

Legal hunting for conservation of highly threatened species: The case of African rhinos

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Abstract

Legal hunting of threatened species—and especially the recreational practice of “trophy hunting”—is controversial with ethical objections being increasingly voiced. Less public attention has been paid to how hunting (even of threatened species) can be useful as a conservation tool, and likely outcomes if this was stopped. As case studies, we examine the regulated legal hunting of two African rhino species in South Africa and Namibia over the last half-century. Counter-intuitively, removing a small number of specific males can enhance population demography and genetic diversity, encourage range expansion, and generate meaningful socioeconomic benefits to help fund effective conservation (facilitated by appropriate local institutional arrangements).

Legal hunting of African rhinos has been sustainable, with very small proportions of populations hunted each year, and greater numbers of both species today in these countries than when controlled recreational hunting began. Terminating this management option and significant funding source could have negative consequences at a time when rhinos are being increasingly viewed as liabilities and revenue generation for wildlife areas is being significantly impacted by COVID-19. Provided that there is appropriate governance, conservation of certain highly threatened species can be supported by cautiously selective and limited legal hunting.

KEYWORDS

consequentialism, conservation finance, endangered species, privately protected areas, rhinoceros, social-ecological, trophy hunting, wildlife trade policy

1 | INTRODUCTION

Cecil the lion's death invigorated challenges to both the social legitimacy and conservation contribution of legal recreational hunting of rare and threatened species ('t Sas-Rolfes, 2017). This prompted recent efforts to prevent hunt-

ing trophy imports to Western countries such as the United Kingdom and the United States (Dickman et al., 2019). Aside from ethical arguments voiced against trophy hunting (Ghasemi, 2021) many in the popular and social media claim that it has caused population declines and that banning it would enhance conservation of currently legally

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hunted species. However, for at least some species the inverse may be true (IUCN, 2016).

Moral critics of recreational hunting, and especially the taking of trophies, tend to raise objections by appealing to deontological or virtue ethical arguments, which are mostly concerned with the nature of, or motivations for, specified actions (Nelson et al., 2016).

However, if biodiversity conservation is considered an ethical and policy imperative, then pragmatic consequentialist arguments, which are concerned with the outcomes of actions, are also relevant (Johnson et al., 2019). The European Union Court of Justice recently affirmed that, consistent with the precautionary principle, environmental policy and laws pertaining to hunting should be informed by good science (Epstein et al., 2019). This in turn, implies evaluating the consequences of policy measures in a social–ecological context (Di Minin et al., 2021).

We document the extent and outcomes of regulated hunting of Africa's two rhino species in South Africa and Namibia over the last half-century as a dual case study. After outlining its history, the ecological and socioeconomic arguments for it, and evident impacts on rhino conservation, we conclude with some remarks on policy implications for conservation in general.

2 | HISTORY OF RHINO HUNTING

Historically, Africa's free-ranging populations of white rhinos (*Ceratotherium simum*) and black rhinos (*Diceros bicornis*) were substantially reduced through expansive agricultural development and uncontrolled hunting for sport, meat, and rhino horn. Black rhinos were reduced to low numbers in South Africa and Namibia, and by 1885 southern white rhinos (*C.s.simum*) had been reduced to a single population of only ~20–50 in what is today Hluhluwe-iMfolozi Park (HiP), South Africa. Under strict protection, numbers of both species recovered in both countries, following which carefully regulated legal hunting recommenced.

2.1 | WHITE RHINO

The southern white rhino population in HiP grew steadily under protection from 1885 and by 1961 numbers had reached such high levels that concerns about potential “overgrazing” and accelerated bush encroachment led to the start of a bold white rhino translocation and reintroduction programme (Player, 2013). Hundreds of rhinos were moved to numerous public and private reserves within South Africa (including Kruger National Park), and to seven former African range states, and zoos and safari

park around the world. Early founder groups were often markedly female-biased, creating an excess male problem in the original source population (see Supplementary Material 1a). The Natal Parks Board therefore sought to increase the number of areas willing to take more males by allowing private purchase of excess rhinos for a nominal fee and easing protective legislation to allow legal hunting in 1969. Recreational hunting of some of those animals under permit started in 1972 when the total wild population was estimated at ~2100.

Initially, a regular low-cost supply of excess rhinos from state areas led to excessive hunting on some private reserves (Buys, 1987). This changed when market-driven live rhino auctions were introduced in 1986, and new South African legislation in 1991 further secured private ownership of rhinos. Increased live sale prices resulted, encouraging a focus on breeding, and white rhino numbers on private land in the country have continued to grow since (Emslie et al., 2019). Sales of excess animals provided an additional source of funding for state conservation, and promoted growth of the private conservation sector, with some of it driven by hunting tourism. Namibia also implemented legislative changes to enable private landowners to benefit from wildlife on their land, including white rhinos, while maintaining permitting controls over hunting, which had commenced in 1982. The success of this model prompted the easing of international controls for South African white rhino hunting trophy exports in 1994.

From 2006, “pseudo-hunting” of white rhino in South Africa to obtain horn for illegal sale into Asian markets temporarily became a problem (Milliken & Shaw, 2012). The implementation of control measures by South Africa in 2012 brought this abuse under control (Emslie et al., 2019). To date the number of white rhinos hunted has not been subject to any quotas, but apart from the peak pseudo-hunting period, high prices have generally ensured that only a limited number are hunted each year. The most recent South African white rhino biodiversity plan includes sustainable hunting as a key strategic component toward meeting its conservation target.

2.2 | BLACK RHINO

Continental black rhino numbers declined sharply to around 2360 in 1994/95. Subsequent protection and active use of translocations to enhance recovery saw numbers more than double across the continent, to an estimated 5366–5627 by 2017 (Emslie et al., 2019). South Africa and Namibia have both grown their black rhino numbers from a small base—from ~110 rhinos in South Africa in 1933, and ~300 in Namibia in 1970. Range and numbers have increased since, with both countries now conserving

similar numbers, jointly comprising ~3975 (70.6%) of Africa's black rhinos in 2018—up from only about 2.9% (~741) in 1973.

An excess male problem (see following section) had also long been identified in some black rhino populations and confirmed by detailed population status reporting collated by the SADC Rhino Management Group (RMG) since 1989 (Adcock, 2001). In response, in 2004, both South Africa and Namibia successfully applied for CITES quotas to export up to five black rhino trophies each per annum. Building on scientific recommendations (Leader-Williams et al., 2005) the SADC RMG, in consultation with stakeholders, developed a black rhino hunting permit application approval system for use in South Africa. This was adopted and became part of the country's current black rhino biodiversity management plan. Its criteria were designed to ensure that only applications to hunt specific black rhino that further demographic and/or genetic conservation of breeding populations are approved. From 2019, South Africa's black rhino export quota changed, to 0.5% of the total population (automatically adjusting the maximum quota up or down in response to changes in rhino numbers). In Namibia, the Ministry of the Environment and Tourism makes all the decisions relating to how many and which black rhino are to be hunted, pursuant of its conservation goals.

3 | BIOLOGICAL CONSERVATION ASPECTS

Rhino population performance is density dependent (e.g., Okita Ouma, 2004; Supplementary Material 1b) and all official rhino plans/strategies (national and continental) recommend keeping established populations at productive densities through removals. Regular removals from established populations can maintain productive densities in donor populations and provide founder rhinos that can be invested in new areas with the potential for enhanced growth (Adcock, 2019). The compounding effects of even small increases in growth rates can result in many more rhinos over time, increasing a species' ability to withstand poaching. Managing populations for growth also minimizes loss of genetic heterozygosity through genetic drift (Emslie & Brooks, 1999). While most management removals involve live translocations, some rhinos have also been hunted in Namibia and South Africa.

Rhinos have on average a slightly (statistically significant) male-biased sex ratio at birth (53% males for black rhinos—Adcock, 2001). Chance variation around this mean results in some populations having an even greater male bias. Rhino males are territorial and may fight to obtain or maintain territories. SADC RMG sta-

tus reporting since 1989 has revealed that as black rhino densities have increased in some populations, deaths from fighting have often noticeably increased. Excluding translocation-related mortality, fighting has accounted for 40% of known-cause recorded natural black rhino deaths ($N = 660$). Of these, where sex and age were known ($n = 239/264$), 70.7% were male (35.1% adult males 7+ years and 36.8% calf and subadult males). However, a significant number of breeding adult females (13.8%) and female calves and subadults (14.2%) are also being caught up and killed in fights (SADC RMG data, Adcock, 2019).

Establishing new rhino populations is expensive and, where possible, a slightly skewed female biased founder group is desirable. However, this can negatively impact on the sex ratio of the donor populations if not corrected for by removing additional males.

This excess male problem cannot be solved by simply moving excess males to other populations:

- Reserves with female-biased populations can grow numbers faster and do not want more males.
- Introducing excess males into existing populations carries large risks for the males themselves but also the resident breeding stock (Brett, 1998). Linklater et al. (2011) noted that restocking an area that already had black rhinos had a higher mortality rate (13.4%) compared with an initial introduction (7.9%). Adult male-only introductions comprised only 8.2% of released individuals but 21.9% of introduction-related deaths.
- There are limited opportunities to place excess black rhino males into male-only populations. In 2014, there were 11 such populations established in South Africa and one in Namibia, but these were generally in small areas not suitable for breeding herds. Intermale fighting losses in male-only sites do occur, but are not heightened, due to lack of females (Adcock, 2019).

Middle-aged to old black rhino males (>25 years old) may be pushed out of their territories by younger dominant bulls into suboptimal areas. Such animals are unlikely to breed again (Adcock et al., 1998). Namibian authorities feared that leaving such marginalized animals in areas close to human settlements could lead to opportunistic poaching and stimulate further surges in illegal activity. Previous attempts to catch and reintroduce older black rhino bulls that were displaced from Etosha National Park were mostly unsuccessful, resulting in either fighting-related mortalities or the same rhinos being displaced again. Limited conservation funding could be spent more effectively elsewhere.

Managers need to limit inbreeding and maintain genetic diversity in populations—especially smaller ones. While some degree of inbreeding will be natural, if one or two

dominant males have dominated the breeding for a significant period, their removal can enhance the genetic diversity and long-term viability of that population. Further detail on biological management of excess males is provided in Supplementary Material 1b. Karsten et al. (2011) found that this meta-population strategy appears to be delivering a genetically healthy population.

4 | SOCIOECONOMIC ASPECTS

Rapid human population growth and associated economic pressures (especially prevalent in developing African countries) threaten wildlife through either unsustainable exploitation for subsistence and commercial purposes, or loss of wildlife habitats following land-use changes (IPBES, 2019). Rhinos are especially threatened by poaching to meet the persistent demand for their horns, leading to significant recurring financial obligations to cover essential security and management costs (Di Minin et al., 2022). Such costs vary by area. Items typically include infrastructure provision and maintenance (e.g., roads, fencing), staff expenses (salaries, accommodation, etc.), vehicles/aircraft, equipment (weapons, monitoring, communications, etc.), dog units, and, in some instances, veterinary services and supplementary feeding. The essential challenge for rhino conservators is to meet and contain these substantial costs, which have increased considerably with the increased poaching pressure over the last decade.

Contemporary African rhino conservators include government conservation agencies and, increasingly, private landowners (Emslie et al., 2019). In both South Africa and Namibia, white rhinos on private land are legally owned by the landowners; in South Africa, some black rhinos are privately owned. The institutional arrangements in these countries include selective devolution of wildlife ownership and management authority, a model identified by Child (2019) as having performed best in terms of conserving large mammal populations both outside and within protected areas in Africa. Both countries also employ a conservation financing system that differs significantly from most other countries: being essentially decentralized, diversified, and supported by market mechanisms that channel direct monetary benefits from wildlife to relevant local levels rather than aggregating them centrally (where they are at greater risk of reallocation).

Two rhino conservation financing model variants exist in the two countries. South Africa's model is substantially market-oriented, whereas Namibia uses a hybrid model, treating the two species differently. The market-oriented model supplements rhino protection in state parks by enabling nonstate landowners to benefit financially from activities such as photographic tourism, legal hunting, and

live sales. This creates private incentives to protect and grow rhino populations on nonstate land. State conservation agencies have also benefitted financially from live rhino sales to the private sector (Figure 1a). Figure 1b illustrates the mechanism for financing black rhino conservation in Namibia. Proceeds from black rhino trophy hunts are channeled into a state-administered Game Products Trust Fund and earmarked for contributions to specific rhino monitoring and management activities and support for community conservancies.

Critiques of the socioeconomic effects of trophy hunting suggest that its contributions to country-level GDP are small relative to nonhunting wildlife tourism, and that benefits from hunting may be inequitably distributed, entrenching social inequality (Ghasemi, 2021). Whereas distributional concerns apply to all forms of wildlife tourism (hunting and nonhunting), and socioeconomic transformation remains a pressing priority in many developing countries, the former claim is misleading. National GDP contributions are a poor indicator in terms of both broader socioeconomic relevance and appropriate scale of analysis. GDP metrics fail to consider essential ecosystem services and natural capital (Costanza et al., 1997). Nation states are an arbitrary level at which to make such assessments—more relevant are the global benefits of effective species conservation and ecosystem services provided by intact habitats, functionally populated with rhinos, and the more localized benefits that flow to specific rural landowners and communities, who are thereby incentivized to actively support conservation.

Arguments that contrast photographic with hunting tourism are misguided as these activities are mostly complementary rather than competing. Historically, hunting tourism has often acted as a pioneering developmental activity, providing the economic impetus to later establish photographic wildlife tourism operations. The hunting trophy fee and associated income generated (e.g., daily rates) per individual animal hunted is substantial—in at least one photographic tourism area where occasional high-value hunts still take place, the latter still recently funded the largest proportion of reserve expenditure (Cooney et al., 2017). Contemporary hunts typically take place in areas much less suited to photographic tourism and which sometimes form buffer zones or corridors to supplement protected areas. The current relatively small annual number of paying rhino hunters (<100) generates far more conservation revenue per capita (with far lower environmental impact) than the far greater number of nonhunting tourists who can repeatedly observe a small sample of habituated animals in relatively confined areas (Shumba et al., 2021; Figure 2). A sensitivity analysis in Namibia demonstrates interdependence of the two activities and that the permanent loss of hunting tourism income would render most

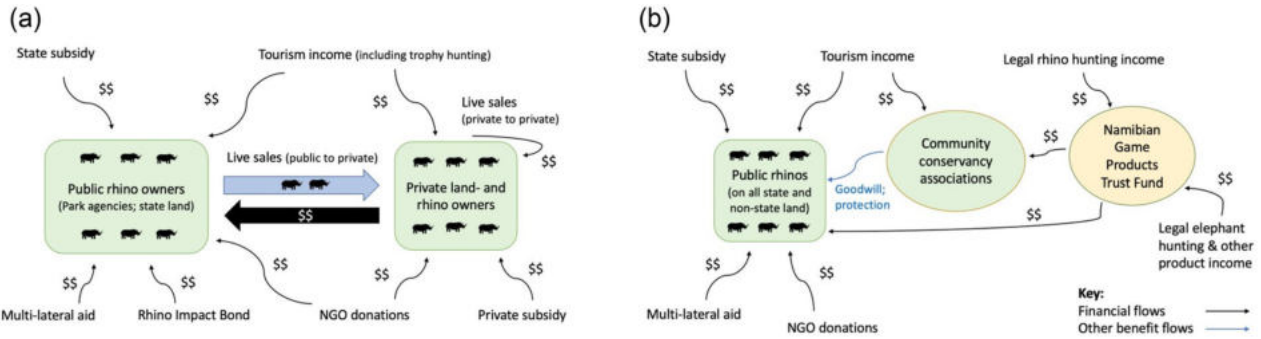


FIGURE 1 Financing models for rhino conservation: (a) for South Africa and white rhinos in Namibia, and (b) for black rhinos in Namibia

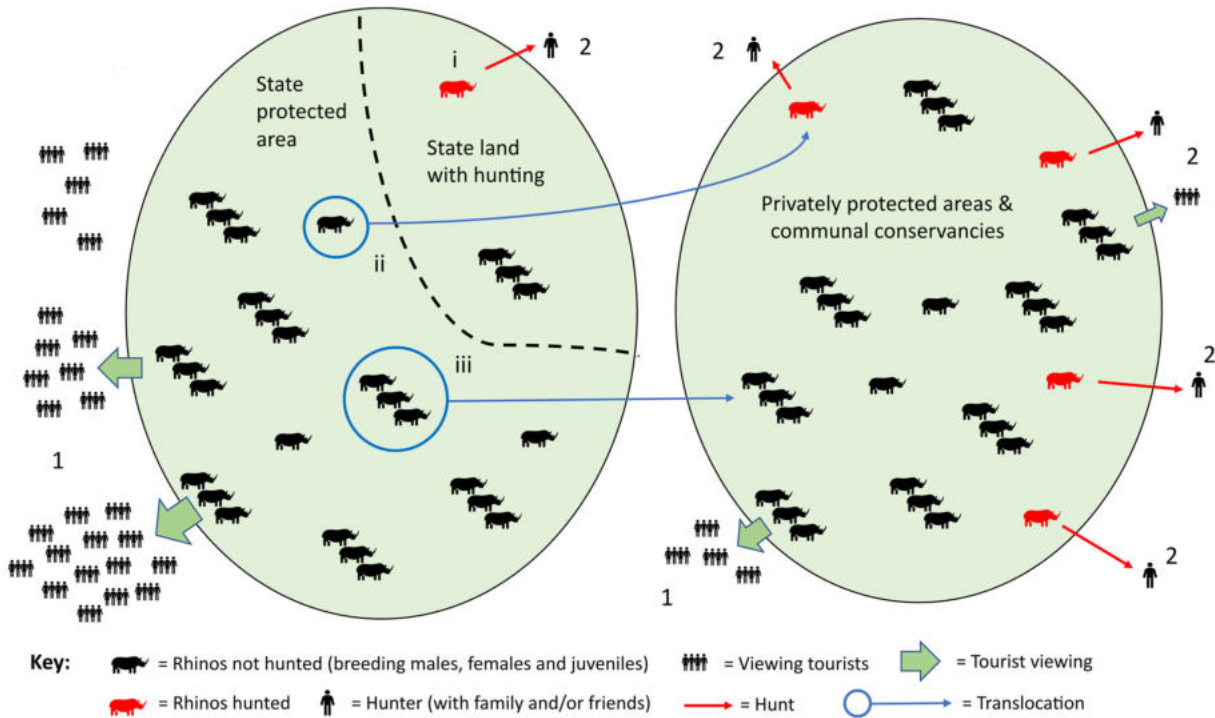


FIGURE 2 Rhino use on public and private lands, showing relative contributions of (1) numerous nonhunting tourists and (2) few legal hunting tourists. Rhinos move to private and hunting areas through (i) natural dispersal, (ii) translocation of excess males, and (iii) translocation of breeding herds. Hunts support additional range to that supported by nonhunting tourists alone and translocations provide financial support to reserves selling surplus rhinos

community conservancies economically unviable (Naidoo et al., 2016).

5 | CONSERVATION IMPACT OF LEGAL RHINO HUNTING

By helping address the problems of excess males, high population densities, and inbreeding, limited targeted rhino hunting can help advance demographic and genetic conservation goals. The generation of additional revenue

also helps pay for and incentivize rhino conservation action.

Figure 3a shows the growth of southern white rhino numbers since hunting started and how in relative terms the number hunted has been very small. While there have been no negative impacts following black rhino hunting, as discussed above hunting of white rhino was temporarily problematic for two periods (overhunting on private land in early years and later “pseudo-hunting” as shown by Figure 3b). Actions taken resolved these issues and white rhino numbers still increased during both periods.

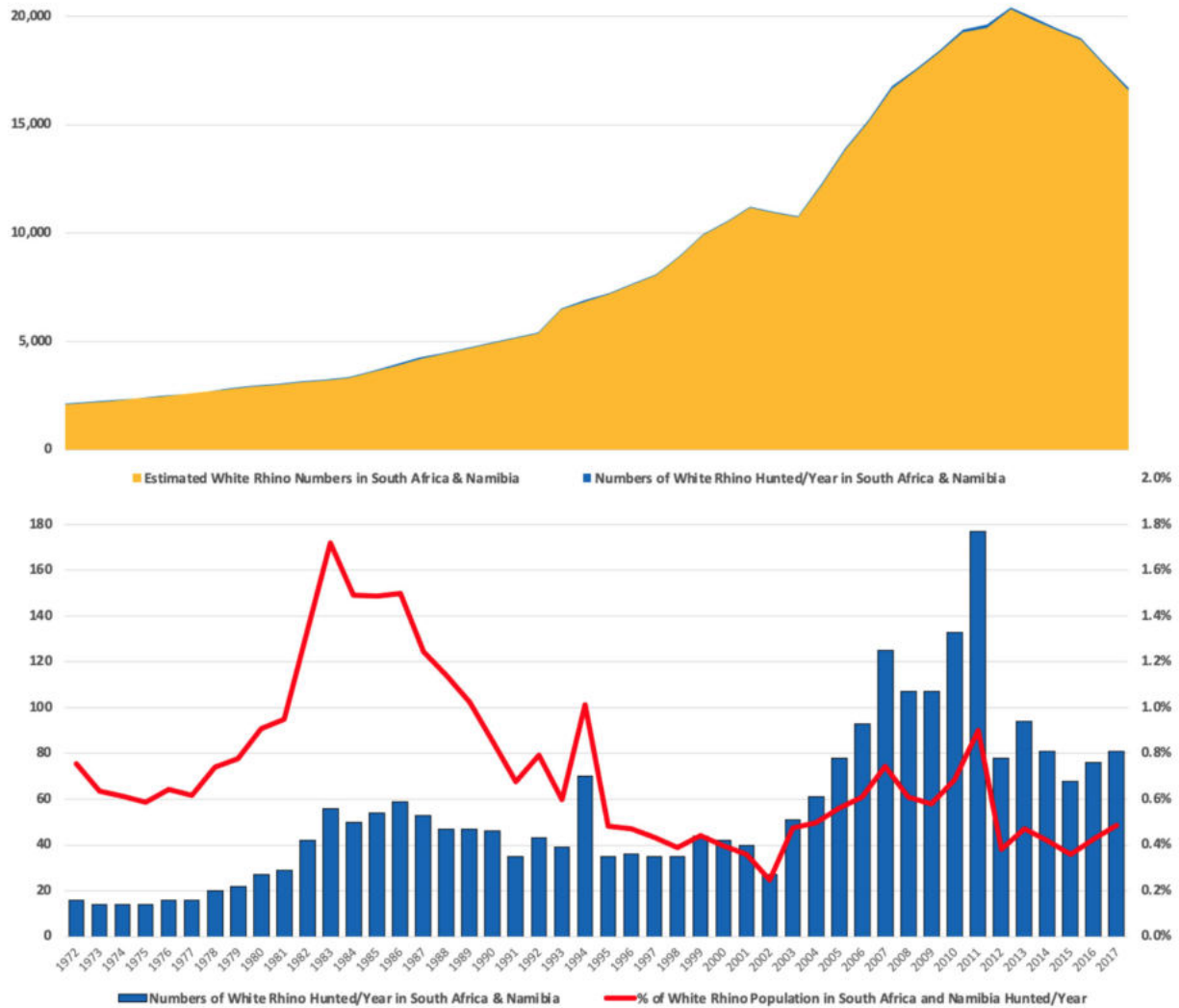


FIGURE 3 (a) Estimated numbers of live white rhinos in South Africa and Namibia (in yellow) and numbers legally hunted in these countries (blue). (b) Absolute numbers of white rhino legally hunted (blue, left Y-axis) compared with relative % of population hunted (red, right Y-axis)

From the first hunt in 2005 until the end of 2018, a total of 47 black rhinos had been hunted in South Africa and 12 in Namibia. Total numbers of white rhinos hunted (1972–2018) are estimated at 2 538 (South Africa) and 61 (Namibia). Estimated inflation-adjusted 2021 US\$ values for trophy fee turnover for white and black rhino up to and including 2018 for these two countries exceed \$154 million and \$18.5 million, respectively, with trophy fee averages of \$58,956 (white) and \$314,847 (black), yielding a total average of ~\$8.2 m per year during recent years (see Supplementary Material 2 for detailed data). For context, these figures exclude additional income from daily rates, linked tourism activities, taxidermy, and various derivative economic benefits such as employment, and habitat and

ecosystem service provision on marginal land areas (where the incremental impact of such funds is substantial).

Figures 4 and 5 show trends in numbers of southern white and black rhinos in the two major rhino hunting countries relative to rhino numbers in other African range states, reflecting key policy change dates. Overall numbers of both species have increased since legal hunting restarted (with an 11-fold increase in white rhino numbers in South Africa and Namibia up to their peak in 2012), which has clearly been sustainable. The real threat to rhino populations is poaching for horn, causing escalated protection costs and reduced local incentives to conserve rhinos and their habitats—and not legal hunting (Emslie et al., 2019). The 15% decline of continental white rhino numbers after 2012 to end 2017 was primarily the result of increased

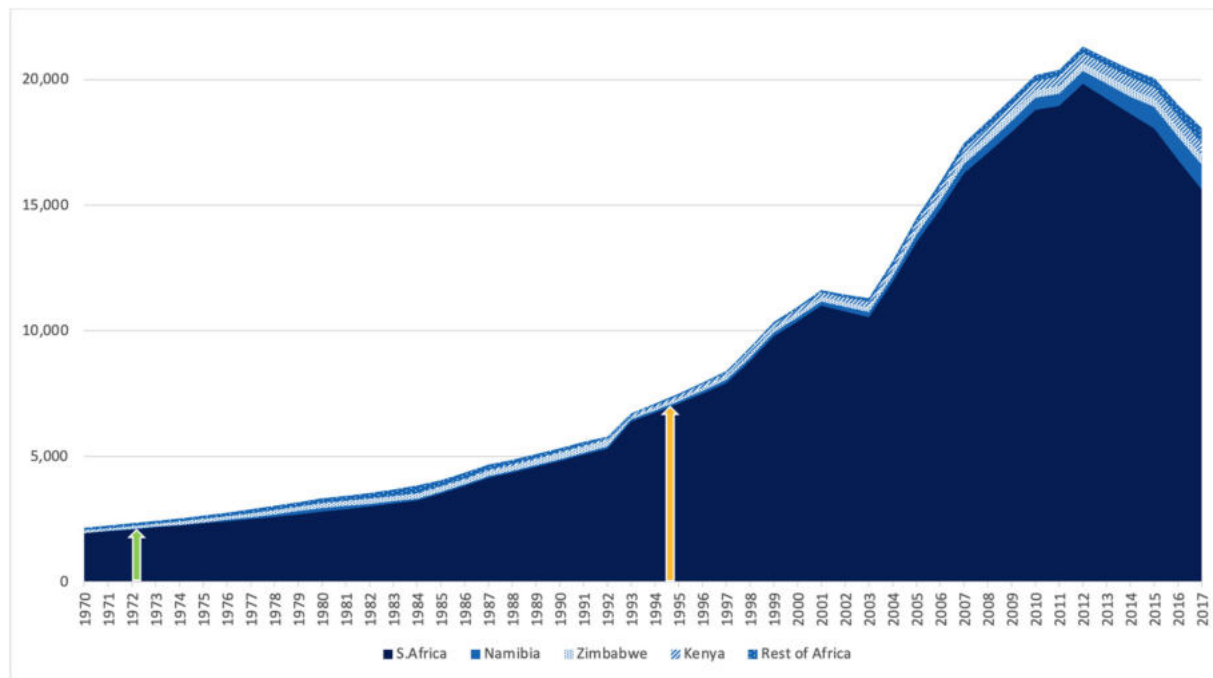


FIGURE 4 Total numbers of southern white rhinos by range state, with green arrow indicating commencement of legal hunting in South Africa, and yellow arrow indicating date of eased restrictions on South African trophy exports

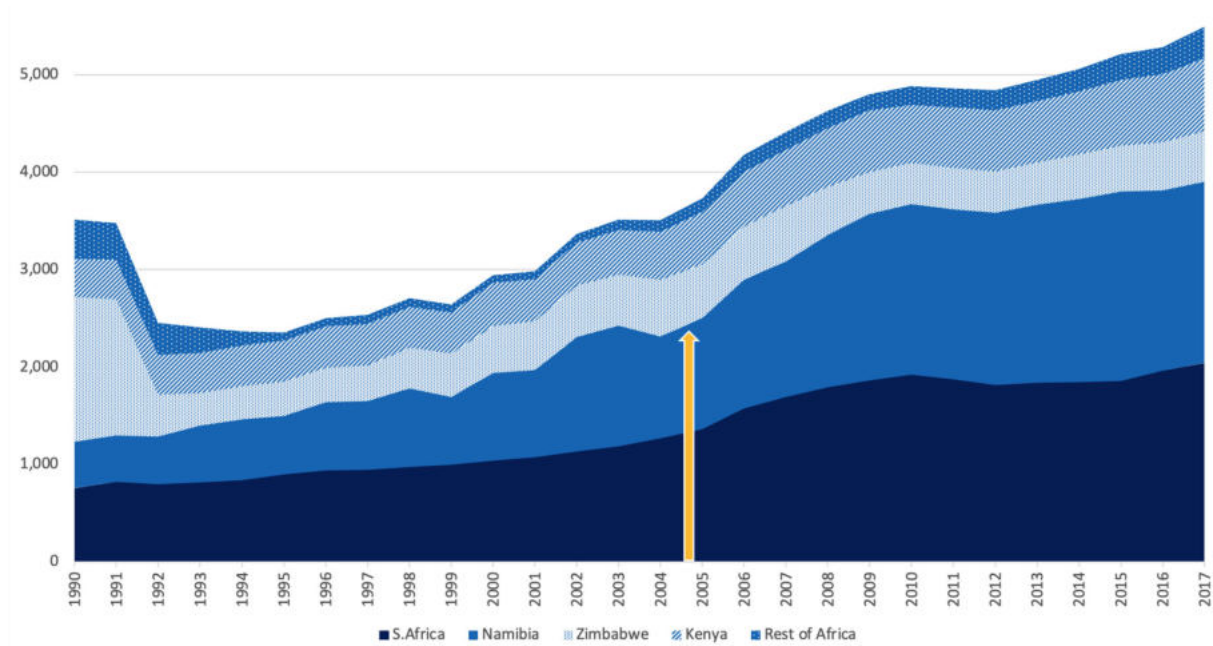


FIGURE 5 Total numbers of black rhinos by range state, before and after commencement of legal hunting, with yellow arrow indicating date of international approval of quotas for limited South African and Namibian hunts and trophy exports

poaching, especially in the Kruger National Park (where hunting is not permitted), rather than legal hunting (with 423 legally hunted rhinos compared with 6087 recorded poached over the five years 2013–2017). Legal hunting is very selective and almost entirely males whereas poachers

frequently kill valuable breeding females, also causing calf loss.

6 | CONCLUSION

The African rhino case studies suggest that appropriately managed and regulated legal hunting (with trophy exports) can reinforce (rather than compromise) species and habitat conservation. This positive outcome is achieved through institutional arrangements that direct the flow of socioeconomic benefits to locally relevant levels, thereby providing both (1) a source of finance for essential rhino security and management and (2) positive incentives for rural communities and private landowners to support conservation more generally. Similar results have been achieved for various other species in other contexts in southern Africa and elsewhere in the world (Cooney et al., 2017). Importantly, careful selection of animals to be hunted can ensure that small starting population sizes are not an impediment to the successful employment of this strategy. In the case of white rhinos, it helped enable their numbers and range to grow significantly.

Nowak et al. (2019) suggest that trophy hunting bans “create opening for change.” In the case of African rhinos, there is a high risk that such action now would result in negative socioeconomic consequences at both local and national levels (Parker et al., 2019) with concomitant adverse outcomes for rhino conservation. As Africa struggles with declining sources of conservation funding in the wake of COVID-19 (Lindsey et al., 2020), policy makers must trade off such risks against the application of evolving ethical standards. Perhaps counter-intuitively, it is for relatively rare but actively managed species such as African rhinos that such complete hunting bans may carry the highest risk of an adverse conservation outcome.

Mindful of the increasing animosity towards trophy hunting, we suggest that regulation of hunting and trophy trade of threatened species should be evaluated on a case-by-case basis, given that there remain clear instances, such as for African rhinos, where legal hunting contributes positively toward achieving specified conservation goals.

ACKNOWLEDGMENTS

We thank David Cook, Pierre du Preez, and Coenraad Vermaak for insights relating to historical events; Piet Beytell and Fillemon Iifo of the Namibian Ministry of the Environment, Forestry and Tourism, and Mpho Tjiane of the South African Department of Forestry, Fisheries and the Environment, for assistance with data provision. MtR gratefully acknowledges funding from Oppenheimer Generations Research and Conservation. Information on data sources is provided in Supplementary Material 3.

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How to cite this article: 't Sas-Rolfes M., Emslie R., Adcock K., Knight M.. Legal hunting for conservation of highly threatened species: The case of African rhinos. *Conservation Letters*. 2022;15:e12877. <https://doi.org/10.1111/conl.12877>