximum number dehorned = maximum available numbers multiplied by the number of adult or sub-adult rhinos in a population (assumed to be 78%); 4) Total horn mass = maximum number dehorned multiplied by 0.8 kg (average annual horn growth of an adult rhino); 5) Private owners would dehorn *all* available adult animals.

The potential minimum horn accumulation that could be acquired from all sources of horn in 2012, including natural mortalities, breakoffs and dehorning would be 2,339 kg (Table 22). The maximum horn accumulation for 2012 would be 3,606 kg. It was assumed that black rhinos would not be dehorned for commercial purposes.

Table 22. Minimum and maximum future horn accumulation for all rhinos in South Africa.

| Year | Horn mass (kg) from state white rhinos – natural mortalities | Horn mass (kg) from private white rhinos – natural mortalities | Horn mass (kg) from all black rhinos – natural mortalities | Horn mass (kg) from break-offs (both species) | Horn mass (kg) from de-horned white rhino | Total annual horn mass (kg) accumulation |
|------|--|--|--|---|---|--|
| | 25% recovery | 75% recovery | 25% recovery | | National trade | Minimum |
| 2012 | 388 | 221 | 16 | 37 | 1,677 | 2,339 |
| 2013 | 394 | 234 | 17 | 37 | 1,778 | 2,460 |
| 2014 | 401 | 248 | 17 | 37 | 1,884 | 2,587 |
| 2015 | 409 | 263 | 18 | 37 | 1,997 | 2,724 |
| 2016 | 416 | 278 | 19 | 37 | 2,117 | 2,867 |
| 2017 | 425 | 295 | 20 | 37 | 2,244 | 3,021 |
| 2018 | 434 | 313 | 21 | 37 | 2,379 | 3,184 |
| 2019 | 443 | 332 | 22 | 37 | 2,521 | 3,355 |
| 2020 | 453 | 351 | 23 | 37 | 2,673 | 3,537 |
| | 75% recovery | 75% recovery | 75% recovery | | International trade | Maximum |
| 2012 | 1,163 | 221 | 48 | 37 | 2,137 | 3,606 |
| 2013 | 1,182 | 234 | 50 | 37 | 2,265 | 3,768 |
| 2014 | 1,203 | 248 | 52 | 37 | 2,401 | 3,941 |
| 2015 | 1,226 | 263 | 55 | 37 | 2,545 | 4,126 |
| 2016 | 1,249 | 278 | 58 | 37 | 2,698 | 4,320 |
| 2017 | 1,274 | 295 | 61 | 37 | 2,860 | 4,527 |
| 2018 | 1,301 | 313 | 64 | 37 | 3,032 | 4,747 |
| 2019 | 1,329 | 332 | 67 | 37 | 3,214 | 4,979 |
| 2020 | 1,359 | 351 | 70 | 37 | 3,406 | 5,223 |

Assumptions: 1) Minimum and maximum horn recoveries will be 25% and 75% respectively; 2) Horn recovery on private land will be consistently high at 75%; 3) The number of dehorned rhinos under domestic trade assumes 51% of private owners would dehorn; 4) The number of dehorned rhinos under international trade assumes 65% of private owners would dehorn.

7.2 Assessment of the potential national demand for rhino horn

7.2.1 The national market for rhino horn

While the question of the amount of rhino horn that might be available *for sale* from state and privately owned rhinos is straightforward to estimate, the question of who will *buy* the horn if trade is only legalised within South Africa is not so simple, for at least two reasons. First, local trade is currently banned, so there are no legal buyers of rhino horn in South Africa. Without a legal market to analyse, there are few ways in which to study such a potential market. Using historical information might be one option if suitable data were

available, but this is not possible here because information regarding the identity of horn buyers before the national moratorium was implemented were very limited (see sections 6.1.1 & 6.1.2 for further explanation).

Second, it is alleged that many of the rhino horns sold with legal permits before 2009 were subsequently smuggled out of the country (see section 6.1.2), meaning that the traders that bought the horn did so with dishonest intentions at the outset. If domestic trade were legalised before sufficient permitting controls are put in place, or if regulations are not enforced, it is possible that the same (or new) traders would buy horn and smuggle it out of the country again (see sections 8.1 on risks of lifting the national moratorium). However, if effective permitting controls are implemented before national trade is legalised, and if buyers have to be officially certified as traders, it will be difficult for traders to export horn out of the country without being detected (as long as stockpile auditing occurs). Dishonest traders would then be less likely to buy rhino horn for trafficking, and the number of potential legal buyers of horn will be lower than before 2009.

Before the national moratorium was implemented, the amount of horn traded with permits within South Africa was limited to approximately 100 kg per year (see section 6.1.3). This is twenty times less than the minimum amount of horn that might be available from newly acquired horn in 2012 alone (Table 22). While the international trade ban remains, it is not at all clear who would buy rhino horn if the national moratorium were lifted, and it is very unlikely that the market size for rhino horn within South Africa would be large enough to account for all the horn that would be available.

During the surveys, rhino experts were asked the following question: *What kind of people (individuals or organisations) would buy horn if the national moratorium was lifted (but the international trade ban remained) and what do you think they would do with it?* Out of 45 responses, 44% thought that speculators would buy horn. These would be people anticipating international trade being legalised in the future. Twenty-nine percent of experts thought that dishonest traders would buy horn to smuggle out of the country, 18% thought there was no local market for horn while 9% thought that Asians would buy the horn.

Private owners were asked the following question: *If trade in rhino horn was legalised nationally, will you buy or sell horn?* As indicated in 6.1.3, 65% of private rhino owners indicated that they would sell horn if the national moratorium were lifted. Only 2 owners (4%) indicated they would buy horn, but gave no indication as to what they would do with it.

7.2.2. The potential income to be generated from national trade in rhino horn

The question relating to the potential income to be generated from national trade in rhino horn does not have an exact answer due to the fact that it is not clear who would buy horn and how much they would buy if only local trade was allowed. It is likely that there would be fewer buyers than before the moratorium was implemented (see 7.1.2), meaning that most of the potentially available horn would not be sold. However, if *all* the horn available

in 2012 was sold (minimum 2,339 kg) at the 2008 price of R35,000/kg, the total income generated might be R81,865,000 in 2012 (Table 23).

Table 23. Potential income generated from rhino horn sales if the national moratorium was lifted and all the horn sold.

| Year | Annual horn accumulation | Price of horn SA Rand/kg | Annual income from horn |
|-------------|---------------------------------|---------------------------------|--------------------------------|
| 2012 | 2,339 | R35,000 | R81,865,000 |
| 2013 | 2,460 | R35,000 | R86,100,000 |
| 2014 | 2,587 | R35,000 | R90,545,000 |
| 2015 | 2,724 | R35,000 | R95,340,000 |

Assumptions: 1) All horn would be sold; 2) Horn price would be same as in 2008.

7.3. Opinions on trading rhino horn

Rhino experts and private rhino owners were asked their opinions on legalising trade in rhino horn under the scenarios of lifting the national moratorium while the international trade ban remained and legalising both national and international trade. Sixty-two percent of experts disagreed with lifting the national moratorium on trade in rhino horn if the international trade ban remained (Table 24). The main reasons given included that this would do nothing to satisfy demand in Asia or prevent poaching, current permitting controls are insufficient to prevent laundering of horn, there is insufficient capacity to regulate national trade, and South Africa's international reputation would be tarnished. In contrast to this, 62% of experts agreed with lifting the national moratorium on trade in rhino horn if the international trade ban was also lifted (Table 25). The main reasons given included that a controlled international trade should result in a reduction in the price of horn (which would reduce the incentives to poach rhinos), international trade would generate funds to pay for better anti-poaching security in a sustainable way, the current international trade ban is not preventing poaching, and trade would reduce the risk of storing horn by reducing the size of stockpiles.

Fifty-six percent of private owners agreed with lifting the national moratorium on trade in rhino horn, even if the international trade ban remained, because they believed it would give live rhinos a value, would generate funds for anti-poaching, would be the first step towards legalising international trade, and would help reduce poaching (Table 26). Ninety-four percent of private rhino owners agreed with international trade in rhino horn for similar reasons to those given for lifting the national moratorium (Table 27).

Table 24. Expert responses to the question: Do you agree with the idea of legalising trade in rhino horn if the national moratorium is lifted but the international trade ban remains?

| Responses | Reasons given |
|-------------------|---|
| No: 62% | <ul style="list-style-type: none"> • There is no end-user market in South Africa, so this would not deal with the core issue of demand in Asia, so it will not do anything to curb poaching. Should not be done without international trade • Permitting controls are not currently sufficient to prevent laundering of horn and leakage of horn out of South Africa. It will only encourage illegal activity • There is insufficient capacity to regulate national trade due to enforcement capacity shortages • Illegal activities will tarnish South Africa’s international reputation, might be detrimental to future chances of negotiating international trade, and might result in CITES implementing stricter controls on trophy hunting • Will send mixed messages to the world and to end-user markets |
| Yes: 30% | <ul style="list-style-type: none"> • Private owners will have more confidence and incentive to buy and protect rhinos • Will satisfy some of the demand (even if this happens through illegal leakage of horn), bring down prices and reduce poaching • Allows stockpiles to be sold, generates funds to pay for anti-poaching and reduces the risks of storing horn stockpiles • The CITES international trade ban has not worked • Every rhino horn sold reduces poaching pressure |
| Depends: 5% | <ul style="list-style-type: none"> • Depends what South Africa is trying to achieve by legalising national trade • Depends what happens to the price of horn • Depends whether the supply is sustainable |
| Don’t know: 3% | |

Table 25. Expert responses to the question: Do you agree with the idea of legalising international trade in rhino horn?

| Responses | Reasons given |
|-------------------|--|
| Yes: 62% | <ul style="list-style-type: none"> • South Africa controls the supply and satisfies the demand, economic forces come into play, horn price drops, the incentive to poach decreases • Generates funds to pay for anti-poaching, incentivises private owners • The current situation is not working and legal trade cannot be worse • It is the only option that is financially sustainable • Rhino horn is renewable and a legal supply can provide more horn to the end-user than the current poaching • There are other examples of threatened species recovering under legal trade (e.g. vicuña) • Gets rid of stockpiled horn, which reduces risks of theft • Anti-poaching and protectionism will not stop poaching on their own • Makes live rhinos more valuable than dead rhinos (which would be the opposite to the current situation) – rhinos must have a value to survive • It is not feasible to pretend that the trends of the last 4 decades will be reversed by persisting with these failed policies |
| Depends: 18% | <ul style="list-style-type: none"> • Depends on how the trade is controlled • Depends on how the horn is obtained and if this is sustainable • Depends if laundering can be prevented • Depends on what happens to demand in Asia |
| No: 17% | <ul style="list-style-type: none"> • The economic theories are too simplistic and based on too many assumptions, and no one can agree on how to do it • We do not understand the demand in Asia or how the markets work; we do not know that trade will not increase the demand • Just create conduits for illegal activity • Will not be sustainable • If end-users source their horn from both legal and illegal markets, legal trade will fail |
| Don't know: 3% | |

Table 26. Private rhino owner responses to the question: Do you agree with the idea of legalising trade in rhino horn if the national moratorium is lifted but the international trade ban remains?

| Responses | Reasons given |
|------------------|--|
| Yes: 56% | <ul style="list-style-type: none"> • Will reduce poaching (44%). • Puts money back into security (17%) • Gives lives rhinos a value (17%) • Is the first step towards international trade (17%) • Private owners can get rid of their horn (5%) |
| No: 44% | <ul style="list-style-type: none"> • Will have no beneficial effect for rhinos if international trade ban remains (60%) • Will encourage illegal trade (40%) |

Table 27. Private rhino owner responses to the question: Do you agree with the idea of legalising international trade in rhino horn?

| Responses | Reasons given |
|------------------|--|
| Yes: 94% | <ul style="list-style-type: none"> • Will reduce poaching (37%). • Gives lives rhinos a value (33%) • Puts money back into security (15%) • Demand will not go away, is only solution that makes financial sense (15%) |
| No: 6% | <ul style="list-style-type: none"> • International trade cannot be controlled (50%) • Will stimulate demand (50%) |

7.4. Potential legal horn supplies vs. current supply from illegal sources

It is theoretically possible to reduce rhino poaching by supplying a legal source of rhino horn to consumer markets as long as there is sufficient horn to meet demand. As discussed in section 6.3.3, demand should be considered in terms of market size, which is determined by multiplying the quantity of horn consumed by the price of horn. Determining the current market size for rhino horn is, however, complicated because international trade in rhino is illegal. Without knowing the current price of rhino horn on the black market or the likely price of horn if trade were legalised, the quantity of rhino horns required to ‘satisfy the demand’ cannot be estimated.

However, if the quantities of rhino horns are considered in isolation, these appear to be sufficient to match the numbers being exported illegally. The minimum quantities of rhino horn removed illegally from South Africa in 2010 and 2011 were 2,681 kg and 2,639 kg respectively (Table 12) (the 2011 estimate does not include pseudo-hunting because hunting permit data for that year were not yet available). The estimated mass of horn that could be produced in 2012 by natural mortalities, break-offs and dehorning has been estimated to be 2,339-3,606 kg (Table 22), and this quantity would increase each year that South Africa's rhino populations continue to grow. At the end of 2011, South Africa also had a horn stockpile of approximately 16,596 kg.

8. IMPLICATIONS OF LIFTING OR NOT LIFTING THE NATIONAL MORATORIUM

8.1. Implications of lifting the national moratorium

8.1.1. Lifting the national moratorium may lead to laundering of illegal rhino horn into legal trade, and leakage of rhino horn into the illegal international market

Before 2009, some horns traded legally within South Africa were allegedly being smuggled out of the country and finding their way onto the illegal international market. The moratorium was implemented to stop this activity, and trade in rhino horn within South Africa is currently prohibited. The moratorium prevented rhino owners from legally selling registered horn to criminal elements that were likely to subsequently export the horn illegally, and it also removed the possibility of illegal horn (poached or stolen) being laundered into legal stockpiles, which could then be sold legally. Both smuggling of horn out of South Africa and laundering of illegal horn into legal supplies were tarnishing South Africa's reputation, and the enactment of the moratorium was viewed very favourably (see section 8.2 below).

If the moratorium were lifted, and a legal domestic trade in rhino horn re-established, opportunities for laundering illegal horn into the legal system would reopen, and there would be strong financial incentives for legal (registered) horn to be smuggled out of the country again. If laundering and smuggling were to resume, this would have a negative impact on South Africa's reputation in terms of compliance with CITES requirements, and might result in some Parties requesting an uplisting of white rhino back to Appendix I. Not only would this make it harder to negotiate legal international trade in rhino horn in the future (an option that South Africa may wish to pursue eventually), it might worsen the current situation if private owners had less incentive to look after rhinos. Being listed on Appendix I, however, does not necessarily prohibit trophy hunting, so this possibility would be dependent on the kind of restrictions that could be implemented through the CITES process.

One of the most important hurdles South Africa will need to overcome in order to legalise national trade in rhino horn, is to prove to the Parties to CITES that internal effective trade controls have been implemented and are sufficient to prevent the laundering of illegally obtained rhino horn.

8.1.1.1. Risk 1: If the moratorium is lifted, rhino horn will be smuggled out of South Africa through leaky international ports

South Africa is currently unable to prevent a significant quantity of rhino horn from being smuggled out of the country, mostly out of Kruger National Park through Mozambique, but also some through its international ports. A comparison between the large numbers of rhinos being poached with the small numbers of horns being seized suggests that many horns are evading detection and are either being stockpiled locally or exported illegally. South Africa's land, sea and air borders appear to be highly porous with few mechanisms in place to prevent smuggling of wildlife species or derivatives. While both the SARS K9 dog unit as well as the SAPS dog unit do have biodiversity sniffer dogs, there are not enough dogs to adequately cover the ports of entry and exit that are considered to be high risk, let alone other border points.

8.1.1.2. Risk 2: If the moratorium is lifted, large amounts of unregistered horn will be laundered onto the legal market

It is alleged that some rhino horn owners are not yet complying with the permitting requirements for reporting possession of horns as per the TOPS regulations under NEMBA (Government Gazette No. 29657, Notice No. 150, 23 February 2007) or for marking horns as per the TOPS regulations under NEMBA (Government Gazette No. 29657, Notice No. 150, 23 February 2007) and the norms and standards (Government Gazette No. 32426, Notice No. 756, 20 July 2009). While this situation exists, the effectiveness of attempted controls on domestic trade of rhino horn within South Africa would be questionable. It is highly likely that illegally obtained rhino horn would be laundered into the legal market and passed off as legitimate.

8.1.1.3. Risk 3: If the moratorium is lifted, there may be insufficient capacity to control and regulate domestic trade.

South African conservation law enforcement is already overloaded in dealing with current poaching and smuggling, and lifting the national moratorium would place additional burdens on the system. There is insufficient capacity for this to be done effectively and it is already drawing resources away from other important conservation fields in South Africa. Moreover, provinces have not coordinated with each other on law enforcement issues in the past, making effective regulation of potential rhino horn trade unlikely.

8.1.1.4. Risk 4: If the moratorium is lifted, there may be temptation for officials to facilitate criminals in laundering and smuggling horn through bribery.

Legalising domestic trade in rhino horn may create opportunities for wildlife criminals to bribe officials to facilitate laundering of horns.

8.1.2. Lifting of the national moratorium may tarnish South Africa's international conservation reputation

South Africa developed a reputation as a world leader in rhino conservation because it increased both white and black rhino populations and maintained relatively low levels of poaching during periods when many other rhino range states were experiencing population declines. In recognition of these successes and the potential contribution of a sustainable use approach to rhino conservation, the Conference of Parties to CITES

approved the down-listing of the South African white rhino to Appendix II in 1994, which allowed for limited live export of animals to appropriate and acceptable destinations, as well as the (continued) export of hunting trophies. In 2004, the Conference of Parties to CITES approved an annual trophy-hunting quota of five black rhinos (restricted to the hunting of adult bulls).

However, South Africa's reputation has been tarnished in the last decade by some contentious circumstances that have either been harmful to rhino conservation or have been inconsistent with CITES principles and resolutions, for example those defined by Resolution Conference 9.14 (Rev. CoP15) (www.cites.org/eng/res/09/09-14R15.php). One contentious activity has been the pseudo-hunting of white rhinos that started in 2003 (see sections 3.2.2 and 6.2.3). Although pseudo-hunting is not recognised in Resolution Conference 9.14 (Rev. CoP15), it was raised as a problem in paragraph 11 of the Report to the Secretariat of the 62nd Meeting of the CITES Standing Committee in Geneva, 23-27 July 2012 (SC62 Doc. 47.2) (<http://www.cites.org/eng/com/SC/62/E62-47-02.pdf>). The South African Government implemented measures to prevent pseudo-hunting in 2009 by issuing norms and standards for trophy hunting (Government Gazette No. 32426, Notice No. 756, 20 July 2009), which were amended in April 2012 (Government Gazette No. 35248, Notice No. 304, 10 April 2012) when it was found that the original norms and standards had not been as effective as was hoped. So far it appears that the amended norms and standards have been more effective.

A second contentious situation has been the inadequate reporting, permitting and auditing of rhino horn in private stockpiles (section 6.1.5), which has contributed to the failure to prevent illegal export of horn. Resolution Conference 9.14 (Rev. CoP15) urges all parties that have stocks of rhinoceros horn to identify, mark, register and secure such stocks. Although TOPS regulations (Government Gazette No. 29657, 23 February 2007, Government Notice No. 150) have required registration of rhino horn in South Africa since 2007, and the original and amended norms and standards (Government Gazette No. 32426, Notice No. 756, 20 July 2009; Government Gazette No. 35248, Notice No. 304, 10 April 2012) placed strict regulations on private owners for marking rhino horn, there are allegedly still some private rhino owners who are non-compliant and have not registered their horn stockpiles. With regards measures for the prevention of illegal export of rhino horn, South Africa implemented the national moratorium on trade in rhino horn in 2009 (Government Gazette No. 31899, Notice No. 148, 13 February 2009), which stopped the sale of horn to foreign nationals who were allegedly exporting the horn to Asia; this moratorium was well received by Parties to CITES.

A third issue has been irregularities in South Africa's live white rhino exports to China since 2006 and a lack of transparency with regards where the rhinos have been going and how many have been shipped (Milliken *et al.*, 2009). To deal with this potential problem, South Africa recently started coordinating with the World Association of Zoos and Aquariums to ensure that any future applications for exporting live white rhinos are thoroughly investigated with regards whether the destinations are appropriate and acceptable (as is required by the Appendix II annotation for white rhinos).

Whilst the abovementioned positive steps have been taken, the recent surge in poaching and revelations that some members of the wildlife industry were involved in illegal activities has not improved South Africa's international standing, even though, so far, neither rhino species have gone into decline. Some Parties to CITES may still have concerns regarding South Africa's management of some of these issues, including the ineffectiveness of law enforcement to curb the ongoing poaching surge, uncoordinated information management at the national level, and the ongoing insufficient recording of private horn stockpiles. Lifting the national moratorium on trade in rhino horn within South Africa while there is still some degree of non-compliance by private rhino owners may be viewed negatively by some Parties to CITES.

8.1.2.1. Risk 1: If the moratorium is lifted, CITES may implement stricter measures relating to the export of hunting trophies

Lifting the moratorium in an attempt to reverse the current restrictive approach to rhino conservation in South Africa might have repercussions from CITES, who may perceive this as reducing interventions to address illegal activities. There have been instances where CITES Parties have instituted stricter domestic measures relating to trade of CITES listed species where Parties have concerns relating to the sustainability of the off-take in a specific country. Importation of black rhino trophies into the United States of America (USA) is currently not allowed in terms of its Endangered Species Act; if they were to react negatively to a lifting of the national moratorium by banning the import of white rhino trophies the impact on legitimate trophy hunters would be significant, and the incentives for private rhino owners to conserve rhinos would decline. Since trophy hunting constitutes an important source of income for rhino owners that make a valuable contribution to rhino conservation, securing a sound trophy hunting industry is of utmost importance.

International groups opposed to sustainable use would challenge any relaxation of restrictions. Since some of these groups yield significant power in the international media and also carry influence at CITES, by further highlighting South Africa's recent deteriorating record they could threaten to undermine any attempts to bring about change and may also threaten other aspects of the wildlife economy (e.g. the tourism industry). Even though white rhinos in South Africa do not merit uplisting to Appendix I on scientific grounds, it is possible for any Party (even non-rhino range states) to make an application for such an uplisting, and if a 2/3 majority were achieved, the uplisting would take place. The Party concerned would, however, have to consult with South Africa before taking such action.

8.1.2.2. Risk 2: If lifting the national moratorium tarnishes South Africa's reputation, any potential future attempts to legalise international trade may be jeopardized

If lifting the national moratorium provided a conduit for horn to leave the country illegally, this would jeopardize South Africa's attempts at further discussions on opening up international legal trading channels in the future.

8.1.3. Lifting the national moratorium may result in/lead to compliance and enforcement challenges

Regulation 70(1) of the TOPS regulations under NEMBA (Government Gazette No. 29657, 23 February 2007, Government Notice No. 150) requires any person in possession of rhino horn to have their horn permitted, marked and registered on the national database. Additionally, Paragraph 2 of the 2012 norms and standards (Government Gazette No. 35248, Notice No. 304, 10 April 2012) provides additional requirements relating to the marking of rhinoceros horn. However, an unknown, but potentially large number of rhino horn owners are not currently complying with these regulatory provisions for at least three possible reasons. First, some horn owners do not trust the permitting authorities to keep their personal information confidential. Second, some horn owners may not want the authorities to know they have horn so that they can sell it illegally and avoid the complications of auditing. A third reason is that some people who have legally obtained horn are not aware of the permitting requirements. Examples of the latter might be people who hunted rhinos in the 1960's or people who have inherited horns originating from early rhino hunts. While this situation exists, the effectiveness of attempted controls on domestic trade of rhino horn within South Africa would be questionable, and it is highly likely that illegally obtained rhino horn would be laundered into the legal market and passed off as legitimate.

8.1.3.1. Risk 1: If the moratorium is lifted while there are non-compliant rhino horn owners, laundering of horn may occur

If the national moratorium is lifted while some rhino owners are non-compliant with the TOPS Regulations under NEMBA and the current norms and standards relating to the marking and permitting of rhino horn, there is a risk that illegal horn will be laundered into the legal market. If the authorities do not know how many rhino horns there are in private stockpiles (and who owns them), it will be extremely difficult to regulate trade and prevent laundering. This will tarnish South Africa's international reputation and may negatively impact the practice of sustainable utilisation of rhinos in South Africa in the future (see section 8.1.2)

8.1.3.2. Risk 2: If the moratorium is lifted while there are non-compliant rhino horn owners, law enforcement capacity will be stretched

If the national moratorium is lifted while some rhino owners are non-compliant with the TOPS regulations relating to the marking and permitting of rhino horn, the capacity of law enforcement will be stretched with the additional burden of enforcement. South Africa already lacks sufficient law enforcement capacity to deal with the current levels of wildlife crime, so would be even less equipped to maintain control if the extra burdens of enforcing legal domestic trade in rhino horn became necessary. Additionally, this would result in less resources being available for other conservation issues in South Africa that are currently being neglected due to a lack of capacity.

8.1.4. Lifting the national moratorium may send conflicting messages to CITES about South Africa's position on trade

8.1.4.1. Risk 1: Lifting the moratorium is contrary to CITES goals of reducing trade in rhino horn

Since 1977, the policies that CITES has adopted to reduce rhino poaching have been to prevent illegal international trade in rhino horn and to discourage the use of rhino horn in traditional consumer markets. These are currently encapsulated in Resolution Conference 9.14 (Rev. CoP15). If South Africa lifts the national moratorium on trade in rhino horn, this might be viewed by some Parties as encouraging the use of rhino horn (even though it would only legalise trade within South Africa), which would run counter to the principles that CITES is currently advocating for rhino conservation. Without first bringing private rhino owners into full compliance with TOPS regulations and norms and standards, and without clearly explaining to Parties of CITES the reasons for doing so, lifting the national moratorium might create confusion in international conservation circles: while CITES would be trying to discourage trade and consumption of rhino horn, South Africa would appear to be doing the opposite. This could be detrimental to both approaches and might hinder attempts to reduce poaching.

8.1.4.2. Risk 2: Lifting the moratorium might legitimize the use of rhino horn as medicine

If South Africa lifts the national moratorium on trade in rhino horn, this may send the message to potential consumers of rhino horn in Asia that South Africa considers the use of rhino horn in medicine to be acceptable. Although lifting the moratorium would not affect the domestic bans in Asian countries, it might encourage greater use of horn. Given the high level of publicity that would accompany any policy of legalising trade in rhino horn, it is likely that very large numbers of potential consumers would become aware that South Africa had taken such a step.

This issue also raises the moral dilemma of whether it is acceptable to trade a product that will primarily be used as medicine, when the western scientific consensus of the selling country is that the product has few genuine medicinal properties (this applies to the specific case of legal international trade in rhino horn, not domestic trade within South Africa, but is relevant because domestic trade might lead to international trade). While this may be harmless in some circumstances, such as when it is used by the “face consumers” described in section 6.3.3, it could be harmful when used for life-threatening diseases. A relatively recent, and possibly increasingly large rhino horn consumer group in Vietnam are those who believe that rhino horn cures cancer (Milliken, 2012). However, this is a value judgement, and assumes that western medicine is superior to traditional methods used in Asia. It is also not within the remit of the current study.

8.1.5. Lifting the national moratorium will do little to reduce poaching

If the national moratorium on trade in rhino horn was lifted in South Africa (without scope for legal international trade), but sufficient controls were in place to prevent illegal export of stockpiled horns (i.e. no horn leakage out of the country occurred), there would be no additional supply of rhino horn to Asia. The consumer demand would not be met through legal means, leaving poaching or theft from horn stockpiles as the only methods to supply horn. Horn prices on the black market would remain high, criminal syndicates would

remain involved and the incentive to poach would remain high. The only potential benefit of legalising domestic trade in rhino horn in terms of an impact on poaching might be if private owners were able to recuperate some of their costs spent on protecting rhinos and recirculate the money back into anti-poaching. However, as discussed in section 7.2.1, it is not clear whether there would be sufficient buyers of rhino horn in South Africa if domestic trade was legalised without some form of legal international trade, so private owners may have no market for rhino horn in South Africa.

8.2. Implications of *NOT* lifting the national moratorium

8.2.1. If the national moratorium is not lifted, the incentive to poach rhinos will remain high

In general, the risks of *not* lifting the national moratorium are different to the risks of lifting it, but they are not always mutually exclusive. The most important example of a risk that arises whether or not the moratorium is lifted (while maintaining the international ban) is that it is likely that neither action will help reduce poaching.

If the national moratorium on trade in rhino horn remains in place, thus maintaining the *status quo*, opportunities for domestic leakage of horns onto the market (as allegedly occurred before the moratorium) will remain tightly constrained. If the loopholes for obtaining horn through pseudo-hunting were satisfactorily closed, the only remaining way to get rhino horn would be through poaching or stealing from state and private stockpiles. If consumer demand remained intact, the price of horn would likely increase as it became harder to obtain and, given the increased involvement of criminal syndicates (which is inevitable with this kind of prohibition and the subsequent potential financial rewards), the financial incentives for poachers to kill rhinos or steal from stockpiles would increase. Protecting rhinos would, therefore, become more expensive and, without means to recuperate costs, this would soon become financially unsustainable. Securing horn stockpiles would also become a more expensive and dangerous activity.

8.2.2. If the national moratorium is not lifted, protecting rhinos may become financially unsustainable and lead some private rhino owners to de-stock

The national moratorium prevents private rhino owners from selling rhino horn (which is constitutionally their personal property) and reduces the potential income they could make from their rhinos. Many private owners do not wish to trophy hunt their rhinos, while many do not have the capacity for ecotourism, leaving selling live rhinos as the only option to recuperate money spent on anti-poaching. With the market for live rhino currently depressed as it is (section 6.2.4), this may result in a financial loss. This is an unsustainable situation that could result in one of two outcomes: 1) private owners might stop paying for anti-poaching and leave their rhinos vulnerable; or 2) private owners might sell all their rhinos and invest in less risky but commercially valuable wildlife species (if they cannot find buyers for their rhinos, they may have them legally or illegally hunted). If private rhino owners start de-stocking, this will decrease the distribution range over which rhinos are found within South Africa and will reduce the income generated by state reserves from rhino sales. Destocking may also result in a long-term reduction of rhino numbers in South Africa which, when added to the likely high or increased poaching, could

affect the viability of the national rhino herd. Such a reduction in range would increase poaching pressure on state-protected areas as poachers would be forced to focus on the remaining populations. Reduced range would also reduce the potential population growth of rhinos, thus reducing the resilience of the national herd to illegal off-take.

8.2.3. If the national moratorium is not lifted, live-sale prices of rhinos may decrease and reduce the incentive to protect them

Live rhino prices may drop and large conservation organisations that benefit financially from live sales (e.g. SANParks, Ezemvelo) will lose income for conservation. Any excess rhinos produced in conservation areas may have nowhere to go if population equilibrium levels are reached. Consequently, a major income stream would be cut-off and reduce funds available for anti-poaching.

8.2.4. If the national moratorium is not lifted, storing rhino horns will become an increasing security risk for private owners

Rhino horns are accumulated through natural mortalities and dehorning (which is often done as an anti-poaching measure), but rhino horn owners currently have no way to sell their horn. Because rhino horn is a valuable commodity, private owners do not view destroying their stocks as a financially sound option while there is hope that international trade may be legalised in the future, but storing it securely is a serious challenge. Due to the high value, criminals have been known to commit armed robbery to obtain rhino horn from private properties, creating major safety risks for people involved. As a result, private rhino owners often resort to placing their horn in bank vaults or in safekeeping facilities, adding to the financial burdens of keeping rhinos.

8.2.5. If the national moratorium is not lifted, private rhino owners may consider taking legal action against the South African government

While private game ranchers personally chose to buy rhinos, the government encouraged them to stock rhinos because of the direct financial and ecological benefits obtained by National and provincial parks to sell rhinos. Before 2009, private rhino owners were free to sell rhino horn within South Africa (although it was not common until after 2000), but now they are not allowed to sell horn even though they consider it their legal property. According to the survey of private rhino owners, a small proportion of rhino owners believe this violates their constitutional rights. Moreover, the poaching crisis is forcing private rhino owners to invest money in anti-poaching security, creating a significant financial burden with insufficient means of recuperating their losses. The moratorium is also forcing private owners to store rhino horn, which is a very high security risk if horns are kept on private property. The national moratorium was intended to be a short-term measure, but it has been left in place for over three years. If the government does not reopen local trade, some owners may take legal action.

8.2.6. If the national moratorium is not lifted, illegal activities might be perversely stimulated rather than reduced

According to some analysts and industry role-players, continuing to enforce restrictions (including the national moratorium on trade in rhino horn and strict TOPS hunting regulations under NEMBA) may stifle the private rhino industry and result in serious financial and conservation repercussions for both the private and public sector. Depending on the policy direction taken, incentives or perverse incentives could be created. For example, some private rhino owners have plausibly argued that the implementation of onerous TOPS permitting requirements under NEMBA (Government Gazette No. 29657, Notice No. 152, 23 February 2007) and norms and standards (Government Gazette No. 35248, Notice No. 304, 10 April 2012) in provinces with weak institutional capacity has not only created a massive administrative and logistical burden, but has also greatly increased security risk as sensitive information has been leaked to criminal elements. Consequently some owners feel it is far easier and safer to sell illegal hunts and avoid compliance with the law by operating in a clandestine manner. Increased regulation may thus have the unintended consequence of stimulating illegal activity within the wildlife industry rather than reducing it.

9. MITIGATING THE RISKS OF LIFTING AND NOT LIFTING THE NATIONAL MORATORIUM

9.1. Mitigating the risks of *lifting* the moratorium

9.1.1. Laundering and leakage

9.1.1.1. Measures to prevent smuggling of rhino horn through international ports of entry and exit

- Set up and maintain a secure, national electronic rhino permitting system and database for live rhinos and rhino horn stockpiles (including a DNA database);
- Consider initiating an amnesty period in which private rhino owners can register any undeclared horn stockpiles. This could only be done on condition that owners were able to provide proof of legitimate acquisition, and with the proviso that all legal provisions for an amnesty were in place and that legal processes that needed to be followed were considered;
- Ensure private owner personal data is stored securely and provide evidence that this is being done;
- Assist private rhino owners with security for their horn stockpiles if requested;
- Enforce compliance of private owners with all TOPS permitting regulations under NEMBA (Government Gazette No. 29657, Notice No. 150, 23 February 2007) and current norms and standards (Government Gazette No. 35248, Notice No. 304, 10 April 2012), and capture all data on electronic permitting system;
- Conduct regular audits of horn stockpiles to discourage illegal sales;
- Deploy sufficient sniffer dogs at all ports of entry/exit to assist officials with detecting wildlife products;

- Train all officials working at the ports of entry and exit in methods of detecting wildlife being smuggled as well as the relevant legislation to assist them with arrest and seizure;
- Ensure that all captured smugglers are prosecuted and that very high penalties are imposed, including prison sentences. Fines are no longer adequate to deter rhino related crimes;
- Ensure there is enough scanning equipment at the cargo areas of the airports.

9.1.1.2. Measures to prevent laundering of horn

- Set up secure, national, electronic rhino permitting system and database for rhino horn;
- Only issue possession permits for rhino horns when sufficient proof of legal ownership or acquisition is provided;
- Enforce compliance with all TOPS permitting regulations under NEMBA (Government Gazette No. 29657, Notice No. 152, 23 February 2007) and current norms and standards (Government Gazette No. 35248, Notice No. 304, 10 April 2012): all horn harvested from legally owned rhinos must be permitted, marked (with an implanted microchip) and identified (DNA sample taken for profile);
- DNA certificate must be issued with each possession permit for each horn;
- Rhino horn stocks (private and government) must be regularly audited;
- Only legitimate rhino horn owners who are fully compliant with the TOPS Regulations under NEMBA, norms and standards and provincial conservation legislation, and who have full certification as proof of compliance, should be allowed to trade their horns to legitimate buyers.

9.1.1.3. Measures to increase capacity to control and regulate domestic trade.

- Increase budget allocated to government departments dealing with environmental and biodiversity issues to enable them to fulfil their duties;
- Fill all vacancies with competent people who can fulfil their mandated duties professionally;
- Increase training of officials to include an understanding of organised crime, fraud and corruption and the consequences of legally traded horn entering the black market;
- Form a national Environmental Management Inspector investigation unit – at present the provinces are not working together and there should be better interprovincial co-operation.

9.1.1.4. Measures to prevent bribery and corruption

- Eradicate corruption by removing and legally prosecuting corrupt officials;
- Prosecute any member of public attempting to corrupt an official or who offers a bribe to ensure permits to allow trading of horn;
- Increase training and awareness campaigns promoting the enforcement and prosecution of any person caught offering or accepting bribes and make sure that such people are successfully convicted and receive strong penalties;

- Ban any person formally charged with bribery and corruption (even if not yet prosecuted) from applying for any permits pertaining to rhino and rhino horns, until court case has been concluded;
- Suspend any official suspected of accepting bribes or being involved in corrupt activities pending criminal charges and an internal investigation;
- Lie detector tests for officials on a regular basis (or some similar way of rooting out corruption).

9.1.2. Effects on South Africa's international reputation

9.1.2.1. Measures to reduce the negative impacts of lifting the national moratorium on South Africa's reputation with CITES and to prevent the potential implementation of stricter actions by Parties on exports of hunting trophies

- If South Africa addresses the problem areas currently raising concerns with CITES over its management of rhino conservation (as listed in section 8.1.2), lifting the national moratorium would probably have few reputational repercussions. Addressing these problem areas would require the following actions:
 - Increase coordination of information management at a national level (outlined in section 9.1.1.1);
 - Bring all private rhino horn owners into compliance with TOPS regulations under NEMBA for declaring and registering their horn stockpiles (Government Gazette No. 29657, Notice No. 152, 23 February 2007), and implement regular and effective auditing of these stockpiles (section 9.1.1.2);
 - Reduce illegal export of horns through ports of entry (section 9.1.1.1);
 - Effectively implement the norms and standards for trophy hunting to prevent pseudo-hunting (Government Gazette No. 35248, Notice No. 304, 10 April 2012);
 - Increase transparency on the numbers of white rhinos exported as well as their destinations;
 - Increase law enforcement capacity to prevent poaching as well as catch and prosecute poachers that have killed rhinos (section 9.1.3.2);
- To be effective, a legal trade must have a positive long-term conservation impact on South African rhino populations. Any decision taken must consider this long-term goal;
- Communicate the past success of the sustainable use model for rhino conservation more effectively, in particular the role played by the private sector and the trophy hunting industry;
- Handle public relations carefully and professionally. Any move toward a legal trading regime must be carefully and well presented to the general public, backed with clear and solid arguments, grounded in proper research and established fact;
- Ensure that any pursuit of a change in policy direction with regards to trade in rhino horn is done within the CITES framework, and that obligations as a signatory to CITES are upheld. This is of key importance because South Africa is bound by the convention;
- It is imperative that South Africa makes any decisions going forward with careful and due consideration of all the facts, communicates these effectively to the international community and lobbies for support from other CITES parties in establishing future policy.

9.1.2.2. Measures to reduce the chances of jeopardizing future discussions on legalising international trade

- If the long-term goal for rhino conservation requires the opening of international markets for horn, then any short-term measures must not jeopardize this possibility. To avoid this prospect, the actions outlined in section 9.1.2.1 should be implemented before lifting of the national moratorium.

9.1.3 Problems with compliance and enforcement

9.1.3.1. Measures to prevent non-compliant rhino horn owners from laundering horn

- Set up a secure national, electronic permitting system and database that maintains up to date data on who owns rhinos, where, and how many rhinos there are;
- Screen all staff that will have access to the database to reduce chances of corruption;
- Strict access control to this database must be enforced to prevent confidential information being passed to poaching syndicates;
- Demonstrate and convince private rhino owners that their confidential information will not be leaked to poachers;
- All privately owned rhinos must be registered on the national DNA database;
- All rhino horn stockpiles must be quantified, identified (DNA profile) and registered on the national permitting system and database;
- Horn stockpiles must be audited on a regular basis;
- Suspend permits of private rhino owners or rhino horn owners suspected of permit irregularities or who have been charged with wildlife related crimes until court cases have been finalised;
- Revoke the permits of private rhino owners that do not comply with the requirements of the national permitting system.

9.1.3.2. Measures to increase law enforcement capacity

- Increase budget allocated to government departments dealing with environmental and biodiversity issues to enable them to fulfil their duties;
- Fill all vacancies with competent people who can fulfil their mandated duties professionally;
- Increase training of officials to include understanding organised crime, fraud and corruption and the consequences of legally traded horn entering the black market;
- Form a national EMI investigation unit – at present the provinces are not working together and there should be better interprovincial co-operation;
- Increase intelligence structures to stop poachers before they kill rhinos;
- Establish a national forensics laboratory dedicated to wildlife crime cases;
- Increase the number of magistrates with environmental expertise.

9.1.4. Problems with sending conflicting messages

9.1.4.1. Measures to avoid acting in a manner contrary to current CITES goals of reducing trade in rhino horn

- While CITES rhino conservation goals focus on reducing trade in rhino horn (as well as preventing illegal trade), an action that lifts the national moratorium in South Africa would be in conflict with this. To avoid this situation, South Africa would need to make a convincing argument that a well controlled trade would be beneficial to rhino conservation. Implementing all the procedures listed in section 9.1.2.1 would

help convince Parties that South Africa is attempting to remain consistent with CITES Resolution conference 9.14.

9.1.4.2. Measures to avoid legitimizing the use of rhino horn as medicine

- Send a unified message that there is limited and contradictory scientific evidence that rhino horn has any genuine medicinal benefits, and no clinical evidence that rhino horn is an effective treatment for life threatening diseases like cancer.

9.2. Mitigating the risks of *NOT* lifting the moratorium

9.2.1. Reducing the incentive to poach rhinos

The search for a solution to the rhino-poaching crisis has been an ongoing problem for the South African government since the poaching surge started, and has continued after the implementation of the national moratorium. So far there has been little success and the poaching rate has escalated every year. The following two options are the primary considerations for reducing poaching if legal local trade is not considered:

- Reduce the market size for rhino horn in consumer nations. Given the historically entrenched use of rhino horn in Asia, this would require a very large and expensive advertising campaign in multiple countries, and the outcome of such an effort would be unpredictable. The feasibility of a campaign to decrease the use of rhino horn in Asia is debatable at best, and is likely to have a low success rate in the short-term;
- Increase the risks to poachers. This can be achieved by greater anti-poaching efforts, increasing the rate of capture of poachers, increasing the likelihood of successful prosecution of captured poachers, and imposing harsher sentences after successful convictions. Such anti-poaching and law enforcement activities are expensive, however, and, without sufficient ways to recuperate costs, become financially unsustainable in the long term, especially for private rhino owners.

Legalised international trade in rhino horn is a third theoretical way to reduce poaching, but is outside the scope of this report.

9.2.2. Reducing the chance of private rhino owners destocking

- Private rhino owners must be encouraged to continue buying and conserving rhinos. To do this, they need to be convinced that the government is working towards solutions for the poaching and ways to reduce the financial burden of conserving rhinos;
- The South African government must work with private owners to get the national electronic permitting system in place, but need to convince private owners that their personal and confidential information will not be given to criminal syndicates;
- Streamlining permitting processes (without compromising law enforcement), which is currently a significant burden to private owners, would reduce some concerns;
- Ensure that the future of trophy hunting rhinos in South Africa is secure by continuing to comply with CITES Resolution Conference 9.14.

9.2.3. Halting the decline in live sale prices of rhinos

- Create conditions in which live rhinos are more valuable than poached rhinos. This might involve a reduction in poaching (not easily achieved, as discussed above), assistance with the financial burden of protecting rhinos (such as by finding ways for rhino owners to sell their horn), or a combination of the two.

9.2.4. Reducing the risks of storing horn

- If the national trade ban is going to remain, the government could provide private rhino owners with an option for safely and securely storing their horns (for which they would pay a nominal fee).

9.2.5. Preventing private rhino owners from taking legal action against the government

- If the national trade ban is going to remain, the South African government must show evidence that they are working towards a solution to the poaching and assist private rhino owners with the storage of their rhino horns.

9.2.6. Reducing the chances of onerous permitting restrictions creating a perverse stimulation of illegal activity

- Prevent personal and confidential information about private rhino owners from being distributed to poachers. This can be done through a national electronic permitting system that is only accessible by a small number of security cleared individuals;
- Reduce the complexity of permitting restrictions without increasing the opportunities for private owners to engage in illegal activities.

10. SYSTEMS NEEDED TO REGULATE NATIONAL TRADE IN RHINO HORN

Whether or not the national moratorium is lifted, South Africa must regulate and control the possession and movement of all rhino horns within the country, prevent laundering of illegal horns into legal stockpiles, and prevent legal horns being illegally exported out of the country.

10.1. National rhino permitting system and database: registration of all rhinos on private land and all horn stocks

The first system that needs to be developed and implemented is a secure, centralised, national, electronic permitting system and database. This must be done *before* any trade is legalised to remove the possibility of illegal horn being traded. South Africa must be beyond reproach with Parties to CITES in this regard to exclude the possibility of punitive measures or tighter restrictions on trade in rhinos or their products.

The national permit system must also be set up and secure *before* private rhino owners are required to submit their personal information. Although TOPS regulations under NEMBA already require private rhino owners to acquire permits for their rhinos and rhino horns, some owners have not complied due to fear of having their confidential information shared with poachers. Without a guarantee that their information will be secure, these non-compliant rhino owners will not come forward and an impasse will ensue.

Access to this national permitting system and database should be very strictly controlled. Only a small number of people should have access to the database, and each one should go through a regular security screening process. IT specialists must be involved in working out the technical details for securing the database and controlling access.

The national database should be all encompassing, and include all details of rhinos and rhino horns under private ownership. The following information should be included in the database:

- Owner details
- Number of rhinos and all permit information
- Number of horns in possession, measurements, photograph, microchip information
- DNA profile information for each rhino and each rhino horn
- Trophy hunting permit applications
- Details of professional hunting outfitter and prospective hunter
- Rhino “passports” could be implemented

10.2. Rhino DNA profiling database

A key component of permitting and controlling the movements of rhino horn as well as regulating trade, will be identification of individual rhino horns and ensuring traceability

back to their source (whether from dehorned rhinos, natural mortalities, trophy hunting or poached animals). An effective method of individual identification already exists for rhinos and a successful system has been running for some time. Dr Cindy Harper kindly provided the following information:

The Veterinary Genetics Laboratory at the Faculty of Veterinary Science of the University of Pretoria at Onderstepoort conducts DNA profiling of rhinos and rhino horns, and maintains a rhinoceros database known as the Rhino DNA Index System (RhODIS™). The basic principle of DNA use for forensic evidence and rhino identification is that every rhino's DNA is unique (except for identical twins), so the method is virtually 100% effective. DNA profiling is the most definitive method for directly tracing horns back to an individual animal. Visually identifying horns is highly subjective, while microchips can fail or be removed. DNA can identify the horn even when chopped in small pieces and powdered, and as little as 20mg (0.02g) is sufficient.

At present, the Veterinary Genetics Laboratory is the only laboratory that is able to compare rhino DNA profiles from separately collected samples. A horn or blood sample can be processed in one day, with costs of R350 (until the end of 2012) for a live rhino to be added to the database. If trade were legalised in the future, the costs to verify legitimacy of rhino horn through DNA profile analysis would be R900/sample (until the end of 2012). The laboratory is able to process approximately 12,000 samples a year, so would be able to profile all South African rhinos within two years. Consequently, any bottleneck in processing samples will not be due to the laboratory work.

To date, over 3,500 individual rhinos have been added to the database from private owners, stockpiles, provincial parks, national parks, Namibia, Zimbabwe, Botswana and now Kenya, and the number is increasing daily. The number of private owners who have contributed is unknown at this stage, however, because veterinarians and nature conservation officials submit samples in batches from various owners. The RhODIS™ database holds the biodata from animals provided, and the DNA profile data of the animals. This is managed by the Veterinary Genetics Laboratory as part of the University of Pretoria, who is the custodian of the database. It is maintained on a secure server within the University and only accessed by authorised personnel of the Veterinary Genetics Laboratory.

For the Veterinary Genetics Laboratory to provide an efficient service to the rhino industry (in order to get all private rhinos on the proposed national database quickly), the laboratory would need to know the expected number of horns that will move through the system each year and the expected turnaround time of the samples.

Rhino DNA profiling for commercial rhino horn sales would be handled as a commercial service and the cost of testing the horns to certify legality based on horn value. In order to ensure that there will be no down time when providing the horn certification service, it will be necessary to acquire a duplicate of key equipment in the laboratory and this must be built into the cost calculation of this system. This will require upfront investment and a formal agreement.

10.3. Regular auditing of rhino horn stockpiles and private properties where rhinos are held

Annual checks of privately owned rhino horn stocks should be made to deter clandestine selling of rhino horn without permits. Depending on resources available, random spot-checks could also be instigated, much like happens with dope testing in professional sports. It is likely that some people will try to cheat the system, but if the majority of potential illicit deals are prevented, this will go a long way to tightening up controls and improving South Africa's international conservation image.

10.4. Penalties for non-compliance and illegal activities

An amnesty period should be considered for non-compliant private rhino owners to declare and register their horn stockpiles, on condition that these owners can provide sufficient proof that they own the horn and that it was obtained by legitimate means (e.g. natural death or permitted dehorning activity). For this to occur, however, the South African Government would have to check that all legal provisions were in place and would have to consider the legal processes that need to be followed. Once this period is over, owners that cannot provide evidence of legitimacy of their horn should have it confiscated or, depending on the circumstances, should not be allowed to obtain a permit for trade. Private rhino owners or rhino horn owners who are suspected of permit irregularities or who have been charged with wildlife related crimes should have their permits suspended until the irregularities and court cases have been finalised. Private rhino owners that do not comply with the requirements of the national permitting system should have any permits revoked.

10.5. Preventing smuggling of horn out of the country

Sniffer dogs need to be deployed at as many (preferably all) international ports of entry/exit as possible to assist officials with detecting wildlife products. This would be a big undertaking, but may be the only way to slow the rate of illegal export. All officials working at the ports of entry and exit must be trained in methods of detecting wildlife smuggling as well as the relevant legislation to assist them with arrest and seizure. Scanning equipment must be available at the cargo areas of the airports.

10.6. Incentivise private rhino owners to conserve and protect their rhinos

Private rhino owners have played a major role in the growth and expansion of rhino populations in the country and, if they begin destocking rhinos, national population growth rates will decline. They must be incentivised as much as possible to continue buying and conserving rhinos in South Africa. The South African government must show private rhino owners that they are working towards a solution for the poaching, which might include lifting the national moratorium once control measures are in place and initiating plans for approaching CITES to legalise international trade. If the national trade ban is going to remain, the government must provide private rhino owners with an option for safely and

securely storing their horns (for which they would pay a nominal fee). The government must also try to reduce the complexity of permitting restrictions without increasing the opportunities for private owners to engage in illegal activities. If private rhino owners decide to take legal action against the government over the moratorium, this will be a further blot on South Africa's reputation.

10.7. How should a legal national trade be controlled?

During the rhino expert surveys, many respondents suggested some kind of Central Selling Organisation (CSO) to control the trade in rhino horn. However, a number of alternative mechanisms were suggested about how this process should be established. Determining what system of trade should be used to trade rhino horn on a national basis (or international if such steps were to be taken) is not within the scope of this report, but a strategy must be developed before any trade is legalised. One way to determine the best trade system would be to conduct a workshop of rhino stakeholders that includes economists (including resource economists), market analysts, DEA, TRAFFIC, IUCN AfrSG, and private rhino owners.

10.8. Developing a national rhino management plan for private rhino owners

A national rhino management plan for private rhino owners should be drafted to provide guidelines for suitable management practices, including acceptable stocking densities, minimum numbers of rhinos required to make a legitimate contribution to rhino conservation and avoid genetic problems, options for joining conservancies and creating meta-populations. This would alleviate concerns held by some conservationists that many private rhino populations are too small to make genuine conservation and genetic contributions to the security of the national herd, and would further improve South Africa's standing with Parties to CITES. Consideration could then be given to the possibility that private rhino owners would only be allowed to trade rhino horn (if trade is legalised in the future) if they conformed to the guidelines provided in such a management plan.

Sections 43 to 45 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) would need to be considered to implement such a plan. A biodiversity management plan for the black rhino in South Africa is currently being drafted (Knight *et al.*, in prep.), while a biodiversity management plan for the white rhino is in preparation.

10.9. Preparing a proposal to the Conference of Parties to CITES to legalise international trade in rhino horn

While the measures listed above to reduce illegal activities involving rhino horn are being put in place, South Africa should start seriously investigating the viability of a legal international trade in rhino horn. This may involve economic studies in Asia (especially Viet Nam) to assess the potential market size and negotiations with Asian governments about the possibilities of forming trade partnerships. South Africa must construct convincing arguments for a legal international trade in rhino horn (if international trade is indeed viable) and then begin lobbying CITES parties for support.

11. LEGAL REQUIREMENTS TO BE ADDRESSED IN TERMS OF A NATIONAL TRADE SYSTEM

- a. The current moratorium on the trading in individual rhino horns would need to be repealed in a Government Gazette;
- b. Legislative provisions would be required for issues such as:
 - proving legal possession of rhino horn;
 - permit applications for trading locally in rhino horn;
 - whether trade will be allowed in pieces and derivatives of rhino horns as well as in entire horns;
 - what constitutes an acceptable method for harvesting horns (e.g. collection from natural deaths only or dehorning rhinos under farming conditions);
 - prohibition on the trading in horns seized during enforcement activities;
 - measures put in place to prevent such legally traded horn from ending up on the black market;
 - processes for regulating and monitoring trading in rhino horns (e.g. would a conservation official be required to be present at the handing over of horns to verify permits, markings, micro-chip numbers, etc.);
 - who will be allowed to buy and sell rhino horns?;
 - will such traded horn be allowed to be exported by the new owner of the horn and if so how will this be regulated?;
- c. Records of all horns will need to be accurate and up to date – compliance with current legislation and norms and standards will have to be improved and individuals prosecuted for non-compliance;
- d. National permit issuing authority will need to be in place to monitor national movements of rhino horns;
- e. Government would need to increase staff and budget capacity to handle increased permit application and pre-permit application inspections, marking of horns.

12. ANALYSIS OF SIMILAR SITUATIONS IN OTHER COUNTRIES AND ADVICE ON BEST PRACTICES AND INTERVENTIONS IN THOSE COUNTRIES

This section considers what lessons DEA can learn from experiences of other countries with comparable wildlife trade management issues. Debates over best practice frequently refer to other examples, not only of other species, but also of other commodities ranging from diamonds to drugs.

While the study of trading regimes of other species and commodities is very useful in drawing out principles of sensible trade policy and management interventions, there are significant variations between the different examples and these may imply completely different approaches for/effective management. A distinction must, therefore, be made

between the similarities that can provide useful lessons and the differences that render direct comparisons inappropriate.

Comparisons to trading regimes for high value mineral commodities such as diamonds and gold provide valuable lessons about what is possible to control and what is not. Such high value products are most effectively controlled at source and far less so toward the consumer end of the supply chain. For example, in the diamond industry, the De Beers cartel was able to control the sources of mining/production through to the wholesale level at a time when the number of sources was relatively limited, but this control did not extend to the retail level or secondary markets (although De Beers continued to exercise considerable influence through effective marketing campaigns). More recently, as the number of sources has increased, De Beers has increasingly lost control over the wholesale market too (<http://are.berkeley.edu/~sberto/DeBeersDiamondIndustry.pdf>).

By examining markets for illicit drugs we can learn much about the prospects of influencing levels of demand or trade through law enforcement (which are limited if demand is persistent and price inelastic) (Becker *et al.*, 2006), but in such cases policy is aimed at protecting consumers rather than the source of supply, and this again implies different approaches. For example, it makes sense to destroy confiscated stocks of heroin to protect end users but it does not make sense to destroy confiscated stocks of elephant ivory if the principal objective is to discourage further illegal killing of elephants. This is because (in the latter instance) reducing the potential perceived supply will tend to drive black market prices higher, thus creating even higher economic incentives for illegal harvesting (and a likely consequent increase in illegal killing).

When discussing relevant comparative cases of wildlife trade, typical examples quoted include elephants (ivory), tigers, bears, deer (velvet), crocodilians, ostriches, abalone and vicuñas. Most of these examples share some common characteristics with the rhino horn trade (for example, many relate to products that are consumed in Asian countries, several of which are used in traditional Asian medicines), but almost all also possess a distinguishing characteristic to render a complete and direct comparison inappropriate.

A frequent example is the African elephant. Although elephants are listed on CITES Appendices (either I or II), elephant poaching remains a serious problem and, as with rhino horn, East Asian consumer demand for ivory appears to have increased over the last few years (and with it, levels of poaching) (http://www.traffic.org/home/2011/12/29/2011-annus_horribilis-for-african-elephants-says-traffic.html). However, there are several significant differences between the elephant and rhino cases, and at least two of these render comparisons inadvisable.

First, rhinos offer potentially far higher productivity rates. Whereas elephant ivory can only be practically harvested from dead animals, rhino horn can be renewably harvested from live animals. The compounded rate of rhino horn reproduction and managed population growth (at least 10%) is far higher than the reproductive rates of elephants (approximately 5%) and rate of ivory production. Real rates of production growth for rhinos/rhino horn (at constant prices) comfortably exceed the market growth rates of even

the world's fastest growing economies (<http://www.tradingeconomics.com/gdp-growth-rates-list-by-country>). The same is not necessarily true for elephants and ivory production.

Second, there remain large populations of elephants under institutional conditions that could still be described as 'open access', with very limited specific protection or management control. This is no longer true for rhinos: virtually all surviving rhino populations fall under the jurisdiction of relatively strong institutions with at least nominal incentive systems to invest in their management (and consequent higher levels of monitoring and security). Whereas it still makes theoretical sense to approach the management of certain African elephant populations in the same way as an open access sea fishery (by increasing the cost of harvesting with a trade ban), management of rhino populations should be approached differently – i.e. as for any other valuable terrestrial agricultural livestock species that is effectively owner-managed.

In recent months international environmental groups have claimed that the CITES-approved 2008 'one-off sale' of ivory resulted in an increase in Asian ivory demand (<http://www.ifaw.org/international/resource-centre/making-killing>). This claim is unsubstantiated (ivory demand appears to have been rising irrespective of the one-off sale) and is largely irrelevant to the current rhino situation. The ivory sale in question was inadvertently rigged in favour of the consumer countries (they had monopoly buying power and were able to negotiate very low purchase prices) with resultant distorting effects on the market. Such a rigged one-off sale of rhino horn stocks to consumer countries is not currently contemplated (and is anyway inadvisable, for both economic and conservation reasons: the selling country loses out economically from underselling and the artificially low price potentially stimulates excessive consumption).

Another frequently cited example is that of tiger farming. Rhinos and tigers provide products that are sought after for both ornamental (rhino horn carving and tiger skins) and medicinal (rhino horn powder and tiger bone preparations) purposes in Asian markets. Domestic trade in both species was also effectively banned in consumer countries such as China and Vietnam in the early 1990s and their products were removed from the official pharmacopeia. However, demand for these products persists and some sectors of government in both those countries have argued for commercial captive breeding as a potential source of future supply (for both tigers and rhinos). These calls have been fiercely opposed by international conservation NGOs and to date the only source of supply to those markets is in the form of a limited amount of informal (and technically illegal) leakage from such captive breeding operations.

Some NGOs have claimed that tiger farming has failed to protect wild tigers, but this claim is disingenuous as there is no large-scale legal production and sale of tiger products supplied from captive facilities (and therefore no means by which tiger farming could have a significant positive effect). To date, all these facilities are officially allowed to do is to stockpile products for potential future use. To assess the effects of commercial captive breeding in Asia on wild species we need to investigate examples in which domestic trade is legal. There are many such examples - most are plant species, but they include some

larger mammals such as musk deer and bears (three species of which are farmed in China and Vietnam).

The example of bear farming is controversial. Bear bile extracted from bear gall bladders constitutes another highly prized ingredient in traditional Asian medicines. Unlike tigers, which need to die before their bones can be used, bear bile can be extracted from live animals by a process of 'bile milking'. Bear farming and bile milking operations are fiercely opposed by animal welfare groups for the inhumane conditions they impose upon bears. Environmental groups also argue that bear farming has resulted in illegal live harvesting of cubs from wild Asian populations, although there appear to be no reliable data on whether such harvesting takes place at unsustainable levels.

According to a recent survey of stated consumer preferences in China, wild bile is preferred over farmed bile (Dutton *et al.*, 2011). However, the extent of this is not empirically demonstrated by studies of actual consumer behaviour. Consumers may theoretically prefer wild bile, but may actually prefer to purchase less expensive and genuine farmed bile of known provenance over wild (but potentially fake) bile of uncertain origin. As long as farmed bile is legal and wild bile illegal, any quantitative effect of stated consumer preferences on levels of illegal harvesting from wild populations is merely speculative. Wild bear poaching outside of key consuming and farming countries does not appear to be as serious a problem as the illegal killing of tigers and rhino species; the latter are very obviously threatened worldwide, whereas this is less clearly so with bears.

The South African rhino horn trade question has both striking similarities to and differences with the bear bile trade. In both instances the products sought as traditional medicines can be produced by non-lethal methods and commercial production techniques can provide greater yields than wild harvesting (whether legal or illegal). However, rhino horn can be viably harvested from free-ranging rhinos and the 'farmed' versus 'wild' concern does not apply (whereas certification of origin and authenticity still offers a potential competitive advantage over illegal suppliers). The biological productivity parameters for bears and rhinos are also obviously different.

Another important difference between the bear case and the rhino case is that the former involves both substantial supply and demand within a country (e.g. China or Vietnam) and is therefore principally a domestic trade policy issue. Conversely, since consumer demand for rhino horn exists practically only outside of South Africa, a change in domestic policy cannot be viewed in isolation and must consider interactions with consumer country markets.

A closer analogy to the rhino example is that of the South American vicuña, a camelid species that occurs in five South American countries (Argentina, Chile, Bolivia, Ecuador and Peru). Vicuñas also yield a (slow-growing) valuable product – wool – that can be harvested by non-lethal means. A CITES Appendix I listing in 1975 was followed by a separate vicuña convention, signed by the five range states in 1979. A Peruvian textile company played an active role in implementing a sustainable community harvesting scheme and vicuña populations staged a remarkable recovery, from approximately 10,000 animals in 1965 to

an estimated 350,000 in 2008. Most vicuña populations were also down-listed to CITES Appendix II in 1994. (<http://www.iucnredlist.org/apps/redlist/details/22956/0>).

The institutional context of the vicuña example appears somewhat different from that of rhinos and deserves to be studied in greater detail. For example, most – if not all – vicuñas appear to fall under public or communal ownership regimes rather than any form of private ownership. It also appears that the market for vicuña wool is subject to a significant degree of buyer monopoly power and that benefits flowing to relevant local communities are not as high as they could be (Lichtenstein, 2011). Illegal trade continues to exist, but any illegal killing has clearly been reduced to sustainable levels.

The management of marine species (such as abalone and tuna) involves different institutional constraints from terrestrial non-migratory species such as rhinos and does not provide much material for useful comparison. The examples of ostriches and crocodiles suggest that commercial captive breeding and wild populations can co-exist (Hutton & Webb, 2002), but differences in trade volumes, values and breeding biology also constrain the extent to which we can draw more specific lessons from these to apply to the rhino horn trade. These examples involve products that trade at much higher volumes and lower relative prices; potential captive breeding rates are much higher, and the availability of substitutes suggests lower demand price elasticity.

In summary, the elephant (ivory) and tiger trade examples appear to offer lessons on what types of policies are best avoided (supply restrictions, rigged one-off sales). The bear and vicuña examples bear closer resemblance to the rhino case, especially the latter, which may provide some instructive lessons on proactive measures to be adopted going forward (such as setting up a rhino-specific convention between producer and consumer countries to design an effective supply-chain system that ensures profits from sales are redirected to owner-producers). However, neither the bear nor vicuña examples entail a situation in which 1) domestic trade is legal and 2) international trade is not and 3) the demand for the product in question lies almost exclusively outside of the domestic market. In this sense, the South African rhino case appears to be unique and none of these examples can teach us much specifically about whether it makes sense to lift a domestic trade moratorium while international trade remains illegal, nor about issues of best practice/recommended interventions in this instance.

13. CONCLUSION AND OVERALL RECOMMENDATIONS

There are no simple solutions to the rhino poaching crisis currently being experienced in South Africa, and the government faces pressure from two opposing camps in the trade debate. On one side are the trade-sceptics, a group that includes most rhino range states outside southern Africa, many influential international NGO's and a number of Parties to CITES. If South Africa fails to keep these countries and organisations on side, there could be significant negative repercussions for its policies of sustainable utilisation. On the other side are the pro-trade lobby, mostly comprising private rhino owners and some state conservation agencies. Private rhino owners are responsible for about 25% of South Africa's rhino population and have played an important role in the successful revival of the white rhino, but they are facing an unsustainable financial situation with few options available for recuperating money spent on anti-poaching. If this situation continues, many may eventually be unable to continue paying the increasing sums required to protect their rhinos and/or will be forced to destock. Destocking would shrink area available to white rhinos and may reduce the annual rate of increase and thus the resilience to illegal harvest, and could contribute to and increase the likelihood of South Africa experiencing a national population decline.

It is clear that both trade or no trade scenarios carry risks that could negatively impact South Africa's rhino populations, so determining which option to pursue comes down to a decision on which one is least detrimental to rhino conservation. Taking into account the facts that the mechanisms for controlling a legal trade in South Africa are not yet in place, that the number of rhino horns in private stockpiles are uncertain, and that some private rhino owners are not yet compliant with permitting regulations, it is likely that lifting the moratorium at the present time will lead to laundering of illegal horn into legal stockpiles as well as smuggling of horn out of the country. These acts would tarnish South Africa's reputation with CITES Parties and could jeopardise future attempts to legalise international trade in rhino horn. If international trade in rhino horn were the primary goal for South Africa, damaging the chances of achieving this by legalising national trade now would be counterproductive. Moreover, given that the main demand for rhino horn is in Asia, legalising national trade would do little to satisfy that demand, so poaching would continue.

At the present time, therefore, South Africa should keep the moratorium in place. However, this should not be considered a long-term solution because rhinos are being poached at an ever-increasing rate, and the national moratorium is doing nothing to relieve this. In fact, the restrictions created by the local trade ban may be exacerbating the poaching problem. It is imperative that private rhino owners are incentivised to continue conserving and protecting rhinos in South Africa, but if the national and international trade bans remain in place indefinitely and if the poaching remains high or escalates, many private owners may stop protecting rhinos. If this happens, the prospects for successful rhino conservation in South Africa will worsen significantly.

South Africa must bring all private rhino owners into compliance with TOPS regulations and the norms and standards before it considers lifting the national moratorium and before

making an approach to CITES to legalise international trade in rhino horn. Many Parties to CITES are unlikely to vote in favour of lifting the international trade ban before this happens, and may even consider implementing tighter restrictions on rhino exports (such as white rhino trophies) if South Africa fails to do so. The first step towards achieving this is the creation of a secure, national electronic permitting system and rhino database that deals with all permitting issues for live rhinos and rhino horn, including the marking and identification of horn using DNA profiling. Once this database is established, all private rhino owners must be compelled to disclose exactly how many horns they have stockpiled and submit to the necessary permitting and marking process. They are only likely to do this, however, if they trust the national permitting authority and if they believe that the government is trying to find ways to help them cover the costs of protecting rhinos. The process of developing the database and capturing all private owner information should be completed at least one year before the 17th Conference of Parties that is due to be held in 2016. It is imperative that South Africa is prepared and ready to argue for international trade at this meeting if by that stage the poaching surge has not been brought under control.

While this central rhino database is being developed and implemented, economists must decide on a system to control and regulate trade in rhino horn. This should be done for both national and international trade because legalising international trade may turn out to be the only way to reduce poaching in the future if law enforcement continues to fail. Once the database is successfully implemented and all private rhino owners are compliant with regulations, the national moratorium could be lifted, if by that time it is still deemed necessary.

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15. REFERENCES

- Buijs, D. 1988. A summary of the introduction of white rhino onto private land in the Republic of South Africa. Rhino and Elephant Foundation, Johannesburg. Unpublished.
- Buijs, D. 1998. *Survey: White rhinos on private land, 1997*. Unpublished report, African Rhino Owners Association.

Buijs, D. 1999. *Survey: White rhinos on private land (October 1999)*. WWF-African Rhino Owners Association. 7pp.

Buijs, D. & Papenfus, T. 1996. *Survey: White rhinos on private land, 1996*. Unpublished report, African Rhino Owners Association.

Castley, J.G. & Hall-Martin, A.J. 2003a. The status of the southern white rhinoceros (*Ceratotherium simum simum*) on private land in South Africa in 2001. *Pachyderm* **34**: 33-44.

Castley, J.G. & Hall-Martin, A.J. 2003b. The status of the southern white rhinoceros (*Ceratotherium simum simum*) on private land in South Africa in 2002. Unpublished report, WWF-ARP, 19pp.

Castley, J.G. & Hall-Martin, A.J. 2005. The status of white rhinoceros, *Ceratotherium simum simum*, on private land in South Africa – a summary of findings from a survey conducted in 2004. Unpublished Report, WWF ARP, 28 pp.

CITES. 2010. A guide to using the CITES trade database, Version 7, 2010. United Nations Environment Programme/World Conservation Monitoring Centre, 21 pp.

Conway, A.J. & Goodman, P.S. 1989. Population characteristics and management of black rhinoceros *Diceros bicornis minor* and white rhinoceros *Ceratotherium simum simum* in Ndumu Game Reserve, South Africa. *Biological Conservation* **47**: 109-122.

Dutton, A.J., Hepburn, C., Macdonald, D.W. (2011) A Stated Preference Investigation into the Chinese Demand for Farmed vs. Wild Bear Bile. *PLoS ONE* 6(7): e21243. doi:10.1371/journal.pone.0021243

Emslie, R. 2011(a). *Ceratotherium simum ssp. Simum*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <http://www.iucnredlist.org/details/4185/0>

Emslie, R. 2011(b). *Diceros bicornis*. In: IUCN 2011. IUCN Red List of Threatened Species. Version 2011.2. <http://www.iucnredlist.org/details/6557/0>

Emslie, R.H., Read, C. & Tello, J. 2006. Report on the different target species counted and evidence of poaching activity recorded during aerial and ground surveys undertaken in Southern Garamba National Park and adjoining Domaine de Chasse Gangala Na Bodio, Democratic Republic of Congo, 17th-30th March 2006. IUCN AfRSG Report.

Emslie, R.H., Milledge, S., Brooks, M. van Strien, N.J. & Dublin, H.T. 2007. African and Asian Rhinoceroses – status, conservation and trade: A report from the IUCN Species Survival Commission (SSC) African and Asian Rhino Specialist Groups and TRAFFIC to the CITES Secretariat pursuant to Decisions 13.23-25 taken at the 13th meeting of the Conference of the Parties, and further deliberations at the 53rd and 54th meetings of the Standing Committee. 17pp.

Ferreira, S.M., Greaver, C.C. & Knight, M.H. 2011. Assessing the population performance of the black rhinoceros in Kruger National Park. *S. Afr. J. Wildl. Res.* **41**: 192-204

Government Gazette No. 29657, Notice No. 152, 23 February 2007. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Threatened or Protected Species Regulations.

Government Gazette No. 31899, Notice No. 148, 13 February 2009. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): National moratorium on the trade of individual rhinoceros horns and any derivatives or products of the horns within South Africa.

Government Gazette No. 32426, Notice No. 756, 20 July 2009. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Marking of rhinoceros horn and hunting of white rhinoceros for trophy hunting purposes.

Government Gazette No. 35248, Notice No. 304, 10 April 2012. National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004): Marking of rhinoceros horn and hunting of white rhinoceros for trophy hunting purposes (amended from Notice No. 756 of July 2009).

Hall-Martin, A.J. & Castley, J.G. 2003. The status of the black rhinoceros (*Diceros bicornis*) on private land in South Africa in 2001. *Pachyderm* **34**: 24-32.

Hall-Martin, A.J., du Toit, J.G., Hitchins, P.M. & Knight, M.H. 2009. An excerpt of the 2008 survey of white rhinoceros, *Ceratotherium simum simum*, on private land in South Africa. An unpublished report for WWF-Africa Rhino Programme. 44pp.

Hutton, J. and Webb, G.J.W. (2002). Crocodiles: legal trade snaps back. Pp. 108-120 in *Trade in Wildlife: Regulation for Conservation*, ed. by S. Oldfield. Earthscan Publications: London.

Kock, M.D., Atkinson, M., 1994. *Dehorning of black (Diceros bicornis) and white rhinoceros (Ceratotherium simum): the Zimbabwean experience*. Pages 42-47 in Penzhorn, B.L. et al. 1994 Proceedings of a symposium on rhinos as game ranch animals. Onderstepoort, Republic of South Africa, 9-10 September 1994, pp. i-iv, 1-242.

Knight, M.H., Balfour, D. & Emslie, R.H. In prep. Biodiversity management plan for the black rhinoceros (*Diceros bicornis*) in South Africa: 2011-2020.

Lichtenstein, G. (2011). Use of Vicuñas (*Vicugna vicugna*) and Guanacos (*Lama guanicoe*) in Andean countries: Linking community-based conservation initiatives with international markets. In: Abensperg-Traun, M., Roe, D. and O’Criadain, C., eds. (2011). *CITES and CBNRM. Proceedings of an international symposium on “The relevance of CBNRM to the conservation and sustainable use of CITES-listed species in exporting countries”, Vienna, Austria, 18-20 May.*

- Martin, E.B. 1990. Medicines from Chinese treasures. *Pachyderm***13**: 12-13.
- Milledge, S.A.H. 2007. Illegal killing of African rhinos and horn trade, 2000-2005: the era of resurgent markets and emerging organized crime. *Pachyderm***43**: 96-107.
- Milliken, T. 2012. Final destination. *Africa Geographic* **April 2012**: 40-43.
- Milliken, T., Nowell, K. & Thomsen, J.B. 1993. The decline of the black rhino in Zimbabwe: implications for future rhino conservation. TRAFFIC Report.76pp
- Milliken, T., Emslie, R.H. & Talukdar, B. 2009. African and Asian Rhinoceroses – status, conservation and trade: A report from the IUCN Species Survival Commission (IUCN/SSC) African and Asian Rhino Specialist Groups and TRAFFIC to the CITES Secretariat pursuant to Resolution Conf. 9.14 (Rev. CoP14) and Decision 14.89. 17pp.
- Milliken, T. & Shaw, J. (2012). *The South Africa – Viet Nam Rhino Horn Trade Nexus: A deadly combination of institutional lapses, corrupt wildlife industry professionals and Asian crime syndicates*. TRAFFIC, Johannesburg, South Africa.
- Morkel, P., Geldenhuys, L.J., 1993. Dehorning of black rhinoceros (*Diceros bicornis bicornis*) in Namibia: pp. 350-353. In: Ryder, O.A. Rhinoceros biology and conservation: Proceedings of an international conference, San Diego, U.S.A. San Diego, Zoological Society, pp 1-5.
- Nowell, K. 2012. *Assessment of rhino horn as a traditional medicine*. A report prepared for the CITES Secretariat on behalf of TRAFFIC. Standing Committee 62, Document 47.2 Annex 1. <http://www.cites.org/eng/com/SC/62/E62-47-02-A.pdf>
- Owen-Smith, R.N. 1988. *Megaherbivores: the influence of very large body size on ecology*. Cambridge studies in ecology. Cambridge University Press.
- Pienaar, D.J., Hall-Martin, A.J. & Hitchins, P.M. 1991. Horn growth rates of free-ranging white and black rhinoceros. *Koedoe***34**: 97-105.
- Rachlow, J.L. & Berger, J. 1997. Conservation implications of patterns of horn regeneration in dehorned white rhinos. *Conservation Biology***11**: 84-91.
- SANParks. 2002. *Strategic plan for the conservation and management of rhinoceros (Diceros bicornis and Ceratotherium simum) within South African National Parks 2003-2013*. Unpublished manual of the South African National Parks, Pretoria, South Africa.
- Skinner, J.D. & Chimimba, C.T. 2005. The mammals of the Southern African subregion. Cambridge University Press, Cambridge. 814pp.
- ‘t Sas-Rolfes, M.J. 1990. *Privatizing the rhino industry*. Free Market Foundation. 42pp.

Wilson, D.E. & Mittermeier, R.A. 2011. *Handbook of the mammals of the world*. Vol. 2. Hoofed mammals. Lynx Edicions, Barcelona. 885pp.



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