The risk of restricting options for the conservation of charismatic species: the case for African rhinos

M. ABENSPERG-TRAUN

Abstract The continental populations of the two African species of rhinoceros, the White rhino (*Ceratotherium simum*) and Black rhino (*Diceros bicornis*), once widespread across the continent, have in sum declined from between half a million and a million animals at the end of the 19th century to about 25,000 animals today as a result of excessive hunting and illegal trade in horn, now valued at about US$65,000/kg on the illegal market in Asia. Today, over 80% of African rhinos occur in South Africa where intensive poaching has increased 51-fold from 2007 to the end of 2012. Limiting factors to effectively address the current crisis include: (1) Ineffective CITES trade controls; (2) inadequate conservation funds; (3) corruption and (4) poor cooperation through local communities that coexist with, or live adjacent to, rhinos. It is argued that, in addition to strengthening enforcement and legislation in producer and consumer countries, and demand reduction strategies, there is a need for CITES to evaluate the practicality of a decision-making mechanism and criteria for a future trade in rhinoceros horn (as for ivory), an option which the international CITES community has to date rejected as a complementary strategy to address rhino conservation. The paper lists key issues that require sound evaluation before any decision on the legal trade option should be made.

Key words African rhinoceros, CITES, conservation budgets, poaching, poverty, TCM, trade in horn.

The rhino crisis in Africa

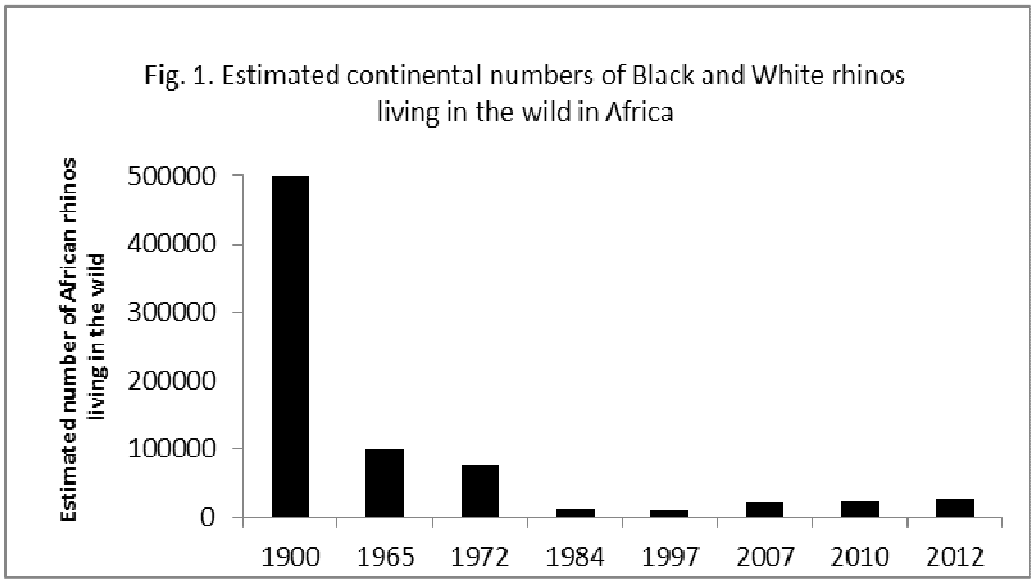
In addition to habitat loss, the greatest threat to the survival of some charismatic species such as rhinoceros is high value international trade in their body parts for wealthy Asian markets, and current levels of poaching of African rhinos, especially in southern Africa, pose a serious threat to the survival of the largest remnant populations on the African continent (Milliken et al., 2009a; ‘t Sas-Rolfes, 2012; Milliken & Shaw, 2012; Emslie et al., 2013).

For the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES), the rhino, next to the tiger, has been one of its greatest challenges. The Convention has a strong compliance mechanism (Reeve, 2006) yet its 1977 ban on trade in rhino horn, while drawing much-needed attention to the plight of rhinoceros, failed to significantly reduce illegal trade. It may even have harmed efforts to conserve African rhinoceros (Leader-Williams, 2003; ‘t Sas-Rolfes, 2000; Bennett, 2011; Conrad, 2012). African rhinos are in desperate need of an effective and sustainable strategy to meet the current crisis, yet how this is to be achieved is a matter of contention. The choice is (1) to largely carry on with „more-of-the-same“ – largely ineffective international trade controls and increasingly unaffordable national enforcement; or (2) to explore additional options to complement existing strategies (Daly et al., 2011; Child, 2012).

Rhino horn has been part of traditional Asian, especially Chinese, medicine (TCM) for at least 2000 and possibly 4000 years (Nowell, 2012), with a significant rise in demand from Viet Nam during the last decade where uses are both traditional and non-traditional ('t Sas-Rolfes, 2012; Milliken & Shaw, 2012). Historically, high demand has also come from Yemen where horns are turned into traditional dagger handles (*jambiyya*) as objects of great prestige (Martin et al., 1997). The wholesale price of rhino horn in the Far East has risen from less than US$50/kg in the early 1970s ('t Sas-Rolfes, 2000) to a retail price of about US$65,000/kg on the black market in China and Viet Nam today ('t Sas-Rolfes, 2012). While demand in the politically and economically unstable Yemen has markedly declined in recent years, economic growth in both China and Viet Nam, the associated rise in demand and the immense profits to be made from trade in rhino horn by criminal syndicates (inside and outside of Asia), and rural poverty in range states, are the driving forces behind today's poaching surge. Having little to lose, for an average African villager living in poverty, the income derived from the sale of a poached rhino horn provides an incentive that far outweighs any concerns associated with potential penalties, even the risk of losing his own life (Dublin and Wilson, 1998). The driving forces behind poaching of African rhinos (financial profit) apply equally to the three Asian species of rhinoceros (e.g. Amin et al., 2006; Martin & Martin, 2006; Milliken et al., 2009a).

Traditionally, powdered or shaved rhino horn in TCM is used in combination with other ingredients mainly to treat a wide variety of ailments such as fever, influenza, rheumatism, poisoning, convulsion and epilepsy, with recent rumours from Viet Nam of positive treatment effects against cancer not supported by traditional TCM pharmacies (Milliken et al., 2009a; Nowell, 2012). Few cases have provided scientific evidence that use of rhino horn has beneficial medicinal effects. However, in some clinical trials at high dosages not used in conventional treatment, some positive effects at fever reduction were detected, but substitutes such as herbs, or ground horn of water buffalo (*Cornu bubali*) or yak (*Cornu bovis grunniens*) achieved comparable effects at lower cost, especially when used in combination with herbal materials (Liu et al., 2011; see Nowel, 2012 for a review of medicinal effects of rhino horn). At best, the medicinal effects of rhino horn remain ambiguous (Nowell, 2012). Regardless, the outcome of clinical tests carried out by either western or Chinese scientists appear to have no relevance to true believers of TCM and the currently observed high demand in rhino horn reflects the deeply-held beliefs in traditional Asian communities about the curative and restorative powers of rhino horn (Patton, 2011). In fact, the documented decline in the supply of traditional Asian drugs, including rhino horn, has led to recommendations for stockpiling, thus maintaining demand (Han, 2009). Today, the use of rhino horn in TCM is prohibited in most traditional Asian consumer countries such as Japan, South Korea, Taiwan and China. While trade in rhino horn inViet Nam is prohibited, there are calls to review and strengthen legislation, enforcement and penalties (CITES Secretariat, 2010; Milliken & Shaw, 2012).

Viet Nam is one of the world's fastest growing economies with a large number of citizens having a hitherto unknown access to disposable income for luxury items such as rhino horn, and has become a major driver of the current rhino crisis in Africa (Milliken & Shaw, 2012). While Viet Nam has an ancient history of using rhino horn in traditional medicine, demand for rhino horn in Viet Nam is not reduced to TCM but a significant amount of horn is destined for non-traditional uses such as an aphrodisiac, to display wealth and success, and as gifts to induce favours among economic and political elites (Milliken & Shaw, 2012).



Source: Emslie and Brooks (1999); Milliken et al. (2009); Emslie (2013); * rough estimate (http://www.savetherhino.org/rhino_info/rhino_population_figures; accessed 10 January 2013).

Due to both legal hunting and supplying Asia with horn, numbers of African rhinos declined from about half a million to a million animals at the turn of the 19th century to about 25,000 today (Fig. 1). In some former African range states, including Cameroon, Central African Republic, Chad, Democratic Republic of the Congo, Ethiopia, Ruanda and Somalia, rhinos are now considered extinct and in the majority of current range states, rhino populations are very small and highly susceptible to poaching (Table 1). In 1977, all species of rhinoceros, including both extant African species, the White (*Ceratotherium simum*) and Black rhino (*Diceros bicornis*), were placed on CITES Appendix I, prohibiting all international trade in the species and its products. Not only did the ban not reduce poaching, it led to a massive increase in the value of rhino horn (e.g. by 400 % on Korean markets), thus providing greater incentives for poaching and illegal trade across Africa (`t Sas-Rolfes, 2000; Leader-Williams, 2003; Rivalan et al., 2007). Two subspecies, the Northern white rhino (*C.s. cottoni*) and the Western black rhino (*D.b. longipes*) are considered to have become extinct in the wild (CITES Secretariat, 2007a; Milliken et al., 2009a). This is despite considerable investment and NGO support over many years, such as in Garamba National Park in the Democratic Republic of the Congo which provided one of the last strongholds of the Northern white rhino (Emslie & Brooks, 1999; Amin et al., 2006). This case also demonstrates that high levels of investment in enforcement alone provide no safeguard against determined rhino poaching.

Table 1
Estimated numbers of White rhinos (*Ceratotherium simum*) and Black rhinos (*Diceros bicornis*) listed by country as of 31 December 2012

Country	White rhino	Black rhino
Angola		1
Botswana	185	9
Kenya	394	631
Malawi		26
Mozambique	1	
Namibia	524	1,750
Republic of South Africa	18,910	2,044
Swaziland	84	18
Tanzania		127
Uganda	14	
Zambia	10	27
Zimbabwe	283	422
Totals	**20,405**	**5,055**

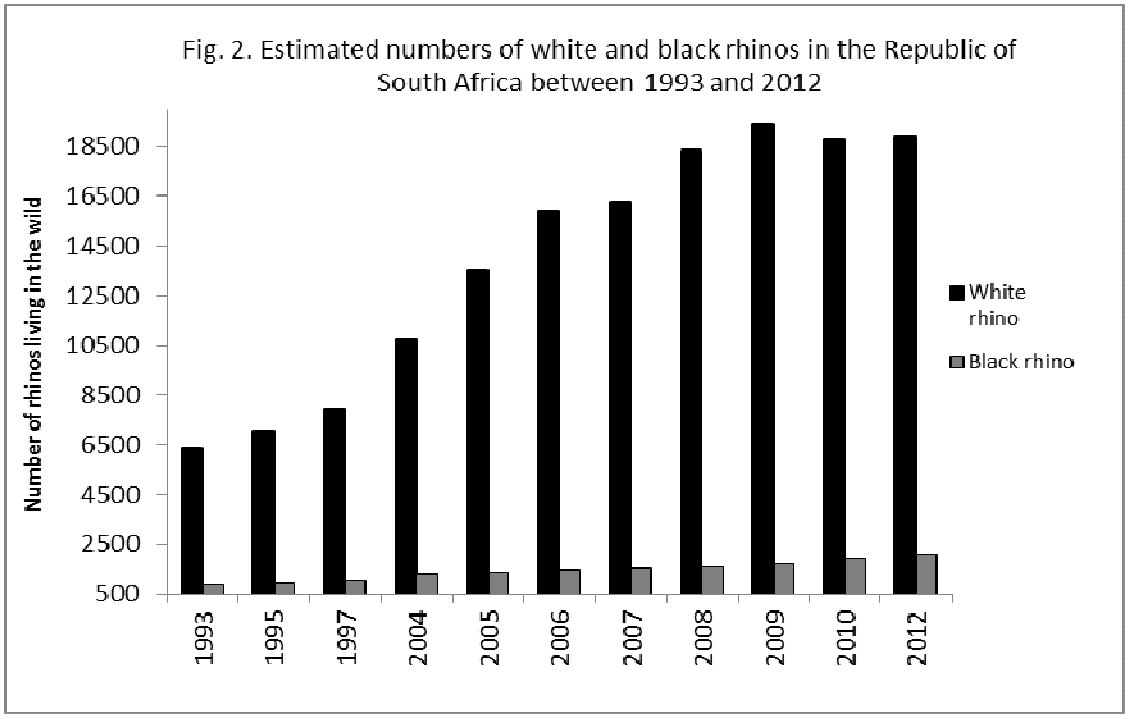
Source: Emslie (2013).

As a result of the poaching surge of the 1970s and 80s, the continental population of the most abundant Black rhino crashed from about 65,000 in the 1970s to about 2,400 by 1995 (Emslie & Brooks, 1999). Convinced of the failure of the CITES ban on trade in rhino horn, the Republic of South Africa considered as early as 1989 to have its rhino populations down-listed to CITES Appendix II and to reopen trade in rhino horn to provide the necessary funds for rhino conservation, but failed for procedural reasons at CITES CoP7 (CITES Secretariat, 1989). At CITES CoP8 (1992), both South Africa (White rhino) and Zimbabwe (Black and White rhino) failed with their proposals for down-listing of their respective rhino populations including a quota for commercial trade in horn.

But there are also success stories in African rhino conservation. Numbers of the White rhino in southern Africa (*C.s. simum*) have recovered from as few as 200 animals towards the end of the 19th century to over 20,000 today, with about 93% currently living in South Africa (Rookmaaker, 2000; Emslie et al., 2013). This is attributable to the establishment of many well-protected breeding groups throughout southern and eastern Africa in the 1960s and 1970s, and their privatization for commercial exploitation, including trophy hunting and live-sales. Its partial down-listing to CITES Appendix II in the Republic of South Africa (1994) and Swaziland (2004), for live-sales to appropriate and acceptable destinations, and associated less strict international regulation of hunting trophies, provided further incentives to conserve the species ('t Sas-Rolfes, 2000). Income derived from live rhino sales to South African National Parks provided 75% of KwaZulu-Natal's parks budget between 2008 and 2011 (Child, 2012). At CITES CoP10 (1997), South Africa failed again with a proposed change to the annotation of the Appendix II listing of its White rhino population to allow bilateral trade in parts and derivatives, including horn (but initially with a zero quota for the international market).

Based on 2007 data, today's rhino strongholds are South Africa, Namibia, Kenya and Zimbabwe (Table 1), with animals from mostly South Africa and Namibia being used to

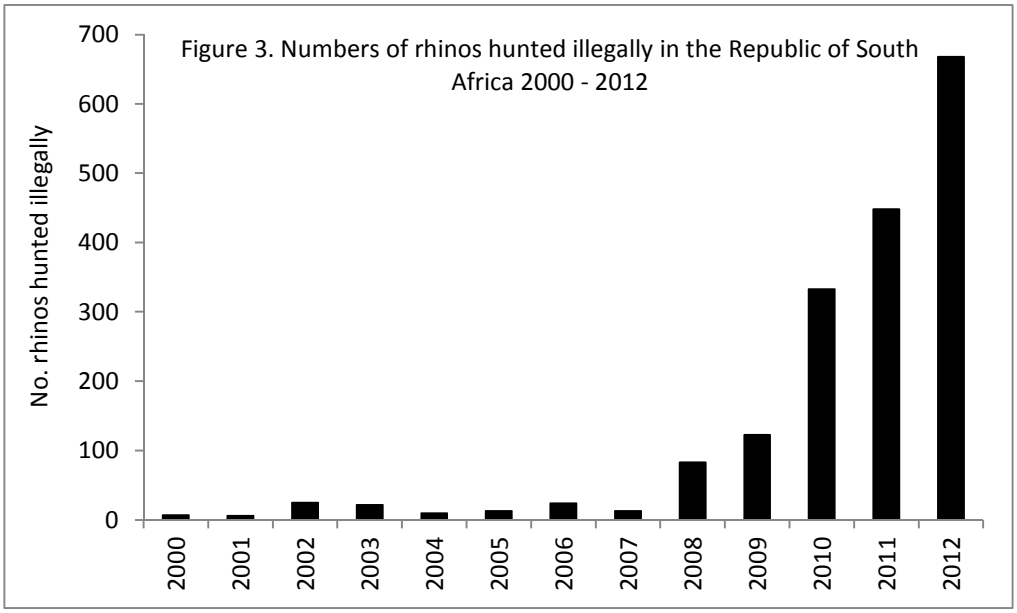
restock rhino populations elsewhere in Africa. The poaching crisis of the late 1970s and 80s nearly destroyed populations in Tanzania, Zimbabwe and Zambia in particular (Dublin & Wilson, 1998), but had declined by the early 1990s, allowing populations to increase, with annual net growth rates for both species in excess of 5% between 1991 and 2010 (Emslie, 2011; Fig. 2). Population increases of both species have been achieved largely by concentrating rhinos in well-protected areas administered by both government and private owners (Emslie & Brooks, 1999). Today, South Africa harbours over 80% of Africa's rhino population, making it the primary target of poaching. Together with Namibia, only two countries hold over 90% of Africa's rhinoceros.



Source: http://www.stoprhinopoaching.com/statistics.aspx; accessed 10 January 2013; Emslie (2013).

But conservation successes are again threatened by an unprecedented upsurge in poaching since 2007. In South Africa poaching has increased 51-fold since then, losing 668 rhinos to poaching in 2012 (Fig. 3; Milliken et al., 2009a). The 2 million hectare Kruger National Park (KNP) holds more than half the South African rhino population and has suffered the highest losses of all protected areas in South Africa, with 425 of the 668 rhinos reported to have been poached in South Africa in 2012, an increase of 169 % since 2011 (http://www.stoprhinopoaching.com/statistics.aspx; accessed 10 January 2013). Given the size of KNP and inherent difficulties of accurate carcass counts in large conservation areas (Frame, 1980), the data provided in Figure 3 should be interpreted as conservative. In overall percentage terms, Zimbabwe has experienced an even worse poaching crisis (Emslie, 2013). Of the range states with significant rhino populations, only Namibia, with its large population of Black rhino, has so far not been seriously affected by the upsurge in poaching (Emslie et al., 2013), possibly because of its remoteness, harsh climatic conditions and effective incentive structures for communities involved in wildlife conservation (Weaver et al., 2010). However, should current rates of increase in poaching continue, it could result in the extinction of African rhinos as soon as 2025 (Rhino Summit, 2012), or at least that deaths

could exceed births as early as 2015-2016 (Emslie et al., 2013), especially in extensive conservation areas where costs of effective protection can not, or will not, be met by affected governments and landowners.



Source: http://www.stoprhinopoaching.com/statistics.aspx; accessed 10 January 2013; Emslie (2013).

CITES, and in situ protection

Rhino conservation during the last decades has been given high priority and focussed on two complementary approaches: in situ protection and international trade controls (Emslie & Brooks, 1999). While in situ protection indirectly addresses supply by attempting to prevent it, CITES has no mechanism to address supply or demand, relying on restrictive trade mechanisms.

Sustainable trade in wildlife has the potential to generate significant economic benefits to wildlife conservation and rural livelihoods (Roe, 2008), and CITES Resolution Conf. 8.3 Rev. CoP13 (2004) recognizes that trade in wildlife can have beneficial conservation effects. But CITES operates largely by restrictive mechanisms, including trade bans. Yet, the quandary is to know for which species a trade ban is likely to be beneficial and for which it is not, and it clearly has not been beneficial in the case of African rhinos. The massive increase in both the price of rhino horn in consuming Asian nations, and poaching following CITES' Appendix I listing of all rhinoceros, suggests that CITES' trade ban has been an inadequate answer to the plight of rhinos. The ban has failed during periods of high demand (1970s and 1980s, and from 2007 onwards), as have past international trade bans on other valuable and highly sought-after materials like drugs, with demand remaining high irrespective of price. In addition to prohibiting international trade in rhino horn, other efforts by CITES to address rhino conservation are reflected in Resolutions Conf. 3.11 (1981), 6.10 (1987) and 9.14 (1994), and its subsequent revisions at the 11th (2000), 13th (2004), 14th (2007) and 15th Conferences of the Parties to CITES (2010). These addressed a moratorium on the domestic sale of government and parastatal horn stocks, law enforcement, penalties, national legislation to ban internal trade, the development of rhino horn substitutes and indicators to

measure conservation success, reporting requirements and the development and implementation of budgeted national conservation and management plans. A call to destroy all government stocks (Res. Conf. 6.10) was repealed in Res. Conf. 9.14 due to poor range state support because of their recognition of the inherent economic value of these resources. At the 16th CITES Conference of the Parties, the CITES Secretariat, and the CITES Rhino Working Group, amongst calls for tougher enforcement and legislative measures made at earlier CoPs, tabled a demand reduction strategy for rhino horn (CITES Secretariat, 2013a, b). Awareness campaigns over the effects of rhino horn use in TCM (including VTM = Vietnamese Traditional Medicine), and non-traditional uses, on rhino populations, and potential alternatives for the treatment of ailments, are important as a potential instrument to reduce demand in the mid- to longer term. However, given two or more thousand years of cultural traditions of using rhino horn in traditional medicine, and its increasing role in non-traditional use in Viet Nam following its economic development, awareness campaigns can not be expected to cause a sufficiently rapid change in behaviour to avoid the death of a large number of rhinos in the foreseeable future.

High demand and lack of control over supply of rhino horn are principal reasons for the failure of the trade ban. In addition, the regulatory system of CITES relies largely on expensive enforcement, which is doomed to fail, particularly for high value species like rhino and in the absence of effective community support (Murphree, 2005; Abensperg-Traun, 2009). In fact, the ban may well be unenforceable under high levels of demand in the majority of range states due to a lack of necessary monetary and human ressources. The extinction of the Northern white rhino, despite significant funding and NGO support, is a case-in-point. For comparison, the USA has invested over a trillion US dollars in the "war on drugs" between 1971 and 2011, which many US drug enforcement officials consider to have been a complete failure (http://www.presstv.ir/detail/184719.html; accessed 29 May 2012). In the absence of a change in consumer demand and horn value, there is little to suggest that the international ban on rhino horn should be any more successful than the ban on drugs. However, CITES has not so far exhausted its options to help reduce illegal rhino horn trade, including comprehensive trade sanctions covering all CITES-listed species against countries that consistently fail to adequately address national enforcement of its laws against rhino horn trade. However, where poor enforcement is not due to lack of political will but to the difficulty of enforcement against entrenched beliefs, comprehensive trade sanctions are likely to be unsuccessful.

Rates of decline in rhino have been directly linked to conservation effort and funding (Leader-Williams, 1990b; Leader-Williams et al., 1990), and in situ rhino conservation measures have prioritized the protection of rhinos in private and government-run sanctuaries. Good biological management of populations for growth and concentrated levels of enforcement during years of comparatively low levels of poaching following the 1970s and 80s have been adequate to achieve significant population increases and effective enforcement interventions to reduce movement of horn (Milliken at al., 2009a), but they have also demonstrated ongoing market demand. However, given that many African countries are amongst the poorest in the world, national conservation budgets and hence law enforcment are generally unable to meet cost-intensive challenges such as the effective protection of high-value species such as elephants or rhinos (e.g. Leader-Williams, 1990). Poverty amongst rural communities and their resentment of conservation areas from which they may derive little or no economic benefits can be added to corruption and inadequate conservation funds as limiting factors for rhino conservation in Africa (Hulme & Murphree, 2001). Poaching strategies have become highly sophisticated and at current levels of

poaching, costs of effectively protecting rhino have been escalating to a level which are unlikely to be met in a country like South Africa where almost half the population lives below the poverty line (http://mg.co.za/article/2011-09-16-poverty-and-inequality-in-south-africa; accessed 29 May 2012). Poverty levels in all other African range states far exceed those of South Africa. Estimated rhino protection costs at current levels of poaching are up to US$20,000/animal/year for South Africa (Martin, 2011). Even a quarter of that cost would translate into approximately US$100 million/year for the South African rhino population alone. Current funds allocated to rhino conservation clearly are not adequate to effectively protect rhinos (e.g. South Africa currently spends US$4,000/rhino/year; Martin, 2011) and drain funds from other priorities. As much as anything else, the current rhino crisis, and those of the past, is a conservation budget crisis and it is questionable whether countries of the developed world and NGOs will be able, and prepared, to provide funds that cover costs for effective protection over any length of time, particularly in the light of failed pledges in the past to meet lost income and enforcement costs in producer countries associated with the ivory and rhino horn trade bans (e.g. 't Sas-Rolfes, 2000; Leader-Williams, 2003). This is despite the fact that rhinoceros, and rhino horn, are Africa's most valuable renewable natural resource, with significant conservation and poverty reduction potential in communal lands in particular (Brown, 2012). Adequate and sustainable levels of funding are even less likely to be forthcoming in the current economic climate.

Increased protection measures (e.g. higher ratio of field staff/km^2 of conservation area) and translocations of surplus animals to unoccupied territories, both within and outside the species' former range, have played a key role in the biological management of the species in the past (Emslie & Brooks, 1999; Milliken et al., 2009a). Another method that has been adopted includes dehorning, but with limited success and at high financial costs (Milliken et al., 1993; Milner-Gulland et al., 1994; Daly et al., 2011). Dehorning in the absence of high levels of anti-poaching measures seems ineffective as horn stumps remain attractive to poachers (Lindsey & Taylor, 2011). Attempts at breeding Black rhino in captivity have failed, as have attempts at maintaining Northern white rhino in captivity (Emslie & Brooks, 1999).

About 22% of South Africa's rhino population is held on private properties for commercial use (Milliken & Shaw, 2012). In economic terms, purchases of live rhinos by private owners have, in the past, provided national and provincial conservation authorities an opportunity to off-load surplus rhinos for much-needed cash for rhino conservation. However, high security costs and risks to rhinos and human lives as a result of the poaching crisis have resulted in a significant decline in live sale prices for the 2008-2011 period, with a US$ 63 million loss of the country`s White rhino market capitalization (rhino numbers x average price), causing many private rhino owners disinvesting in rhinos (Emslie & Knight, 2012). The financial loss for 2012 must have increased further (Emslie et al., 2013). If this trend continues, it may soon cause losses to exceed births of White rhinos in southern Africa, threatenening past conservation successes (R. Emslie, pers. comm., January 2013). Despite some conservation successes for Black and White rhinos in the past, the fate of African rhinoceros currently must therefore be of great concern because:

- the economic growth in China and Viet Nam suggests that the demand for and the value of rhino horn is likely to remain high or may even increase;
- the sharp increase in non-traditional uses of rhino horn in Viet Nam reflects high demand among the growing economic elite;
- for traditional cultural reasons, consumers are likely to resist calls for a change in behaviour in the near future (e.g. a change to horn substitutes);

- the necessary funds to meet national enforcement challenges are increasingly prohibitive and are unlikely to be forthcoming;
- high levels of corruption and low political will to achieve rhino conservation goals in many range states are unlikely to change markedly; and
- CITES' regulatory system, characterized by a lack, or absence, of incentives has failed in the case of rhinos yet seems unlikely to change in the near future.

Exploring the legal trade option

The instruments of CITES have not succeeded to effectively reduce illegal trade in several charismatic high-value species, of which elephants, tiger and rhinos are the best known examples (Berger & Cunningham, 1994; Abensperg-Traun, 2009; Bennett, 2011; Conrad, 2012). It is argued here that trading in rhino horn is a panacea for the current poaching crisis, or that it would guarantee a significant reduction in poaching. However, given current circumstances surrounding rhino conservation in Africa, I do challenge the assumption that the existing approach is the least risky (see also Child, 2012). The international conservation community, including CITES, therefore has the moral obligation to at least consider a feasibility study on the benefits and risks associated with a controlled annual mid- to long-term trade in rhino horn (Lindeque, 2011), as opposed to once-off ivory sales under CITES which have never aimed to address consumer demand but solely to generate short-term income to enhance conservation budgets for elephants. If successful, it would use existing national stockpiles, natural mortalities and horn from dehorning operations to change the balance in favour of an appropriate mix of incentives without the need to kill a single rhino to supplement demand: positive incentives by creating economic benefits in range countries, and negative incentives by achieving more effective protection because of more affordable enforcement. Legal trade would not stop poaching but could help to undermine illegal trade by sustainably and legally meeting annual demand (thus reducing rhino deaths), and to generate much-needed funds for effective rhino conservation connected with rural development (Brown, 2012). Even if current or future levels of poaching were to remain at sustainable levels (no overall decline in rhino numbers), the annual death of a large number of African rhinos, also as resources for African communities, and loss of financial resources for other worthy conservation priorities, should suffice as an argument to seek complementary conservation strategies that minimize rhino deaths. It is significant to note that while 98% of participants at an expert workshop in South Africa in 2011 on legalized trade in rhino horn agreed that legal trade will not stop poaching, an equal percentage considered the trading in horn a legitimate issue to consider (Daly et al., 2011). This is presumably because should evaluation of the legal trade option suggest it to be a valid and feasible additional conservation strategy, even a significant decline in poaching levels would be a worthwhile achievement, in addition to the provision of conservation funds. Restricting supply (trade ban) has not stopped demand and, in conformity with basic economic reasoning, is likely to keep the price of horn high, as was evidenced by the rise in horn price following the trade ban in 1977 ('t Sas Rolves, 2000; Leader-Williams, 2003). Economists go as far as to argue that CITES has regulated the extinction process in rhinos (e.g. Swanson, 1994).

Since the first once-off sale of raw ivory in 1999, it has taken 13 years for CITES to commission a consultancy on a decision-making mechanism and the necessary conditions for a future trade in ivory (Martin et al., 2012), and it is high time for CITES to commission a similar study for the feasibility of a future trade in rhinoceros horn. Such an assessment would not pre-empt any future sales, but rather establish the criteria to be employed

whether sales should occur in the first place. While there are calls for a rapid move to a legal horn trade (Biggs et al., 2013), a negative outcome of an evaluation of the trade option would bring a final end to discussions on the legal trade option. The central question to be addressed would be whether, on balance, legalization of international trade would more likely than not result in better rhino conservation outcome than maintaining the CITES trade ban. Legalization would need to address lengthy CITES procedural issues like the downlisting of Appendix I species and populations, changes to Appendix II population annotations, and national legislation in relevant producer and consumer countries. In addition to CITES procedures, the following points are considered to be central in any evaluation of the feasibility of a potential trade option:

- Would legalization of trade in rhino horn increase demand and hence levels of poaching in both Africa and Asia?
- Could current laws and enforcement capacity in e.g. South Africa adequately control legal supply (as opposed to preventing or prohibiting supply) and government and private stocks? Could, for example, illegal stock be prevented from entering legal trade? Conversely, would potential importing countries like China and Viet Nam be able to ensure adequate chain of custody procedures to prevent laudering of illegal horn?
- What would be the amount of legal supply potentially available in the mid- or long-term?
- Could demand be estimated? And therefore would it be known if it could be met within the available (and legal) supply?
- What would be the consequences for the price of rhino horn?
- Could the equitable distribution of proceeds of horn sales to both rhino conservation and rural communities that co-exist with and live adjacent to rhinos be ensured?
- What relevant lesson does the ivory case, or of other commodities, provide?

Definitive answers to some of these questions may not emerge without attempting a legal trade in rhino horn. Nevertheless, an in-depth analysis of the practicality of the trade option could provide the necessary approximation of the benefit/risk potential required for decision-makers. Besides, the argument that adoption of the legal trade option requires perfect knowledge ignores the central role of adaptive management in nature and species conservation (McCarthy & Possingham, 2007).

Data on known stocks of rhino horn suggest significant economic potential to address both rhino conservation and connected poverty alleviation goals. By early 2007, TRAFFIC has documented over 20,000kg rhino horn in stocks under government and private ownership in Africa, 90% (18,000kg) of which is held in the southern African range states of South Africa, Namibia and Zimbabwe, which also hold over 90% of African rhinos (Table 1). For these countries and at a current wholesale price of US$20,000/kg, this translates into US$360 million (CITES Secretariat, 2007b; Milledge, 2007). This does not take into account the growth of stockpiles since 2007 from natural mortalities and dehorning, and unregistered horn held on numerous private properties holding rhinoceros in South Africa in particular (Milledge, 2005). As of end of 2011, known South African Government-owned and private stockpiles amounted to 15,152kg (Milliken & Shaw, 2012). At a current wholesale price of US$20,000/kg, this translates into US$303 million for South Africa alone.

Evaluation of the trade option could benefit from existing case studies such as ivory (Milliken et al., 2009b) and CITES-listed species such as the vicuña (*Vicugna vicugna*) from

South America. The vicuña once had a continental population of about 2 million animals which declined from over-use to a low of about 10,000 animals in the 1960s before recovering to well over 400,000 animals today. The vehicle for success has been the sustainable harvest of its high-value wool for the international market and alleviation of poverty through effective community involvement (Lichtenstein, 2011). While rhino horn can not simply be compared with vicuña wool, both need to address effective national incentive systems as well as the demands of an international market.

The outcome of the recent crisis summit on African rhinoceros in Nairobi, while clearly important, essentially calls for „more-of-the-same" in terms of conservation strategies - stiffer penalties, funds to enable stricter and better equipped on-the-ground enforcement, strategic collaboration among stakeholders and public awareness campaigns to reduce demand in consumer countries (Rhino Summit, 2012). These echo statements already made on rhinoceros conservation 20 years ago at CITES CoP9 in 1992 (Com. I. 8.13 (Rev.) Annex; http://www.cites.org/eng/cop/08/E-Com-I.pdf); accessed 4 October 2012). The 2012 meeting did address legal rhino horn trade but apparently failed to reach consensus on how to proceed on this issue, if at all. A weakness of the summit report is, that it lacks reference to the link between rhino conservation and rural poverty, despite poverty being a major constraint on conservation goals in general (Adams et al., 2004), and rhino poaching in particular ('t Sas-Rolfes, 2012). It therefore remains to be seen whether the goals set by the summit will significantly impact on rhino poaching in Africa.

Given that a significant decline in demand for rhino horn is unlikely to occur in the foreseeable future, the high commercial value of rhino horn, rather than being a problem, could actually be part of the solution to African rhinoceros. Currently, the greatest incentives clearly are on the side of the poachers rather than the conservationists. Independent of the outcome of the African Rhino Summit of 2012 and current national and international measures to address the rhino crisis, the conservation potential as well as the risks of a legal trade in rhino horn needs to be addressed expeditiously to provide a broader information base for decisions on African rhino conservation.

Acknowledgements

I thank Richard Emslie, Rowan Martin, Russell Taylor, Michael 't Sas-Rolfes and Chris Weaver for their constructive comments which have significantly improved the paper, but the opinions expressed are entirely those of the author only.

References

ABENSPERG-TRAUN, M. (2009) CITES, sustainable use of wild species and incentive-driven conservation in developing countries, with an emphasis on southern Africa. *Biological Conservation*, 142, 948-963.

ADAMS, W.M., AVELING, R., BROCKINGTON, D., DICKSON, B., ELLIOTT, J., HUTTON, J., ROE, D., VIRA, B. & WOLMER, W. (2004) Biodiversity conservation and the eradication of poverty. *Science*, 306, 1146-1149.

AMIN, R., THOMAS, K., EMSLIE, R.H., FOOSE, T.J. & VAN STRIEN, N. (2006) An overview of the conservation status of and threats to rhinoceros species in the wild. *International Zoo Yearbook*, 40(1), 96-117.

BENNETT, E.L. (2011) Another inconvenient truth: the failure of enforcement systems to save charismatic species. *Oryx*, 2011(2), 1-4.

BERGER, J. & CUNNINGHAM, C. (1994) Active intervention and conservation: Africa's Pachyderm problem. *Science*, 263, 1241-1242.

Biggs, D., Courchamp, F., Martin, R. & Possingham, H.P., 2013. Legal trade of Africa's rhino horns. Science, 339, 1038-1039.

BROWN, C., 2012. *Rhino horn trade, poverty and climate change*. http://rhinosurvival.org/wp-content/uploads/2012/02/Rhino_horn_trade.pdf (accessed 13 July 2012).

CHILD, B. (2012) The sustainable use approach could save South Africa's rhinos. *South African Journal of Science*, 108(7/8), Art. '1338, 4 pages. http://dx.doi.org/10.4102/sajs.v108i7/8.1338

CITES SECRETARIAT (1989) *Interpretation and Implementation of the Convention - Trade in Rhinoceros Products*. Doc. 7.26, Seventh Meeting of the Conference of the Parties, Lausanne, Switzerland, 9-20 October 1989.

CITES SECRETARIAT (2007a) *Interpretation and Implementation of the Convention – Species Trade and Conservation Issues: Rhinoceros*. CITES CoP14 Doc. 54, The Hague, Netherlands, 3-15 June 2007.

CITES SECRETARIAT (2007b) *Rhino-Related Crimes in Africa: An Overview of Poaching, Seizure and Stockpile Data for the Period 2000-2005*. CITES CoP14 Inf. 41. A Report Submitted by the CITES Secretariat at the Request of TRAFFIC. The Hague, Netherlands, 3-15 June 2007.

CITES SECRETARIAT (2010) *Rhino Horn Trade Management in Viet Nam, Including Legally Acquired Horns from Trophy Hunting*. CITES CoP15 Doc. Inf. 62, submitted by Viet Nam, Doha, Quatar, 13-25 March 2010.

CITES SECRETARIAT (2013a) Interpretation and Implementation of the Convention - Species Trade and Conservation: Rhinoceros. Report of the Secretariat. CITES CoP16 Doc. 54.2, Bangkok, Thailand, 3-15 March 2013.

CITES SECRETARIAT (2013b) Interpretation and Implementation of the Convention - Species Trade and Conservation: Rhinoceros. Report of the Working Group. CITES CoP16 Doc. 54.1, Bangkok, Thailand, 3-15 March 2013.

CONRAD, K. (2012) Trade bans: a perfect storm for poaching? *Tropical Conservation Science*, 5(3), 245-254.

DALY, B.G., GREYLING, A., FRIEDMANN, Y., DOWNIE, S., DU TOIT, R., EMSLIE, R., EUSTACE, M., MALAN, J., NGHIDINWA, K., O'CRIODAIN, C. & TRENDLER, K. (eds) (2011) *Perspectives on Dehorning and Legalized Trade in Rhino Horn as Tools to Combat Rhino Poaching. Proceedings of a workshop assessing legal trade in rhino horn as a tool in combating poaching as well as a detailed assessment of the efficacy of dehorning as a deterrent to poaching*. Endangered Wildlife Trust, Johannesburg.

DUBLIN, H. & WILSON, A. (1998) *The Fight for Survival: Four Decades of Conserving Africa's Rhinos*. WWF Report, Gland, Switzerland.

EMSLIE, R.H. (2013) African Rhinoceros – Latest Trends in Rhino Numbers and Poaching. CITES CoP16 Inf. 51.

EMSLIE, R.H. & BROOKS, M. (1999) *African Rhino: Status Survey and Conservation Action Plan*. IUCN, Gland, Switzerland & Cambridge, UK.

EMSLIE, R., MILLIKEN, T., & TALUKTAR, B. (2013) *African and Asian Rhinoceros – 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. CoP15). CITES CoP16 Doc. 54.2 (Annex), Bangkok, Thailand, 3-15 March 2013.
FRAME, G.W. (1980) Black rhinoceros (*Diceros bicornis*) sub-population on the Serengeti Plains, Tanzania. *African Journal of Ecology*, 18, 155-166.
HAN, P. (2009) *Effectively Utilizing Traditional Chinese Medicine in Unexpected Events*. Beijing, Strategic and Development Department, China National Group Corporation of Traditional and Herbal Medicine, pp. 1-10.
HULME, D. & MURPHREE, M. (eds) (2001) *African Wildlife and Livelihoods. The Promise and Performance of Community Conservation*. James Currey, Oxford, UK.
LEADER-WILLIAMS, N., ALBON, S.D. & BERRY, P.S.M. (1990a) Illegal exploitation of black rhinoceros and elephant populations: patterns of decline, law enforcement and patrol effort in Luangwa Valley, Zambia. *Journal of Applied Ecology*, 27, 1055-1087.
LEADER-WILLIAMS, N. (1990b) Black rhinos and African elephants: lessons for conservation funding. *Oryx*, 1990(24), 23-29.
LEADER-WILLIAMS, N. (2003) Regulation and protection: successes and failures in rhinoceros conservation. In *The Trade in Wildlife – Regulation for Conservation* (ed. S. Oldfield), pp. 89-99. Earthscan, London, UK.
LEADER-WILLIAMS, N., ALBON, S.D. & BERRY, P.S.M. (1990) Illegal exploitation of black rhinoceros and elephant populations: patterns of decline, law enforcement and patrol effort in Luangwa Valley, Zambia. *Journal of Applied Ecology*, 27, 1055-1087.
LICHTENSTEIN, G. (2011) Use of vicuñas (*Vicugna vicugna*) and guanacos (*Lama guanicoe*) in Andean countries: linking community-based conservation initiatives with international markets. In *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 2010 (eds M. Abensperg-Traun, M., D. Roe & C. O'Criodain), pp. 103-108. IUCN, Gland, Switzerland and IIED, London, UK.
LINDEQUE, M. (2011) *The International rhino conservation problem*. http://rhinosurvival.org/rhino-files/reference-material/ (accessed 18 June 2012).
LINDSEY, P.A. & TAYLOR, A. (2011) *A Study on the Dehorning of African Rhinoceroses as a Tool to Reduce the Risk of Poaching*. Report prepared by the Endangered Wildlife Trust (EWT) for the South African Department of Environmental Affairs (DEA). http://www.environment.gov.za/D6837C83-E5DF-411F-A5BF-DBA1426BD9B7/FinalDownload/DownloadId-3EA49DC30680244A4E7561D90F0E019F/D6837C83-E5DF-411F-A5BF-DBA1426BD9B7/sites/default/files/docs/studyon_dehorning_african_rhinoceros.pdf (accessed 8 November 2012).
LIU, R., DUAN, J.-A., WANG, M., SHANG, E., GUO, J. & TANG, Y. (2011) Analysis of active components of rhinoceros, water buffalo and yak horns using two-dimensional electrophoresis and ethnopharmacological evaluation. *Journal of Separation Science*, 34(3), 354-362.
MARTIN, E.B. & MARTIN, C.B. (2006) Insurgency and poverty: recipe for rhino poaching in Nepal. *Pachyderm*, 41, 61-73.
MARTIN, E.B., VIGNE, L. & ALLAN, C. (1997) *On a Knife's Edge: The Rhinoceros Horn Trade in Yemen*. TRAFFIC International, Cambridge, UK.
MARTIN, R.B. (2011) *A legal trade in rhino horn: Hobson's choice*. http://rhinosurvival.org/rhino-files/reference-material/ (accessed 25 June 2012).
MARTIN, R.B., Cumming, D.H.M., Craig, G.C., Gibson, D.St.C. & Peake, D.A. (2012) *Decision-Making Mechanism and Necessary Conditions for a Future Trade in African Elephant Ivory*.

CITES Standing Committee 62 Doc. 46.4 Annex. Final Report to the CITES Secretariat (CITES Notification No. 2011/046).
MCCARTHY, M.A. & POSSINGHAM, H.P. (2007) Active adaptive management for conservation. *Conservation Biology*, 21, 956-963.
MILLEDGE, S. (2005) *Rhino Horn Stockpile Management: Minimum Standards and Best Practices from East and Southern Africa*. TRAFFIC East/Southern Africa.
MILLEDGE, S. (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. & SHAW, J. (2012) *Update on the South Africa-Vietnam Rhino Horn Trade*. A TRAFFIC Briefing for the 62nd Meeting of the CITES Standing Committee, Geneva, Switzerland, 23-27 July 2012.
MILLIKEN, T., NOWELL, K. & THOMSEN, J.B. (1993) *The Decline of the Black Rhino in Zimbabwe. Implications for Future Rhino Conservation*. TRAFFIC East/Southern Africa.
MILLIKEN, T., EMSLIE, R.H. & TALUKDAR, B. (2009a) *African and Asian Rhinoceroses – Status, Conservation and Trade*. A Report from the IUCN Species Survival Commission (IUCN/SSC) African and Asian Rhino Specialist Group and TRAFFIC to the CITES Secretariat Pursuant to Resolution Conf. 9.14 (Rev. CoP14) and Decision 14.89. Report to CITES 15th Meeting (Doha, March 2010), CoP15 Doc. 45.1 (Rev.1) Annex.
MILLIKEN, T., BURN, R.W. & SANGALAKULA, L. (2009b) The *Elephant Trade Information System (ETIS) and the Illicit Trade in Ivory*. CITES COP15 Doc. 44.1 Annex.
MILNER-GULLAND, E.J., LEADER-WILLIAMS, N. & BEDDINGTON, J.R. (1994) Is dehorning African rhinos worthwhile? *Pachyderm*, 18, 52-58.
MURPHREE, M. (2005) Control and the holy grail. In *The Trade in Wildlife – Regulation for Conservation* (ed S. Oldfield), pp. 52-60. Earthscan, London, UK.
NOWELL, C. (2012) *Assesment of Rhino Horn as a Traditional Medicine*. CITES Standing Committee 62 Doc. 47.2 (Annex), Geneva, Switzerland, 23-27 July 2012. A Report Presented to the CITES Secretariat.
PATTON, F. (2011) Understanding Chinese medicine – the scourge of the rhino. *SWARA*, October – December 2011, 38-40.
REEVE, R. (2006) Wildlife trade, sanctions and compliance: lessons from the CITES regime. *International Affairs*, 82, 881-897.
Rhino Summit Emergency Plan of Action: Towards a Comprehensive Solution to the Rhino Crisis (2012). Nairobi, African Wildlife Foundation. http://www.ssn.org/Documents/Rhino_news/Rhino_May_2012.pdf (accessed 22 May 2012).
RIVALAN, P., DELMAS, V., ANGULO, E., ROSSER, A.M., BULL, L.S., HALL, R.J., LEADER-WILLIAMS, N., COURCHAMP, F., ET AL. (2007) Can bans stimulate wildlife trade? *Nature*, 447, 529-530.
ROE, D. (2008) *Trading Nature. A Report, with Case Studies, on the Contribution of Wildlife Trade Management to Sustainable Livelihoods and the Millennium Development Goals*. TRAFFIC International and WWF International.
ROOKMAAKER, K. (2000) The alleged population reduction of the southern white rhinoceros (*Ceratotherium simum simum*) and the successful recovery. *Säugetierkundliche Mitteilungen*, 45, 54-69.
SWANSON, T.M. (1994) *The International Regulation of Extinction*. Macmillan, London, UK.
`t SAS-ROLFES, M. (2000) Assessing CITES: Four case studies. In *Endangered Species, Threatened Convention. The Past, Present and Future of CITES* (eds J. Hutton & B. Dickson), pp. 69-87. Earthscan, London, UK.

`t SAS-ROLFES, M. (2012) *The rhino poaching crisis: A market analysis*. http://savetherhinotrust.org/component/content/article/7-rhino-news/84-the-rhino (accessed 22 May 2012).

WEAVER, C., HAMUNYELA, E., DIGGLE, R., MATONGO, G. & PIETERSEN, Th. (2010) The catalytic role and contributions of sustainable wildlife use to the Namibian CBNRM Programme. In *CITES and CBNRM. Proceedings of an International Symposium on „The Relevance of CBNRM to the Conservation and Sustainable Use of CITES-listed Species in Developing Countries*", Vienna, Austria, 18-20 May 2010 (eds M. Abensperg-Traun, D. Roe & C. O'Criodain, pp. 59-70. IUCN, Gland, Switzerland and IIED, London, UK.