African and Asian Rhinoceroses – Status, Conservation and Trade

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in Endangered Species of Wild Fauna and Flora (CITES)
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Report from the IUCN Species Survival Commission (IUCN SSC)
African and Asian Rhino Specialist Groups and TRAFFIC

Acknowledgments:

Prepared under contract from the CITES Secretariat by the IUCN Species Survival Commission (IUCN SSC) African and Asian Rhino Specialist Groups and TRAFFIC

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Executive Summary

Status of rhinos

- Africa conserved an estimated 22,137 rhinoceroses (rhinos) comprising 6,195 black and 15,942 white rhinos at the end of 2021. A further 218 black and 1,077 white rhinos resided in ex-situ collections resulting in 23,432 African rhinos worldwide.
- African rhino continental numbers declined by 1.6% per annum from 2017 to 2021. Black rhinos, however, were increasing at 3.0% per annum, while white rhinos were decreasing at 3.1% per annum. This is associated with white rhino declines in South Africa linked to trends in some protected areas, while, regardless of increased security costs, private ownership increased to 53.2% of the national white rhino population.
- Populations within management models other than pure-state approaches performed better for all African rhino sub-species other than northern white rhinos. Most black rhinos (6,031) lived in wild (free) ranging conditions, with close to an estimated one-third of white rhinos (4,883) living in intensive or semi-wild ranging conditions, mostly in South Africa.
- Asia had an estimated 4,014 greater one-horned rhinos in India and Nepal by the end of 2021, and 76 Javan rhinos living in one national park in Indonesia. Indonesia's Sumatran rhino had between 34-47 individuals.
- Greater one-horned and Javan rhinos increased by 3.7% and 4.4% per annum respectively, while Sumatran rhinos decreased at an alarming 13.0% per annum from 2017 to 2021. Overall, Asian rhinos increased by 3.2% per annum.

Trade dynamics

- Trade data from 2018 – 2020 suggested fewer rhino horns (575 – 923) entered the illegal trade markets annually compared to the previous CoP report (2,378). This result is the lowest annual estimate in the past decade since pre-CoP16 and is in line with the decrease in poaching rates and increases in law enforcement efforts. However, 2020 represents an abnormal year with potential low levels of illegal activity, law enforcement and/or reporting due to the COVID-19 pandemic. Coupled with the paucity of data on potential sources of horns entering illegal trade, better data collection and sharing (including DNA samples) could improve and quantify the extent of data on horns entering illegal trade for future reports.
- During 2019 there was an increase in the reported (or estimated) weight and number of whole horns seized, including for the Parties most affected by this in terms of illegal trade volumes (*i.e.* total weight and number of horn seized from seizures made by the Party and seizures in which the Party was implicated in as part of the trade chain); those were (ordered from high to low in in terms of illegal trade volume): South Africa, China and Hong Kong Special Administrative Region (SAR) of China, Viet Nam, Malaysia, and Mozambique.
- With sparse reported seizure data and based on the available evidence, it is not possible to comment on the impact the COVID-19 pandemic had on trade for rhino horn specimens in major end-markets. Given the association of rhino horn with some forms of medicinal use, urgent market and social research should be conducted.
- In recent online monitoring in Viet Nam that focused on elephant, rhino, pangolin and other species a new product was observed as offered for sale – rhino glue; this glue was present in 27% of online advertisements for rhino specimens and was promoted as a treatment for multiple ailments.
- Several other factors might have contributed to the illegal trade dynamics in recent years and might have contributed to the high levels of reported seizure data in 2019; these include the attempt to allow domestic trade for Traditional Chinese Medicine in China in 2018; stricter wildlife laws effective in Viet Nam beginning in 2018; and increased law enforcement cooperation between Parties involved in the illegal trade (*e.g.,* Mozambique and Viet Nam; China and South Africa). Whether the observed reductions in the levels of illegal trade in 2020 are sustainable as economies recover post-pandemic remains to be seen.
- African range States imported 162 and exported 369 rhinos; 81 white rhinos went to countries beyond the African continent, and 60 beyond the historical range of white rhinos on the continent. South Africa reported the national sales of 352 live white rhino and the issuance of 21 permits allowing the potential domestic sale of 574.6kg horn, not all of which was realized.
- South Africa and Namibia reported 236 white and eight black rhinos hunted for trophies. This reflects 0.02% to 0.79% and 0.37% to 1.78% harvesting rates of the annual white rhino populations in South Africa and Namibia respectively. Annual harvesting rates for black rhino range from zero to 0.05% in Namibia and 0.13% in South Africa from 2018 to 2021.

Stocks of specimens of rhinos

- Not all Parties making seizures regularly report stockpile information to the CITES Secretariat. Additionally, Namibia submitted data to the Secretariat, but indicated to the Secretariat that the data are confidential and could not be shared. Therefore, data from Namibia were not provided as anticipated by paragraph 9.a) of Resolution Conf. 9.14 (Rev. CoP17) to be considered in the preparation of this report. In total 21, 18, and 20 Parties reported stockpile information to the CITES Secretariat in 2018, 2019 and 2020, respectively.

- Seven (out of the 13) African range States submitted to the Secretariat stockpile data that were provided for this report. Collectively, these African range States stocks totalled 87.3 tonnes of rhino horns and pieces, where a significant proportion was held in private stocks.
- Of Asian range States only Indonesia shared stockpile information. Public destruction events occurred in India and Nepal, but these events were not reported to the CITES Secretariat as part of the data shared for this report.
- Stockpiles across all non-range States that reported data amounted to two tonnes of rhino horns and pieces. Of those non-range States that were significantly affected by illegal trade based on reported seizure data (China, Hong Kong SAR, and Malaysia), China and Hong Kong SAR did not report any stocks to the CITES Secretariat, Viet Nam last reported stockpile data for 2017.
- In general, there was discrepancy between the expected total weight of stocks from reported or estimated seized weight and the data reported to the CITES Secretariat. Given the inconsistent reporting coupled with past reported evidence of stockpile thefts, and of stockpiled horns being illegally seized, better monitoring of current stocks and reporting by Parties are encouraged.

Incidences of illegal killing

- Africa recorded 2,707 incidences of illegal killings of rhinos from 2018 to 2021, with 90.0% taking place in South Africa. Global government responses to the COVID-19 pandemic during 2020 showed three range States recording lower poaching rates – South Africa estimated a 79.4% reduction in the expected illegal killing of rhinos in Kruger National Park during 2020. However, some range States (South Africa, Kenya) reported increases in poaching activities in 2021. Unconfirmed reports of continued poaching of rhinos in Botswana in 2021 remains a concern.
- African continental poaching rates declined from 3.9% of the continental population during 2018 to 2.3% in 2021. This indicates a continued reduction of continental poaching rates since the surge of illegal killings of rhinos from 2007 onwards, where poaching rates peaked at 5.3% of the continental population in 2015.
- Imperfect carcass detection, as well as indirect effects of poaching such as the deaths of calves that are still dependent on those cows poached, resulted in populations needing to experience less than 3.6% (95% CI: 2.3% - 5.7%) poaching rate for the African rhino numbers to grow.
- Asia recorded 11 incidences of illegal killings of rhinos with all being greater one-horned rhinos from 2018 to 26 April 2022. Detection of carcasses in dense rainforests remains a challenge, and there were no reports of illegal killings of Sumatran rhinos despite substantial population declines. The failure of Parties to submit reports on illegal killing is a matter of ongoing concern.
- Incidences of Asian rhino poaching from 2018 to 2022 continued the declining trends since 2013, coinciding with the declining poaching rates of African rhinos.

Enforcement Issues

- African range States reported 1,588 arrests linked to rhino crimes from 2018 to 2021. During this period, 751 prosecutions relating to rhinos were reported within range States, of these 300 resulted in subsequent convictions. Arrests decreased from a high in 2018 (493) to a low in 2021 (275).
- Despite several challenges associated with legal procedures, delayed prosecutions and offering bail, African range States reported successes in law enforcement and community approaches that may deter poaching attempts. Important elements in some range States included participation by local people in developing and implementing protection initiatives as well operational areas that cost-efficiently maximize the benefits of situational awareness, access control, motivation of staff, and monitoring of rhinos.
- Regional cooperation and collaboration (in law enforcement and sharing of intelligence) through trusted relationships are key elements in combatting and dismantling transnational networks. However, current barriers to this process include delayed DNA forensic evidence resulting from low numbers of registered laboratories, inefficient transfer of samples from seizures, as well as the lack of establishing regional rhino databases. Some Parties indicated that investigations should use seizures to guide further inquiries. Reviews of law enforcement initiatives highlighted values-based leadership, cohesion, transparency, staff wellbeing, integrity and prosecution of compromised people quickly and efficiently, as key requirements to build resilience to corruption. The reviews also identified establishing long-term trusted partnerships that enhance capacity, resources and expertise is additional requirements.
- In Asia, authorities arrested 43 suspects in India, and 27 in Nepal from 2018 to 2021. Parties did not report convictions.

Conservation management

- African range States had 20 rhino conservation plans active, under review or in development from 2018 to 2020. A total of six were active and nationally approved (30%), five were active, but had no formal government ratification (25%), seven were under review (35%), while two range States were developing new plans. Range States reported 94.6% partial or full achievement of assessed objectives.
- African range States reported moving 391 individual rhinos between and within localities in a country, dehorning 2,217 rhinos, treating 57 injured and wounded rhinos and recovering 42 rhino orphans from 2018 to 2021. Despite range States reporting the establishment of at least two new localities and the assessment of several potential localities, authorities are increasingly encountering challenges such as suitable sites with cost effective protection to secure additional areas for rhinos. Several existing localities noted reduced growth in numbers due to ecological and social density-dependence playing out in rhino population dynamics.

- Rhino conservation accountability are embedded within the mandates of range States. Threats to rhinos, however, are at a global – transnational scale, and include environmental change and social drivers. The risks of these additional threats to global rhino conservation outcomes is unclear.
- In Asia, greater one-horned rhinos had formal management plans, with Sumatran rhinos having a three-year emergency action plan, while Javan rhinos had no formal plans.
- High incidences of natural mortalities (possibly related to density) of greater one-horned rhinos requires substantial interventions to address ecological and social limitations in several national parks in India and Nepal.

Efforts to reduce illegal use

- Health reasons was a key motivator in amongst those surveyed for the use of rhino horn in Viet Nam albeit it a non-representative national sample. It is not clear whether the COVID-19 pandemic influenced the use of rhino horn. Some surveys highlighted that rhino horn users also are likely to encourage other people to start using rhino horn for a variety of purposes.
- Various awareness and demand reduction initiatives focused on China and Viet Nam. Where available evaluation, although sparse, highlighted self-reported reduced purchasing, reduced future use and increased social unacceptability for those consumers that had exposure to demand reduction initiatives in Viet Nam. The need for more critical, independent assessments of their efficacy is emphasised.
- African range States noted numerous examples of education and awareness, communication, livelihood assistance, infrastructure improvement and enterprise development considered to contribute towards rhino conservation efforts though may carry risks of stakeholders perceiving initiatives as appeasement. Several initiatives seek increasingly meaningful participation of local people in addressing shared challenges and taking part in decision-making and protection of biodiversity, including rhinos.

Poaching and trafficking challenges

- Range States, implicated countries and interested and affected Parties identified 12 key poaching and trafficking challenges, as well as 29 key best practices. These focus on various aspects including efficient provision of security, effective investigations, contrasting conservation ideologies, adequate support from local people and appropriate influences of policies.

1. Introduction

Demand for horn and resultant poaching continue to place the long-term persistence of the world's rhinoceroses (rhinos) at risk. At the 18th meeting of the Conference of the Parties (CoP18, Geneva, 2019) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the International Union for the Conservation of Nature (IUCN) Species Survival Commission's (SCC) African Rhino Specialist Group (AfRSG) reported that African rhino populations, comprising two white and three black rhino subspecies, declined by 9.9% from an estimated 26,165 individuals in 2012 to 23,562 individuals in 2017. By 2017, the Asian Rhino Specialist Group (AsRSG) noted only 3,693 Asian rhinos remain, comprising the one-horned, Javan and two subspecies of Sumatran rhinos[1]. Overharvesting is a global environmental change driver that, together with other factors[2] such as climate change, habitat alteration, pollution and emergent disease, poses threats to the persistence of all rhino species. However, illegal trade in rhino horn is still considered the primary threat to the persistence of rhinos[3].

Parties recognized the important complimentary threats in Resolution Conf. 9.14 (Rev. CoP17) on *Conservation of and trade in African and Asian rhinoceroses*, and directed the CITES Secretariat to commission the IUCN/SSC African and Asian Rhino Specialist Groups and TRAFFIC to submit a report to the Secretariat on: a) the national and continental conservation status of African and Asian rhino species; b) trade in specimens of rhinos; c) stocks of specimens of rhinos and stock management; d) incidents of illegal killing of rhinos; e) enforcement issues; f) conservation actions and management strategies with an evaluation of their effectiveness; and g) measures implemented by implicated States to end the illegal use and consumption of rhino parts and derivatives. The Resolution further directs that the report should reflect on information from range and implicated States as well as the United Nations Environment Programme World Conservation Monitoring Centre (UNEP WCMC) that the AfRSG, AsRSG and TRAFFIC engage with pursuant to Paragraph eight of Resolution Conf. 9.14. Additionally, Decision 18.115[4] directed the Secretariat "…in consultation with interested Parties and the African and Asian Rhino Specialist Groups of the Species Survival Commission of the International Union for Conservation of Nature (IUCN/SSC) and TRAFFIC, to reflect on challenges and best practices to assist in addressing rhinoceros poaching and rhinoceros horn trafficking".

This report by the IUCN SSC AfRSG and AsRSG, and TRAFFIC to the 19th meeting of the Conference of the Parties to CITES (CoP19, Panama City, 2022), addresses the requirements laid out by Resolution Conf. 9.14 (Rev. CoP17)[5] and matters relevant to the implementation of Decision 18.115. It first focuses on the national and continental conservation status of African and Asian rhino species (Paragraph 7(a) of Res. Conf. 9.14. (Rev. CoP17)), followed by sections on the trade in specimens of rhinos (Paragraph 7(b)), the status of stocks and stockpile management (Paragraph 7(c)), and an update on incidents of illegal killing of rhinos (Paragraph 7(d)). The report then focuses on strategic responses to reduce risks and increase opportunities. It includes elements of law enforcement (Paragraph 7(e)); conservation actions and management strategies with an evaluation of their effectiveness (Paragraph 7(f)); and measures implemented by implicated States to end the illegal use and consumption of rhino parts and derivatives (Paragraph 7(g)). Lastly, this report ends with an updated summary of the challenges and best practices to assist in addressing rhino poaching and rhino horn trafficking,[6] submitted to the 74th meeting of the Standing Committee pursuant to Decision 18.115.

2. The status of rhinoceros species

2.1 Continental and national population trends in African rhinoceroses

As of the end of 2021, estimates reported by range States noted 22,137 rhinos living in the African continent comprising 6,195 black and 15,942 white rhinos (Table 1). The point estimate of number of rhinos at the continental scale was lower than that reported at CoP18 (23,562 by the end of 2017)[7]. The point estimate of black rhino numbers (n = 6,195) was 12.2% higher than the estimate of 5,495 individuals at the end of 2017. In contrast, the point estimate of white rhino numbers (n = 15,942) was 11.8 % lower than the 18,067 white rhinos noted at the end of 2017.

[1] Emslie RH, Milliken T, Talukdar B, Burgess G, Adcock K, Balfour D, Knight MH. 2018. 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. CoP17). COP18, Doc 83.1, Annex 2. Available at https://www.traffic.org/site/assets/files/12220/african-asian-rhinos-iucn-traffic.pdf

[2] Janssen MA, Schoon ML, Ke W, Orner KB. 2006. Scholarly networks on resilience, vulnerability and adaptation within the human dimensions of global environmental change. Global Environmental Change, 16, 240–252.

[3] See Annexure 1 for a history of listings, resolutions and decisions associated with rhinos.

[4] https://cites.org/sites/default/files/eng/dec/valid18/E18-Dec.pdf

[5] See Annexure 2 for methodology, https://cites.org/sites/default/files/document/E-Res-09-14-R17.pdf

[6] https://cites.org/sites/default/files/eng/com/sc/74/E-SC74-37-A1.pdf

[7] Emslie RH, Milliken T, Talukdar B, Burgess G, Adcock K, Balfour D, Knight MH. 2018. 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. CoP17). COP18, Doc 83.1, Annex 2. Available at https://www.traffic.org/site/assets/files/12220/african-asian-rhinos-iucn-traffic.pdf

By 2021, global zoo collections of African rhinos comprised 735 white rhinos and 204 black rhinos. China had 308 white and 14 black rhinos in various collections[8]. In addition, several Asian countries also held small collections of African rhinos. The world thus had an estimated 23,432 African rhinos by the end of 2021.

Four range States contain the largest proportion of African rhinos and largely determine the continental trends since CoP18. For black rhinos, Namibia contributed 34.8% (2,156 out of 6,195; Table 1), South Africa 33.2% (2,056), Kenya 15.1% (938) and Zimbabwe 9.9% (616) of the continental population in 2021. In comparison to 2017[1], South Africa's contribution declined (37.2%. 2,046), Namibia's increased (33.8%, 1,857), Kenya's increased (13.6%, 745) and Zimbabwe's increased slightly (9.5%, 520). For white rhinos, South Africa contributed 81.3% (12,968 out of 15,942), Namibia 7.7% (1,234), Kenya 5.5% (873) and Zimbabwe 2.6% (417) of the continental population. Compared to 2017, South Africa's contribution declined (86.5%, 15,625), Namibia's increased (5.4%, 975), Kenya's increased (2.8%, 513) and Zimbabwe's increased slightly (2.0%, 367).

Nearly all range States with extant black rhino populations recorded increases in rhino numbers by the end of 2021[9]. One exception was Botswana, which noted a substantial decline (-19.4% per annum) in the south-central black rhino (*Diceros bicornis minor*). Chad did not have black rhino in 2017. Chad introduced six south-central black rhino (*D.b. minor*) rhino in 2018, of which four died within a year due to probable nutritional stress[10]. South Africa noted relatively little change at 0.1% annual population growth. South Africa, however, recorded annual decreases in the relatively abundant south-central black rhino (*D. b. minor*) (-1.5% per annum), compensated by annual increases in the two other less abundant black rhino subspecies – eastern black rhino (*Diceros bicornis michaeli*: 8.2%) and south-western black rhino (*Diceros bicornis bicornis*: 5.1%). As a result, five of seven range States reported increases in south-central black rhino (*D.b. minor*). All range States with south-western black rhinos (*D.b. bicornis*) (two) and eastern black rhinos (*D.b. michaeli*) (four) reported increases. From 2017 to 2021, black rhinos irrespective of sub-species increased at an annual population growth rate of 3.0%.

Table 1. Estimates of African rhinoceroses species within Africa as of the end of 2021[11].

	Black rhinoceros				**White rhinoceros**			**African Rhinoceroses**
Range State	*D.b. bicornis*	*D.b. michaeli*	*D.b. minor*	Total for *Diceros bicornis*	*C.s. cotonni*	*C.s. simum*	*Ceratotherium simum*	Rhinocerotidae
Angola	-	-	-	-	-	3	3	3
Botswana	-	-	23	23	-	242	242	265
Chad	-	-	2	2	-	-	-	2
Côte d'Ivoire	-	-	-	-	-	0	0	0
Democratic Republic of Congo	-	-	-	-	-	20	20	20
Eswatini	-	-	48	48	-	98	98	146
Kenya	-	938	-	938	2	871	873	1,811
Malawi	-	-	56	56	-	-	-	56
Mozambique	-	-	2	2	-	14	14	16
Namibia	2,155	-	1	2,156	-	1,234	1,234	3,390
Rwanda	-	28	-	28	-	30	30	58
Senegal	-	-	-	-	-	0	0	0
South Africa	406	115	1,535	2,056	-	12,968	12,968	15,024
Tanzania	-	207	5	212	-	-	-	212
Uganda	-	-	-	-	-	35	35	35
Zambia	-	-	58	58	-	8	8	66
Zimbabwe	-	-	616	616	-	417	417	1,033
Africa	2,561	1,288	2,346	6,195	2	15,940	15,942	22,137

Kenya reported two northern white rhino (*Ceratotherium simum cottoni*) individuals compared to the three noted in 2017. Four of the 12 range States with extant southern white rhinos (*Ceratotherium simum simum*) recorded annual declines (Botswana: -15.6%; South Africa: -4.7%, Mozambique: -18.2%; and Zambia: -14.0%). Note that the southern white rhino (*C.s. simum*) populations in Kenya, Uganda, Senegal, Cote d'Ivoire and Democratic Republic of Congo is outside their recent historical distribution[12]. The large numbers of white rhinos in South Africa defines continental trends with continental white rhino numbers, irrespective of sub-species, declining at an annual growth rate of -3.1%.

The increases based on point estimates elsewhere in white rhinos (533) and black rhinos overall (700) did not offset the decrease of white rhinos in South Africa (2,657). Overall, rhinos on the African continent declined at an annual rate of -1.6% from 2017 to

[8] See Annexure 3.
[9] See Annexure 4 for details.
[10] African Parks. 2021. Update on the underlying cause(s) of the mortalities of four Black Rhino (*D. bicornis minor*) translocated to Zakouma National Park (Chad) from South Africa in October 2018 – seasonal nutrient content of browse in different parts of the landscape. African Parks, Johannesburg, South Africa. Available from Dr Angela Gaylard, angelag@africanparks.org
[11] Estimates make use of definite and probable estimates collated through various sources. See Annexure 4 for details.
[12] Moodley Y, Russo IRM, Robovský J, Dalton DL, Kotzé A, Smith S, Stejskal J, Ryder OA, Hermes R, Walzer C, Bruford MW. 2018. Contrasting evolutionary history, anthropogenic declines and genetic contact in the northern and southern white rhinoceros (*Ceratotherium simum*). Proceedings of the Royal Society B, 285, p.20181567.

2021. While black rhinos determined past continental declining trends from the 1970s to the 1990s, white rhinos have dictated declining trends since the early 2010s (Fig. 1). Rhino estimates reported at CoPs since 2007 reflect these trends (Table 2).

Eastern black rhino (*D.b. michaeli*) was the least numerous black rhino sub-species with 1,288 individuals in 23 populations across three range States within the historical distribution (Kenya, Uganda and Tanzania) and one outside the historical distribution (South Africa) by 2021. Zoo collections held 161 eastern black rhino. South-central black rhino (*D.b. minor*) were extant in nine range States (Botswana, Eswatini, Malawi, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe) and one outside (Chad) their historical distribution with 2,346 living in 62 populations by 2021. Zoo collections had 15 south-central black rhinos. South-western black rhino (*D.b. bicornis*) was the most numerous sub-species with 2,561 individuals in 16 populations within South Africa and Namibia, and none in zoos.

Overall, all three sub-species of black rhinos are recovering since the mid-1990s following significant declines in the two preceding decades. Despite these trends, updated Red List assessments categorized black rhinos as Critically Endangered[13]. An additional consideration is that the historical poaching onslaught[14] also resulted in fragmenting distributions. The distribution of population sizes favoured smaller populations for eastern black rhino (*D.b. michaeli*) (median = 37, 100% of populations <200, n = 27). For south-western black rhino (*D.b. bicornis*) the median size was 31 individuals (92.3% of populations <200, n = 26). Of the 62 populations of south-central black rhino (*D.b. minor*) for which range States provided individual population details (no population details were available for Botswana), 93.5% had sizes <200 individuals. The median size for this sample of south-central black rhino (*D.b. minor*) was 15 individuals.

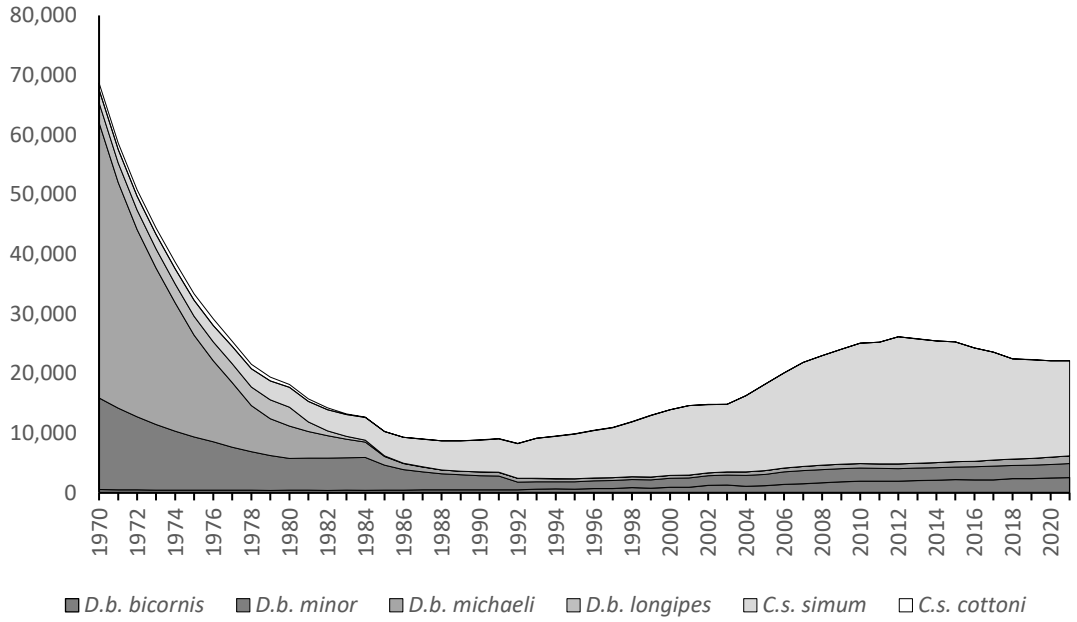

Figure 1. Estimates[15] of African rhinoceroses since 1970 by species and sub-species within Africa. Note that by 2021, one white rhino sub-species, northern white rhino (*C.s. cottoni*), is functionally extinct with only two individuals surviving. One black rhino subspecies, the western black rhino (*D.b. longipes*), was extinct by 2011.

[13] Emslie R. 2020. *Diceros bicomis.* The IUCN Red List of Threatened Species 2020: e.T39321A152729173. https://dx.doi.org/10.2305/IUCN.UK.2020-1.RLTS.T39321A152729173.en

[14] Knight M. 2021. African Rhino Specialist Group Chair report/Rapport du Groupe de Spécialistes du Rhinocéros d'Afrique. Pachyderm, 62, 16-28.

[15] Point estimates derived from the sum of the best available estimates for range States. Missing data in a time series for a range state came from interpolation between time *t* and *t*+*x* using the model $N_{t+x} = e^{rx}N_t$, and pooled per species and sub-species. The year 1970 was the base year. To obtain estimates back to 1970, the analysis used the first 10 and 8 available estimates of black and white rhinoceros in a time series respectively (based on half the generation length) to calculate exponential population change per annum (r). For this purpose, generation length (*T*) used a definition of the time it takes for the population to grow by a factor of its net reproductive rate. $T = \log\frac{R_0}{r}$, where R_0 is the number of female calves a cow are expected to produce in a lifetime. Age at first birth was 6.75 years old, age at last birth was 35.00 years old translating to on average 28.25 reproductive years irrespective of species. Calving interval was every 2.5 years. The population growth (*r*) is when there are no resource limitations set at 8% and 10% per annum for black and white rhinoceros respectively. The analysis then used the exponential model above assuming exponential population change to predict populations back in time.

Table 2. Population estimates for African rhinos within range States reported at Conferences of the Parties since before the poaching of rhinoceroses escalated in 2007. * indicate guesstimates[16]

		White rhinoceros *Ceratotherium simum*			Black rhinoceros *Diceros bicornis*				Rhinocerotidae
Range State	Year	*C.s. cottoni*	*C.s. simum*	Total	*D.b. bicornis*	*D.b. michaeli*	*D.b. minor*	Total	Total
Angola	**2021**		**3**	**3**					**3**
Botswana	2005		99	99			5	5	104
	2007		106	106			7	7	113
	2010		135	135			7	7	142
	2015		239	239			48	48	287
	2017		452	452			50	50	502
	2021		**242**	**242**			**23**	**23**	**265**
Chad	**2021**						**2**	**2**	**2**
Cote d'Ivoire	2017		1	1					1
	2021		**1***	**1***			**1***	**1***	**2***
Democratic Republic of Congo	2005	4		4					4
	2007	4		4					4
	2010								
	2015								
	2017								
	2021		**20**	**20**					**20**
Eswatini	2005		75	75			16	16	91
	2007		89	89			18	18	107
	2010		88	88			17	17	105
	2015		76	76			20	20	96
	2017		66	66			21	21	87
	2021		**98**	**98**			**48**	**48**	**146**
Kenya	2005		234	234		540		540	774
	2007		303	303		577		577	880
	2010	4	361	365		594		594	959
	2015	3	441	444		678		678	1,122
	2017	3	510	513		745		745	1,258
	2021	**2**	**871**	**873**		**938**		**938**	**1,811**
Malawi	2005						10	10	10
	2007						16	16	16
	2010						24	24	24
	2015						26	26	26
	2017						28	28	28
	2021						**56**	**56**	**56**
Mozambique	2005		7	7					7
	2007		9	9					9
	2010		6	6			1	1	7
	2015		29	29			2	2	31
	2017		29	29			1	1	30
	2021		**14**	**14**			**2**	**2**	**16**
Namibia	2005		293	293	1,141			1,141	1,434
	2007		370	370	1,435			1,435	1,805
	2010		469	469	1,750			1,750	2,219
	2015		822	822	1,946			1,946	2,768
	2017		975	975	1,857			1,857	2,832
	2021		**1,234**	**1,234**	**2,155**		**1**	**2156**	**3,390**

[16] See Annexure 4.

Table 2. Continued.

Range State	Year	*C.s. cottoni*	*C.s. simum*	Total	*D.b. bicornis*	*D.b. michaeli*	*D.b. minor*	Total	Total
Rwanda	2005					1		1	1
	2007					1		1	1
	2010								
	2015								
	2017					19		19	19
	2021		**30**	**30**		**28**		**28**	**58**
Senegal	2017		3	3					3
	2021		**3***	**3***		**3***		**3***	**3***
South Africa	2005		13,521	13,521	80	41	1,258	1,379	14,900
	2007		16,273	16,273	113	54	1,321	1,488	17,761
	2010		18,796	18,796	171	60	1,684	1,915	20,711
	2015		18,413	18,413	254	79	1,560	1,893	20,306
	2017		15,625	15,625	331	83	1,632	2,046	17,671
	2021		**12,968**	**12,968**	**406**	**115**	**1,535**	**2,056**	**15,024**
Tanzania	2005					57	44	101	101
	2007					67	56	123	123
	2010					88	25	113	113
	2015					129	4	133	133
	2017					155	5	160	160
	2021					**207**	**5**	**212**	**212**
Uganda	2005		4	4					4
	2007		6	6					6
	2010		9	9					9
	2015		15	15					15
	2017		22	22					22
	2021		**35**	**35**					**35**
Zambia	2005		2	2			6	6	8
	2007		1	1			16	16	17
	2010		7	7			27	27	34
	2015		10	10			32	32	42
	2017		14	14			48	48	62
	2021		**8**	**8**			**58**	**58**	**66**
Zimbabwe	2005		308	308			527	527	835
	2007		313	313			546	546	859
	2010		290	290			431	431	721
	2015		330	330			472	472	802
	2017		367	367			520	520	887
	2021		**417**	**417**			**616**	**616**	**1,033**
Africa	2005	4	14,543	14,547	1,221	639	1,866	3,726	18,273
	2007	4	17,470	17,474	1,548	699	1,980	4,227	21,701
	2010	4	20,161	20,165	1,921	742	2,216	4,879	25,044
	2015	3	20,375	20,378	2,200	886	2,164	5,250	25,628
	2017	3	18,064	18,067	2,188	1,002	2,305	5,495	23,562
	2021	**2**	**15,940**	**15,942**	**2,561**	**1,288**	**2,346**	**6,195**	**22,137**

Although white rhinos were declining in the decade up to 2021, with one sub-species, the northern white rhino (*C.s. cottoni*) functionally extinct, the high overall continental numbers resulted in the updated Red List assessment categorizing white rhinos as Near Threatened.[17] The *C.s. simum* population sample sizes reported by range States (n = 246, population details not available from Botswana) revealed most populations were comprised of a small number of individuals (median population size = 9 and 94.7% of the populations comprised fewer than 200 individuals).

[17] Emslie R. 2020. *Ceratotherium simum*. The IUCN Red List of Threatened Species 2020: e.T4185A45813880. https://dx.doi.org/10.2305/IUCN.UK.2020-1.RLTS.T4185A45813880.en.

The predominance of small populations highlight risks to their continued persistence due to increased vulnerability to stochastic processes associated with small populations[18]. For instance, Namibia noted a reduction in south-western black rhinos (*D.b. bicornis)* due to an extended drought in some small populations[19]. Swaziland previously noted a substantial impact on its two small southern white rhino (*C.s. simum*) populations during a severe drought[20]. In contrast, South Africa previously reported a relatively minor consequence of drought in one of its relatively large populations of south-central black rhinos (*D.b. minor*), but short-term impacts of droughts on southern white rhinos (*C.s.simum*)[21] resilience to climate fluctuations in the large population of Kruger National Park[22].

The influence of South Africa's rhino conservation contributions on continental trends manifests not only through the large number of rhinos, but also through the large number of populations. South Africa had 50 populations of black and 324 white rhinos by the end of 2021. In addition, private ownership played and continues to play a key role. Black rhino private ownership increased from none before the 1990s to 22.9% (440) of South Africa's population by 2010[23], reaching a peak of 27.4% (505 in 2014), but has declined in 2021 to 21.1% (434) of South Africa's 2,056 black rhinos. Note that by 2021, custodian and community ownership contributed another 5.8% (119).

White rhino private ownership fluctuated from 17.5% (1,175 in 1994) to 29.5% (3,119 in 2003) of South Africa's population from 1970 until 2012. From 2012-2021, the contribution of private ownership steadily increased and comprised an estimated 53.2% (6,900) of South Africa's 12,968 white rhinos by 2021. The increase during this period occurred despite 48out of 171 (28%) private owners surveyed in 2018 disinvesting in white rhinos. Note that at that time 57% of private owners were pursuing business-as-usual (largely ecotourism business models), while 15% were buying more rhinos[24]. Custodian and community ownership contributed 0.9%.

These trends of increasing contributions of management approaches that are non-State or some form of non-State with State partnership is not unique to South Africa. By the end of 2021, management approaches other than pure-State approaches contributed 51.8% (602) of *D.b. michaeli*, 81.6% (662) of *D.b. minor* and 76.0% (2,259) of *C.s. simum* individuals in range States other than South Africa. Management approaches other than pure-State approaches contributed 32.2% (694) to *D.b. bicornis* individuals in Namibia, the only other range State managing this sub-species. The information provided by range States also reflected improved performance of rhinos within management approaches other than pure-State approaches (Fig. 2). Annual population growth within pure-State management approaches was generally lower than within non-State or partnership with State management approaches irrespective of the sub-species.

Available secure land for rhinos was also fragmented. Range States reported availability of relatively small areas within various land-uses. For instance, the median of areas available at 24 localities for eastern black rhinos (*D.b. michaeli*) was 215 km^2 with 79.1% of the properties irrespective of management approaches <1,000 km^2 in size. For south-central black rhinos (*D.b. minor*), the median area was 261 km^2 at 49 localities with 81.6% of those areas <1,000 km^2. A median size of 310 km^2 for 26 localities of south-western black rhinos (*D.b. bicornis*) were noted with 96.2% of those properties<1,000 km^2 in size.

[18] Lande R, Engen S, Saether BE. 2003. Stochastic population dynamics in ecology and conservation. Oxford University Press on Demand.
[19] Piet Beytell, Namibia Range State Representative, AfRSG, piet.beytell@meft.gov.na
[20] Mick Reilly, Eswatini Range State Representative, AfRSG, conservation@biggameparks.org
[21] Ferreira SM, le Roex N, Greaver C. 2019. Species-specific drought impacts on black and white rhinoceroses. PLoS One, 14, p.e0209678.
[22] le Roex N, Ferreira SM. 2021. Rhino birth recovery and resilience to drought impact. African Journal of Ecology, 59, 544-547.
[23] See Annexure 5 for details.
[24] Clements HS, Knight M, Jones P, Balfour D. 2020. Private rhino conservation: diverse strategies adopted in response to the poaching crisis. Conservation Letters, 13, p.e12741.

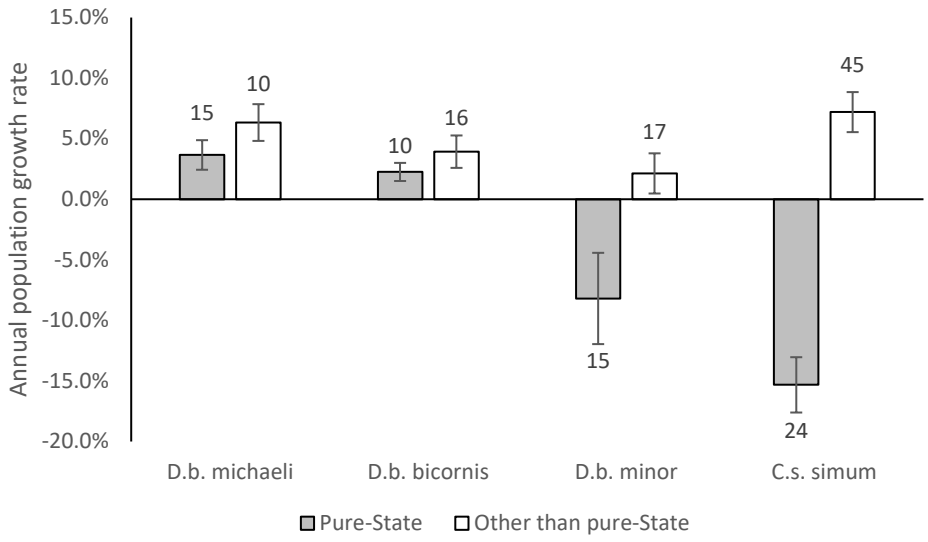

Figure 2. Population performance indicated through annual population growth rates from 2017 to 2021 calculated for this report[25] within pure-State models compared to management models that are non-State or have a non-State entity of some form in partnership with the State (Other than pure-State) by the end of 2021. Error bars reflect one standard error. The numbers indicate the number of populations that had detailed data to contribute to the analyses.

Black rhino home ranges vary considerably (*e.g.* 1.7 km^2 to 55.0 km^2 [26]) primarily determined by habitat type and browse availability. In some instances, the availability of the size of areas where black rhinos are already present add some additional constraints through, for instance, reduced habitat variability in smaller localities. For example, South Africa noted a reduction in population performances for south-western black rhino (*D.b. bicornis*) due to social and ecological limitations playing out when densities increase[27]. At higher densities, for instance, social stress and reduced food availability per capita rhino lessen survival and birth rates. This resulted in 50.0% (n = 4 of 8) of black rhino populations with no poaching pressure in South Africa growing at less than the target of 5% per annum. In some instances, low growth rates were associated with other aspects such as general lower productivity of a locality[28] when, for instance, the particular vegetation available to rhinos has lower nutritional value due to soil types and climatic conditions.

For southern white rhinoceros (*C.s. simum*), the high frequency of small areas available to rhinos (median = 27 km^2, 99.5% of the 201 localities that range States provide were <1,000 km^2 in size) may associate with the type of management models pursued, particularly in South Africa[29]. For instance, in the sample of populations from South Africa (n = 127), management ranged from 2.1% intensive, 30.7% semi-wild and 67.2% free-ranging (wild) approaches. The relative contributions of numbers of rhinos at these localities in South Africa indicate that 0.2% and 37.0% of individuals lived in intensive and semi-wild conditions respectively. By the end of 2021, 62.8% of South Africa's southern white rhino (*C.s. simum*) individuals were living in wild ranging conditions. Outside South Africa, range States reported 1.5%, 0.5% and 98.0% of southern white rhino (*C.s. simum*) individuals living in intensive (1.5%), semi-wild (0.5%) and wild conditions (98.0%). Note that there were 1,077 individuals in zoos and collections worldwide living largely in intensive ranging conditions. Southern white rhino (*C.s simum*) in these collections contributed 6.3% to the global population of 17,019 individuals.

South-western black rhinos (*D.b. bicornis*) lived exclusively in wild ranging conditions within Namibia and South Africa with none in zoos. Within range States, eastern black rhino (*D.b. michaeli*) also lived nearly exclusively in wild ranging conditions – the 115 individuals outside their historic range in South Africa lived in semi-wild ranging conditions. Worldwide, zoos managed 161

[25] Annual rate of increase estimation made use of the model $N_{t+1} = \left(N_t + N_{i,t\to t+1} - N_{r,t\to t+1}\right)e^r$ where N_t is the population size at time *t*, $N_{i,t\to t+1}$ the number of introductions into a population from time to *t* to time *t+1*, $N_{r,t\to t+1}$ the number of removals from a population from time to *t* to time *t+1* and r is the exponential growth rate. The analyses used annual estimates, when available, and records of introductions and removals that range States reported for each population and obtained a point-estimate of *r* for each population. The analyses used an approach weighting the estimated *r* for each population by its observed population size in 2021(or predicted from the model if no 2021 estimate was available) to calculate the average growth and confidence intervals for each sub-species within different management models within a range State and the continent as a whole.

[26] Linklater WL, Plotz RD, Kerley GI, Brashares JS, Lent PC, Cameron EZ, Law PR, Hitchins PM. 2010. Dissimilar home range estimates for black rhinoceros *Diceros bicornis* cannot be used to infer habitat change. Oryx, 44, 16-18.

[27] e.g. le Roex N, Paxton M, Adendorff J, Ferreira SM, O'Riain MJ. 2018. Starting small: long-term consequences in a managed large-mammal population. Journal of Zoology, 306, 95-100.

[28] Brodie JF, Muntifering J, Hearn M, Loutit B, Loutit R, Brell B, Uri-Khob S, Leader-Williams N, Du Preez P. 2011. Population recovery of black rhinoceros in north-west Namibia following poaching. Animal Conservation, 14, 354-362.

[29] e.g. Clements HS, Knight M, Jones P, Balfour D. 2020. Private rhino conservation: diverse strategies adopted in response to the poaching crisis. Conservation Letters, 13, p.e12741.

eastern black rhino (*D.b. michaeli*) individuals in intensive ranging conditions contributing 11.1% to the global population by 2021.

Similarly, the majority of south-central black rhinos (*D.b. minor*) (97.9%) lived in wild ranging conditions within range States. South Africa and Zimbabwe reported few localities where individuals lived in semi-wild ranging conditions. Only 38 south-central black rhinos (*D.b.minor*), a small fraction (0.6%) of the worldwide population were collaboratively in managed breeding facilities which included zoos and a number of private owners in 2021 within the Southern Black Rhino Sustainability Program

2.2. National and continental population trends in Asian rhinoceroses

The world had a minimum of 4,124 Asian rhinos comprising of the greater one-horned rhino (*Rhinoceros unicornis*), Javan or lesser one-horned rhino (*Rhinoceros sondaicus sondaicus*) and Sumatran rhinos comprising two sub-species *Dicerorhinus sumatrensis sumatrensis* and *Dicerorhinus sumatrensis harrisoni*, the eastern Sumatran rhino by the start of 2022 (Table 3). Since 2017, greater one-horned (*R. unicornis*) and Javan rhinos (*R. sondaicus*) increased by 3.7% and 4.4% per annum respectively, while Sumatran rhinos (*D. sumatrensis*) decreased at 13.0% per annum. Overall, Asian rhinos increased by 3.2% per annum[30]. With the exception of Sumatran rhinos, this bodes well as increases in the reporting period improved compared to previous reporting periods at CoP meetings (Table 4). Note that by 2020, there were 223 greater one-horned rhinos in various zoos across the world[31].

The greater one-horned rhino (*R. unicornis*) has a status of Vulnerable on the IUCN Red List[32]. Surveys in 2022 confirm numbers in Assam, India, are growing and had an estimated 2,885 individuals in four populations in April 2022. India reported an increase of 235 rhinos from February 2018 when Assam had 2,650 individuals. Kaziranga National Park in Assam conserves the majority (81%) of India's population, with numbers continuing to increase. India re-established a population in Manas National Park beginning in 2008. The park now holds 40 greater one-horned rhino, with births offsetting earlier poaching losses. Since 2015, numbers in Uttar Pradesh have increased by six to 38. The new counts in West Bengal since the 2015 estimate of 255 noted that rhinos increased to 339 at March 2022. The last wild rhino translocation in Assam was in 2021, with a male and female moved to Manas National Park.

Table 3. Estimates of Asian rhino numbers[33] by country, species and subspecies by early 2022.

	Greater one-horned rhino	Javan (Lesser one-horned rhino)	Sumatran rhino			Asian Rhinoceroses
Range State	*Rhinoceros unicornis*	*Rhinoceros sondaicus*	*D. s. sumatrensis*	*D. s. harrisoni*	*Dicerorhinus sumatrensis*	Rhinocerotidae
India	3,262					3,262
Nepal	752					752
Indonesia		76	32 - 44	2-3	34 – 47	110 - 123
Asia	4,014	76	32 - 44	2-3	34 – 47	4,124 - 4,137

In Nepal, heavy poaching in a period of socio-political unrest caused the greater one-horned rhino (*R. unicornis*) numbers to fall to a low of 410 in 2005. The population recovered to 752 by 2022. This growth resulted from a political stability in the country and the re-engagement of the army to assist with rhino protection since 2010, which curbed poaching. Nepal reported only one rhino poached from 2018 to April 2022. The majority (92%) of Nepal's rhinos occur in one population at Chitwan National Park. Recent surveys provide a conservative estimate of 694 rhino in the Park. Note that since the start 2021 to April 2022 authorities detected 32 natural mortalities in addition to the one poached. Nepal also translocated 13 rhino from Chitwan National Park to other areas. By early 2022, Bardia National Park had 38 rhino, nine more since 2019; Suklaphanta National Park held 17 rhino, eight more since 2015 following translocation of five rhinos; and Parsa National Park held three individuals. The trends in greater one-horned rhinos (*R. unicornis*) in India and Nepal is encouraging as 90.9% of the populations (n=11) all increased from the 2018-2019 to the 2021-2022 estimates[34].

[30] Population growth based on an exponential model, $N_t = N_0 e^{rt}$ where N_t is the population sizes at time t and r is the exponential growth rate. Estimation used $r = \frac{\ln N_{t+x} - \ln N_t}{x}$ and calculated average growth per species and Asian rhinos as a whole weighted by the population sizes reported in 2017.

[31] Steck BL. 2021. International Studbook for the Greater one-horned rhinoceros 2020. Zoo Basel, Switzerland.

[32] Ellis S, Talukdar B. 2019. *Rhinoceros unicornis*. The IUCN Red List of Threatened Species 2019: e.T19496A18494149. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T19496A18494149.en.

[33] Based on data held by the AsRSG and World Wildlife Fund data. Chair AsRSG, Bibhab Talukdar, b.talukdar@rhinos.org.

[34] See Annexure 6, Figure A6.1 for details.

Table 4. Population estimates for Asian rhinos within range States reported at Conferences of the Parties since before the poaching of rhinoceroses escalated in 2007.

		Greater one-horned rhinoceros *Rhinoceros unicornis*	Javan rhinoceros *Rhinoceros sondaicus*			Sumatran rhinoceros *Dicerorhinus sumatrensis*			Rhinocerotidae
Range State	Year	*R. unicornis*	*R. s. sondaicus*	*R. s. annamiticus*	Total	*D.s. sumatrensis*	*D.s. harrisoni*	Total	
India	2007	2,150							2,150
	2009	2,364							2,364
	2012	2,730							2,730
	2016	2,912							2,912
	2018	2,939							2,939
	2021	**3,262**							**3,262**
Nepal	2007	413							413
	2009	435							435
	2012	534							534
	2016	645							645
	2018	649							649
	2021	**752**							**752**
Indonesia	2007		40-50		40-50	180-200		180-200	220-250
	2009		38-44		38-44	140-200		140-200	178-244
	2012		35-45		35-45	120-180		120-180	155-225
	2016		63		63	73	3	76	139
	2018		65-68		65-78	37-75	3	40-78	105-146
	2021		**76**		**76**	**32-44**	**2-3**	**34-47**	**110-123**
Pakistan	2007	2							2
	2009	2							2
	2012	Maybe Present							Maybe Present
Malaysia	2007					75-90	25-30	100-120	100-120
	2009					0-70	20-30	20-100	20-100
	2012					Maybe Present	20-30	20-30	20-30
Viet Nam	2007			3-5	3-5				3-5
	2009			0-5	0-5				0-5
	2012			Extinct					Extinct
Asia	2007	2,565	40-50	3-5	43-55	255-290	25-30	280-320	2,888-2,940
	2009	2,801	38-44	0-5	38-49	140-270	20-30	160-300	2,999-3,150
	2012	3,264	35-45	Extinct	35-45	120-180	20-30	140-210	3,439-3,519
	2016	3,557	63		63	73	3	76	3,696
	2018	3,588	65-68		65-68	37-75	3	40-78	3,693-3,734
	2021	**4,014**	**76**		**76**	**32-44**	**2-3**	**34-47**	**4,124-4,137**

The Critically Endangered[35] Javan rhino (*R. sondaicus*) exists only in Ujung Kulon National Park in west Java, Indonesia. As reported to CoP18, monitoring is improving with camera traps now covering the entire park. Park authorities reported five Javan rhino found dead with horns intact between 2016 and 2022. These were most likely from natural causes. Camera trap data indicate that at least four calves were born in 2017, three in 2018, four in 2019, two in 2020 and five in 2021. The total estimated population in 2022 is 76 individuals. With all individuals in a single population, in addition to a poaching threat, the species is particularly vulnerable to stochastic events such as disease carried by domestic cattle, and potential natural disasters such as volcanic activity[36] or a major tsunami. For instance, a relatively small tsunami caused by a landslide in the Sunda Straits following an eruption of "Anak Krakatau" (son of Krakatoa, situated north of Ujung Kulon) hit the northern portion of the park in December 2018. The tsunami generated waves up to five meters, some of which crashed ashore in Ujung Kulon, killing two park agency officers, damaging office posts with a total death toll of >400 people. No rhinos were known to be lost in this catastrophe.

[35] Ellis S, Talukdar B. 2020. *Rhinoceros sondaicus*. The IUCN Red List of Threatened Species 2020: e.T19495A18493900. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T19495A18493900.en.

[36] The "Anak Krakatau" volcano is active immediately north of the park.

Plans to establish a second population within the species' historic range continue to show little progress. Strategically, a second population would not only reduce risk[37], but would promote breeding in the current population by freeing up food resources for remaining females, assuming a sufficient area of suitable and well-protected habitat can be identified.

The Sumatran rhino (*Dicerorhinus sumatrensis*), also categorized as Critically Endangered[38], occurs in four isolated sites in Indonesia, possibly in up to ten sub-populations, with some estimated to number between only two and five animals, which remains unsustainable. In addition to known populations in three National Parks in Sumatra, two to three rhinos may survive in Kalimantan (Indonesian Borneo). It is not clear which subspecies these individuals might be. No existing Sumatran rhino sub-population most likely comprises more than 30 individuals. The minimum total number of Sumatran rhino was 73 individuals in 2015[39]. At present, numbers are likely to be considerably fewer and the populations have declined rapidly. Monitoring effort has not been sufficient to obtain precise estimates of any of the populations on Sumatra. Ground information from Bukit Barisan Selatan National Park recorded no sightings or signs of rhino for several years, and most experts agree numbers are likely fewer than five individuals. The Park authority in Way Kambas National Park estimated the population to be 12-14 individuals in 2019.

Uncertainty also exists around numbers in Gunung Leuser National Park due to its large area, undulating forested terrain, and patchy photo-trapping effort. Limited photo-trapping over the last dozen years recorded at least 18 different individuals, but it is likely that there may be as many as 20-30 in this population. Despite a successful trial of intensive camera trapping in a study area in Gunung Leuser National Park more than five years ago, which yielded high average sighting frequencies of individual rhino, this methodology has not been rolled out across all Sumatran rhino (*D. sumatrensis*) range areas at the scale needed to reliably assess numbers, distribution and population structure. Such monitoring data would not only help guide security needs assessments and patrol deployment, but would also enable informed biological management decision-making. Improved monitoring data could also help guide decisions regarding consolidating some very small outlier populations that may be non-viable if left alone. Population viability analyses highlighted that any population with fewer than ten animals would not be viable[40].

Field ranger densities in thick rainforest habitats in Indonesia also remain lower than minimum recommended levels in Africa, where rangers observe rhinos much more easily. There are significant infrastructure and equipment needs. In addition to poaching, factors such as population fragmentation, habitat conversion, invasive species and possible vegetation succession remain important threats to the survival of the Sumatran rhino (*D. sumatrensis*). Authorities seized the horns of at least three Sumatran rhino (*D. sumatrensis*) since 2014 (see Section 3). The need to increase efforts to monitor, secure and manage remaining wild populations is critical to save this species from extinction.

3. Trade dynamics

3.1 Illegal trade

3.1.1 Estimates of rhino horns entering the illegal market

Consistent with previous reports to the CoPs, data were sought for several sources of horns entering the illegal market: horns from poached rhinos; horns stolen from natural mortality; thefts from government stockpiles; other reported thefts from private stocks, museums, etc.; horns illegally sold from private stocks; and horns obtained from legal trophy hunts that may have entered illegal trade (Table 5 (a)). The total the number of horns entering trade from the above sources is then discounted by the illegally obtained horns that were recovered in situ, or that were confiscated as seizures (Table 5 (b)).

The following section describe the data sources and estimation methodologies for each source of horn entering the trade, or removal from illegal trade. It is noted that where applicable, two estimates are provided for each category whereby a minimum, or lower limit, estimate was based on the reported data even if localized and opportunistically collected (*e.g.*, one report of theft, or recovery in situ from one poached population), and a maximum, higher limit, estimate was based on reasoned extrapolation to the rest of the population or range. Data were summarized for the most recent years following the last CoP report on 'African and Asian Rhinoceroses – Status, Conservation and Trade'[1], viz. 2018 – 2020.

[37] Haryono Muh. Miller PS, Lees C, Ramono W, Purnomo A, Long B, Sectionov, Waladi Isnan BD, Aji BD, Talukdar B, Ellis S. (Eds.) 2016. Population and Habitat Viability Assessment for the Javan Rhino. Apple Valley, MN: IUCN/SSC Conservation Breeding Specialist Group.

[38] Ellis S, Talukdar B. 2020. *Dicerorhinus sumatrensis*. The IUCN Red List of Threatened Species 2020: e.T6553A18493355. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T6553A18493355.en.

[39] Miller PS, Lees C, Ramono W, Purwoto A, Rubianto A, Sectionov, Talukdar B, Ellis S. (Eds.) 2015. Population Viability Analysis for the Sumatran Rhino in Indonesia. Apple Valley, MN: IUCN/SSC Conservation Breeding Specialist Group.

[40] Miller PM. 2016. Population viability analysis for the Sumatran rhino in Indonesia. https://policycommons.net/artifacts/1368834/population-viability-analysis-for-the-sumatran-rhino-in-indonesia/1983006/

3.1.1.1 Sources of horns for illegal markets

Horns from poached rhinos. The reported number of poached African rhinoceroses from 2006 – 2021 was based on data collected for this report from the AfRSG State representatives (see Section 5, Table 8 - Incidents of illegal killing of rhinoceroses). From 2018 – 2020, 2,206 individuals were reportedly poached from African range States. For Asian rhinos, no poaching incidences were reported by the AsRSG. To calculate the minimum number of horns entering illegal trade from poached rhinos, the recorded number of individuals (2,206) was multiplied by a factor of two horns per rhino for a total of 4,412 horns. However, not all poached individuals are detected due to factors including survey effort, time since death, and other environmental conditions, and a recent study at Kruger National Park estimated that roughly 10% of carcass go undetected[41]. Therefore, as an upper range estimate, the reported number of poached individuals were adjusted by a factor of 0.9 to account for imperfect detection (*i.e*. 2,206 divided by 0.9, which equals 2,451). Similarly to the minimum estimate, the adjusted number of poached individuals was multiplied by two to assess the number of horns entering illegal trade for a total of 4,902 horns; this constituted the largest ~ source of horns illegally entering trade (~95%, depending if min or max estimate, out of the total number of horns illegally entering trade; Table 5).

Horns stolen from natural mortalities. No data on horns stolen from natural mortalities were reported. While it is likely that this source for horns entering illegal trade is relatively small, additional studies need to be conducted to support extrapolation of any estimate to the range. Therefore, no further estimates were provided in this report.

Thefts from government stockpiles. No thefts from government stockpile were reported (see Section 4 - Stocks of specimens of rhinoceros and stock management). While discrepancies occurred between the amount of stock reported to the CITES Secretariat and the expected number of horns or weight seized from illegal activity (Section 4), and while these discrepancies were not always accounted for by reported or unreported destruction events, it was not assumed the missing horns entered illegal trade. However better accounting of stockpile data might be warranted to ensure that is not the case.

Other thefts (private stocks, museums, etc.). In general, no other notable forms of thefts were reported, and no further estimates were calculated. Regarding museum thefts, while the problem seemed to be prevalent in the early 2010's in European countries[42], no recent notable thefts were recorded, and none were estimated.

Horns illegally sold from private stocks. Only one seizure made by the South African Police Service[43] in 2019 of illegally possessed rhino horns that were reported to have originated from a private stock was included in the database. In this case, 181 horns were transported between South African provinces without proper permits and by two individuals who were not named as the official permitted buyer of the horns, and who were convicted in 2020 of illegal possession of these horns[44]. This seizure was not reported as an illegal sale, rather as an illegal possession; however given the circumstances of the case, as also detailed in a decision by the High Court of South Africa in a related suit by the private owner to return the horns[45], in which the permit holder of the legal sale claimed he "did not intend purchasing the 181 horns from the applicant nor receiving them into his possession and that he had agreed to permit applications being submitted in his name in exchange for money", this seizure was included as an illegal sale in this report and provided the minimum and maximum estimate for illegally sold horns from private stocks from 2018 - 2020. As all these horns were also recovered and appear in the seizure data, the net input to illegal trade was zero.

Horns obtained from legal trophy hunts that might have entered illegal trade. Trophy hunting is permitted in South Africa and Namibia (see Section 3.2.1 Trophy hunting of rhinos), however no official data were centrally collected on the number of horns from legal trophy hunts that were found to enter illegal trade. Hence a minimum number of zero was used. An estimated maximum was derived from reported discrepancies between trophy rhino products that were imported and exported in the CITES Trade Database, which maintains records of export and import trade reported by Parties in their Annual Reports. Permits for trophy specimens and horns exported or imported for hunting, personal or commercial purposes were obtained[46], and the number of trophies and horns recorded as imported by each Party were calculated annually and compared against the number of trophies and horns exported by South Africa or Namibia, respectively[47]. However, the latter can be considered as an upper limit estimate, as there could be a time lag between export and import permit issuance and reporting and other explanations for discrepancies. To account for possible time lags in reporting and using the most recent data on annual report submission by CITES Parties[48], the discrepancy in the reported export versus the imported records was included only if the Party has reported for that year. Assuming a trophy represented two horns, reported import and export figures were converted to horns to provide

[41] Ferreira SM, Dziba L. 2022. Rhinoceros accounting in Kruger National Park. Unpublished data, sam.ferreira@sanparks.org.
[42] https://www.museumsassociation.org/museums-journal/news/2011/09/01092011-rhino-horn-thefts-continue/#
[43] https://www.saps.gov.za/newsroom/msspeechdetail.php?nid=20103
[44] https://www.dffe.gov.za/mediarelease/rhinohorn_poachersconviction
[45] http://www.saflii.org/za/cases/ZAGPPHC/2022/33.pdf
[46] See Annexure 7 for details.
[47] Tables A7.1 and A7.2 in Annexure 7 for South Africa and Namibia respectively.
[48] https://cites.org/sites/default/files/reports/annual-reports/annual-reports.pdf

the maximum number of horns entering illegal trade from trophy hunts (n = 103; 2% of maximum estimated horn entering trade) in the reporting period.

3.1.1.2 Recovery of illegally obtained horns

Horns illegally obtained that are recovered in situ. Minimum number of horns recovered *in situ* (n = 299) were based on data from Kruger National Park in South Africa from 2018 – 2020[49]. The same dataset from KNP provided an estimate that on average from 2018 – 2021, 17% of the horns from poached carcasses were recovered in the field. Therefore, as a maximum estimate of recoveries of illegally obtained horns in situ - the number of horns sourced from poaching reported here (n = 4,412) was multiplied by 0.17 to estimate 750 of horns recovered in situ. It is noted that because this is a recovery estimate, the higher number of 750 horns was applied to the minimum horns entering the trade column, whereas the lower number of 299 horns was applied to the maximum horns entering the trade.

Horns recovered in confiscations or seizures. The number of horns recovered from seizures is based on the reported seizure data and the methodologies to estimate the number of horns (if not reported) as described in detail in section 3.1.2. Major illegal trade flows and countries most affected. Unlike previous reports, the numbers were collated collectively for African and Asian rhinoceros species for a total of 2,119 recovered horns from confiscations or seizures from 2018 – 2020.

3.1.1.3 Estimated horns intended for illegal trade

In total 4,593 – 5,186 horns were estimated as intended for illegal trade from 2018 – 2020 (Table 5). Of these, 2,418 – 2,869 (53% - 55%) were recovered by law enforcement efforts, the majority (~85%) attributed to seizures and confiscation while the reminder attributed to recoveries of horns *in situ*. Accounting for the recovered horns, it is estimated that a total of 1,724 – 2,768 horns entered illegal trade from 2018 – 2020. Averaged per year, 575 – 923 horns entered the illegal trade annually from 2018 – 2020 (Table 5).

The annual number of horns entering trade is the lowest annual estimate in the past decade since pre-CoP16 (Table 6) and may be a sign that law enforcement efforts are improving. However, 2020 likely represents an abnormal year due to the COVID-19 pandemic, which negatively impacted economies, travel and trade and likely affected illegal activity, law enforcement efforts, and reporting efforts. While several factors in addition to the pandemic can affect the reduction of horns entering trade - *e.g.,* effective law enforcement, or reduction in wild populations size - it is impossible to discern with the data at hand the potential factors attributing to the decline; therefore, continued monitoring and more consistent reporting of data on sources of horns that might enter trade (*i.e*. missing data from Table 5) are warranted. It is noted that existing mechanisms to trace rhino horn sources are available with the Rhino DNA Indexing System (RhODIS; see Section 6.2.2 - DNA Forensic systems), which in turn can help improve on the estimates of horns entering the illegal trade whether from private or States managed stocks, or from legal (trophy hunting, private stock sale, dehorning) or illegal (theft, poaching) activities.

[49] Sandra Snelling, SANParks Data, 22 April 2022, sandra.snelling@sanparks.org

Table 5. Estimated number of rhino horns by source entering illegal trade from 2018 – 2020.

Description of source or recovery of horns	No. of horns		Description of data source and estimation methods
	Min	Max	
a) Source of horns intended for illegal markets			
Horns on all recorded poached rhinos	4,412	4,902	Minimum estimate based on 2018-2020 poaching data presented in this report multiplied by a factor of 2 horns per poached rhino; maximum estimate based on poaching data corrected for carcass detection probability of 0.90.
Horns stolen from natural mortalities	0	0	No data to inform this source of horns.
Thefts from government stockpiles	0	0	No data to inform this source of horns.
Other thefts (private stocks, museums etc.)	0	0	No data to inform this source of horns.
Horns illegally sold from private stocks	181	181	Based on reported seizure of illegally possessed horns in South Africa in 2019 by individuals not named on a legal sale permit that originated from a privately held stock.
Horns obtained from legal trophy hunts that may have entered illegal trade	0	103	No data to inform minimum estimate. In the absence of other information, a proxy was used for maximum estimate based on discrepancies in 2018-2020 trophy and horn trade data for hunt, personal, and commercial purposes from the CITES Trade Database while accounting for the reporting by Parties as reported by CITES Annual Reports reporting table[50].
Source Total	4,593	5,186	
b) Recovery of illegally obtained horns			
Recoveries of illegally obtained horns *in situ*	750	299	Lower estimate (maximum column) based on data from Kruger National Park (KNP), South Africa; higher estimate (minimum column) based minimum poached horns reported in this table, times the proportion of poached horns (17%) that are recovered *in situ* based on KNP estimates[51].
Confiscations/seizures	2,119	2,119	Based on data obtained from the CITES Illegal Trade Reports, TRAFFIC database, and five Parties that were collated into a seizure database for this report to ensure no duplication. If not reported, number of horns were estimated using species-specific weight (kg) to number of horns conversion factor as described in main text and Annexure 8[52].
Recovery Total	2,869	2,418	
Total rhino horns entering illegal trade	**1,724**	**2,768**	
Annual estimate of horns entering illegal trade from 2018 - 2020[53]	**575**	**923**	

[50] See Annexure 7.
[51] Sandra Snelling, SANParks Data, 22 April 2022, sandra.snelling@sanparks.org
[52] See Annexure 8.
[53] Calculated as the total rhino horns entering illegal trade divided by three years in the timeframe analysed.

Table 6: Estimated average number of African rhino horns sourced for illegal markets per year, 2000-2020[54].

Time period	Jan'00-Dec'05 (Pre-**CoP 14**)	Jan'06-Sept'09 (Pre-**CoP15**)	Jan'09-Sept'12 (Pre-**CoP16**)	Oct'12-Dec'15 (Pre-**CoP17**)	Jan'16-Dec'17 (Pre-**CoP18**)	Jan'18-Dec'20 (Pre-**CoP19**) (Min – Max)
Estimated horns entering trade per year in time period	106	408	1,140	2,674	2,378	575 - 923

3.1.2 Illegal trade flows and Parties most affected

3.1.2.1 Input seizure data

Three sources of data on seizures of illegally traded rhinoceros specimens and products where utilized in this report. A total of 482 seizure records for the years 2016 – 2020, reported by Parties in their Annual Illegal Trade Reports and received from the CITES Illegal Trade Database maintained by the United Nations Office on Drugs and Crime (UNODC)[55]; 994 records were obtained from TRAFFIC's database on the illegal wildlife trade for the years 2010 to 2021; and 17 additional records were received from five Parties (Austria, Kenya, Liberia, Malaysia, and the United States of America) in response to a data collection call by the IUCN's AfRSG and TRAFFIC[56]. Databases were cleaned, merged, and checked for duplicates, and where needed, information for each record was combined from different databases to obtain the most detail. The resulting merged database consisted of 1,233 unique records of seizures of rhinoceros specimens from 2010 – 2021. As ITR Data for 2021 are not available yet, data analysis was focused on the years 2010 – 2020 for a total of 1,180 seizures. It is noted that the composite database consisted of datasets with differing methods of collections and time frames. Furthermore, the data presented here (see Table 7) are simply aggregated and are not bias-adjusted for any reporting or seizure rates differences between years or Parties. Therefore, caution is warranted when comparing data aggregates.

Consistent with field 14 of the data collection form in the Annex of Resolution Conf. 9.14 (Rev. CoP17), data were categorized into number of horns and weight for seized whole horns; number of pieces and weight for seized worked horn, pieces of horn, and skin specimens; and weight for seized powdered horn or other specimens. Of the 1,180 seizures, 838 were related to whole rhino horns; 51 consisted of seizures of worked horn products; 179 consisted of seizures of pieces of horn; seven of skin products; seven of horn powder products; and 69 of other rhino specimens such as body, head, teeth, bones, etc.[57] An additional 67 records did not have any quantity information on any of the specimen types and were omitted. Similar to previous CoP reports, the illegal trade flows analysis presented here (section 3.1.2) is focused on trade in horns (whole or pieces) hence sample size analysed consisted of 1,003 records from 2010 - 2020.

3.1.2.2 Weight estimations

Reported seizures data often had incomplete data whereby only the number of horns, pieces, or their total weight was reported. Additionally, the species of rhinoceros for the specimen seized was not always known (thereby seizures reported as Rhinocerotidae). To summarize trade flows and consistent with previous analyses to the CoP, weight was estimated for records with number of whole horns but no weight reported, and for records with number of horn pieces but no weight reported. Additionally, the number of whole horns was estimated for records with whole horn weight reported but no number of whole

[54] Milledge S. Rhino-related crimes in Africa: an overview of poaching, seizure and stockpile data for the period 2000-2005. CoP14 Inf. 41. CITES Secretariat, Geneva, Switzerland.

Milliken T, Emslie RH, 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. CoP17 Doc. 68 Annex 5. CITES Secretariat, Geneva, Switzerland.

Emslie RH, Milliken T, Talukdar B. 2012. 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 (RevCoP15). CoP16 Doc. 54.2 Annex 2. CITES Secretariat, Geneva, Switzerland.

Emslie R, Milliken T, Talukdar B, Adcock K, Ellis S, Knight MH. 2016. 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. CoP15). CoP17 Doc. 68 Annex 5. CITES Secretariat, Geneva, Switzerland.

Emslie RH, Milliken T, Talukdar B, Burgess G, Adcock K, Balfour D, Knight MH. 2018. 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. CoP17). COP18, Doc 83.1, Annex 2. Available at https://www.traffic.org/site/assets/files/12220/african-asian-rhinos-iucn-traffic.pdf

[55] Eighty-five records were removed as they were identified as: duplicates of the same seizure based on date, location, quantity and additional information (n = 40); illegal killing incidents where it was not clear a horn was seized (n = 44); records consisted of non-rhinoceros species (*n* = 1).

[56] An additional thirteen Parties replied that they had made no seizures of rhino specimens in the reporting period.

[57] Note some records might have had multiple specimen categories (e.g. whole horn and worked horn) seized and are therefore summarized more than once in the tallies provided. Hence the total of 838+179+51+7+7+69+67 = 1,218 is greater than 1,180 records spanning 2010-2020.

horns, or for records with reported or estimated weight from horn pieces[58]. The following details the methodology for each estimation procedure.

Seizures of whole horns. Weight estimation for seizures reporting number of pieces as whole horns was based on a species-specific estimate of kg per whole horn. If the seizure record specified species of rhino as one of the five extant species (subspecies were assumed at the species level), we used estimates of weight per whole horn from previous studies[59] [60] [61]. For seizures of whole horns where more than one rhino species was specified (n = 8), which consisted only of African rhinoceros species, a weighted average was assigned per horn based on the frequency of the white and black rhino species in the seizure data[62]. For seizures of whole horn for which only the family Rhinocerotidae was specified (n = 814), it was assumed that if the country of discovery or the country of origin of the illegal consignment was a range State for Asian species (India, Indonesia, or Nepal), then the specimens seized were of Asian rhinoceros species (n = 111); otherwise, it was assumed that the seizure consisted of African species, even if specimens were seized in non-African rhinoceros range States. A weighted average for Asian species was derived similarly to African species. Once all weight estimates per whole horn type, *i.e.,* species-specific, mixed, or general African or Asian species, were derived, weight was estimated by multiplying the reported number of whole horns seized by the species-specific kg per whole horn ratio.

Seizures of horn pieces. To estimate the weight of seizures with reported horn pieces and missing weight, a linear regression was derived from seizures reporting both data, *i.e.,* the number of horn pieces and their weight (n = 84). The regression was then used to predict weight for seizure with number of horn pieces but no weight (n = 48)[63]. It is noted that due to small sample size of seizures reporting both number of pieces and weight for Asian rhinoceros species (n = 6), a separate regression was not constructed for Asian and African species; hence the three seizures of Asian species for which weight is estimated, may present an over-estimate, however it is likely insignificant out of 1,003 seizures considered in this analysis.

3.1.2.3 Number of whole horns estimation.

In addition to weight, the number of whole horns were also estimated for records with weight but missing number of whole horns, or for records of seized horn pieces that had weight reported or derived based on the above procedures. For whole horn seizures, the same species-specific ratio of weight per whole horn reported in Table A8 were used to derive the number of whole horns from reported weight (Annexure 8). For horn pieces seizures, the same ratios were used on either the reported weight or the estimated weight of the number of pieces based on the regression model[58].

[58] A summary of weight and whole horn estimation methods for seizure records reporting only no of horn/pieces, weight or both. X denotes no data existed or estimation performed. Conversion factor refers to the species-specific weight per whole horn reported or derived as detailed in Annexure 8. Regression relates to the regression to estimate weight form number of pieces (pcs).

Summary of estimation approaches

	Reported seized no. horns	Reported seized weight	Estimated no. whole horns for seizure	Estimated total weight of seizure
Whole horns	No. horns	X	X	Reported no. horns * Conversion factor
	X	horn weight	Reported weight / Conversion factor	X
	No. horns	horn weight	X	X
Horn pieces	No. pcs	X	By regression est. weight / Conversion factor	By regression
	X	Pcs weight	Reported pcs weight / Conversion factor	X
	No. pcs	Pcs weight	Reported pcs weight / Conversion factor	X

[59] Pienaar DJ, Hall-Martin AJ, Hitchins PM. 1991. Horn growth rates of free-ranging white and black rhinoceros. Koedoe, 34, 97-105.
[60] Leader-Williams N. 1992. The World Trade in Rhino Horn: A Review. TRAFFIC International, Cambridge, U.K.
[61] See Table 8A, Annexure 8.
[62] Annexure 8 for detailed methodology
[63] See Annexure 8.

Table 7. Total number of seizures of rhino horn specimens and their weight and number of whole horns that were reported or estimated to be seized globally. Data, presented for the most recent three years since last CoP18 report[1] and cumulatively for 2010 – 2020. Because seizures may be counted more than once, i.e., for the Party making the seizure (sz-in) as well as the Party(ies) implicated in the seizure (sz-out), it is not appropriate to sum all estimated weights. Data are sorted highest to lowest based on the estimated (Est.) weight (kg) of seizures from 2018 – 2020, and colour shading for every variable indicates the top six values from the highest (darker colour) to the 6th highest (lightest colour).

Party * Party is part of the National Ivory and Rhino horn Action Plan process.	2018 - 2020				2010 - 2020			
	No. seizures made by Party (sz-in)†	No. seizures Party implicated in (sz-out)††	Est. weight (kg) of all seizures Party involved in (sz-in+sz-out)‡	Est. no. of whole horns from all seizures Party involved in‡	No. seizures made by Party (sz-in)	No. seizures Party implicated in (sz-out)	Est. weight (kg) of all seizures Party involved in (sz-in+sz-out)	Est. no. of whole horns from all seizures Party involved in
South Africa	103	26	2,399	1,116	307	85	5,367	2,340
China & Hong Kong SAR	62	28	1,507	622	197	110	3,250	1,412
Viet Nam*	23	20	927	371	75	79	2,364	1,016
Malaysia	2	7	543	205	4	14	911	352
Mozambique*	10	8	485	211	46	41	1,578	697
United Arab Emirates	2	6	354	149	4	20	455	215
Qatar	0	11	324	164	2	39	634	317
Namibia	32	1	155	57	55	6	380	145
Turkey	8	0	149	82	9	2	205	111
Philippines	0	1	93	38	1	1	106	44
Ethiopia	1	4	75	28	1	17	158	76
Russian Federation	3	0	66	48	4	0	86	55
Angola	2	3	39	14	2	8	62	26
Singapore	1	1	37	14	4	4	97	51
Zimbabwe	6	0	37	19	17	2	121	56
Uganda	0	1	20	15	6	5	161	86
India	19	1	14	21	83	1	63	93
France	5	0	13	7	17	12	203	97
Zambia	2	0	11	4	5	3	83	39
United States of America	2	1	9	4	8	3	128	55
Botswana	2	0	7	3	5	3	52	19
Cambodia	1	0	7	3	7	4	163	75
United Kingdom	1	1	7	3	13	1	125	54
Thailand	1	4	7	7	15	15	299	169
Nepal	8	1	7	10	29	2	24	34
Kenya	3	0	6	4	14	12	447	188
Czech Republic	2	0	5	2	6	0	114	39
Lao PDR	5	1	5	6	7	10	90	52
Netherlands	0	1	5	2	4	2	56	28
Rwanda	1	0	5	2	1	1	9	7
Switzerland	1	0	5	2	1	2	17	7
Portugal	2	0	4	2	4	1	45	17
Belgium	1	0	2	1	8	2	54	22
Spain	1	0	2	1	5	1	21	9
Indonesia	2	0	2	4	7	2	26	22
Germany	1	0	1	1	5	1	28	17
Malawi	1	0	1	1	4	2	191	91
Other countries (n = 14)[64]	0	0	0	0	21	5	319	140

† *No. seizures made by Party* indicate the number of seizures the Party made within its jurisdiction.

†† *No. seizures Party implicated in* indicates the number of seizures made outside of the Party's jurisdiction and in which the Party was named as the country of origin, export, transit, or destination in the illegal trade chain.

‡ *Est. weight (kg) and Est. no. of horns from all seizures Party involved in* are summed across all seizures made by the Party, or that the Party was implicated in, where estimates are either the reported or derived weights or no. of whole horns using methodologies described in main text and Annexure 8.

[64] Data summaries across 14 countries that did not have any recent seizures from 2018 -2020 but otherwise had at least one seizure from 2018 – 2020. Those countries are: Australia, Cameroon, The Democratic Republic of Congo, Eswatini, Guinea, Hungary, Ireland, Italy, Liberia, Slovakia, South Sudan, Sweden, United Republic of Tanzania, and Yemen.

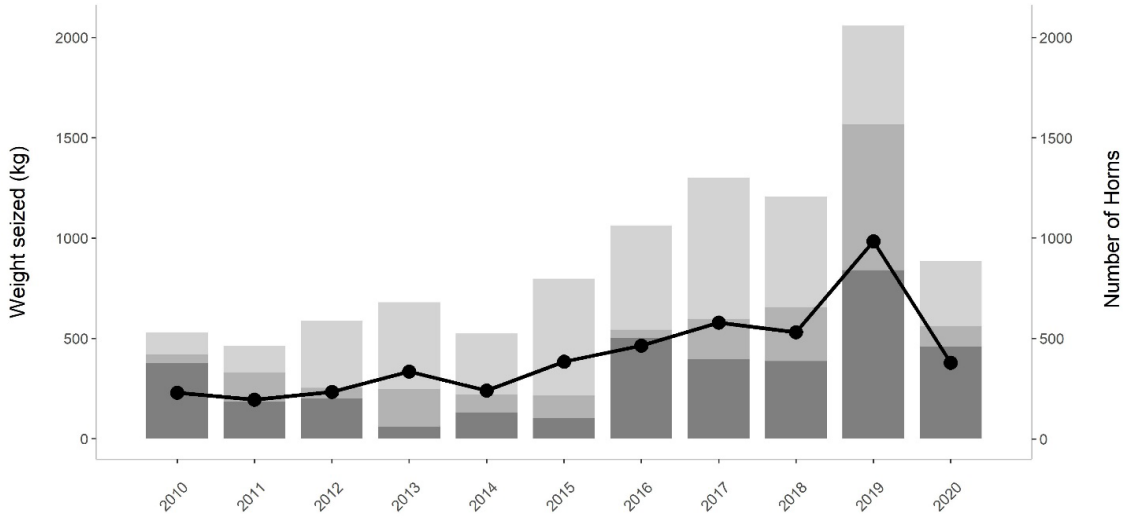

Figure 3. The total annual weight (bars) and the number of rhinoceros whole horns seized (line) by the Parties from seizures included in the analyses from 2010 – 2020 (*n* = 1003). Totals are based on reported data and estimated data for the weight or the number of whole horns. Darkest grey bars represent data for South Africa, medium grey bars represent data for China and Hong Kong SAR, and the lighter grey bars represent all other Parties in the database.

3.1.2.4 Summary of illegal trade flows

Illegal trade flows were summarized per year for each of the 52 Parties represented in the analysis as 1) the number of seizures made by the Party (No. seizures made by Party; Table 7); 2) the number of seizures that implicated the Party as the country of origin, export, transit where the illegal consignment passed undetected, or where the country was listed as the country of destination (No. seizures Party implicated in); 3) the total weight (kg) seized for both seizures made within the Party's jurisdiction or that implicated the Party, where weight was estimated based on the procedures described above for records with number of horns or pieces but no weight (Est. weight (kg) of all seizures Party involved in); 4) the total number of whole horns derived based on the procedures described above (Est. no. of whole horns from all seizures Party involved in). Table 7 presents data summaries for these four variables for the last three years since CoP18, and cumulatively for the period 2010 – 2020.

The three most affected Parties based on the most recent estimated weight (kg) of reported seizures (hereafter volume or trade volume for brevity), is the same as reported to the last CoP (in decreasing order): South Africa, China (with Hong Kong SAR), and Viet Nam. Malaysia was 4th most affected (previously 5th) and Mozambique was 5th most affected for volume of the trade (previous 4th). The following sections provide additional Party-specific details on the characteristics of trade and contextual supportive information for each of the Party just mentioned.

South Africa

South Africa was the Party most affected by illegal trade (highest values) in the number of seizures made in South Africa and second most affected in the number of seizures that implicated South Africa in the recent (2018 – 2020), as well as overall (2010 – 2020), periods analysed (Table 7; Fig. 3). Overall for the seizures transactions in which South Africa was involved, 1,116 whole horns were reported, or estimated, to have been seized in the last three years, potentially representing over 558 individual rhinos or approximately 4% of the estimated total population of rhinos in South Africa in 2021 (Table 2) and 22 % of the decline in the species since 2017 (Section 2.1 - Continental and national population trends in African rhinoceroses).

During the same period, the reported number of poached rhinos in South Africa steadily dropped from 769 in 2018 to 394 in 2020 (Section 5. Incidents of illegal killing of rhinoceroses), and the Party reported making hundreds of arrests nationally for rhino poaching and rhino horn trafficking[65]. Such law enforcement efforts are commendable, although it is evident from recent government reporting that 1) corruption is still of major concern as it "… continue[s] to seriously undermine the work being undertaken to counter the poaching", and 2) that the lifting of the moratorium on domestic trade in rhino horn which went into effect in 2017 may have resulted in "…some of the rhino horn which was sold in terms of permits issued by the department as part of the legal domestic trade has been linked to illegal activities." Given that more than half of the existing rhino populations are owned in private hands (Section 2.1) and that the majority of the South African rhino horn stocks are held privately (Section 4), the latter concern can have ramifications to South African rhinoceros populations. Even so, expert genetic opinion suggests

[65] https://www.dffe.gov.za/mediarelease/barbaracreecy_rhinopoaching_sixmonthreportback_july2019

negligible leakage from private stocks during the reporting period[66]. Utilizing already collected DNA sampling of stocks and seized horns may allow to quantify the leakage of private stocks as sources into illegal trade.

Only 23% of the reported seizures that were made in South Africa (n = 307) included trade chain information. Of those, over half (37 out of 72 seizures) were apparently destined for China and Hong Kong SAR. Similarly, of the seizures implicating South Africa (n = 85), 54% were seized in China and Hong Kong SAR. Along with reports by government officials that Chinese nationals are occasionally arrested in connection to illegal trade in rhino horns in South Africa[67], it is evident an illegal trade link between the Parties exists. The sharing and reporting of DNA information from seizures made overseas can enhance the investigations of illegal trade activities[68]; however, as noted in paragraph 8 of SC74 Doc. 37, the South African government does not always receive timely reporting from other Parties and it can take three to six months for permits to be issued and DNA samples to be delivered for analysis. More timely sharing of DNA samples as well as other intelligence information, can further aid in international collaboration as was the case in a 2021, when sharing of information between South African and Chinese officials resulted in the arrests of one individual in South Africa and two individuals in China and the seizure of more than 32 horns[69].

China and Hong Kong SAR

During the past three years as well as the full period analysed (2010 – 2020), China and Hong Kong SAR reported the largest number of seizures in which the Party was implicated in, that is seizures made by other Parties that listed China and Hong Kong SAR as the country (or territory) of export, transit or destination of illegal shipments. During the same period China and Hong Kong SAR was the second most affected Party by illegal trade for seizures made within the Party's jurisdiction and for the overall volume of trade (i.e. for seizures made within the Party's jurisdiction and in which the Party was implicated) in terms of weight (1.5 tonnes) and number of whole horns (622) that were reported or estimated to have been seized (Table 7, Fig. 3). While the majority of seizures were reported, or assumed to be reported, as African rhino species, six seizures reportedly involved Asian rhino species including the greater one-horned (*n* = 3), Sumatran (*n* = 2), and Javan (*n* = 1) rhinoceroses.

Two major events related to rhino horn trade in China and Hong Kong SAR occurred since seizure data were last analysed for the CoP18 report. First, on 29 October 2018, China had revoked the 1993 circular that had banned "the import, export, sale, purchase, transport, carrying, and mailing of rhino horn"; nullified "all rhino horn-related medicinal standards and … further medicinal use"; promoted "the use of rhino horn substitutes"; and mandated "that all horn stocks be registered"[70]. China's State Council replaced the circular with one permitting the use of rhino horns in medical research or in healing, and specified horns can be sourced only from farmed animals. The new circular further stipulated that powdered horn products "…can only be used in qualified hospitals by qualified doctors recognized by the State Administration of Traditional Chinese Medicine[71]" (TCM). However, ending the 25-year-old ban on rhino horn usage drew criticism[72], which led to the postponement of the new regulations and the status quo maintaining of the previous trade ban[70]. Nevertheless, reported seizure data suggests higher number of rhino horns seized that involved China and Hong Kong SAR in the illegal trade (Fig. 3) in 2019, when almost three times as many horns (304) and three times as much weight (1.57 tonnes) were reported as seized compared to 2018 (110 horns and 0.66 tonnes seized)[73].

A second major event potentially impacting illegal trade trends in rhino horns included the COVID-19 pandemic. In 2020 the spike in trade of rhino horn products noted above had subsided, with 44 horns weighing 0.56 tons estimated in the total reported illegal trade in which China and Hong Kong SAR were involved. However, 2020 was an abnormal year of low activity due to reduced economic activity including trade and travel, and while seized trade might have subsided, national policy actions may have potentially spurred an uptake of rhino horns as TCM. In January 2020, China's National Health Commission included in a list of approved COVID19 treatments *Angong Niuhuang Wan*, which is a popular manufactured traditional medicine that substituted buffalo for rhino horn when the latter was banned as a TCM in 1993 (SC62 Doc. 47.2)[74]; nevertheless, Cheung *et al.*[70] observed that TCM practitioners were prescribing rhino horn to treat ailments including those caused by SARS and COVID-19. Only few (n = 7) seizures reported any quantity of seized rhino horn powder between 2010 – 2020[75]; hence, it is impossible to assess any potential effects of the intended relaxed ban in China in 2018 on use of rhino horn products in TCM and continued monitoring is warranted.

[66] Cindy Harper, RhODIS®, cindy.harper@erhodis.org
[67] https://www.dffe.gov.za/mediarelease/barbaracreecy_rhinopoaching_sixmonthreportback_july2019;
[68] https://www.dffe.gov.za/mediarelease/rhinopoaching_sa
[69] https://www.dffe.gov.za/mediarelease/rhinopoaching_2021
[70] Cheung, H., Mazerolle, L., Possingham, H.P., and Biggs, D. (2021). China's Legalization of Domestic Rhino Horn Trade: Traditional Chinese Medicine Practitioner Perspectives and the Likelihood of Prescription. Front. Ecol. Evol., 21 April 2021 | https://doi.org/10.3389/fevo.2021.607660
[71] http://english.www.gov.cn/policies/latest_releases/2018/10/29/content_281476367121088.htm
[72] https://www.unep.org/news-and-stories/statement/official-statement-reversal-ban-trade-rhino-and-tiger-parts-achina
[73] It is again noted that these are the aggregated non bias-adjusted data hence caution should be made when inferring any trend.
[74] http://www.rhinoresourcecenter.com/pdf_files/138/1389957235.pdf
[75] An additional eight seizures mention powdered horn in the comments but provided no quantity information for the amount of powdered horn seized.

Finally, it is worth noting that strict implementation of China's ivory trade ban has led to scaled-up efforts on the part of the Chinese government, especially the Anti-Smuggling Bureau of China Customs, to pursue transnational crime groups engaged in wildlife trafficking between Africa and Asia. At least two major Chinese syndicates, both known to have smuggled quantities of rhino horn, in addition to ivory, from Tanzania, Kenya, Mozambique and Nigeria, have been dismantled, one in Shuidong, Guangdong province[76] and the other in Putian, Fujian province[77]. These landmark cases have the potential to alter the criminal landscape not only in China, but also in several African countries. As also previously noted and in line with Decision 18.111, Chinese officials are collaborating with international investigations to curtail international illegal trade in rhinoceros products, however more timely sharing of reports and information (including DNA samples), and reporting to the Parties on existing stocks can further advance existing efforts to curtail illegal trade in rhino horn products.

Viet Nam

Viet Nam was the third most affected by illegal trade for all variables in Table 7 except for seizures made by the Party for which it had the 4th highest value for both periods (*i.e.,* 2018 – 2020 and 2010 – 2020). Seizure data for Viet Nam (whether seizures made by the Party or in which the Party was implicated) consisted only of reported, or assumed to be, African rhinoceros species.

Similar to China and Hong Kong SAR, two major events relating to illegal rhino horn trade occurred since the last CoP18 report – one relating to internal policy action, and the second relating to potential uses of rhinoceros horn products as traditional medicine to treat ailments including those that can be caused by COVID-19. Viet Nam's updated wildlife law (No. 12/2017/QH14) and penal code (No. 100/2015/QH13) took effect on 1 January 2018 and included 1 - 15 years of imprisonment and up to ~660,000 USD in fines for illegally possessing, transporting, and trading rhino horns, where the severity of the punishment depended on the amount of rhino horn illegally traded[78]. One study subsequently found that, from 2018 through 2019, the number of wildlife trafficking seizures increased by 44% and, in the first half of 2020, 97% of wildlife trafficking cases resulted in arrests and 68% in convictions with custodial sentence[79]; further, average prison sentences reached four-and-a-half years, a 360% increase compared to data from 2017. Additional evidence to the increased law enforcement efforts made by Viet Nam were noted by the CITES Secretariat's report to SC74 which drew attention to the Party's participation in several law enforcement operations by the World Customs Organization (WCO) and INTERPOL, provided a list of seizure made by the Party and criminal procedures instituted, and noted Requests for Mutual Legal Assistance (MLA) submitted to other Parties as well as the Party's collaboration with the NGO community "...in support of investigations that led to arrests and prosecutions in at least three cases involving illegal ivory and rhinoceros horn" (SC74 Doc. 37)[80]. Examining the number of rhino horn seizures in the collated database used for this report, it was noted that there was an increase after implementation of the new wildlife law, where the number of reported seizures made by Viet Nam in 2019 totalled 92 horns and 235 kg; however, levels were similar to those in 2017 (96 horns; 237 kg), and 2015 (96 horns; 191 kg)[73].

Exploring the trade chain for seizures in which Viet Nam was implicated in as a country of origin, export, transit or destination (n = 79): South Africa (n = 12) followed by Mozambique (n = 8) were most commonly named as countries of origin for illegal shipments that implicated Viet Nam; for reported country of export on seizures implicating Viet Nam, Mozambique was most commonly named country of export (n = 24) followed by South Africa (n = 14). As noted above, Vietnamese law enforcement agencies are reportedly collaborating with international organizations (i.e. WCO, INTERPOL) on several operations[81], and additional evidence for recent collaborations is provided by the South African government in a recent illegal consignment from 2021 that resulted in the seizure of 138 kg of rhino horns[82]. Along with Viet Nam's use of MLA requests on multiple occasions to obtain information from, or provide information to, other Parties on rhino trade crime[80], and the submission of some rhino horn samples to the South African authorities[83] these are encouraging signs for the Party's commitment to curtail illegal rhino horn trade and its linkages between Viet Nam and African countries.

These encouraging law enforcement efforts since 2018 are in part due to Viet Nam's participation in the National Ivory and Rhino Action Plan (NIRAP) under the direction of the CITES Standing Committee and should be noted[84]. However, the impacts of the COVID-19 pandemic may have presented challenges to such positive progress. A recent study on the correlation of socio-demographic attributes with wildlife consumption involving 5,000 respondents in five countries (Hong Kong SAR in China, Japan, Myanmar, Thailand and Viet Nam) during the first phase of COVID-19 found that Viet Nam was the only country in which respondents who were extremely worried about a future pandemic were more likely to have increased their consumption of

[76] https://eia-international.org/report/shuidong-connection-exposing-global-hub-illegal-ivory-trade/
[77] https://wildlifejustice.org/wp-content/uploads/2022/02/WJC_Bringing-down-the-Dragon_Report_Executive-Summary_February-2022_SPREADS.pdf
[78] https://env4wildlife.org/wp-content/uploads/2021/05/Penal-Code-100_2015_QH13.pdf
[79]https://eia-international.org/wp-content/uploads/EIA-Report-Vietnams-Footprint-in-Africa-Spreads-2021-11.pdf
[80] https://cites.org/sites/default/files/eng/com/sc/74/E-SC74-37.pdf
[81] https://cites.org/sites/default/files/eng/com/sc/74/E-SC74-37-A4.pdf
[82] https://www.dffe.gov.za/mediarelease/rhinopoaching_2021
[83] https://www.dffe.gov.za/mediarelease/rhinopoaching_sa
[84] The Party can improve on its reporting of rhino horn stocks to the CITES Secretariat as called for in Resolution Conf. 9.14 (Rev. CoP17) for better accountability of increasingly seized rhino horn products (as per Section 4 - *Stocks of specimens of rhinoceros and stock management* it is noted that Viet Nam has not submitted any stockpile information to the Secretariat since 2017).

wildlife as a result[85]. In the same survey, respondents for whom access to medical treatment was severed by the pandemic were more likely to use traditional wildlife-based medicine as surrogates and have reportedly made recent wildlife purchases and were more likely to buy such products again in the future. Therefore, added vigilance for such markets might be warranted as part of strengthening law enforcement efforts in Viet Nam.

Research in Viet Nam conducted by TRAFFIC in 2022[86], identified that 27% of 118 online advertisements in that country by 55 sellers were for rhino horn 'glue', a relatively new commodity available there to consumers. This product is a combination of ingredients including rhino horn, rhino skin, pangolin, seahorse, gecko, and other traditional medicine components. It is being sold to Vietnamese consumers as a treatment for male sexual enhancement, as a tonic for liver, kidney, and eyes, to help treat insomnia, 'wastage' and low appetite, and as already noted, a detoxicant, joint strengthener and potential cure for cancer. The treatment is of 6-12 g per day taken in porridge, steamed, or mixed with alcohol or dissolved in the mouth (like candy). Further investigation is required to understand the significance of this relatively new commodity coming into the marketplace, as well as how widespread and prevalent it is amongst which specific target audiences. Despite the long list of purported and unproven health benefits, it remains unclear whether it is being taken to either ward off, or treat, COVID-19.

Malaysia and Mozambique

While Malaysia serves as a transit country and possibly an entrepôt in the rhino horn trade between Africa and Asia, Mozambique primarily functions as a country of export for rhino horn specimens from rhinos poached in neighbouring South Africa. Both Malaysia and Mozambique had similar levels of overall illegal trade in recent years (2018 – 2020) in terms of the reported or estimated number of horns and weight (*i.e.*. 205 horns at 543 kg for Malaysia and 211 horns at 485 kg for Mozambique) for seizures made within the Party's jurisdiction or those made by other Parties that listed Malaysia and Mozambique in the known trade chain. The two Parties were respectively the 4th to 5th most affected by illegal trade based on the summarized variables in Table 7, where despite having similar reported seizure data levels in recent years[87], over the full range of the summarized data (2010 -2020), Mozambique had higher number of seizures in which it was implicated and higher levels of overall illegal trade (estimated number of horns and weight for seizures in and seizure out; Table 7).

Few seizures were made by Malaysia (2 from 2018 – 2020; 4 from 2010 - 2020), but those consisted of large quantities of whole horns (14 – 37) with a respective weight of 39 to 110 kg; the largest seizure made by Malaysia was of 37 whole horns weighing 110 kg, which also included 13 horn pieces for a combined reported seized weight of 116 kg; this shipment originating in South Africa and was reportedly destined for Viet Nam in 2018. Most recent seizures that implicated Malaysia (n = 7 from 2019 - 2020) all originated from South Africa, and either transited via Hong Kong SAR to Malaysia or were directly shipped to Malaysia as the country of destination; of those seven seizures, five reported mode of transport and all were via air parcels. Of the non-range States Malaysia had the second largest rhino horn stock and has been reporting regularly to the CITES Secretariat. As noted in Section 4.3 (Stocks and stockpile management of Non-range States), the declared stocked amount fell short of the estimated weight that should have been seized. While participating in the National Ivory Action Plan (NIAP) process since 2013, and unlike Viet Nam and Mozambique, Malaysia does not include rhino considerations as part of its NIAP.

Of the seizures made in Mozambique that included information on the country of destination (28 out of 46), 75% were destined for Viet Nam. Similarly, 64% (14 out of 22 that included information on the country of destination) of the seizures that implicated Mozambique also reported Viet Nam as a country of destination. This illegal trade link was recognized by the Parties, and in a ceremony in Hanoi on 1 August 2017, Mozambique and Viet Nam agreed a Memorandum of Understanding on Cooperation in Wildlife Conservation and Protection (SC70 Doc. 27.4 Annex 16)[88]. Several additional law enforcement agreements were signed in 2018[89] and 2019[79], which provide a strong legal basis for collaboration to combat the illegal trade that persist between the two Parties. Finally Mozambique has been implementing a National Ivory and Rhino Action Plan (NIRAP) since 2014; the plan calls for the establishment of "a formal Ivory and Rhino Horn Stockpile Management Programme, under the control of ANAC [National Administration For Conservation Areas], with Standard Operating Procedures that detail the administrative chain of custody and the physical chain of custody for the country's ivory and rhino horn to be effectively executed and sustained at national, provincial and local levels, including the strengthening of storage facilities" (SC74 Doc. 28.4 Annex 12)[90]. Despite being an important part of its action plan, Mozambique has not submitted a rhino horn stock declaration to the CITES Secretariat since 2018. Additionally, pursuant to Decision 18.111, Mozambique was one of the Parties called upon to report to each meeting of the Standing Committee on law enforcement activities associated with rhino horn investigations and seizures, but did not submit a written report or an oral report to the 74th meeting of the Standing Committee (SC74 Sum. 6 (Rev. 1))[91].

[85] Naidoo *et al.* 2021 Nature Ecology & Evolution 5:1361 – 1366; https://www.nature.com/articles/s41559-021-01546-5.pdf
[86] TRAFFIC *In prep* Report to Saving Threatened Wildlife, Viet Nam. Under Agreement to WWF from USAID.
[87] It is noted again that these are data aggregates and not bias-adjusted data hence caution should be made when comparing data between countries.
[88] https://cites.org/sites/default/files/eng/com/sc/70/E-SC70-27-04-A16.pdf
[89] https://Viet Nam.wcs.org/News/Media-Releases/ID/11761/Mutual-Legal-Assistance-Treaty-between-Viet Nam-and-Mozambique.aspx
[90] https://cites.org/sites/default/files/eng/com/sc/74/E-SC74-28-04-A12.pdf
[91] https://cites.org/sites/default/files/eng/com/sc/74/exsum/E-SC74-Sum-06-R1.pdf

It is worth noting that the *United Arab Emirates (UAE)*, which previously was 19th most affected by illegal trade based on trade volume values, is now the 6th most affected Party; this is despite having relatively fewer reported seizures made by the Party or that implicated UAE in the trade chain. The latter suggests that on average, seizures made in UAE are of greater weight. Indeed, two exceptionally large seizures were recorded for UAE in 2019: 55 horn pieces weighing 125 kg were seized in Viet Nam having reportedly exported from UAE, and a seizure of 36 horn pieces weighing 116 kg was reportedly exported from South Africa to UAE. In general, UAE seemed to function as a transit country for shipments originating in African countries and destined for Viet Nam.

3.2 Legal Trade

3.2.1 Trophy hunting of rhinos

South Africa and Namibia permitted hunting of white rhino from 1968 and 2011, respectively. CITES Parties approved the annual hunting of five adult male black rhinos each in Namibia and South Africa in 2004 (Resolution Conf. 13.5)[92]. At CoP18, Parties adopted a revised science-based quota for South Africa of the total number of hunting trophies of adult male black rhino not exceeding 0.5% of the total black rhinos in the year of the export with the quota applied to 0.5% of the total of each sub-species (Resolution Conf. 13.5 (Rev. CoP18))[93].

Applications for black rhino hunts in South Africa from 2009 to 2017 were from hunters from 15 countries with long-standing records of participating in rhino trophy hunting. In the same period, South Africa reported 39 countries that had hunters entering the rhino trophy hunting market[94]. From 2018 to 2021, Namibia and South Africa had clients from 34 countries hunting rhinos[95]. South Africa declined four (2018), one (2019), two (2020) and one (2021) applications. Although 80 (77 white rhino, 3 black rhino), 61 (all white rhino), 19 (all white rhino) and 103 (all white rhino) applications were approved, only 72 (70 white rhino and two black rhino, 2018), 58 (2019), eight (2020) and 102 (2021) hunts were completed.

Most trophy hunts (121 white and two black rhinos) came from applicants originating from the USA. Hungary (20 white and one black rhino) and Russia (21 white rhinos) had the second most applicants, followed by Spain with 13 applicants that hunted white rhino. Overall, Europe and the Americas provided the bulk of hunting applications. Note that Australasia (one from New Zealand and Australia each) and Eastern Asia (one from China and Indonesia each) contributed very few hunters, contrasting previous patterns before 2012.

During the reporting period from 2018 to 2021, Namibia noted two years of substantial increase in the hunting of white rhinos (17 in 2019, and 22 in 2021 compared to the previous highest of 11 in 2016) (Fig. 4). The incidences of hunting of white rhino in South Africa increased from 2004 and reached a peak of 173 individuals hunted in 2011. After South Africa introduced pseudo-hunting[96] control measures[97] in 2012, the number of white rhinos hunted per year ranged from 64 to 91- the norm for hunts prior to the surge in poaching. During the reporting period from 2018 to 2021, South Africa reported eight to 102 individual rhinos hunted annually. Note that both South Africa and Namibia reported substantially lower numbers of hunts during 2020, the year when government responses to the COVID-19 pandemic restricted international leisure travel. The legal harvesting rates (percentage of the white rhino population within a country in a specific year) ranged from 0.37% to 1.78% in Namibia and 0.02% to 0.79% in South Africa over the reporting period from 2018 to 2021, similar (Namibia) or lower (South Africa) than natural mortality rates (*e.g.* 0.5% to 1.8%[98]).

[92] https://cites.org/eng//eng/res/13/13-05.php
[93] https://cites.org/sites/default/files/document/E-Res-13-05-R18.pdf
[94] Emslie RH, Milliken T, Talukdar B, Burgess G, Adcock K, Balfour D, Knight MH. 2018. 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. CoP17). COP18, Doc 83.1, Annex 2. Available at https://www.traffic.org/site/assets/files/12220/african-asian-rhinos-iucn-traffic.pdf
[95] See Annexure 9 for details.
[96] Hunts purported to be for collecting hunting trophies (horns), but in fact arranged to obtain horns for sale.
[97] Emslie, R., Milliken, T., Talukdar, B., Adcock, K., Ellis, S., & Knight. M. H. (2016). 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. CoP15). CoP17 Doc. 68 Annex 5. CITES Secretariat, Geneva, Switzerland.
[98] Ferreira SM, Greaver C, Simms C, Dziba L. 2021. The impact of COVID-19 government responses on rhinoceroses in Kruger National Park. African Journal of Wildlife Research, 51, 100-110.

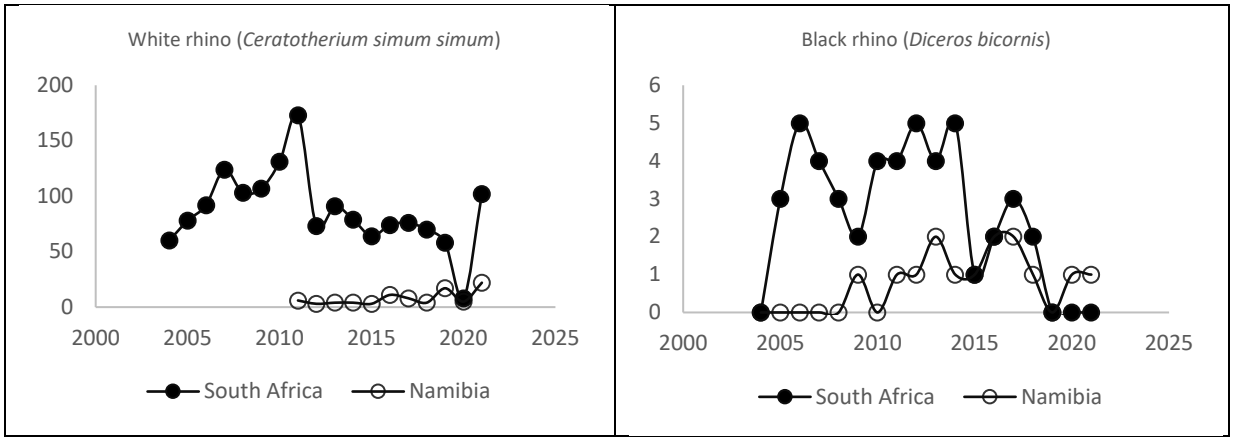

Figure 4. Number of white and black rhino hunted in South Africa and Namibia. Data up to 2017 extracted from previous reports.

South Africa used 69.2% (45 black rhino individuals hunted) of the total hunting quota available from 2005 to 2017 while Namibia only used 15% (10 black rhino individuals hunted). From 2018 to 2021, Namibia and South Africa reported the hunting of three and two black rhinos, respectively, substantially lower than the full quota of 20 over the reporting period for each country. South Africa only implemented the newly adopted proportional quota setting for 2022[99]. The fluctuating legal harvesting rates ranged from zero to 0.05% in Namibia and zero to 0.13% in South Africa, substantially lower than natural mortality rates (*e.g.* 1.1% to 6.0%[100]).

Namibia reported revenue from trophy hunting of black rhino ranging from US$27,495 to US$300,000 per rhino during the reporting period from 2018 to 2021. Note that a black rhino hunt during 2020, the year of intense global travel restrictions in response to the COVID-19 pandemic produced the lowest revenue. Excluding the 2020 outlier resulted in hunting revenue ranging from US$270,000 to US$300,000 per rhino. South Africa did not formally report prices for trophy hunts. A collation of trophy hunting nominal fees noted US$300,299 per rhino in 2018[101]. These prices suggest that the revenue from trophy hunting of black rhinos during 2021 would be US$330,449 in Namibia and US$330,779 in South Africa. It is noted as an important form of revenue to support conservation costs[102].

Revenue through hunting of white rhinos in Namibia ranged from US$15,000 to US$60,216 per animal. South Africa did not formally report prices for trophy hunts. An evaluation of hunting records noted a nominal price of US$80,080 per hunt in 2018 with the present 2021 nominal price US$88,208[103]. Fees can vary as prices can be for hunting or the package associated with the costs of a hunting safari.

3.2.2 Trade in live rhinos

African rhino range States reported 162 imports (15 *D.b. michaeli*, 43 *D.b. minor* and 104 *C.s. simum*) during the period 2018 to 2021. Six of the reported imports of eastern black rhinos (*D.b. michaeli*) came from zoos in the USA and the Americas. The rest of the imports irrespective of sub-species originated from another range State.

Rhino range States reported 369 exports (10 *D.b. michaeli*, 28 *D.b. minor* and 331 *C.s. simum*). The reported exports for black rhinos irrespective of sub-species (*D.b. michaeli* and *D.b. minor*) were all to other range States. Range States exported 81 southern white rhinos (*C.s. simum*) beyond the African continent to the Americas and Asia. In addition, range States within the recent historical distribution of rhinos irrespective of sub-species, exported 60 southern white rhinos to African countries beyond white rhino historical distribution[104]. A key concern is that cross-validation of reported exports from a specific range State did not always match reported imports by the destined range State or country[105]. This may arise from mismatches in the timing of the issuing of CITES export and import permits, delay in implementation of the range State exchanges of rhinos, as well as unforeseen circumstances such as the loss of a rhino as part of translocation operations.

[99] Mpho Tjiane, mtjiane@environment.gov.za
[100] Ferreira SM, Greaver C, Simms C, Dziba L. 2021. The impact of COVID-19 government responses on rhinoceroses in Kruger National Park. African Journal of Wildlife Research, 51, 100-110.
[101] Michael t'Sas-Rolfe, Unpublished data, tsas.rolfes@gmail.com
[102] t Sas-Rolfes M, Emslie R, et al. 2022. Legal hunting for conservation of highly threatened species: The case of African rhinos. Conservation Letters 10.1111/conl.12877
[103] Michael t'Sas-Rolfe, Unpublished data, tsas.rolfes@gmail.com
[104] See Moodley Y, Russo IRM, Robovský J, Dalton DL, Kotzé A, Smith S, Stejskal J, Ryder OA, Hermes R, Walzer C, Bruford MW. 2018. Contrasting evolutionary history, anthropogenic declines and genetic contact in the northern and southern white rhinoceros (*Ceratotherium simum*). Proceedings of the Royal Society B, 285, p.20181567.
[105] See Annexure 10 for details.

South Africa reported the national sale of 352 white rhinos for the period 2018 to 2021. Although trends in prices for white rhinos adjusted for inflation from 2007-2018 reflected a 67% drop in US$ value[106], it is hard to robustly evaluate price trends because sales take place in various combinations of age, sex and numbers of rhinos. Even so, a sample of auction prices in South Africa noted average prices of US$26,937 in 2018 (n = 4), US$10,023 in 2019 (n = 38) and US$10,595 in 2020 (n = 36)[107].

India and Nepal do not allow trade in live greater one-horned rhinos (*R. unicornis*). Similarly, for Sumatran (*D. sumatrensis*) and Javan rhino (*R. sondaicus*) there is no live trade of these species.

3.2.3. Domestic trade in rhino horns

During 2017, South Africa lifted a moratorium on the domestic trade of rhino horn[108] and established regulations allowing a tightly controlled legal trade in rhino horn within the country. South Africa issued 21 permits for sale of up to 574.6 kg comprising 689 horns or pieces of horns from 2018 to 2021. Six permits issued in 2018 were for 527.0 kg comprising of 645 horns or pieces of horn. Permits issued since then comprised less volume (2019: three permits, 23.9 kg, n = 13 pieces; 2020: one permit, 4.7 kg, n = 2; 2021: 11 permits, 19.0 kg, n = 29). From 2018 to 2021, South Africa issued only one permit for a black rhino horn (5.6 kg, two pieces). It is not clear how many of the permits resulted in completed sales transactions. The Private Rhino Industry reported low interest from buyers and high volatility in the market with prices ranging from offers to buy at US$1,693 to US$5,016 per kilogram[109].

3.2.4 Contribution of rhinos to other socio-economic activities

Several range States reported aspects that associated with other socio-economic activities particularly in how the global lockdown responses to the COVID-19 pandemic influenced the ability to sustain activities that protect, conserve and enhance rhinos. Except for South Africa and Namibia, range States primarily depended on income through viewing and experiential tourism, as well as external support through non-government organizations, funding agencies and philanthropic donations supplementing diminishing tax-based revenue. For example, the Sera Wildlife Conservancy[110] in Kenya, the first community in East Africa to dedicate a sanctuary for eastern black rhino (*D.b. michaeli*), relied on an initial capital investment of US$2,000,000. The Conservancy had an annual operational budget of US$1,000,000 by 2021 supported by sources of funding from bilateral grants (66.0%), non-government organizations (10.0%), private sector (8.0%), carbon sales (12.0%) and tourism (4.0%)[111]. Similarly, the North Luangwa Conservation Programme[112] in Zambia had an annual operational budget of US$4,500,000 by the end of 2021 provided through support from non-government organizations, bilateral grants, philanthropic donations, various charities and trusts, as well as private individuals.

South Africa and Namibia also raised revenue through national sales of rhinos and derivatives, as well as a trophy hunting international market. For instance, Namibia reported an estimated US$1,237,575 raised through trophy hunting during the reporting period. South Africa most likely raised significantly more revenue given that the country had 240 completed trophy hunts compared to the 51 of Namibia irrespective of sub-species.

Range States at present do not quantify the economic cascades of these various sources of funds. For instance, funding sourced through donations and external fund raising supports a robust rhino security industry and sustains numerous rhino-related non-government organizations. For example, an estimated 7.0 to 7.4% of 3,155,265 people that lived in the municipalities that abut Kruger National Park benefited directly or indirectly from rhino security initiatives in the Greater Kruger Region by 2018[113].

By the end of 2021, there were numerous non-government entities raising funds and awareness about rhinos globally – the exact number is not clear. The annual collective budget elements that focus on rhino conservation within numerous organizations is likely to be large focusing on supporting anti-poaching and rhino conservation initiatives as well as reducing the illegal demand and use of rhino derivatives.

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[106] Emslie RH, Milliken T, Talukdar B, Burgess G, Adcock K, Balfour D, Knight MH. 2018. 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. CoP17). COP18, Doc 83.1, Annex 2. Available at https://www.traffic.org/site/assets/files/12220/african-asian-rhinos-iucn-traffic.pdf

[107] https://www.wildlifeauctions.co.za/game_info.php

[108] Collins A, Cox C, Marire J. 2020. On the judicial annulment of the 'domestic' trade moratorium in South African rhinoceros horn: a law and economics perspective. European Journal of Law and Economics, 49, 361-372.

[109] Private Rhino Owners Association, Pelham Jones, Pelham@vibe.co.za. Standardized to US dollar value at exchange rates on 31 December 2021 i.e. 0.0627 ZAR to 1 USD

[110] https://www.tusk.org/projects/sera-wildlife-conservancy/

[111] Ian Craig, ian.craig@nrt-kenya.org

[112] https://fzs.org/en/projects/zambia/north-luangwa-national-park/

[113] Jooste J, Ferreira SM. 2018. An appraisal of green militarization to protect rhinoceroses in Kruger National Park. African Studies Quarterly, 18, 49-59.

Kenya, South Africa, Namibia and Zambia provided examples of initiatives that seek to enhance the well-being of local people through leveraging opportunities associated with rhinos. For instance, Namibia, in partnership with non-government organizations and private sector tourism has a community rhino-guarding programme integrated with a rhino-walking tourist business initiative[114]. Kenya[115] and Zambia[116] provided examples of integrating local people into accountability, decision-making and benefit sharing as part of the rhino management teams at some localities.

South Africa reported that most white rhinos are in private or custodian ownership with these carrying costs and benefits. South Africa is implementing the transformation of the country's wildlife economy[117]. This seeks to distribute equitable opportunities and enhance a vibrant wildlife industry within which rhinos play a key role.

4. Stocks of specimens of rhinoceros and stock management

In line with paragraphs 2a) and 7a) of Resolution Conf. 9.14 (Rev. CoP17), information on stocks of rhinoceros horns were declared to the CITES Secretariat and aggregated data shared with the IUCN and TRAFFIC for the purpose of this report. Yearly totals of whole horns and horn pieces that were obtained from legal, illegal, or unknown acquisitions were reported by 32 Parties from 2016 – 2020, although the number of Parties reporting for each year varied as follows: 19 for 2016, 20 for 2017, 21 for 2018, 18 for 2019, and 20 for 2020. An additional 21 Parties reported pre-2016 stock data. Namibia reported stockpile data to the Secretariat, but indicated to the Secretariat that the data are confidential and could not be shared. Therefore, data from Namibia were not considered in the preparation of this report. Finally, for South Africa, updated stockpile data were obtained from the CITES Management Authorities.

4.1 African rhinos range States

Ten African range States[118] reported stockpile data, most (n = 7) with updated data through 2020. Collectively these stocks totalled 87.3 tonnes of rhino horns and pieces. For security reasons, no additional details are provided here as to stocks held by individual Parties. However, it is noted that a significant proportion of stocks were held privately, where the rest comprised of State stocks from legal sources (e.g., retrievals from natural mortalities, dehorning activities, etc.), and illegal sources (seizures). In general, for State-owned stocks from illegal sources, the reported stocks exceeded the reported seized weight based on data obtained as described in section 3.1.2[119], but were smaller than the estimated weight of horns from seizures when accounting for seizures that reported number of horns, but not weight (Table 7). However, one Party, which was amongst most involved in trade (Table 7), reported a cumulative stockpile weight that represented only a third of what would be expected, assuming all reported seized weight[119] was stockpiled and with no destruction events reported.

4.2 Asian rhinos range Sates

Of the Asian range States, only one Party reported stockpile information that amounted to less than 1 kg unchanged since 2016. This is despite having at least one seizure in 2018 reporting some seized weight. Factoring all reported seized weight from 2010 – 2020 for the three Asian range States of India, Indonesia, and Nepal (see section 3.1.2 - *Major illegal trade flows and countries most affected*), a minimum of 10 kg should have been stockpiled unless it had otherwise been destroyed without being reported to the CITES Secretariat. This reporting issue is further supported by evidence from two destruction events from India and Nepal. In a public event on World Rhino Day - 22 September 2021[120], the government of the State of Assam, India, which holds the bulk of the total global population of greater one-horned rhino (*R. unicornis*), destroyed 2,479 (1,305.25 kg) horns near Kaziranga National Park; 94 rhino horns were marked for preservation and should amount to a stockpile of approximately 68 kg assuming the estimated weight of 0.72 kg per whole horn of the greater one-horned rhino (Annexure 8). Similarly in a public event on the World Biodiversity Day on 23 May 2017[121], the Nepalese government burned 357 rhino horns from its stockpile.

4.3 Non-range States

[114] http://www.wildernesstrust.com/portfolio/kunene-rhino-conservation-project/
[115] e.g. https://www.tusk.org/projects/sera-wildlife-conservancy/
[116] e.g. https://fzs.org/en/projects/zambia/north-luangwa-national-park/
[117] https://www.dffe.gov.za/projectsprogrammes/wildlifeeconomy
[118] Angola, Botswana, Eswatini, Kenya, Malawi, Mozambique, South Africa, Uganda, Zambia and Zimbabwe.
[119] That is, summarizing only reported weight and excluding weight estimation procedures done for this analysis.
[120] https://www.thehindu.com/news/national/other-states/on-world-rhino-day-2500-horns-turned-to-ashes-in-assam/article36612440.ece
[121] https://www.zsl.org/conservation/news/nepalese-government-publicly-burns-huge-illegal-wildlife-stockpile-0

Sixteen additional non-range States reported stockpile data[122] that collectively amounted to 2 tonnes of rhino horns and pieces. Of the non-range States most affected by the illegal trade (Table 7 – China and Hong Kong SAR, Viet Nam, and Malaysia), China and Hong Kong SAR did not report any stocks to the CITES Secretariat, Viet Nam reported last for 2017, and Malaysia's reports were up-to-date with 2020 also reported. Again, seizure data reported on in Section 3.1.2 suggest that stocks held in non-range States should be higher given seizures reported from 2010 – 2020. For one Party, the last report to the CITES Secretariat from 2017 indicated a destruction event in 2016 and a remaining stock which, based on more recent seizure data should have doubled, but was not reported as such.

5. Incidents of illegal killing of rhinoceroses

5.1 African rhinos

Since 2017, poaching incidents continued to decline at a continental scale (Table 8). During 2021, eight range States reported no poaching. Even so, range States reported 501 incidences of illegal killing of rhinoceroses across the continent during 2021, a substantial decline from 1,125 reported for 2017. During the reporting period (2018 to 2021), however, range States noted 2,707 incidences of poaching. Note that incidences of illegal killing of rhinos in Botswana were not available for 2021 although reported trends are of concern. Given the estimates reported by Botswana previously (see Table 2) and from 2018 to 2021 during the present reporting period, likely imperfect carcass detection similar to other large areas[123] and deaths of calves depending on cows[124], poachers killed an estimated 53 rhinos for which rangers could find carcasses[125]. Detected poaching incidences across African range states were therefore most likely approximately 554 rhinos during 2021. South Africa (90.0%) and Namibia (8.0%) recorded the bulk of the illegal killing incidences on the African continent in 2021. Noteworthy is Kenya, the country with the third highest number of rhinos, which reported no incidences of illegal killing of rhinoceroses in 2020, but six during 2021.

Note that South Africa reported an increase in the incidences of illegal killing of rhinos in 2021 compared to 2020. This likely reflects a COVID-19 induced lower poaching rate reported in Kruger National Park[126] that realized when global government responses to the pandemic effectively disrupted travel and supply chains that may have been used. Managing the risks of the pandemic to human health resulted in a 79.4% reduction in poaching pressure during the two months that South Africa implemented hard-lockdown regulations. Best models suggested largest reduction when global responses affected all elements of the international supply chain. For example, the trends in South Africa from 2017 to 2019[127] predicted 445 illegal rhino killings for 2020, while South Africa reported 394. The benefit of the COVID-related lowering of poaching rates for rhinos diminished when South Africa reported 451 illegal killings of rhinos during 2021, substantially higher than the 337 that the 2017 to 2019 trends predicted.

Kenya, Namibia and Zimbabwe most likely also experienced lower poaching pressure induced by global government responses to the COVID-19 pandemic, although strong responses coordinated across various sectors of law enforcement and conservation support with range States prior to the COVID-19 year most likely contributed towards reducing poaching rates. Both Namibia and Zimbabwe recorded substantial declines from 2019 to 2020. Kenya noted six illegally killed rhinos in 2021, while there were none in 2020. Namibia noted 40 poached rhinos in both 2021 and 2020, the COVID-year. The number of rhinos poached in Botswana in 2021, were estimated by the authors of this report to be similar in number to figures reported in 2020.

Table 8: Detected African rhino poaching mortalities by range State since 2006[128]. Zeros reflect reports of no detected poached carcasses by a range State.

Range State	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021

[122] Australia, Cote d'Ivoire, Germany, Spain, Ethiopia, Japan, Lao DPR, Malaysia, New Zealand, Philippines, Qatar, Slovakia, Thailand, United Kingdom, United States of America, and Viet Nam.

[123] Estimated at 82.6% (95% CI: 72.0% – 93.2%) of carcasses detected. Ferreira SM, Dziba L. 2022. Rhinoceros accounting in Kruger National Park. Unpublished data, sam.ferreira@sanparks.org.

[124] Estimated at 52% of dependent calves also perishing when an adult cow dies. Nhleko ZN, Ahrens R, Ferreira SM, McCleery RA. 2021. Poaching is directly and indirectly driving the decline of South Africa's large population of white rhinos. Animal Conservation, https://doi.org/10.1111/acv.12720.

[125] Estimated exponential growth (r_t) from estimates and poaching data from 2017 to 2021 using $N_{t+1} = \left[N_t - \frac{P_t}{d} - \left(\frac{P_t f_c}{d}\right) m_{dc}\right] e^{r_t}$ where N_t is population size of all rhinos in year t, P_t is detected poaching incidences in year t, d is the probability that rangers will detect a carcass, f_c is the fraction of the rhinos that are adult cows set at 0.25 and m_{dc} the mortality rate of dependent calves when cows die. Average r_t for years 2018, 2019 and 2020 provided the expected r_t value for 2021 that equated to -0.9%. This allowed estimating the most likely detected carcasses that will result in the population estimate of all rhinos in 2021.

[126] Ferreira SM, Greaver C, Simms C, Dziba L. 2021. The impact of COVID-19 government responses on rhinoceroses in Kruger National Park. African Journal of Wildlife Research, 51, 100-110.

[127] $P_{t+x} = P_t e^{-0.274x}$, where P_t is the number of illegal killings at time t

[128] Update from Knight M. 2021. African Rhino Specialist Group Chair report/Rapport du Groupe de Spécialistes du Rhinocéros d'Afrique. Pachyderm, 62, 16-28.

Botswana	0	0	0	0	0	0	2	2	1	0	1	9	18	31	55	na[129]
Chad	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
DR Congo	0	0	2	2	-	-	-	-	-	-	-	-	2	0	0	0
Côte d'Ivoire	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
Eswatini	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0
Kenya	3	1	6	21	22	27	29	59	35	11	10	9	4	4	0	6
Malawi	0	0	0	0	0	0	2	1	1	1	1	1	0	0	0	0
Mozambique	0	9	5	15	16	10	16	15	19	13	5	5	8	6	2	0
Namibia	0	0	0	2	2	1	1	4	30	97	61	44	93	56	40	40
Rwanda	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
Senegal	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0
South Africa	36	13	83	122	333	448	668	1004	1215	1175	1054	1028	769	594	394	451
Tanzania	0	0	2	0	1	2	2	0	5	5	0	2	0	0	0	0
Uganda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zambia	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Zimbabwe	21	38	164	39	52	42	31	38	20	50	35	36	34	82	12	4
Total	**60**	**62**	**262**	**201**	**426**	**532**	**751**	**1123**	**1324**	**1349**	**1167**	**1125**	**930**	**773**	**503**	**501**

With the above limitation to reported data in mind, the poaching records resulted in a general trend of declining poaching rates at the start of each calendar year since 2015 (Fig. 5). By 2021, the African continent recorded an annual poaching rate of 2.3% based on reported carcasses. Including estimated poaching events in Botswana, suggests a likely poaching rate of 2.5% at the continental scale. During the reporting period, the continental poaching rate was the highest during 2018 at 3.9%.

Note that range States did not correct for biases, mainly those pertaining to carcass detection, in the poaching records. Carcass detection is not perfect due to the interval over which rangers patrol and search for carcasses; the various rates at which carcasses disintegrate; and rangers not detecting some carcasses[130]. For small populations or rhinos living in relatively small areas, range States typically monitor individual rhinos intensely and reconcile missing animals against detected carcasses. In some instances, this results in delayed carcass detection. Monitoring intensely in large areas is challenging and can accentuate imperfect carcass detection. For large populations or rhinos living in relatively large areas, four range States (Tanzania, Botswana, Namibia and South Africa) reported the potential influences of imperfect carcass detection, one of which is also delayed detection. For instance, Namibia reported updated numbers of rhinos poached as far back as 2018 in 2022. In only one case, Kruger National Park, South Africa reported a formal estimation of imperfect carcass detection. Annual carcass persistence (50% of carcasses disappeared by 2.86 years) was 0.928 (95% CI: 0.916-0.935) with rangers searching throughout the year having a probability of observing a carcass that persisted was 0.898 (0.770-1.000)[131]. Overall, the probability of detecting a dead rhino in an extensive large savannah ecosystem like Kruger National Park was 0.826 (0.720 – 0.932).

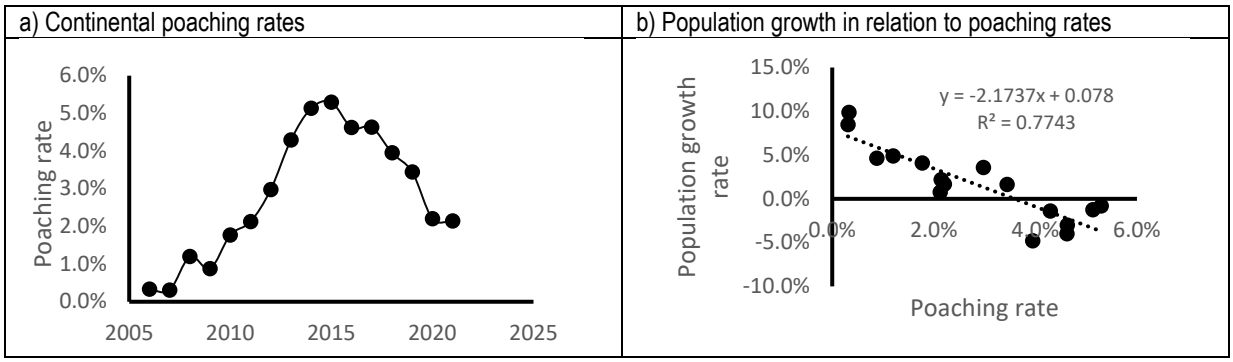


Figure 5. Continental poaching rates (a)[132] since the resurgence of poaching in the past generation of rhinos and the relationship between continental growths in rhinoceros numbers, irrespective of sub-species, and poaching rates (b).

In addition to the role of imperfect carcass detection, the effects of decreasing poaching rates are not resulting in substantive population increases because the illegal killing of rhinos has additional indirect effects on rhinoceros dynamics. Because calves are typically dependent on their mothers for milk up to one year and defence up to three years old, poaching resulted in the reduction of the lifetime reproductive output per cow from approximately 6 to 0.7 calves[133]. An additional indirect effect on

[129] Not available.
[130] Huso MM. 2011. An estimator of wildlife fatality from observed carcasses. Environmetrics, 22, 318-329.
[131] Ferreira SM, Dziba L. 2022. Rhinoceros accounting in Kruger National Park. Unpublished data, sam.ferreira@sanparks.org.
[132] Poaching rate is the number of detected carcasses within a calendar year expressed as a fraction of the population at the start of that calendar year. Note that for 2021 the rate is conservative as it excludes the unknown poaching incidences from Botswana.
[133] Nhleko ZN, Ahrens R, Ferreira SM, McCleery RA. 2021. Poaching is directly and indirectly driving the decline of South Africa's large population of white rhinos. Animal Conservation, https://doi.org/10.1111/acv.12720.

recruitment rates realized when densities of black rhinos decreased in one example from South Africa due to increased predation, reduced mating opportunities, or social disruption of black rhinos by poaching[134]. Offsetting these additional indirect consequences of poaching was harder when drought resulted in natural deaths of white rhinos increasing during the drought and recruitment rates decreasing a year later[135] – these vital rates recovered two and three years later. Black rhinos appeared to suffer no detectable effects due to the drought[136].

A key additional requirement to understand the influences of poaching on populations is the need to consider other interventions and the cumulative effect of these on rhino populations. An additional factor impacting rhino populations is management interventions and, in particular, introductions and removals through translocation. Overall, range States reported the translocation of 391 individual rhinos irrespective of species between populations within a range State (see Section 7), and 501 individual rhinos between range States or to non-African countries during 2018 to 2021 (see Section 3). The trends in Kruger National Park, the largest and hardest hit single population, serve as illustration of these varied consequences[137]. Accounting for all the direct and indirect influences on south-central black and southern white rhinos resulted in models explaining 83% and 93% of the respective trends, predicting values for 2020 similar to that estimated using standard rhino surveys. Moreover, these additional interventions included with poaching rates indicate a slow rate of recovery to pre-poaching population sizes, and not predicted to be realized until between 2030 and 2040[138].

These factors most likely vary across the different populations of rhinos in the African continent. Indeed, the continental annual growth in rhinos declined as the continental annual poaching rate increased (Fig. 5). This provides a global threshold index – at a poaching rate of 3.6% (95% CI: 2.3% - 5.7%) the continental rhino population will remain stable. Given that most range States have national targets of 5% annual population growth (see Section 7), this requires a poaching rate lower than 1.3% (95% CI: 0.2% - 2.6%).

5.2 Asian rhinos

During the period 2019 to the present (April 2022), India reported 10, while Nepal noted one poached greater one-horned rhino (*R. unicornis*) (Table 9). Indonesian authorities are not aware of illegally killed Javan rhinos since the mid-1970s. Indonesian authorities have not detected a Sumatran rhino carcasses since 2006, when rangers found a rhino snared and its horn removed in Way Kambas National Park. There are no further official records available with regard to illegal killing of Sumatran rhino, but since the population continues to decline, authorities suspect that poaching is playing a key role. Carcass detection is challenging in the dense rain forest habitat that Sumatran rhinos favour.

Table 9: Detected Asian rhino poaching mortalities by range State since 2013[139]. Zeros reflect reports of no detected poached carcasses by a range State.

Range State	2013	2014	2015	2016	2017	2018	2019 - 2021
India	41	34	24	22	11	7	10
Nepal	0	0	0	0	1	0	1
Indonesia	na[140]	na	na	na	na	na	na
Total	41	34	24	22	12	7	11

Since 2013, the poaching pressure on greater one-horned rhinos (*R. unicornis*) has continued to decrease. From 2013 to 2021 greater one-horned rhinos poaching mortalities reduced to 3.6 rhinos killed per year. The trend of declining poaching incidences of greater one-horned rhinos coincide with declining trend in poaching rates recorded for African rhinos since 2015.

6. Enforcement issues

6.1 Security and anti-poaching

[134] le Roex N, Ferreira SM. 2020. Age structure changes indicate direct and indirect population impacts in illegally harvested black rhino. PloS one, 15, p.e0236790.
[135] Ferreira SM, le Roex N, Greaver C. 2019. Species-specific drought impacts on black and white rhinoceroses. PLoS One, 14, p.e0209678.
[136] le Roex N, Ferreira SM. 2021. Rhino birth recovery and resilience to drought impact. African Journal of Ecology, 59, 544-547.
[137] See Annexure 11, Figure A11.1.
[138] Ferreira SM, Dziba L. 2022. Rhinoceros accounting in Kruger National Park. Unpublished data, sam.ferreira@sanparks.org.
[139] Historic records from Emslie RH, Milliken T, Talukdar B, Burgess G, Adcock K, Balfour D, Knight MH. 2018. 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. CoP17). COP18, Doc 83.1, Annex 2. Available at https://www.traffic.org/site/assets/files/12220/african-asian-rhinos-iucn-traffic.pdf
[140] Not available.

6.1.1 African rhinos

Traditional poaching methods are increasingly unsuccessful, and several range States noted changes in the *modus operandi* used by poachers. Botswana noted that in vast open areas, syndicates used satellite phones where there is no cellular network coverage to coordinate operations and at times spend weeks in the bush. This allows syndicates to restock their supplies while illegally hunting and eventually move what they poached out of protected areas. Tanzania also noted challenges with detecting rhino threats and poaching in expansive areas like the Selous Game Reserve and Nyerere National Park.

In South Africa, there is evidence of targeted efforts by organized syndicates to infiltrate Kruger National Park employees to solicit information that assists them with poaching, such as rhino locations and ranger deployments. Drop-offs of poachers after entering as tourists have become a major problem. For instance, rangers located carcasses 200 m to 700 m from tourist roads indicating that suspected poachers have knowledge of the rhino's location. In addition, rangers report shots without an associated detected incursion.

Poachers are also responding to broad scale dehorning to increase rhino safety at sites across South Africa. Evidence suggests that syndicates shift operations and target regions in the country where they perceive authorities/private owners dehorned fewer rhinos. In addition, with the start of dehorning, groups appear to spend longer times in Kruger National Park, presumably searching for horned rhino.

The examples from Botswana, South Africa and Tanzania highlight specific challenges, some which associate with large expansive areas over which rhinos roam. In response, SANParks, the management authority of Kruger National Park, are investing more in focused technology to enhance access control to focal core areas of rhino activity and visible policing to deter such drop-offs. Field based guardianship of rhinos and individual monitoring of them in core areas can assist to address issues, improve situational awareness and identify developing risks. Similarly, TANAPA, the management authority in Tanzania established additional dedicated rhino monitoring teams.

In smaller areas, Tanzania and Namibia noted continuance of poacher approaches with heavy firearms used to kill rhinos. No range State noted any incidences of poisoning targeting rhinos. Malawi and Chad, however, noted snaring for bush-meat that can pose secondary threats to rhinos.

The varying patterns of poacher tactics across the continent resulted in range States initiating various initiatives. For instance, Namibia established Operation Blue Rhino[141] while Mozambique initiated the Anti-Poaching Coordination Operations Centre (APCOC)[142]. All these initiatives seek to enhance the benefits of cooperation across different national and international law enforcement agencies. Co-operation and collaboration across State, private, communal, and non-government organizations within range States also emerged as key initiatives. South Africa rolled out a situational awareness platform known as CMORE, developed by the Council of Scientific Industrial Research (CSIR), into the integrated wildlife zones. Platforms such as these and others like Earth Ranger in several other range States allows collaboration that uses real-time insights and analytical capability, linking, for example, camera traps and ranger patrols, while integrating a range of other systems.

Range States highlighted some key lessons. A combination of anti-poaching measures can contribute to the reduction of poaching in rhinos, but formal evaluation of effectiveness and efficiency remains low. Even so, key events can have major impacts. For instance, Zimbabwe made a major breakthrough in arresting an organized criminal syndicate that was responsible for the illegal supply of firearms and ammunition to poaching syndicates. Key improvements in law enforcement may contribute further. Eswatini advocated the listing of arrested suspects on Interpol 24/7 Purple Notices[143] in case judges grant bail and suspects attempt to cross the border. It reflects calls to adopt a zero tolerance to poaching and trafficking along the judicial chain.

Despite these experiences, a central theme is the critical importance of the responsiveness of anti-poaching units. This carries risks as was noted by Mozambique when authorities apprehend people from local communities creating strained relationships between communities and reserves despite various ongoing community initiatives. In this context, South Africa highlighted that demand, particularly from Asian countries in relation to rhino products, drives poaching of wildlife – international drivers have effects on local people. The illicit trade in South Africa (including poaching and trafficking) requires understanding within the context of drivers of crime such as inequality, high levels of poverty, high levels of lawlessness, embedded criminal networks and lack of robust governance, specifically in rural areas adjacent to parks. Job losses, no alternative income opportunities and threatened livelihoods, some associated with past social injustices and some with recent events like the COVID-19 pandemic, lead to ongoing and, at times, increased poaching and exploitation of the environment. Some examples from Kenya[144],

[141] https://n-c-e.org/resource/operation-blue-rhino
[142] Carlos Pereira, clpereira@anac.gov.mz
[143] https://www.interpol.int/content/download/625/file/GI-02%20-%20NOTICES%20Factsheets_EN.pdf
[144] e.g. https://www.tusk.org/projects/sera-wildlife-conservancy/

Namibia[145] and Zambia[146] highlighted how devolving responsibility and accountability to local people, including meaningful participation in law enforcement initiatives, can enhance local rhino conservation objectives in concert with improving the well-being of people.

Evaluation of poaching pressure in southern Africa reflected some of the insights provided by range States. An approach that seeks robust situational awareness inclusive of access control with support from good leadership[147] and motivated staff with high integrity, together with robust monitoring of rhinos may be key factors that associate with low poaching incident rates[148]. These circumstances may be easier to achieve in smaller areas that also have some form of management partnership. A key requirement is to evaluate these observations and adapt to changing circumstances.

6.1.2 Asian rhinos

India and Nepal's anti-poaching efforts in the field and intelligence-based investigations continued to be critical in combatting poaching of greater one-horned rhino (*R. unicornis*). In July 2018, the Chief Minister of Assam Province in India appointed 90 youths from local communities surrounding Kaziranga National Park as constables to form a Special Rhino Protection Force. This special force focus on protecting rhinos in Kaziranga, Orang and Manas National Parks. The Assam government also provided semi-automatic weapons to a Special Rhino Protection Force and Assam Forest Protection Force to counter rhino poachers who also use high-powered, sophisticated weapons.

Javan rhinos (*R. sondaicus*) receive protection in Indonesia's Ujung Kulon National Park, using foot patrols for more than three decades. Authorities recently deployed video camera traps and marine patrolling. The last known poaching event was in the early 1970s.

Anti-poaching units in Bukit Barisan, Way Kambas, and Gunung Leuser National Park in Indonesia protect Sumatran rhinos (*D. sumatrensis*) since the mid-1990s. The Global Environment Facility provided funding for the initial protection activities. Since then, the International Rhino Foundation (IRF) and the then-Leuser International Foundation (now Forum Konservasi Leuser or FKL) provided the financial support for the initiative. These units continue to comprise one park ranger, who has authority to carry a weapon and make arrests, and a number of staff hired and trained from local communities.

Population viability analyses modelling indicated that Javan (*R. sondaicus*)[149] and Sumatran (*D. sumatrensis*)[150] rhino numbers are so low that populations cannot tolerate any poaching. Law enforcement efforts need strengthening, particularly in Sumatra.

6.2 Criminal syndicates

6.2.1 Investigations and cooperative initiatives

Increasingly, range States recognise that illegal killing is an element of local, regional and international criminality, often involving organized crime and transboundary syndicates. For instance, Eswatini noted poaching syndicate strategies of coercion and corruption of strategically positioned individuals to assist in the poaching of rhinos and trafficking of rhino horn. Botswana reported sophisticated cross border syndicates with access to levels of weaponry and ammunition unknown in the country, making use of local people to provide important information and facilitating poacher's movement. Zambia noted the focus of law enforcement and investigations targeting known routes of horn trafficking. A key element that several range States noted was examples of informal cooperation in the absence of formal cooperation between law enforcement agencies.

Both Namibia and South Africa established specific focal responses. Namibia's Operation Blue Rhino[151] is a formal cooperation between the Protected Resources Division of the Namibian Police Force within the Ministry of Home Affairs, Immigration, Safety and Security and the Intelligence and Investigation Unit within the Ministry of Environment, Forestry and Tourism. Ratified until 2025, active collaboration and sharing of information and resources amongst numerous partner organisations have contributed to the reduction of commercial poaching and trafficking of illegal game products.

[145] http://www.wildernesstrust.com/portfolio/kunene-rhino-conservation-project/
[146] e.g. https://fzs.org/en/projects/zambia/north-luangwa-national-park/
[147] Ball M. Wenham C. Clegg B, Clegg S. 2019. What does it take to curtail rhino poaching? Lessons learned from twenty years of experience at Malilangwe Wildlife Reserve, Zimbabwe. Pachyderm, 60, 96-104.
[148] Ferreira SM, Dziba L. 2021. Where are rhinos safest? South African Journal of Science, 117, 1-3.
[149] Haryono, Muh., Miller, P.S., Lees, C., Ramono, W., Purnomo, A., Long, B., Sectionov, Waladi Isnan, B.D., Aji, B.D., Talukdar, B., and Ellis, S. (Eds.) 2016. Population and Habitat Viability Assessment for the Javan Rhino. Apple Valley, MN: IUCN/SSC Conservation Breeding Specialist Group.
[150] Miller PS, Lees C, Ramono W, Purwoto A, Rubianto A, Sectionov, Talukdar B, Ellis S. (Eds.) 2015. Population Viability Analysis for the Sumatran Rhino in Indonesia. Apple Valley, MN: IUCN/SSC Conservation Breeding Specialist Group.
[151] https://n-c-e.org/sites/default/files/2020-06/2020_Brochure_Blue-Rhino-Identity_rgb_final_200605s.pdf

South Africa initiated the National Integrated Strategy to Combat Wildlife Trafficking (NISCWT)[152]. Although not ratified, implementation focused on coordinating forums and structures, and establishing an Environmental Enforcement Fusion Centre (EEFC) as well as Wildlife Security Zones. The NISCWT focuses on increasing abilities to detect, prevent and combat wildlife trafficking; improving law enforcement to effectively investigate, prosecuting and adjudicating wildlife trafficking as part of transnational organized crime; and increasing national and international law enforcement cooperation and collaboration.

Malawi established an Inter-Agency Committee on Combating Wildlife Crime (IACCWC) in 2014, and together with the National Environmental Security Task Force (NEST) is playing a key role in combatting wildlife crime. Formation of the specialized Wildlife Crimes Investigations and Intelligence Unit (WCIIU) in 2016 jointly comprising Wildlife and Police Investigators under the Department of National Parks and Wildlife continued networking within the country and across the borders. The placement of officers and sniffer dogs at points of entry and exit has complemented the efforts of the Unit.

6.2.2 DNA Forensic systems

The RhODIS® Rhino DNA Indexing System[153,154] established in 2010, continues to play important roles in prosecutions and convictions. South Africa, however, highlighted particular challenges associated with seizure information at foreign international ports of exit and entry. This links to slow responses in alerting possible source countries, obtaining samples from confiscated products and derivatives despite having multi-lateral agreements in place. Improved compliance with the use of the CITES *Form for collection and sharing of data on rhinoceros horn seizures and on samples for forensic analysis* referenced in Resolution Conf. 9.14 (Rev. CoP17) can aid the timely submission of seizure details and samples to the relevant authorities and labs.

The sharing of forensic samples and enhancing the use of DNA to link crime scenes within a range State with arrests and seizures made in other range States or by Parties elsewhere is a key area that requires improvement. For instance, Eswatini as well as Zimbabwe highlighted that cooperation with South African law enforcement counterparts is essential for efficient collection of evidence that links South African rhino crime scenes with seizures made. Even so, in many instances, however, cooperation is not taking place often related to confusion over chain-of-evidence procedures, as well as uncertainty of the admissibility of an expert statement from a foreign expert/laboratory in a local court. A key element leading to delayed forensic evidence is the low number of registered laboratories, as these represent vital service providers of DNA forensic information.

The Government of India initiated DNA profiling of rhinos for a national database using samples from dead rhinos. India began developing a RhODIS-type capacity, with an initial focus on improving crime scene investigation, including training and sample collection. The RHODIS-India programme provided tamper-proof kits used for rhino crime investigations.

6.2.3 Cooperative enforcement

A key ongoing initiative is the Lusaka Agreement on Co-operative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora (Lusaka Agreement)[155]. The Lusaka Agreement guide some member states to the Agreement[156] and recommended CITES Parties undertake activities intended to reduce and ultimately eliminate illegal trade in wild fauna and flora. An additional initiative was the revision of the Southern African Development Community Law Enforcement and Anti-Poaching Strategy (SADC-LEAP) 2022-2032[157].

Revision of SADC-LEAP's previous implementation highlighted marked successes in various protected areas in stopping major declines in several species – these successes usually associated with meaningful partnerships. Note that rhino horn was still a big contributor to seized commodities. The SADC-LEAP review highlighted numerous end markets for various wildlife products, but most demand comes from Southeast Asia. In addition, targeted corruption increased, with a convergence of illegal wildlife trade with other illicit flows of commodities, and new markets emerged.

Key insights from the SADC-LEAP review provide guidance for rhino protection efforts. Values-based leadership, cohesion, transparency, integrity and prosecution of compromised people quickly and efficiently, are key requirements to build resilience to corruption. Regional cooperation and collaboration through trusted relationships are a key element to dismantle transnational networks. Understanding other drivers of poaching of high-value species in local communities can help design and implement

[152] https://static.pmg.org.za/170530NISCWT.pdf
[153] Harper CK, Vermeulen GJ, Clarke AB, Jacobus I, Guthrie AJ. 2013. Extraction of nuclear DNA from rhinoceros horn and characterization of DNA profiling systems for white (*Ceratotherium simum*) and black (*Diceros bicornis*) rhinoceros. Forensic Science International: Genetics, 7, 428-433.
[154] Harper C, Ludwig A, Clarke A, Makgopela K, Yurchenko A, Guthrie A, Dobrynin P, Tamazian G, Emslie R, van Heerden M, Hofmeyr M. 2018. Robust forensic matching of confiscated horns to individual poached African rhinoceros. Current Biology, 28, R13-R14.
[155] https://leap.unep.org/content/treaty/lusaka-agreement
[156] Congo (Brazzaville), Kenya, Liberia, Tanzania, Uganda, Zambia and Lesotho with South Africa, Ethiopia and Eswatini as signatories.
[157] Shared with the SADC Technical Committee for its meeting on 29 March 2022 as well as all governments and cooperating donor and civil society, but is not in the public domain. Contact Alastair Nelson, alastair@conservationsynergies.com.

actions that reduces overall criminality. Even so, the focal key element is establishing long-term trusted partnerships that enhance capacity, resources and expertise.

Viet Nam noted two important initiatives. The first focused on Mutual Legal Assistance requests when addressing cases involving investigations associated with rhino horn seizures. Viet Nam also established a Memorandum of Understanding with Mozambique on wildlife conservation and protection.

6.3 Arrests, prosecutions, convictions and sentences

6.3.1 African rhinos

Ten range States reported 1,588 arrests made within range States linked to rhino crimes in the reporting period from 2018 to 2021. From 2018 to 2021, reported prosecutions linked to rhinos within range States were 751, with 300 reported subsequent convictions. Arrests decreased from a high of 493 in 2018 to a low of 275 in 2021 (Fig. 6).

South Africa was a major contributor to arrests in the period from 2018 to 2021 (1,078 representing 67.9% of the total). South Africa previously noted 680 arrests in 2016 and 518 in 2017. The trend since 2016 to 2019 (2018 had 401 arrests; 2019 had 332 arrests) predicted that South Africa should have recorded 261 arrests in 2020, however, South Africa reported 156. This likely reflects the effect of government responses to the COVID-19 pandemic. Note that South Africa reported a reduction in poaching rates in 2020 most likely to associated with the COVID-19 pandemic (see Section 5). Arrests during 2021 after the release of government responses, however, were 189, higher than the 122 that pre-COVID trends predicted.

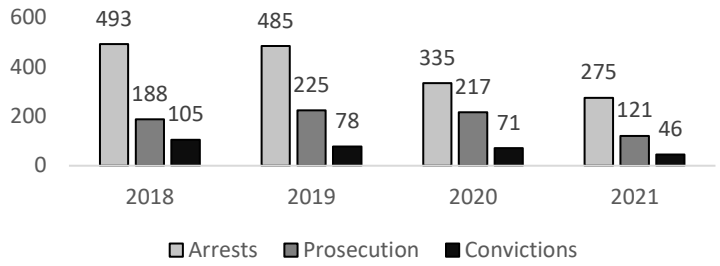


Figure 6. Arrests, prosecutions and convictions associated with rhinos reported by range States[158] from 2018 to 2021.

The ratio of prosecutions to arrests per calendar year increased from 2018 to a high in 2020, the year of intense government lockdown responses to the COVID-19 pandemic (Table 8). In 2021 this ratio again declined to a level similar to that of 2019. The highest ratio of convictions relative to prosecutions per calendar year was in 2018 (Table 10). Annual ratios over the period 2019 to 2021 averaged 35.1%. Even so, within specific calendar years, the ratio of convictions to arrests fluctuated between lows in 2019 and 2021, to highs 2018 and 2020. Overall, within the specific calendar years, the ratio of convictions to arrests fluctuated between lows in 2019 and 2021, and highs in 2018 and 2020. Conviction rates remained relatively low compared to the number of arrests, with the highest being 21.3% in 2018.

Table 10. Ratios of convictions, prosecutions and arrest to each other during 2018 to 2021.

Ratio of prosecutions and arrests: 2018 to 2021			
2018	2019	2020	2021
38.1%	46.4%	64.8%	44.0%
Ratio of convictions relative to prosecutions			
2018	2019	2020	2021
55.9%	34.7%	32.7%	38.0%
Ratio of convictions to arrests			
21.3%	16.1	21.2%	16.7%

[158] Botswana, Kenya and Mozambique did not provide information on law enforcement and legal sanctioning outputs.

Records of arrests, prosecutions and convictions reported by seven Range States (Fig. 7) included details at the various levels of involvement and roles of perpetrators in poaching and trafficking[159] and some examples of legal cases[160]. Most (70%) arrests were at Level 2 irrespective of the calendar year. It is likely that this trend originates from largely reactive responses to crime already having taken place and that Level 2 perpetrators are many more than those at Level 3 or Level 4. Testing this observation will require detailed information on the specifics of the particular laws broken that lead to arrests such as possession of a fire-arm in a protected area rather than an actual rhino poaching event.

A major concern remains the apparent low conviction rates. The ratio of convictions to arrests was 11.9% in this sample of range States that reported. Level one conviction ratio was 32.1%, level two 7.1% and level three 4.3%. These patterns suggest that successful prosecution is harder at higher levels with more complexity of crimes or charges. One aspect is to evaluate what the legal basis of prosecution and conviction was – criminal cases for instance, may have clear-cut legal tactics at lower levels of poaching arrests such as being convicted or illegal possession of a firearm. Links to rhino cases at higher levels require in-depth investigations to link activities to rhino crimes and proceed with civil legal tactics. Some range States do recognize the opportunities associated with civil legal actions and asset forfeiture options. For instance, the Prevention of Organized Crime Act[161] in Eswatini enables asset forfeiture. Tanzania established prosecution units in every wildlife authority (TANAPA, NCAA and TAWA) in the country that deals with rhino crimes. The Criminal Procedures Act in Tanzania[162] guides asset forfeiture procedures for these units.

Interpreting the patterns in arrests, prosecution and convictions, however, is further challenging. For instance, yearly ratios of prosecutions and convictions to arrests are only indicative, as lengthy legal procedures will often have completion of prosecution associated with a specific arrest in a subsequent calendar year. As a result, these summary statistics do not use consistent formal systems to track procedures on a case-by-case basis. Several range States reported variable levels of tracking cases once law enforcers made arrests. Namibia, Tanzania, Zambia and Zimbabwe reported formal procedures to track progress with cases by relevant enforcement authorities, while the Prevention of Organized Crime Act[163] in Eswatini provides legal guidance.

Although interpretation is challenging, several range States noted varying aspects associated with the granting of bail. Some range States, like Zambia, have no bail option available for rhino crimes, while Eswatini, South Africa and Zimbabwe reported constitutional rights of bail to offenders. A key element is prioritizing the commencement of a case as soon as possible. For instance, Eswatini noted that defence lawyers used "languishing in custody without trial" to justify bail applications. Zimbabwe also noted that persons repeatedly receiving bail often absconded and in several instances, continued poaching.

South Africa also noted a delay in or non-prosecution of many suspects. Many suspects continue to engage in illegal activities relating to rhino even while out on bail, awaiting trial. In addition, South Africa reported the release of several convicted prisoners linked to rhino poaching, partly because of authorities seeking to manage the spread of infections in prison during the COVID-19 pandemic. This resulted in many subsequent arrests of suspects previously involved in wildlife crime.

Fines varied considerably across the levels of poaching for countries. One example of fines at Level 1 equated to $752.40[164], while those at Level 2 ranged from $94.05 to $13,321.60. At Level 3, judges imposed fines ranging from $106.59 to $9,781.20 in the detailed level-based information that range States provided. Prison sentences that range States reported ranged from seven to 24 months for Level 1 poachers. Level 2 were longer – 24 to 52 months. Level 3 sentences ranged from 4 months to 120 months. One Level 4 conviction resulted in 29 months prison sentence. Variation associates with charges as well as accentuating circumstances that judges consider when imposing these sanctions on convicted perpetrators[165]. Some range States have minimal sentences, but also indicated some uncertainty in how rigorously judges apply these guidelines.

Disrupting the financing of criminal syndicates and the facilitation of the export of illegally obtained rhino horn remains a challenge. In South Africa, the more active involvement recently in tackling illegal wildlife trade by the Financial Intelligence Centre (FIC) and banking institutions is likely to have a significant impact in these areas. Although progress within range States is slow to maximize asset forfeiture opportunities, Eswatini reported a case where the court ordered compensation to owners of animals proved to have ownership by DNA, even across borders in other countries[166].

[159] Level 1 - Poachers who typically enter protected areas, reserves, private or communal properties to hunt for rhino and poach them.
Level 2 - People that act as transporters who are paid for transporting rhino horn typically from the poachers to other key people within a criminal syndicate.
Level 3 - People that act as local intermediaries who often oversee a number of poaching teams and transporters.
Level 4 - People that act as exporters who transport or facilitate transport of rhino horns via airports or harbours to international destinations.
Level 5 - Traders who sell trafficked rhino horn directly to consumers in end-user states.
[160] See Annexure 12
[161] Mick Reilly, conservation@biggameparks.org
[162] https://www.tanzanialaws.com/principal-legislation/criminal-procedure-act
[163] Mick Reilly, conservation@biggameparks.org
[164] Standardized to US dollar value at exchange rates on 31 December 2021 i.e. 0.0627 ZAR to 1 USD
[165] See Annexure 12 for some examples of key cases provided by Zimbabwe and South Africa.
[166] Mick Reilly, conservation@biggameparks.org

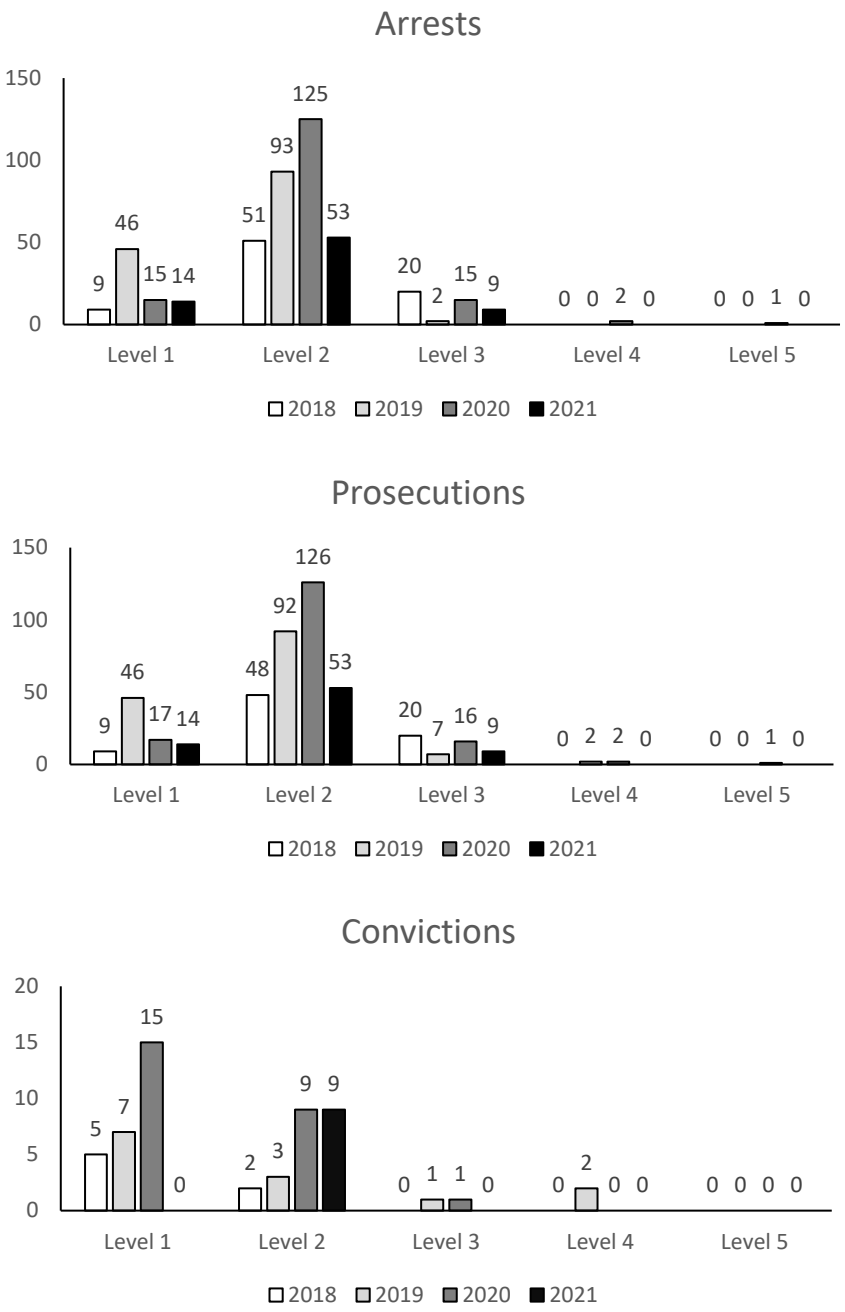


Figure 7. Arrests, prosecutions and convictions across various levels of poaching and trafficking reported by seven range States[167].

6.3.2 Asian rhinos

India arrested 43 suspects linked to rhino poaching cases in three Provinces in the period since 2018 (April 2022). In 2021, Nepal made a number of arrests when authorities apprehended 27 rhino poachers[168]. Nepalese authorities identified another 47 suspects involved in rhino poaching and horn trafficking and it was reported that investigations in this regard is ongoing.

[167] Uganda, Eswatini, Zambia, Tanzania, Rwanda, Chad and Namibia
[168] https://kathmandupost.com/province-no-3/2021/07/06/27-rhino-poachers-arrested-in-the-current-fiscal-year-1625539862

In India and Nepal, jail terms under national wildlife legislation are generally high. Although fines in both countries remain low compared to the value of horns in illegal trade, in most cases fines continue to be an addition to a jail term, rather than an alternative. In Assam Province of India, the 12 District Courts established in November 2016 by the Guwahati High Court are now fast-tracking hearing of all wildlife-related cases, with several cases already on trial. Penalties for killing a rhino in Assam include a minimum seven years' imprisonment with a Rs75,000 fine (US$1,007[169]). For example, the Golghar Court in Assam sentenced a poacher to seven years' imprisonment and a fine of Rs50,000 (US$671) for killing a rhino in Kaziranga. In India, prosecutors can argue harsher sentences of up to 14 years jail term if evidence suggest an offender has killed rhinos on more than two occasions. In Nepal, the minimum sentence is five years imprisonment up to a maximum of 15 years with a minimum fine of US$50.

7. Rhino conservation management

7.1 Management plans and strategies

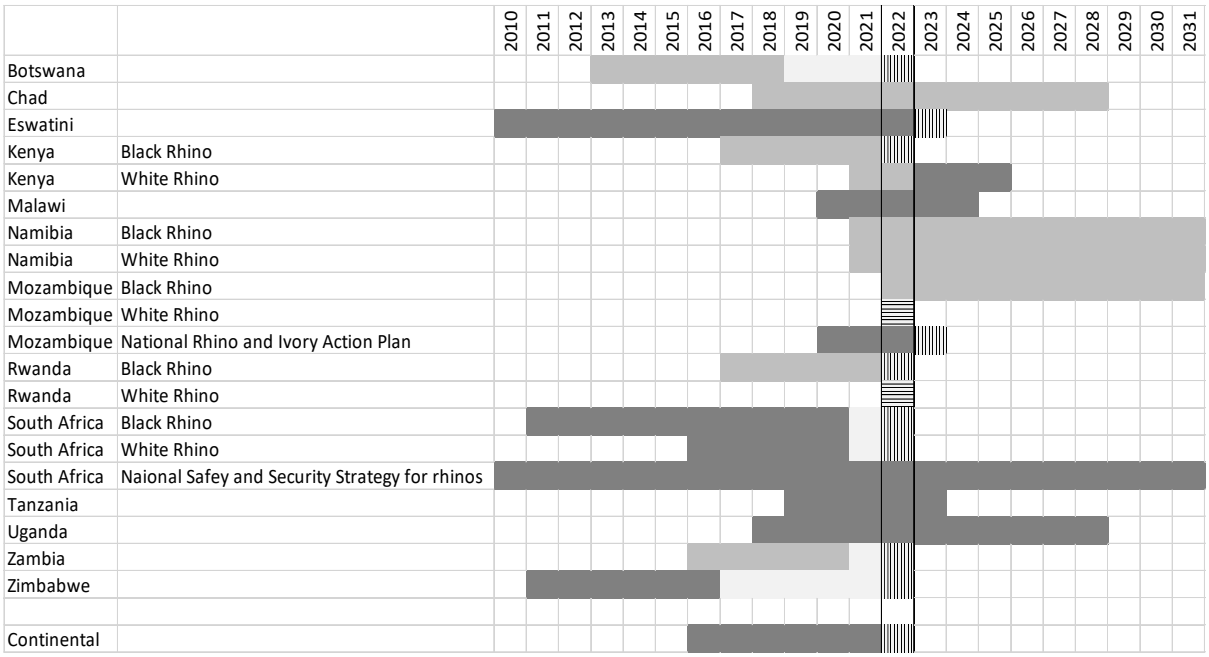
7.1.1 African rhinos

The most recent and active management plans and strategies varied considerably in status (Fig. 8). Kenya, Mozambique, Namibia, Rwanda and South Africa reported separate plans, or intention of plans, for black and white rhinos. Mozambique also reported an active National Rhino and Ivory Action Plan, while South Africa noted the National Safety and Security Strategy for rhinos.

A total of 20 rhino conservation plans were active, under review or being developed in African range States from 2018 to 2020. A total of six (30%) were active and nationally approved, five (25%) were active, but had no formal government ratification. Seven (35%) were under review although range States continued to implement outdated plans. Two range States (Mozambique and Rwanda) were developing plans for white rhinos, which had no formal plans previously. The African Rhino Conservation Plan that focuses on the continental scale expired at the end of 2021 with planned revision for 2022. One key challenge is that, although this plan was supported by most range States, it carries no formal mandate. Rhino conservation accountability is instead embedded within national range State mandates. The risks to global rhino conservation outcomes are unclear as threats to rhinos and the values of conservation outcomes are on a global scale associated with several global environmental change drivers[170].

Although range State plans varied somewhat, there were common components including rhino protection and biological management, followed by a variety of supporting and enabling objectives. Range States reported assessment of achieving some objectives, with 89% of range State plans reporting partial or complete achievement. For biological aspects, range States reported 91.3% of associated objectives partially or fully achieved. Around 51.0% of the enabling and supporting objectives within the various range State plans did not receive any formal assessment by range States. Of the 56 objectives assessed, 94.6% of these achieved partial or full achievement. Thirty-four objectives had no formal assessment.

[169] Currency exchange based on rates as of 31 December 2021.
[170] Sala OE, Chapin FS, Armesto JJ, Berlow E, Bloomfield J, Dirzo R. et al. 2000. Global biodiversity scenarios for the year 2100. Science, 287, 1770–1774.



Dark grey bars – ratified by central government; Medium grey bars – not ratified by central government; Light grey bars – implementation of expired plans; vertical lines – plans under review; horizontal lines – plans under development. Focus is on the status by the start of 2022.

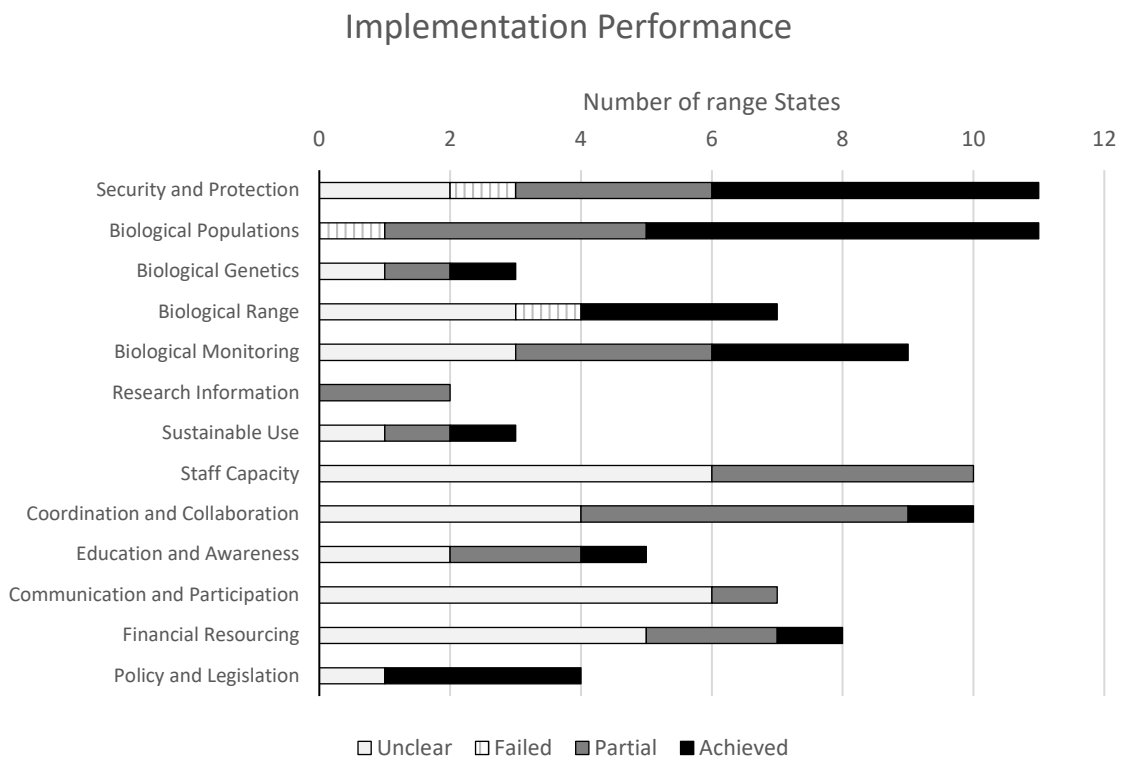


Figure 8. The status of rhino management plans across range States (Top) and the implementation performance against various objectives (bottom) for extant rhino populations within the historical distribution of rhinos.

7.1.2 Asian rhinos

India launched its national rhino strategy in 2019 with conservation currently coordinated at the state level in Assam, West Bengal and Uttar Pradesh. India's National Strategy for the Conservation of the greater one-horned rhino (*R. unicornis*) is that by 2030, habitat where rhinos live has increased by 5% compared to their present distribution. Objectives focus on strengthening protection; expanding the present distribution; research and monitoring; transboundary engagement; and enforcement. Nepal revised and updated its National Conservation Action Plan for the greater one-horned rhino active from 2017 to 2021. The current plan focused on managing and maintaining three viable populations in Nepal.

For Javan rhinos (*R. sondaicus*), Indonesia does not have a formal management plan and this requires development following the population viability assessment of 2015[171]. The Government of Indonesia has developed an Emergency Action Plan for Sumatran rhinos, planned to be implemented in the 2019-2021 period. However, it is not clear how well implementation proceeded.

7.2 Coordination and implementation mechanisms

Range States continue to promote continental and regional coordination through membership in various groups. Government responses to the COVID-19 pandemic, however, affected various coordinating mechanisms. The AfRSG members completed a virtual meeting that had interactive sessions over a six-week period. Discussions focused on key strategic areas including the status of rhinos, incidences of the illegal killing, stockpiles, trade and various enabling activities including cooperation between states and with local communities.

Coordination and implementation actions spanned various areas associated with rhino conservation, particularly at the local scale. One example was the integration of biological management and rhino security activities. For instance, Kenya reported shared activities to build capacity in habitat suitability assessments with Tanzania as well as identification of suitable sites for black rhino reintroductions with Uganda. At the same time, Kenya and Tanzania enhanced the management of cross-border populations of the Mara-Serengeti complex through joint security, monitoring and data sharing.

South Africa reported several coordinating mechanisms given the large numbers of rhinos in numerous localities spread across several provinces. Wildlife priority forum meetings between the Department of Fisheries, Forestry and the Environment (DFFE) and Provincial authorities (*e.g.* Gauteng Department of Agriculture and Rural Development (GDARD); Department of Small Business Development, Tourism and Environmental Affairs (DESTEA), South African Polices Service (SAPS) and the Private Rhino Owners Association (PROA)) was on a quarterly basis, and aimed to co-ordinate wildlife issues with an emphasis on rhino poaching. National meetings between investigators (*e.g.* National Biodiversity Investigators Forum (NBIF)) were aimed at sharing information. These collaborations allowed pro-active monthly joint SAPS patrols, roadblocks and suspect vehicle searches.

At a local protected area scale, several national parks and provincial reserves coordinate with local law enforcement agencies for collective cooperation to protect and conserve rhinos. The Greater Kruger Environmental Protection Forum (GKEPF) is an initiative that facilitates collective management and protection of rhinos living in several abutting reserves including Kruger National Park and the various private and provincial reserves bordering the Park, both in South Africa and Mozambique. The focus is on regional rhino conservation outcomes that integrate biological management with security initiatives, including cooperation for cross border operations.

In India, various non-government organizations (NGOs) working in and around areas containing rhinos proactively assisted and complimented the management authorities. This lead to an improved partnership, especially in Manas National Park, which lost all its rhinos during a period of civil strife in the late 1990s-early 2000s. Gradual efforts of forest officials complemented by NGOs and local communities worked in tandem to bring back rhinos to Manas from 2006 onwards. As of April 2022, the Park's population was estimated at 44 rhinos. More than 100 ex-poachers surrendered their arms and vowed to contribute towards restoring the past glory of Manas, which is a World Heritage Site.

In Nepal, better coordination among law enforcement agencies and partnership with local NGOs and village level institutions yielded encouraging results with no poaching from 2018 to 2021.

Indonesia's rhino protection efforts reflect collaboration between government, local NGOs and local communities. Government officers have the authority to make arrests and carry a weapon, however, NGOs and community members are not allowed to carry firearms when conducting joint operations.

[171] Haryono Muh, Miller PS, Lees C, Ramono W, Purnomo A, Long B, Sectionov, Waladi Isnan BD, Aji BD, Talukdar B, Ellis S. (Eds.) 2016. Population and Habitat Viability Assessment for the Javan Rhino. Apple Valley, MN: IUCN/SSC Conservation Breeding Specialist Group.

7.3 Major conservation actions and field activities

7.3.1 African rhinos

Most African range States' conservation activities focus on influencing the vital rates of populations[172]. Range expansion initiatives focused on new south-central black rhino populations in Eswatini and Zimbabwe each, a new southern white rhino population in Rwanda and the assessment of two additional areas in Kenya. Malawi completed supplementary introductions to one population of south-central black rhinos, while Botswana completed an initiative of supplementary introductions of south-central black rhinos that started prior to CoP18. Botswana finished the planning phase of additional introductions of south-central black rhinos from Zimbabwe, but was not carried out due to government responses to the COVID-19 pandemic and increases in poaching risks. Chad also completed planning a supplementary introduction of black rhinos following the loss of four rhinos after the initial introduction[173]. Zambia and Botswana reported initiatives aimed at enhancing populations. Zambia completed a plan to expand the rhino sanctuary in North Luangwa National Park. In response to an extended drought during the reporting period, Botswana noted supplementary feeding of rhinos.

Botswana also reported the translocation of rhinos from high-risk poaching areas to safer localities. Within Kruger National Park, white rhinos naturally move extensively, which often places them in areas with a high poaching risk for extended periods. SANParks previously moved rhinos, particularly females, from high poaching risk areas to protect their reproductive value (including protecting any associated calves as well as the compound effect of future breeding by their calves), but other rhinos quickly took up the vacated space. Alternative subsequent approaches aimed to reduce poaching impacts on rhino cows by providing maximum protection and breeding opportunities. This focused on removing young white rhino males from areas with high densities of cows and releasing them into areas far from cows in an attempt to 1) deflect poaching effort towards males away from cows; and 2) reduce rhino forage competition that influences rhino cow conception and mortality rates in the areas of high rhino densities.

Complimentary approaches focused on dehorning rhinos. Extensive dehorning of animals on private land in KwaZula/Natal led to a reduction in poaching at the local scale. This, however, may deflect poaching to areas where there are rhinos with intact horns. In Kruger National Park, the targeted dehorning of cows to significantly reduce poaching incentives in important core areas was trialled and the potential benefits of inducing higher survival for cows was assessed[174]. Upon review, the data illustrated that poachers visited core areas attracted by remaining horned animals, but often killed more than one rhino to make up for the loss of horn weight. The approach of SANParks in Kruger National Park is now to dehorn all rhinos in core cow areas and only cows in peripheral high-risk areas.

Botswana, Namibia and elsewhere in South Africa also embarked on dehorning a large number of rhinos in an attempt to reduce the poaching incentives. The value of dehorning remains a contentious issue and the dehorning of large and robust free ranging populations in extensive areas is particularly complex as an understanding of the social, behavioural, and evolutionary impacts are limited. However, focusing on managing the effects of poaching on cows and calves increased the strategic need and operational importance of well-managed orphanages within South Africa. Recovering orphans and raising females to adulthood with subsequent release into the wild is a key requirement to help maintain the reproductive potential of a population.

These management approaches resulted in a large increase in the dehorning of rhinos with 2,217 rhinos dehorned from 2018 to 2021. These comprised no eastern, but mainly south-western (136) and south-central (209) black rhinos, as well as southern white rhinos (1,872) (Fig. 9). The majority of dehorning initiatives were focused in South Africa and Namibia. Motivation for dehorning focused primarily on creating disincentives for poaching. South Africa, however, reported primary and secondary motivations that associated with stockpiling for future potential international trade in rhino horn. Dehorning in South Africa has the potential to develop a form of tourism linked to the dehorning operations in private areas, generating income that may exceed the costs of these operations. An additional motivation emerged with some private owners stockpiling as insurance against financial loss associated with the death of a rhino irrespective of the cause of death. This insurance value may originate from South Africa indicating policies that seek to dispose of rhino horn through philanthropic purchase of stock and the destruction of stocks (see Section 8.2.2 Policy review and development).

[172] See Annexure 13, Figure A13.1.

[173] African Parks. 2021. Update on the underlying cause(s) of the mortalities of four Black Rhino (*D. bicornis minor*) translocated to Zakouma National Park (Chad) from South Africa in October 2018 – seasonal nutrient content of browse in different parts of the landscape. African Parks, Johannesburg, South Africa. Available from Dr Angela Gaylard, angelag@africanparks.org

[174] SANParks, Unpublished data, danie.pienaar@sanparks.org

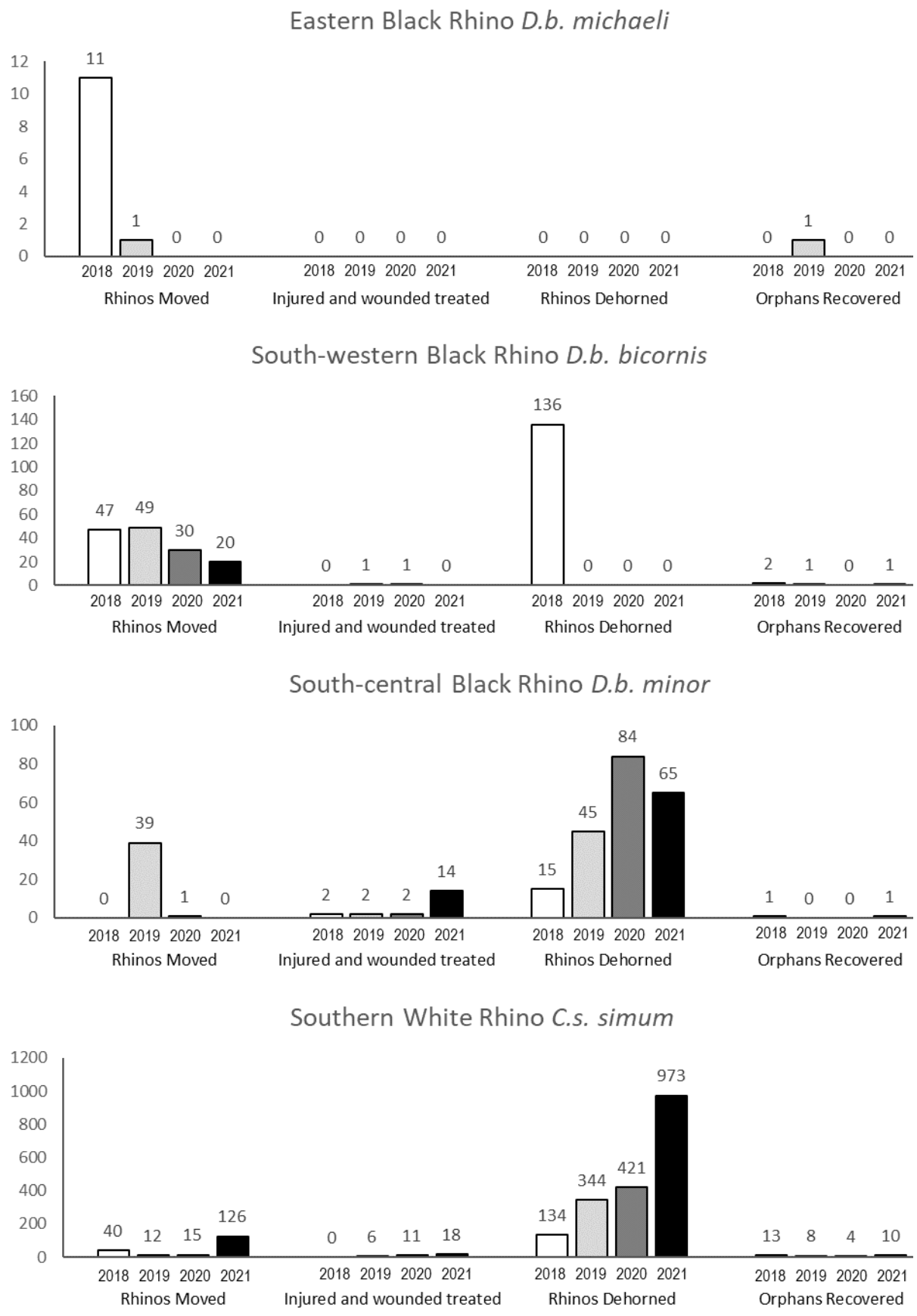


Figure 9. A summary of the number of rhinos involved in active conservation activities illustrating trends from 2018 to 2021.

The higher value that cows have for population recovery in the short-term was also a focus for some populations in South Africa. The accumulation of what are termed "excess" or "surplus" black rhino males, that are post-breeding bulls, as well as other bulls selected through targeted management (commonly for reasons such as genetics) or random events in small populations (fewer than 50 individuals) continues to be an issue that requires attention. South Africa and Namibia implement hunting of such males as part of interventions. The hunting response is limited, administratively burdensome to implement, but contributes significantly in financially supporting conservation activities in those reserves undertaking hunting. It, however, does carry some reputational risks for authorities and associated reserve managers.

All range States grapple with the weight of increased security costs associated with managing rhino populations. South Africa established wildlife zones to reduce opportunities for crime groups by equalising and standardising protection to all important rhino populations in South Africa; and concurrently strengthening integrated information-led enforcement[175]. The efficacy of these zones remains to be tested, but it is clear that they can also serve a role in the biological management of rhinos.

A key development is the development of Wildlife Conservation Bonds. The approach finances conservation through the creation of an outcome-driven structured bond that channels funds from bond investors to conservation outcomes. The longer-term objective of testing this bond structure is to create a new investment asset class that can widen the investor base, and thus reduce the global financing gap for biodiversity conservation. The World Bank (International Bank for Reconstruction and Development, IBRD) priced the Wildlife Conservation Bond (WCB), or "Rhino Bond", during early 2022. A five-year $150 million Sustainable Development Bond includes a potential performance payment from the Global Environment Facility (GEF), which will contribute to protecting and increasing black rhino populations beginning with two protected areas in South Africa, the Addo Elephant National Park (AENP) and the Great Fish River Nature Reserve (GFRNR).

Range States implement various monitoring programmes. Tanzania and Rwanda reported intensifying the use of tracking devices to assist in monitoring of rhinos. Uganda enhanced the rhino monitoring capacity through additional dedicated monitoring staff. Improving the use of information for decision-making was the focus of a data verification process that Kenya completed. Namibia also enhanced various levels of capacity through focused training initiatives including rhino monitoring skills.

Range States reported relatively few incidences of treatment and rehabilitation of rhinos injured through natural causes. In contrast, range States moved 391 individual rhinos between and within localities in a country from 2018 to 2021. These comprised eastern (12), south-western (146) and south-central (40) black rhinos, as well as southern white rhinos (193). Within range States, translocations focused on enhancing ranges of rhinos and mitigating the risks of inbreeding. South Africa reported large numbers of within country translocations of southern white rhinos (n=145), most likely associated with national trade in live rhinos. Some of the reported imports and exports between range States (see Section 3.2.2) focused on expanding ranges and supplementing existing populations. For instance, Rwanda imported 30 southern white rhinos to establish a population outside the historical range in 2020, while Malawi imported 17 black rhinos in 2019 to supplement a population.

A component of reported rhino activities focused on additional re-active responses to consequences and threats posed by the illegal killing of rhinos. Range States reported 42 orphans recovered and placed into rhino orphanages for care. The release of orphans back into the wild once recovered and self-reliant, however, is the ultimate goal – few range States reported releases. Within Kruger National Park, an estimated 32.6% of orphans generated by poaching may ultimately survive[176] for future release into free-ranging populations and further contribution to rhino conservation objectives.

7.3.2 Asian rhinos

As in Africa, the greatest rhino conservation successes in Asia continue to occur where there has been significant political will backed by active resourcing of sites, combined with dedicated staff commitment to effective action in the field. While poaching of greater one-horned rhinos (*R. unicornis*) in Nepal is under control, the natural deaths recorded in Chitwan National Park is high despite many conservation efforts by different stakeholders. Natural mortality during the seasons from 2018-2019 was 43 rhinos. Nepal noted 26 in 2019-2020, 22 during 2020-2021 and 27 natural mortalities in 2021 to April 2022. This highlights the need for several priority interventions using research and monitoring to document and define the carrying capacity and limitations of existing rhino habitats. The risk of death from different diseases was also an important factor contributing to rhino mortality rate. Authorities may need to enhance existing habitat management activities, while also addressing community engagement on conservation, poaching and the reduction of illegal wildlife trade.

[175] Department of Fisheries, Forestry and the Environment, Johan Jooste, jjooste@dffe.gov.za

[176] Calculation based on the recovery of 64 southern white rhino (28 males, 36 females) and seven south-central black rhino (five males, two females) calves in Kruger National Park from 2012 to 2019. The recorded standing age distributions in Kruger help predict the expected number of orphans that the illegal killing of rhinos should generate. Rangers discover approximately 50% of orphans before they die either through malnutrition of predators that kill them. From 2012 to 2019 rangers discovered 89 orphaned calves in total of the estimated 178 orphans that poaching generated in that period. Veterinarians euthanized 18 of these as their condition was such that they would not through veterinary care. Of the 71 recovered, 13 died while in veterinary care at orphanages. Fifty-eight calves survived equating to 32.6% of the orphans that illegal killing of rhinos generated from 2012 to 2019.

Range expansion was a priority in Assam Province, India. Authorities captured 22 wild greater one-horned rhinos in Kaziranga National Park and Pabitora Wildlife Sanctuary and released these in Manas National Park from 2008-2021. In the coming few years, the Assam government plans to intensify rhino translocation efforts to protected areas like Laokhowa and Burhachapori Wildlife Sanctuaries. Authorities also expanded the area of Orang National Park with an additional 200 km^2 added in January 2022, enlarging its size from 78.80 km^2 to 278.80 km^2, which could support 50-60 rhinos. Assam's Kaziranga National Park which now holds 2,613 rhinos expanded from its original 430 km^2 in 1974 to 1,030 km^2 in 2022.

In September 2018, inspired by the Government of Indonesia's Emergency Action Plan for Sumatran Rhino, Indonesia created the Sumatran Rhino Rescue initiative bringing together the national government, international and Indonesian NGOs. The aim was to implement a collaborative plan to save the species with key objectives including: (1) conducting search and rescue operations to relocate rhinos in the wild; (2) building new facilities and bolstering the capacity to care for and breed rhinos; (3) coordinating partners across the regions of Indonesia to collaborate on a single, country-wide breeding program; and (4) raising the profile of the Sumatran rhino so that a global constituency can contribute to the species' protection.

8. Measures to end the illegal use and consumption

8.1 Demand management

8.1.1 Development and implementation of measures

In line with the CITES Resolution on Demand Reduction (Resolution Conf. 17.4[177]) in this section 'demand reduction' refers to "well-targeted, species-specific, evidence-based campaigns …engaging key consumer groups and targeting the motivations for the demand, including the speculative nature of the demand, and develop[ing] specific messaging approaches and methods for target audiences."

The following overview is based on desk-based secondary research focused on one piece of commercially commissioned consumer research, ~ 10 academic peer reviewed and journal published articles, >20 news items and one donor report summarizing activities. Although care has been taken, the limitations of this approach are recognized. The review was pragmatic rather than systematic, and effort was made to remove the risk of any subjective bias, recognizing that TRAFFIC is already delivering rhino horn demand reduction initiatives of their own, which feature prominently here.

8.1.1.1 Motivations for consumption

Based on insight from consumer research conducted in 2021 in Viet Nam[178], multiple motivations for consumption of rhino horn were reported. The survey in (Fig. 10) was conducted using purposive sampling, and so specifically sought out self-reported buyers or users of rhino horn in the past year (65%), or intenders of buying or using rhino horn in the past three years (35%)). Respondents fitting this criteria were asked to identify why they would recommend rhino horn to others in the future. Due to the nature of the sampling used it was not possible to compare transitions with the prominence of different motivations against a 2018 baseline; however, results indicate that 54% of the responses listed "Good for health" as a reason why to own or buy rhino horn, and all top seven answers that were selected in at least 10% of the responses listed health related reasons (Fig. 10).

8.1.1.2 Considerations around the potential impact of COVID-19

Since the last IUCN report prepared for the 18th meeting of the Conference of the Parties to CITES on African and Asian rhinoceros' status, conservation, and trade[179], the COVID-19 pandemic has caused an unprecedented toll on human life, as well as affecting the global economy, and human living standards around the world. At an early-stage of the pandemic, media articles[180, 181] provided anecdotal information on rhino horn featuring in unproven treatments for COVID-19 advertised on social media. An investigation[182] pinpointed illegal wildlife traders in China and Lao PDR offering Angong Niuhuang Wan pills produced in North Korea, explicitly identifying rhino horn amongst the ingredients. In the Chinese version of this TCM treatment for febrile diseases (*e.g.,* fevers), the National Health Commission approved ingredient list includes buffalo horn instead.

[177] https://cites.org/sites/default/files/document/E-Res-17-04_0.pdf
[178] Survey Report on Consumption of Wildlife Products. IndoChina Research for USAID. 2021.
[179] https://cites.org/sites/default/files/eng/cop/18/doc/E-CoP18-083-01.pdf
[180] https://www.nationalgeographic.com/animals/article/chinese-government-promotes-bear-bile-as-coronavirus-covid19-treatment
[181] https://www.independent.co.uk/climate-change/news/coronavirus-china-cure-rhino-horn-medicine-north-korea-outbreak-a9325856.html
[182] https://eia-international.org/news/china-and-laos-wildlife-traffickers-exploiting-coronavirus-fears-to-peddle-illegal-wildlife-fake-cures/

As noted in Section 3.1 of this report, despite the announcement on October 29th, 2018, by China's State Council that it planned to reopen aspects of its domestic trade in rhino horn (banned since 1993) and conditionally permit medicinal rhino horn use[183], the postponement to this decision[184] that followed broad criticism[185] was upheld during the pandemic. One study[186] observed that "TCM practitioners prescribe rhino horn… for dispelling heat, detoxifying the blood, and treating wenbing (温病, wenbìng); "warm heat" pathogenic diseases most associated with acute infections and epidemics in southern China. Notable epidemics of wenbing, known as wenyi (溫疫, wenyì), include SARS and COVID-19".

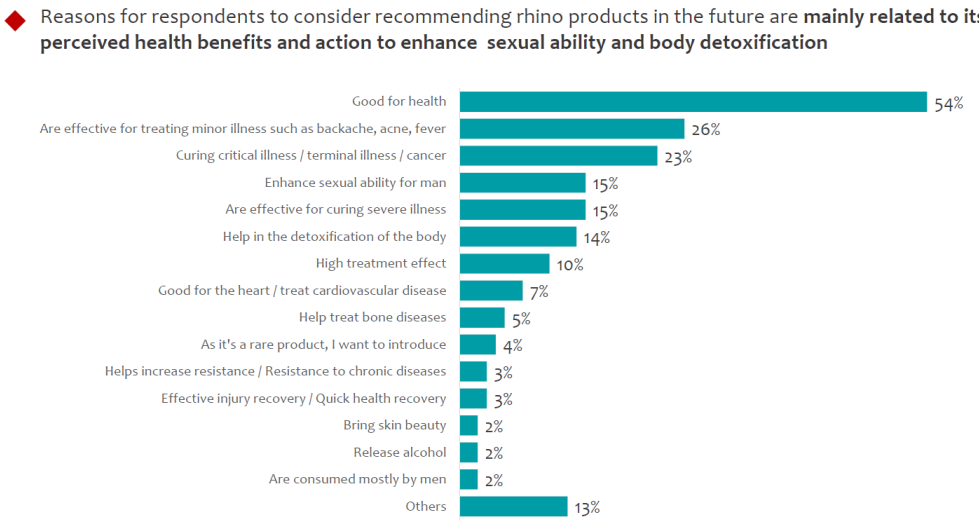


Figure 10. Insight from Consumer Research regarding Rhino Product Consumer Motivations conducted in 2021 for Viet Nam[178]. It is noted that respondents could select more than one response hence percentages do not add to 100%.

8.1.1.3 Demand reduction activities

Most rhino horn demand reduction activities have continued to focus on end markets and consumer target audiences in Viet Nam. The enduring need for efforts to mitigate end-markets in country could reflect transitions in use-type and an expanded pool of potential and actual purchasers and user-groups, made possible through otherwise positive socio-economic development concentrated in urban centres[187]. Impact assessments conducted by commercial research firms suggest progress has been made with past demand reduction efforts, although despite wide criticism[188],[189] the research methods employed still rely on self-reported measures of change, and interest in acquiring rhino horn in the future evidently does remain (see below).

Since the previous IUCN report to CoP18 ~10 significant social and behaviour change campaigns have been delivered (reaching > 1m people and delivered for more than 12 months). Target audiences for these campaigns ranged from affluent businessmen, aged 30-55, identified as the main target audience for status driven use of rhino horn (Chi initiative - TRAFFIC/ USAID), through to primary school students (HSI), religious groups (WildAid/ Change), government leaders (TRAFFIC and SRI) and Chinese tourists (GIZ and partners). Activities spanned more 'passive' engagements such as the placement of campaign materials in areas where they were likely to be seen by target audiences, through to more 'active' engagements such as dedicated workshops with National Assembly members and the production of handbooks and other training materials providing supplementary information on conservation case studies, the rationale for rhino conservation, suggested desired behaviours and policy implementation examples. The combined outreach from this work was well over 50 million people, but those largely concentrated in urban centres in the country, particularly Ho Chi Minh City (HCMC), Hanoi and Da Nang.

[183] http://english.www.gov.cn/policies/latest_releases/2018/10/29/content_281476367121088.htm
[184]http://www.china.org.cn/china/Off_the_Wire/2018-11/12/content_71941870.htm?from=groupmessage
[185] https://www.unep.org/news-and-stories/statement/official-statement-reversal-ban-trade-rhino-and-tiger-parts-china
[186] Cheung H, Mazerolle L, Possingham HP, Biggs D. 2021. A survey of traditional Chinese medicine consumers to investigate the impact of China's legalization of rhino horn trade on stigmatization and likelihood of use. Conservation Science and Practice. Nov;3 (11): e536. https://conbio.onlinelibrary.wiley.com/doi/pdf/10.1111/csp2.536
[187] Naidoo R, Bergin D, Vertefeuille J. 2021. Socio-demographic correlates of wildlife consumption during early stages of the COVID-19 pandemic. Nature Ecology & Evolution, https://doi.org/10.1038/s41559-021-01546-5.
[188] Paras 12-14 inclusive, CITES SC69 Doc 15: https://cites.org/sites/default/files/eng/com/sc/69/E-SC69-15.pdf
[189] https://pubmed.ncbi.nlm.nih.gov/30259569/

8.1.1.4 Summary of research and insight into impact of activities

In Viet Nam, the research firm Indochina Research Limited[190] was engaged to conduct an independent rapid assessment of the impact of the Chi Phase III Initiative. Face-to-face interviews were conducted through purposive sampling with self-reported rhino horn users or owners, and those who had stated intention to buy rhino horn in the past three years. The interviews were conducted in Hanoi, Da Nang, and HCMC, in line with the geographic focus for Chi Phase III. Progress was tracked by comparing those who had been exposed to the initiative and those that had not. Intention to purchase rhino horn was found to be significantly lower among those exposed to the Chi III campaign (49%) compared to those that had not (71%). The perception that buying or using rhino horn products is socially acceptable was also significantly lower among those exposed to Chi III (22%) compared to those that were not (33%). Likelihood to recommend rhino horn products was also significantly lower among those exposed to the Chi III campaign (38%) compared to those that were not (53%). However, the residual figures of those with intention to purchase rhino horn in the future was still high and based on the motivations data in Fig. 10, and emergence of rhino horn glue as a health treatment, should be further explored.

8.2 Enabling tools and policy

8.2.1 Legislative tools

Range States reported adaptations in several legislative tools. These focus on various strategic aspects including changes in legal sanctions for wildlife crimes, enhancing enforcement procedures, and updating rhino regulations.

Malawi reported a landmark milestone with an amendment to the National Parks and Wildlife Act, in 2017, that removed the option of a fine and extended the maximum custodial penalty to 30 years for the most serious offences against endangered species. Malawi subsequently developed the Sentencing Guidelines for Wildlife Crimes in Malawi Courts to support the Judiciary in determining appropriate sentences for wildlife crime. Kenya reported implementation of punitive penalties for wildlife crime embedded in the Wildlife Conservation and Management Act (1976) has led to lengthy sentences and higher bonds, the details of which is not available. Botswana is in the process of adopting changes in legal sanctions associated with wildlife crimes as part of a review to the Wildlife Conservation and National Parks Act.

Eswatini adapted the Wildlife and Flora Protection Act to enhance the regulation and control of illegal hunting; possession, keeping, capture, movement and trafficking of game and game products; and the regulation of issuance of permits. Part of this was in response to challenges with extradition of foreign offenders, awarding of bail, and inefficient case processing.

South Africa amended the Norms and Standards for the Marking of Rhinoceros and Rhinoceros Horn and the Hunting of Rhinoceros for Trophy Hunting Purposes of 2012. Implementation was from 2018. The purpose of the norms and standards in general is to 1) Compel the marking of live rhinos that are required to be darted (regardless the purpose of darting) by means of a microchip in each of the horns, as well as a microchip in the body; 2) Compel the reporting of mortality of any rhino (regardless the cause of mortality); 3) Compel the safe-keeping of rhino horns; 4) Provide a procedure for the management of trophy hunting of rhinos; 5) Compel the collection of DNA samples from live rhinos or rhino horn (for both diagnostic and forensic purposes), and to provide procedures relating to the collection of the DNA samples; and 6) To provide a procedure for the voluntary destruction of rhino horn.

South Africa established horn trade legislation after the establishment of a national horn trade option within the country. The legislation include 1) Regulations relating to trade in rhino horn; 2) Prohibitions that provide restrictions of activities involving rhino horn; 3) Amendment of the Alien and Invasive Species List (deleted Eastern black rhinoceros, *D.b. michaeli*, as an invasive species); and 4) Amendment of the List of Critically Endangered, Endangered, Vulnerable and Protected Species (to include Eastern black rhinoceros, *D.b. michaeli*, as a protected species). The DFFE published these legislative developments and adaptations in 2020 for implementation.

8.2.2 Policy review and development

Two range States reported wildlife policy reviews that have influences on rhino conservation outcomes. Kenya established a Wildlife Policy in 2020 that seeks to create an enabling environment for conservation and management of wildlife for current and future generations. The policy provides a coordinated framework among all the actors in the wildlife sector. Kenya has also provided guidelines on the translocation of endangered species.[191]

South Africa has developed a draft policy position, undergoing considerable debate by various stakeholders, on the conservation and ecologically sustainable use of elephant, lion, leopard and rhinoceros. The overall objective is to provide a stable base for

[190] https://indochina-research.com/contact-us/Viet Nam/
[191] KWS. 2019. Guidelines for Translocation of Wildlife Species in Kenya. KWS, Nairobi

conservation, growth and development in respect of the afore-mentioned species. More specifically, once implemented, the policy position will aim to promote the management of rhinos in extensive wildlife systems to prevent the domestication of rhinos in captive facilities, while considering the rhino poaching risk, and set a policy position for future international trade in rhino horn for commercial purposes. South Africa plays an important role in rhino conservation due to its large contribution to continental rhinos. Therefore, policy direction in South Africa will influence other range States and can have implications for continental rhino conservation objectives and associated benefits.

8.3 Other strategic and game changing responses to minimize trade-off risks

Increasingly, range States reported inclusive approaches at the site level as key elements of achieving success. This aims at meaningful participation in addressing shared challenges and taking part in decision-making and protection of biodiversity including rhinos. Good examples are the Namibian community rhino-guarding programme[192] and the Kenyan[193] and Zambian[194] initiatives that integrate local people as part of rhino management teams at some localities.

Most examples provided by range States focused on community outreach initiatives. This targeted education and awareness to sensitize local people on the importance of conservation, issues of rhino management and inspiration to take ownership and responsibility for conserving their own environment (*e.g.*, Uganda, Eswatini, Rwanda, South Africa and Malawi). In Malawi, this included supporting scholars and students with bursaries and rolling out literacy programs. Engagement through meetings with local forums focused on crime prevention including the recruitment of informants on wildlife crimes (Eswatini). Malawi reported regular engagement with Traditional Authorities that include Village Natural Resource Management Committees through dedicated staff at protected areas. South Africa also noted dedicated staff engaged with local boards and numerous Communal Property Associations on aspects of protected area management providing a forum for interaction and cooperation.

An additional element of community outreach involved assistance with provision of portable water (Eswatini). Kenya reported an example of an economic stimulus package to cushion conservancies against the impacts of the COVID-19 pandemic, while South Africa continued with approaches that allocate portions of entry fees to protected areas to community projects in neighbouring localities. Malawi noted 'Umuganda' activities around protected areas with reserve staff facilitating improving livelihoods through healthcare. Eswatini noted the provision of canine assistance to police and communities as part of crime prevention initiatives within localities abutting protected areas. Eswatini reported the provision of opportunities to maintain ancient ceremonies and culture (*e.g.,* the Butimba National Hunt) with such activities contributing to recognizing values of biodiversity including that of rhinos.

Range States also noted that infrastructure support is an additional element of community outreach. These included building new schools (*e.g.,* Malawi and Eswatini) and providing equipment. Range States often noted partnerships as part of establishing robust relationships between protected areas and local people. Outdoor sports events (*e.g.* marathons, mountain bike races and soccer; Eswatini and South Africa) play key roles and help to entrench values of natural places while raising funds for community projects.

Range States provided some examples of assisting neighbouring communities with income generating activities such as honey and chili production, irrigation support for vegetable growers and livestock pass-on schemes (Malawi). A key element is providing opportunities for local people to participate in tourism opportunities and trade in products associated with traditional experiences (*e.g.,* Eswatini) or, in one instance, a focused rhino tracking experience (*e.g.* Namibia).

A key challenge is the absence of formal assessment of the impacts of these examples of education and awareness, communication, livelihood assistance, infrastructure improvement and enterprise development on the well-being of local people. In many instances, initiatives carry risk of perceived, and experienced as, appeasement by the local people especially when the experience high levels of environmental impacts such as regular damages caused by wildlife. Some range States reported initiatives and processes[195] that seek meaningful partnerships with local people to co-develop and co-manage localities associated with rhinos. Zambia noted examples of linking livelihoods to landscapes in North Luangwa. Kenya reported the continuance of the establishment of conservancies that allow public participation in wildlife conservation. South Africa provided an example of the Great Fish River Nature Reserve co-managed with the Likhayalethu Communal Property Association, and communities deriving benefits from incorporation of portions of their land into project sites. Partnerships with local communities was a sub-element of management models other than pure-State models where rhino populations outperformed those that experienced pure-State management (See Section 2).

[192] http://www.wildernesstrust.com/portfolio/kunene-rhino-conservation-project/
[193] e.g. https://www.tusk.org/projects/sera-wildlife-conservancy/
[194] e.g. https://fzs.org/en/projects/zambia/north-luangwa-national-park/
[195] e.g. Arnstein SR. 1969. A ladder of citizen participation. Journal of the American Institute of Planners, 35, 216-224.

In India and Nepal, efforts to engage fringe communities to garner their support for rhino conservation has been further intensified through government livelihood programmes. In Nepal, a buffer zone management committee in fringe villages around areas containing rhinos received encouraging financial incentives. Proactive participation in management of the buffer zone helped economic uplifting of local people leading to a decline in rhino poaching. Similarly in India, an eco-development committee established by forest officials could garner positive support towards conservation. In addition, NGOs in Assam engaged village defence patrol groups around rhino areas to remain vigilant against rhino poachers in the past three to four years. The programme provides field equipment to these groups to intensify their vigil in fringe villages. This improved intelligence gathering leading to either prevention of rhino poaching or detection of suspects involved in rhino poaching.

In Indonesia's Ujung Kulon National Park, authorities hired more than 250 local community members since 2011 to help manage the 5,100 ha Javan Rhino Study and Conservation Area (JRSCA), located in the Parks' eastern portion. Ujung Kulon is home to a fast-growing endemic palm species (*Arenga obtusifolia*). The palm, which can grow to 16 metres, chokes out other understory plants, including the Javan rhinos' preferred vegetation. The JRSCA work aims to clear the forest of *A. obtusifolia* and to allow other native plants to regenerate, while also creating supplementary income for local farmers.

In Sumatra, the Ministry of Environment and Forestry and local communities initiated a habitat restoration project to replant and restore a section of Way Kambas National Park to create more forested space for Sumatran rhinos and other wildlife. The park hired local farmers to grow the new seedlings to replant the site and local workers to plant seedlings and maintain the area. Fire destroyed the first site in 2019, but the site has since been restored and a second site developed. The second site is next to prime habitat for rhinos, elephants, tigers and other wildlife. Villagers living nearby often collect fruits and other resources from the area. Reforested seedlings should grow to maturity in just a few years, providing food for rhinos and other wildlife. Authorities plan to hire additional workers to harvest browse from mature trees, which will help to feed the rhinos at the nearby Sumatran Rhino Sanctuary.

9. Challenges and best practices to address poaching and trafficking

The AfRSG and AsRSG in the context of Decision 18.115 conducted a survey focusing on rhino range States and other specialists in addressing rhino poaching and trafficking within the specialist groups to which representatives from Asian (two of three, India and Indonesia) and African (nine of 12) range States responded[196]. This represented 99.9% of white and 99.9% of black rhino individuals in Africa, as well as 82% of greater one-horned, 100% Javan and 100% Sumatran individual rhinos in Asia. Following the report to SC74 (Annex 1 to document SC74 Doc. 37), the AfRSG, AsRSG and TRAFFIC solicited further input from implicated countries as well as those that made interventions associated with rhinos at CoP18. The follow-up surveys did not flag key new strategic challenges, but reported the prevalence of existing challenges, detailed below.

The report to SC74 making use of 24 responses from range States and experts noted that the most referenced *poaching* challenges (n = 77) included general law enforcement, communities and governance, as well as trade and financial sustainability. However anti-poaching initiative examples (n = 66) were, compared to poaching challenges, disproportionately focused on law enforcement, including animal and habitat security, the use of technological tools that enhance enforcement by rangers, and investigation of small crimes with less focus on criminal networks and syndicates. Respondents deemed that only 53.4% of anti-poaching initiatives were successful.

For *trafficking* challenges (n = 46), general law enforcement, law enforcement that targets criminal networks and syndicates, and collaborative cooperation between different law enforcement agencies within and between range States were reported at similar frequencies by respondents. Barriers to addressing trafficking challenges associated with collaboration and cooperation, socio-economic, and some law enforcement aspects. Respondents deemed 45.7% of initiatives aimed at curbing trafficking as successful.

The poaching and trafficking reflections by respondents were consistent with previously reported and peer-reviewed published considerations that included aspects such as the need for improved integrity and reduced incentives for corruption as well as other enabling aspects including political support and financial sustainability. However, some new insights emerged, such as the benefits of co-management, accountability, responsibility and participation in decision-making by local communities. Additionally, deployment of dedicated and focused task teams illustrated improved successes in apprehension, prosecution and convictions.

The various inputs provided by survey respondents and reflections from previous work allowed the identification of 12 key poaching and trafficking challenges and 29 key responses (Table 11). These focus on aspects including efficient provision of security, effective investigations, contrasting conservation ideologies, adequate support from local people and appropriate influences of policies.

[196] https://cites.org/sites/default/files/eng/com/sc/74/E-SC74-37-A1.pdf

Table 11. A summary of key strategic challenges and initiatives to address poaching and trafficking of rhinos and parts of rhinos.

Challenge	Initiative
1. Efficient provision of security to rhinos through anti-poaching responses	Develop and implement integrity management systems that focus on building proud trustworthy staff while acting swiftly and fairly on ranger involvement.
	Appropriately, resource rangers with training, equipment and well-being support systems inclusive of equitable and fair employment conditions.
	Re-size large protected areas into optimal zones achieving anti-poaching efficiency.
	Compliment anti-poaching rhino security initiatives with rhino monitoring protection initiatives.
	Develop and implement an integrated regional safety and security strategy beyond the boundaries of parks focusing on societal well-being inclusive of rhinos as well.
2. Effective investigations, intelligence gathering and sharing	Improve awareness and implementation of existing transnational forensic sampling and data sharing initiatives.
	Develop and/or enhance existing national and regional coordination of information associated with rhino crimes.
	Develop and enhance the use of technology including facilitating legislative changes.
3. Adequate deterrence effect of prosecution	Develop and implement community-policing strategies.
	Develop and implement support to improve prosecution processes.
	Develop and implement appropriate legal sentencing sanctions.
	Develop and implement asset seizure complimentary approaches.
4. Integrity at various levels across the illegal supply chain	Develop and implement integrated anti-corruption strategies that focus on addressing systemic corruption, including amnesty periods, and building a proud trustworthy staff complement while acting swiftly and fairly on involvement in corruption.
5. Understanding and responding to the dynamics of the consumer mark	Develop and implement national illegal wildlife trade strategies in consumer countries.
	Develop and implement market research and consumer branding tools from other disciplines for evidence-based insights to inform interventions while sharing findings.
	Use an adaptive management approach embedded in behaviour change theory that are culturally appropriate to develop and implement initiatives aimed at reducing illegal demand, as well as monitoring and evaluating activities.
	Facilitate the development and implementation of platforms for meaningful engagement between producing range States and consumer countries at the producer and consumer level.
6. Contrasting conservation ideological expectations associated with trade in rhino horn	Facilitate discussions between rhino range States, consumer countries and globally-influential countries inclusive of non-government organizations and across stakeholders by using combinations of scenario setting techniques and expert methods such as Delphi techniques.
7. Appropriate influence on policies	Develop and implement scenario planning including consequences of expected and unexpected outcomes on the well-being of people and species alike.
	Facilitate and advocate for the development and implementation of meaningful participation by principally affected stakeholders as part of an inclusive approach to develop policies.
8. Adequate local community support	Develop and implement meaningful consultation processes using adaptive planning techniques to achieve common socio-economic-ecological objectives for regions where people live adjacent to protected areas, where national laws permit.
	Develop and implement co-ownership and responsibility with local people including decision-making and implementation of anti-poaching and curbing trafficking strategies, where national laws permit.
	Facilitate and advocate the development of local economies that include enhanced infrastructure and services improving including establishing connections among many small businesses and adding value to locally produced products.
9. Political will and support	Use existing political multi-lateral arrangements to place rhino conservation and the contribution to the well-being of people on the agenda.
	Facilitate multi-lateral engagements between Asian countries and African range States on environmental risks and opportunities.
10. Adequate communication and messaging	Develop guidelines for the establishment of appropriate communication strategies and implementation thereof for rhino range States and consumer countries aimed at range of stakeholders that has varied impacts on the achievement of rhino conservation initiatives.
11. Appropriate conservation capacity	Facilitate and encourage re-aligning and providing resources for enhancing rangers' as well as other officials' responsibilities towards the full spectrum of conservation activities.
12. Funding sustainability	Develop and implement diverse funding mechanisms that embrace the broad spectrum of threats to biodiversity values as well as benefits from biodiversity values associated with rhinos.

In a follow-up survey with targeted 46 non-range States, undertaken by TRAFFIC, of rhinos. Of the 46 non-range State Parties contacted, thirteen responded by stating no seizures of rhinoceros specimens had been made within their territories. No further responses to the survey were provided and therefore no further inferences from their jurisdiction could be made. Only two Parties provided survey responses, and another Party referred to already published reports. Of the Parties submitting responses, one Party listed initiatives to combat rhino horn trafficking that included: cyber-patrolling, inspections at antique shops, and proactive targeting of cargo/postal shipments associated with an increased likelihood for containing ivory and rhino horns. The same Party noted funding constraints as a challenge and suggested the COVID-19 pandemic reduced the number of inspections resulting in less supervision on target groups. Another Party detailed a successful initiative on suspending import of rhino horns as parts of hunting trophies from South Africa, later to be extended to imports from all countries. The Party reported that this initiative was implemented in response to the fact that a high number of imported horns were unaccounted for during subsequent inspections and concluded that the suspension worked as no additional illegal imports were recognized.

10. Conclusion

Globally rhinos experienced a significant decline from the 1970s to the 1990s primarily due to the impacts of illegal overharvesting, such as poaching, and habitat change. Rhino numbers in Africa improved over the next two decades. Resurgence of poaching for rhino horn degraded the conservation and associated values of rhinos with the global rhino population declining from 2017 to 2021. On a continental scale, the threats of illegal overharvesting to the persistence of African rhinos peaked in 2015 (5.3% poaching rate), but subsequently declined to the present rate (2.3%, 2022). Although poaching rates have declined from 2017 onwards, the recorded illegal harvesting intensity from 2018 to 2021 were for two years higher than a threshold at which populations will remain stable *i.e.,* 3.6% of the continental population annually.

At the continental scale, three critical insights provide guidance. First, nearly all rhinos live in populations comprised of <200 individuals, with population localities isolated and often distant from each other, with the exception of a few southern white rhino populations in South Africa and one south-western black rhino population in Namibia. In addition, these small, fragmented populations occur in landscapes comprised of various land-use practices involving a variety of local people. Stochastic effects and the fragmented nature of habitats on small populations requires appropriate ecological and social frameworks to achieve favourable outcomes for both rhinos and people. For instance, meta-population theory[197] provides opportunities to mimic population processes such as dispersal by young males across the distributional range of a species, rather than isolated within a rhino range State. This can enhance the restoration of rhinos as a driver of ecological dynamics as well as socio-economic opportunities for people within their historical range.

A second critical insight is that, with rare exception, rhino populations associated with collaborative partnership management, or non-pure State models, performed better than what those in State-only management models. This may primarily arise from limited State resources allocated to other government priorities, despite the authorities having a constitutional mandate for heritage conservation. Collaborative partnerships do not necessarily carry the burden of constitutional mandates and often primarily have accountability to funding sources. This, however, allows collaborative partnerships to focus on rhino and associated people outcomes without the burden of having to prioritize resources to accommodate other broader societal challenges. Even so, having enabling and incentivizing policies favours the trade-off of gaining benefits for rhinos and the contribution they can make to the well-being of people versus risks associated with outsourcing constitutional mandates and responsibility to partners with non-constitutional accountability.

A third critical insight also associates with collaborative management partnerships. Several local examples in Kenya, Namibia, Zambia and South Africa highlight that dissolving accountability, decision-making, management and hence benefits to local people owning, living or using landscapes associated with rhino populations, has shown key benefits resulting in rhino population increases. Capacity across several government functionalities and co-management at the local, and site level, would thus enhance positive outcomes for both rhinos and people.

These insights reflect on how range States through various mechanisms have and can effectively address poaching drivers within a country's control *i.e.* inadequate law enforcement, human-wildlife conflict disincentives and unclear ownership or user rights. These insights also provide a conceptual theory of change. Support, facilitation, coordination and advocacy of enabling socio-ecological frameworks and governance conditions across the distributional range of a sub-species could enhance persistence of rhinos living in fragmented landscapes and improving benefits associated with all the values of rhinos, including leveraging social investment.

[197] Elmhagen B, Angerbjörn A. 2001. The applicability of metapopulation theory to large mammals. Oikos, 94, 89-100.

Law enforcement and information flow to enforcement agencies in India and Nepal in past few years has vastly improved, leading to a decrease in greater one-horned rhino poaching events, although poaching attempts still continue to occur. Prior information gathering and strict law enforcement led to the conviction of poachers in two incidents in Assam during 2021.

With the precipitous and ongoing decline in Sumatran rhino populations, despite protection by anti-poaching units in three parks, range States noted that it is highly likely that poaching incidents have gone undetected because of the species' rainforest habitat. Detection of carcasses in dense forests remains a challenge, as there have been no reports of illegal killings or natural deaths of Sumatran rhinos, yet information noted population declines. Monitoring and law enforcement efforts including surveillance in Indonesia need strengthening in all Indonesian rhino areas.

In terms of illegal trade in rhino horn, it is noted that during 2018 – 2020, fewer rhino horns entered the illegal markets with annual estimates lower than those reported since CoP16 (or 2009). These results are in line with the reported reduction in rhino poaching. However, it is also noted that reported seizure data in 2019, before the COVID-19 pandemic, were highest since 2010 whereas reported data were lower in 2020 during the pandemic. The last three years included several policy changes in consumer States that, which, along with the COVID-19 pandemic, might have influenced the aggregated summaries of illegal trade in rhino horn presented in this report. Following proposed changes to trade regulations in China in 2018, in which rhino horn uses for Traditional Chinese Medicine (TCM) were to be permitted but were later postponed, it is possible that illegal activity has increased in response to consumer demand for TCMs. In Viet Nam, it was reported that a new medicinal product – rhino glue - is apparently being marketed for multiple ailments. While demand surveys in consumer State markets suggests prevalence of health-related motivations in the consumption of rhino horn, presumably in its powdered form to be used for medicinal purpose, seizure data of powdered horn is scarce and it is impossible to deduce a causal relationship to seizure rates with the data at hand. Given the relatively low levels of seizures noted in 2020, which are likely due to the effects of the COVID-19 pandemic on law enforcement effort, reporting effort, or overall illegal trade activity, continued monitoring of consumer markets and demand along with vigilance of reported seizure data aggregates are warranted.

The higher levels in reported seizure data in 2019 may also be attributed to increased law enforcement activity following policy changes in Viet Nam, a Party that was significantly affected by illegal trade in this reporting period as well as in past CoP reports based on number of horns seized and their weight. In 2018, legislation relating to the possession, transport and trading of rhino horn products were revised to include up to 15 years imprisonments and high fines, and several reports suggest that increased enforcement efforts by Vietnamese authorities ensued. Additional trans-boundary agreements were signed between Viet Nam and Mozambique, where the latter Party does not hold a large portion of the African rhino population, but neighbours South Africa in which the highest number of rhinos occur. It is therefore possible that the increase in reported seizure data in 2019 is a direct effect of increased law enforcement efforts by Viet Nam whether domestically or in collaboration with other Parties. If such law enforcement efforts are successful, and if all other factors remain the same (i.e. law enforcement and reporting efforts), it is possible to expect that overtime less illegal activity will occur and be seized in Viet Nam. However, if high levels of reported seizures persist, a thorough evaluation should be conducted on the effectiveness of these law enforcement efforts to identify gaps, weaknesses, and mitigating measures. Finally, it is noted that while the increase in reported seizure data in 2019 might be a direct effect of increased law enforcement efforts by Viet Nam, Mozambique and other Parties, it is hard to determine a causal link without additional supportive information and perhaps further analyses to correct for any biases in seizure and reporting rates (as is done for the illegal trade in elephant specimens[198]).

One such source of supportive information that can advance the analysis about the sources of illegally traded rhino horn and lend insights to trade dynamics is cross referencing DNA from rhino poaching scenes and stocked horns with samples obtained from seized horns. For example, cross-referencing DNA data may allow inference on illegal sales from privately owned stocks; further, it can provide insights on trade links between Parties on the basis of the origin of seized horns, data that are already sough-after by law enforcement authorities to aid in their investigations. Additionally, improved reporting on rhino horn stockpiles in line with the requirements in Res. Conf. 9.14 (Rev. CoP17), and on imports and exports of rhino horn trophies in line with the requirements in Res. Conf. 11.17 (Rev. CoP18), may explain the discrepancies between reported seized rhino horns and the declared stocks for the former, and import and export permits for the latter. However, insight from DNA analyses were not available for this report and Parties have previously noted challenges in the timely submission and sharing of the DNA samples. Improving on DNA sampling and data sharing by the Parties, maintaining and funding a centralized database, and timely sharing the data among Parties and for future analyses of illegal trade can aid in quantifying the contribution of different sources of rhino horn to the illegal market. Coupled with the systematically collected seizure data from the CITES annual illegal trade reports, which were made available for the first time to this analysis, and TRAFFIC, sharing of supportive information can strengthen the inference from future analyses on the illegal trade of rhino horn specimens.

Acknowledgements

[198] https://cites.org/sites/default/files/eng/com/sc/74/E-SC74-68.pdf

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Annexure 1. A summary of listings, resolutions, related resolutions, decisions and related decisions[199] associated with rhinos by CITES Parties.

Date	Type	Detail
1 Jul 1975	Listing	Appendix I: *Ceratotherium simum, Dicerorhinus sumatrensis, Rhinoceros sondaicus, Rhinoceros unicornis* Appendix II: *Diceros bicornis*
4 Feb 1977	Listing	Appendix I: Family listing Rhinocerotidae spp
CoP3, 1981	Resolution	Conf. 3.11 Trade in Rhinoceros Horn.
CoP6, 1987	Resolution	Conf. 6.10 Trade in Rhinoceros Products
16 Feb 1995	Listing	Appendix I: Family listing Rhinocerotidae spp excluding South African population of *Ceratotherium simum simum.* Appendix II: South African population of *Ceratotherium simum simum* for exclusive trade in live rhinos and hunting trophies.
CoP9, 1994	Resolution	Conf. 9.14 Conservation of Rhinoceros in Asia and Africa
CoP10, 1997	Decision	Decision 10.45 The range States should report at the 11th meeting of the Conference of the Parties, through the Secretariat, the measures that they have taken to conserve their rhinoceros populations.
CoP11, 2000	Resolution	Conf. 9.14 (Rev. CoP11) Conservation of and trade in African and Asian rhinoceros
CoP11, 2000	Related Resolution	Conf. 11.3 Compliance and enforcement
CoP13, 2004	Resolution	Conf. 9.14 (Rev. CoP13) Conservation of and trade in African and Asian rhinoceros
CoP13, 2004	Resolution	Conf. 13.5 Establishment of export quotas for black rhinoceros hunting trophies
CoP13, 2004	Related Resolution	Conf. 11.3 (Rev. CoP13) Compliance and enforcement
12 Jan 2005	Listing	Appendix I: Family listing Rhinocerotidae spp excluding South Africa and Swaziland populations of *Ceratotherium simum simum.* Appendix II: South African and Swaziland populations of *Ceratotherium simum simum* for exclusive trade in live rhinos and hunting trophies.
CoP14, 2007	Resolution	Conf. 9.14 (Rev. CoP14) Conservation of and trade in African and Asian rhinoceros
CoP14, 2007	Resolution	Conf. 13.5 (Rev. CoP14) Establishment of export quotas for black rhinoceros hunting trophies
CoP14, 2007	Related Resolution	Conf. 11.3 (Rev. CoP14) Compliance and enforcement
CoP15, 2010	Resolution	Conf. 9.14 (Rev. CoP15) Conservation of and trade in African and Asian rhinoceros
CoP15, 2010	Related Resolution	Conf. 11.3 (Rev. CoP15) Compliance and enforcement
CoP16, 2013	Related Resolution	Conf. 11.3 (Rev. CoP16) Compliance and enforcement
CoP17, 2016	Resolution	Conf. 9.14 (Rev. CoP17) Conservation of and trade in African and Asian rhinoceros
CoP17, 2016	Resolution	Annex to Res. Conf. 9.14 (Rev. CoP17) Form for collection and sharing of data on rhinoceros horn seizures and on samples for forensic analysis
CoP17, 2016	Related Resolution	Conf. 11.3 (Rev. CoP17) Compliance and enforcement
CoP17, 2016	Related Resolution	Conf. 17.4 Demand reduction strategies to combat illegal trade in CITES-listed species
CoP17, 2016	Related Resolution	Conf. 17.9 Trade in hunting trophies of species listed in Appendix I or II
CoP18, 2019	Resolution	Conf. 13.5 (Rev. CoP18) Establishment of export quotas for black rhinoceros hunting trophies
CoP18, 2019	Related Resolution	Conf. 11.3 (Rev. CoP18) Compliance and enforcement
CoP18, 2019	Decision	18.110 Parties should ensure the timely reporting of seizures and submission of DNA samples to range States, and continuously review trends associated with the illegal killing of rhinoceroses and illegal trade in rhinoceros specimens, and the measures and activities they are implementing to address these crimes, to ensure that these measures and activities remain effective and are quickly adapted to respond to any newly identified trends, and report to the Secretariat in time for consideration by the Standing Committee on any activities conducted in this regard.
CoP18, 2019	Decision	18.111 China, Mozambique, Myanmar, Namibia, South Africa and Viet Nam are encouraged to make every effort to further strengthen their implementation of paragraphs 1 e) and 2 d) of Resolution Conf. 9.14 (Rev. CoP17) on Conservation of and trade in African and Asian rhinoceroses, including by pursuing the initiation of joint investigations and operations aimed at addressing members of organized crime networks across the entire illegal trade chain, and to report to the Secretariat on any activities conducted in this regard, in time for consideration by the Standing Committee.
CoP18, 2019	Decision	18.112 Zimbabwe is encouraged to pursue the expeditious finalization of outstanding cases in court related to rhinoceros poaching and rhinoceros horn smuggling, to consider measures that could be implemented to facilitate the swift processing of such cases in future, and to report to the Secretariat on any activities conducted in this regard, in time for consideration by the Standing Committee.

[199] https://cites.org/eng/prog/terrestrial_fauna/Rhinoceroces

CoP18, 2019	Decision	18.113 At its 74th meeting, the Standing Committee shall review the recommendations of the Secretariat reported under Decision 18.115, and any issues of concern brought to its attention under Decision 18.114, and make any additional recommendations for further action and request additional reporting, as appropriate, and prepare proposals for consideration of the 19th meeting of the Conference of the Parties.
CoP18, 2019	Decision	18.114 The Secretariat shall review the reports received under Decisions 18.110, 18.111 and 18.112, and bring any issues of concern that may arise to the attention of the Standing Committee at its 74th meeting (SC74).
CoP18, 2019	Decision	18.115 The Secretariat shall, in consultation with interested Parties and the African and Asian Rhino Specialist Groups of the Species Survival Commission of the International Union for Conservation of Nature (IUCN/SSC) and TRAFFIC, explore options to reflect on challenges and best practices to assist in addressing rhinoceros poaching and rhinoceros horn trafficking in the report prepared for the Conference of the Parties in accordance with paragraph 7 of Resolution Conf. 9.14 (Rev. CoP17) and prepare recommendations for consideration by the Standing Committee, at SC74.
CoP18, 2019	Decision	18.116 Parties in which illegal markets for rhinoceros horn exist are encouraged to develop demand reduction programmes targeted at key identified audiences, taking into consideration the provisions in Resolution Conf. 17.4 on Demand reduction strategies to combat illegal trade in CITES-listed species and taking advantage of the experience and expertise developed in other jurisdictions and by other organizations. Parties are urged to close those markets that contribute to poaching or illegal trade.
CoP18, 2019	Related Decision	18.76 Parties are urged, in compliance with Resolution Conf. 11.17 (Rev. CoP18) on National reports, to submit an annual illegal trade report by 31 October 2020 and 31 October 2021 covering actions in the preceding years and in accordance with the report format distributed by the Secretariat.
CoP18, 2019	Related Decision	18.86 The Secretariat shall, subject to external funding: a) develop CITES guidance on demand-reduction strategies to combat illegal trade in CITES-listed species, taking into consideration the results of the study commissioned by the Secretariat in accordance with Decision 17.48, paragraph a), and any recommendations resulting from the workshop convened in accordance with Decision 17.48, paragraph b); b) convene a workshop for Parties and experts to review the guidance and to provide training to the Parties in designing and implementing demand-reduction campaigns to combat illegal trade in CITES-listed species; c) submit the draft CITES guidance on demand-reduction strategies to combat illegal trade in CITES-listed species to the Standing Committee for its consideration; and d) support interested Parties in implementing demand-reduction strategies to combat illegal trade in CITES-listed species and provide necessary technical cooperation to those Parties on an ongoing basis.
CoP18, 2019	Related Decision	18.87 The Standing Committee shall review the guidance developed in accordance with Decision 18.86 and make recommendations for consideration by the Conference of the Parties at its 19th meeting.
CoP18, 2019	Related Decision	18.147 Parties are invited to provide information to the Secretariat regarding: a) cases where they have issued, or received requests to issue, CITES permits and certificates for specimens produced through biotechnology; b) other situations when they have applied the interpretation of Resolution Conf. 9.6 (Rev. CoP16) on Trade in readily recognizable parts and derivatives to fauna and flora products produced through biotechnology; and c) technological developments and applications taking place, particularly in their jurisdiction, that may result in the manufacture of specimens produced through biotechnology that may have impact on the interpretation and implementation of the Convention.
CoP18, 2019	Related Decision	18.148 The Animals and Plants Committees shall: a) review the complete study on “Wildlife products produced from synthetic or cultured DNA”, monitor the most recent scientific and technological advancements and applications that may lead to the synthetic production of specimens of CITES-listed species, and make recommendations for consideration by the Standing Committee, including appropriate revisions to existing resolutions; and b) provide any relevant scientific advice and guidance on matters relevant to international trade in specimens produced through biotechnology and communicate it to the Standing Committee, as appropriate.
CoP18, 2019	Related Decision	18.149 The Standing Committee shall: a) discuss whether and how to apply the term “readily recognizable part or derivative” to trade in products of biotechnology, which might potentially affect international trade in CITES-listed specimens in a way that would threaten their survival, including enforcement of CITES provisions; b) communicate to the Animals and Plants Committees any matters that may require scientific advice and guidance, as appropriate; and- c) make recommendations for consideration at the 19th meeting of the Conference of the Parties, including appropriate revisions to existing resolutions or the development of a new resolution on trade in specimens produced from biotechnology.
CoP18, 2019	Related Decision	18.150 The Secretariat shall: a) present the study on “Wildlife products produced from synthetic or cultured DNA”, along with the Secretariat’s findings and recommendations, to the Animals and Plants Committees; b) collate information received from Parties in relation to Decision 18.147, as well as any other information received from Parties, governmental, intergovernmental and nongovernmental organizations and other entities related to the issue of specimens produced through biotechnology; c) communicate with the Secretariat of the Convention on Biological Diversity (CBD), the Food

		and Agricultural Organization of the United Nations (FAO), the International Union for Conservation of Nature (IUCN) and other relevant organizations as appropriate, to keep abreast of the discussions taking place on other fora on issues that may be relevant to specimens produced through biotechnology; and d) share the information collated under paragraphs b) and c) and report progress on the implementation of this Decision to the Animals and Plants Committees, and the Standing Committee, as appropriate.
CoP18, 2019	Related Decision	18.171 The Secretariat shall, in consultation with Parties and stakeholders, prepare draft guidance on the use of the simplified procedures and on the use of the exemption for scientific exchange. The draft guidance shall be shared with the Standing Committee for review, amendment as appropriate, and endorsement. The guidance should include consideration of other types of specimens in addition to those identified in document CoP18 Doc. 56, paragraph 13 with a focus on the international movement of CITES specimens where the trade will have a negligible impact on the species concerned. The Secretariat shall also develop a dedicated page on the CITES website on simplified procedures. If so requested and subject to external funding, the Secretariat shall organize specific training workshops on simplified procedures.
26 Nov 2019	Listing	Appendix I: Family listing Rhinocerotidae spp excluding South Africa and Eswatini populations of *Ceratotherium simum simum.* Appendix II: South African and Eswatini populations of *Ceratotherium simum simum* for exclusive trade in live rhinos and hunting trophies.

Annexure 2: Methodology

Through Paragraph 8 of Resolution Conf. 9.14 (Rev. CoP17), Parties requested the AfRSG, AsRSG and TRAFFIC to engage with range and implicated States as appropriate, as well as with UNEP WCMC, when producing the report. In addition, the report should reflect the outcomes of these consultations.

The AfRSG requested information (Annexure 2) from thirteen African range States that have formal representation as members of the AfRSG. These included Botswana, Chad, Eswatini, Kenya, Malawi, Mozambique, Namibia, Rwanda, South Africa, Tanzania, Uganda, Zambia and Zimbabwe. All thirteen range States with extant populations within the historical distribution of African rhinos responded. The AfRSG also requested information from three African countries that have extant populations beyond the historical distribution (Côte d'Ivoire, The Democratic Republic of Congo and Senegal) through the respective CITES Management Authorities. Senegal responded.

The AsRSG used the same format that AfRSG sent to African rhino range states, but the AsRSG put Asian rhino species in the tables to get information on three species of Asian rhinos. AsRSG members from the three range states submitted key information which was used in this report.

The European Association of Zoos and Aquaria (EAZA) assisted the AfRSG and AsRSG to extract information on rhinos held in zoo collections through summary information provided via the Zoological Information Management Systems. These represent six global regions (Africa, Asia, Europe, North America, South America and Oceania). The China Biodiversity Conservation and Green Development Foundation (CBCGDF)[200] provided information on African rhinos held in various collections in China.

TRAFFIC engaged with the Parties to solicit updated rhino horn seizure information and stockpile data with mass emailing to all Parties for which an email address could be obtained. Emails were translated into Spanish and French and were sent to CITES Management Authorities Parties in their official language of the Convention. Response was received from 15 Parties where six Parties shared their updated seizure data, eight Parties reported they had made no seizure pertaining to rhino horn specimens, and one Party reporting their stockpile data.

These various sources of data extracted from range States, implicated States, Zoological Associations, UNEP WCMC and CBCGDF provide the basis for analyses of the status, conservation and trade of Asian and African rhinos pursuant to Resolution Conf. 9.14 (Rev. CoP17).

In support of Decision 18.115, members of the AfRSG (representatives of 13 range States of Botswana, Chad, Eswatini, Kenya, Malawi, Mozambique, Namibia, Rwanda, South Africa, Tanzania, Uganda, Zambia and Zimbabwe) and AsRSG (three range States of India, Indonesia and Nepal) received a survey questionnaire. Other members of the AfRSG and AsRSG that comprised specialist scientists, policy makers, non-government supporters and experts within TRAFFIC also received questionnaires. Responses from nine African and two Asian range States; eight AfRSG and three TRAFFIC experts; in-person and email discussions with two additional members of the AfRSG; and three experts that were not members of the AfRSG, AsRSG or TRAFFIC provided the basis of the IUCN report on poaching and trafficking challenges for SC74[201].

After the SC74 meeting, the AfRSG, AsRSG and TRAFFIC sent questionnaires with an updated question on the impact of COVID-19 to 46 additional Parties that were identified as consumer States in the illegal horn trade in the CoP18 report or those that made interventions on rhinos at CoP18. The AfRSG also sent these updated questionnaires to the CITES Management Authorities of three African countries (Côte d'Ivoire, The Democratic Republic of Congo and Senegal) with extant populations beyond the historical distributions of rhinos and six African Countries where rhinos went extinct since 1970 (Angola, Cameroon, Central African Republic, Ethiopia, Somalia and Sudan).TRAFFIC also sent the questionnaire.

The IUCN report to SC74 and additional information provided the basis of the summary on challenges and best practices associated with poaching and trafficking pursuant to Decision 18.115.

[200] http://www.cbcgdf.org/English/

[201] https://cites.org/sites/default/files/eng/com/sc/74/E-SC74-37-A1.pdf

Annexure 3: Estimates of African rhinoceroses species within zoos and other collections in the world as of the end of 2021.

	Black rhinoceros				White rhinoceros			African Rhinoceroses
Facility or Country	*D.b. bicornis*	*D.b. michaeli*	*D.b. minor*	*Diceros bicornis*	*C.s. cotonni*	*C.s. simum*	*Ceratotherium simum*	Rhinocerotidae
Africa Zoos	-	-	-	1	-	12	12	13
Asia Zoos	-	12	-	16	-	100	100	116
Europe Zoos	-	85	2	87	-	312	312	402
North America Zoos	-	54	36	90	-	254	254	324
Oceania Zoos	-	10	-	10	-	48	48	58
South America Zoos	-	-	-	-	-	9	9	9
Zoos	-	161	38	204	-	735	735	918
China[202]	-	-	-	14	-	308	308	322
Guatemala	-	-	-	-	-	2	2	2
Japan	-	-	-	-	-	6	6	6
Malaysia	-	-	-	-	-	4	4	4
Viet Nam	-	-	-	-	-	22	22	22
Asia	-	-	-	14	-	342	342	356

[202] China Biodiversity Conservation and Green Development Foundation, http://www.cbcgdf.org/English/

Annexure 4. Estimates of black rhinoceros sub-species population size (N[203]) within range States and zoos by the end of 2021 distinguished between definite (D[204]), probable (P[205]) and guesstimates (G[206]). The annual rate of increase since 2017 (r[207]) provides a reflection on population as well as overall performance of populations (n) of rhinoceroses within a range State since CoP18. Note that in several range States, detailed population information was only available for a sub-set of populations.

	Diceros bicornis bicornis						*Diceros bicornis michaeli*						*Diceros bicornis minor*						*Diceros bicornis*					
Range State	**D**	**P**	**G**	**r**	**n**	**N**	**D**	**P**	**G**	**r**	**n**	**N**	**D**	**P**	**G**	**r**	**n**	**N**	**D**	**P**	**G**	**r**	**n**	**N**
Angola	-	-	-	-	-	**-**	-	-	-	-	-	**-**	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Botswana	-	-	-	-	-	**-**	-	-	-	-	-	**-**	23	-	-	na[208]	2	**23**	23	-	-	na	2	**23**
Chad	-	-	-	-	-	**-**	-	-	-	-	-	**-**	2	-	-	-27.4%	1	**2**	2	-	-	-27.4%	1	**2**
Côte d'Ivoire	-	-	-	-	-	**-**	-	-	-	-	-	**-**	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Congo	-	-	-	-	-	**-**	-	-	-	-	-	**-**	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Eswatini	-	-	-	-	-	**-**	-	-	-	-	-	**-**	48	-	-	5.7% (4.7-6.7)	2	**48**	48	-	-	5.7% (4.7-6.7)	2	**48**
Kenya	-	-	-	-	-	**-**	909	29	31	4.6% (2.0-7.2)	16	**938**	-	-	-	-	-	**-**	909	29	31	4.6% (2.0-7.2)	16	**938**
Malawi	-	-	-	-	-	**-**	-	-	-	-	-	**-**	56	-	-	6.1% (4.8-7.4)	2	**56**	56	-	-	6.1% (4.8-7.4)	2	**56**
Mozambique	-	-	-	-	-	**-**	-	-	-	-	-	**-**	2	-	-	25.9%	1	**2**	2	-	-	25.9%	1	**2**
Namibia	2155	-	-	2.4% (0.3-4.4)	8	**2,155**	-	-	-	-	-	**-**	1	-	-	-	1	**1**	2,156	-	-	2.4% (0.3-4.4)	9	**2,156**
Rwanda	-	-	-	-	-	**-**	28	-	-	6.2%	1	**28**	-	-	-	-	-	**-**	28	-	-	6.2%	1	**28**
Senegal	-	-	-	-	-	**-**	-	-	-	-	-	**-**	-	-	-	-	-	**-**	-	-	-	-	-	**-**
South Africa	406	-	-	5.4% (2.0-8.8)	8	**406**	115	-	-	8.2%	1	**115**	1,535	-	-	-9.0% (-16.9 - -1.0)[209]	41	**1,535**	2,056	-	-	-4.7% (-10.6 - 1.3)[210]	50	**2,056**
Tanzania	-	-	-	-	-	**-**	207	-	-	5.4% (4.5-6.2)	6	**207**	5	-	-	-20.1% (-43.3 – 3.0)	2	**5**	212	-	-	4.2% (-0.2-8.6)	8	**212**
Uganda	-	-	-	-	-	**-**	-	-	-	-	-	**-**	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Zambia	-	-	-	-	-	**-**	-	-	-	-	-	**-**	58	-	-	5.6%	1	**58**	58	-	-	5.6%	1	**58**
Zimbabwe	-	-	-	-	-	**-**	-	-	-	-	-	**-**	616	-	-	3.0% (-0.6–6.6)	11	**616**	616	-	-	3.0% (-0.6–6.6)	11	**616**
Africa	**2,561**	**-**	**-**	2.8% (1.0-4.6)	**16**	**2,561**	**1259**	**29**	**31**	**5.0% (3.1–6.9)**	**24**	**1,288**	**2,346**	**-**	**-**	**-4.1% (08.6 – 0.5)[211]**	**64**	**2,346**	**6,166**	**29**	**31**	1.0% (-0.9 – 3.0)[212]	**104**	**6,195**

[203] Most range States provide estimates based on some form of individual identification. Even so, range States make use of a variety of methods including 1) completely known or almost completely known population based on individual identification; 2) a minimum number of the confirmed rhinos seen based on individual identification within a period; 3) a mark-recapture estimate based on the sighting and re-sighting history of a sample of individually marked rhinos; 4) a total count using a helicopter as an observation platform to cover the entire area used by a population; 5) a total count using a fixed-wing aircraft as an observation platform to cover the entire area used by a population; 6) a sample count using a helicopter as an observation platform to survey blocks that cover parts of area used by a population informing the Jolly estimator; 7) a sample count using a fixed-wing aircraft as an observation platform to survey blocks that cover parts of area used by a population informing the Jolly estimator; 8) a sample count using a helicopter as an observation platform to survey strips that cover parts of area used by a population informing the Jolly estimator; 9) a sample count using a fixed-wing aircraft as an observation platform to survey strips that cover parts of area used by a population informing the Jolly estimator; 10) a distance sampling estimate based on ground-based observations and distances from the observer at a point or along a transect; 11) a distance sampling estimate based on helicopter-based observations and distances from the observer along a transect; and (12) a distance sampling estimate based on fixed-wing aircraft-based observations and distances from the observer along a transect. **N** reported is the sum of definite and probable number of rhinos present by the end of 2021.

[204] Number of rhinos definitely present based on either a complete count of the population in question, or a population estimate based on the analysis of sufficient recent data collected using the above methods. Surveys updated in 2019 to 2021.

[205] Based on surveys not updated since the end of 2018, including those in the process of updating. Estimates based on surveys older than five years are Speculative Guesstimates.

[206] Previous Guesstimates for which there is no new information. It also includes old surveys not updated since the end of end of 2016. NOTE: Guesstimates are not included in the country totals.

[207] Annual rate of increase estimation made use of the model $N_{t+1} = \left(N_t + N_{i,t\to t+1} - N_{r,t\to t+1}\right)e^r$ where N_t is the population size at time t, $N_{i,t\to t+1}$ the number of introductions into a population from time to t to time $t+1$, $N_{r,t\to t+1}$ the number of removals from a population from time to t to time $t+1$ and r is the exponential growth rate. The analyses used annual estimates, when available, and records of introductions and removals that range States reported for each population and obtained a point-estimate of r for each population. The analyses used an approach weighting the estimated r for each population by its observed population size in 2021(or predicted from the model if no 2021 estimate was available) to calculate the average growth and confidence intervals for each sub-species and species within a range State and the continent as a whole. Populations that had their 95% confidence intervals of estimated growth excluding zero were changing significantly.

[208] Detailed population information not available.

[209] Note South Africa provided detailed population data for calculation for 12 populations

[210] Total populations with detailed information was 21.

[211] Total populations with detailed information was 32.

[212] Total populations with detailed information was 83.

Annexure 4 continued. Estimates of white rhinoceros sub-species population size (N[213]) within range States and zoos by the end of 2021 distinguished between definite (D[214]), probable (P[215]) and guesstimates (G[216]). The annual rate of increase since 2017 (r[217]) provides a reflection on population as well as overall performance of populations (n) of rhinoceroses within a range State since CoP18. Note that in several range States, detailed population information was only available for a sub-set of populations.

	Ceratotherium simum cottoni						*Ceratotherium simum simum*						*Ceratotherium simum*					
Range State	D	P	E	r	n	**N**	D	P	E	r	n	**N**	D	P	E	r	n	**N**
Angola	-	-	-	-	-	**-**	-	3[218]	-	-	1	**3**	-	3	-	-	1	**3**
Botswana	-	-	-	-	-	**-**	242	-	-	na[219]	12	**242**	242	-	-	na	12	**242**
Chad	-	-	-	-	-	**-**	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Côte d'Ivoire	-	-	-	-	-	**-**	-	-	1	-	-	**0**	-	-	1	-	-	**0**
Congo	-	-	-	-	-	**-**	-	20[220]	-	-	1	**20**	-	20	-	-	1	**20**
Eswatini	-	-	-	-	-	**-**	98	-	-	7.9% (6.7-9.0)	2	**98**	98	-	-	7.9% (6.7-9.0)	2	**98**
Kenya	2	-	-	-13.6%	1	**2**	868	3	12	13.8% (10.4-17.2)	10	**871**	870	3	12	13.6% (10.2-17.1)	11	**873**
Malawi	-	-	-	-	-	**-**	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Mozambique	-	-	-	-	-	**-**	14	-	-	-21.5%	1	**14**	14	-	-	-21.5%	1	**14**
Namibia	-	-	-	-	-	**-**	1,234	-	-	5.9% (2.1-9.6)[221]	5[222]	**1,234**	1,234	-	-	5.9% (2.1-9.6)[223]	5[224]	**1,234**
Rwanda	-	-	-	-	-	**-**	30	-	-	-	1	**30**	30	-	-	-	1	**30**
Senegal	-	-	-	-	-	**-**	-	-	3	-	-	**0**	-	-	3	-	-	**0**
South Africa	-	-	-	-	-	**-**	12,968	-	-	-11.2% (-16.6 - -5.8)[225]	324	**12,968**	12,968	-	-	-11.2% (-16.6 - -5.8)[226]	324	**12,968**
Tanzania	-	-	-	-	-	**-**	-	-	-	-	-	**-**	-	-	-	-	-	**-**
Uganda	-	-	-	-	-	**-**	35	-	-	9.6% (6.2-11.2)	2	**35**	35	-	-	9.6% (6.2-11.2)	2	**35**
Zambia	-	-	-	-	-	**-**	8	-	-	-11.0%	1	**8**	8	-	-	-11.0%	1	**8**
Zimbabwe	-	-	-	-	-	**-**	417	-	-	3.7% (-1.0–8.4)	9	**417**	417	-	-	3.7% (-1.0–8.4)	9	**417**
Africa	**2**	**-**	**-**	**-13.6%**	**1**	**2**	**15,914**	**26**	**16**	-7.8% (-11.5 - -4.2)[227]	**369**	**15,940**	**15,916**	**26**	**16**	-7.8% (-11.5 - -4.2)[228]	**370**[229]	**15,942**

[213] Most range states provide estimates based on some form of individual identification. Even so, range States make use of a variety of methods including 1) completely known or almost completely known population based on individual identification; 2) a minimum number of the confirmed rhinos seen based on individual identification within a period; 3) a mark-recapture estimate based on the sighting and re-sighting history of a sample of individually marked rhinos; 4) a total count using a helicopter as an observation platform to cover the entire area used by a population; 5) a total count using a fixed-wing aircraft as an observation platform to cover the entire area used by a population; 6) a sample count using a helicopter as an observation platform to survey blocks that cover parts of area used by a population informing the Jolly estimator; 7) a sample count using a fixed-wing aircraft as an observation platform to survey blocks that cover parts of area used by a population informing the Jolly estimator; 8) a sample count using a helicopter as an observation platform to survey strips that cover parts of area used by a population informing the Jolly estimator; 9) a sample count using a fixed-wing aircraft as an observation platform to survey strips that cover parts of area used by a population informing the Jolly estimator; 10) a distance sampling estimate based on ground-based observations and distances from the observer at a point or along a transect; 11) a distance sampling estimate based on helicopter-based observations and distances from the observer along a transect; and 12) a distance sampling estimate based on fixed-wing aircraft-based observations and distances from the observer along a transect. **N** reported is the sum of definite and probable number of rhinos present by the end of 2021.

[214] Number of rhinos definitely present based on either a complete count of the population in question, or a population estimate based on the analysis of sufficient recent data collected using the above methods. Surveys updated in 2019 to 2021.

[215] Based on surveys not updated since the end of 2018, including those in the process of updating. Estimates based on surveys older than five years are Speculative Guesstimates.

[216] Previous Guesstimates for which there is no new information. It also includes old surveys not updated since the end of end of 2016. NOTE: Guesstimates are not included in the country totals.

[217] Annual rate of increase estimation made use of the model $N_{t+1} = \left(N_t + N_{i,t\to t+1} - N_{r,t\to t+1}\right)e^r$ where N_t is the population size at time *t*, $N_{i,t\to t+1}$ the number of introductions into a population from time to *t* to time *t+1*, $N_{r,t\to t+1}$ the number of removals from a population from time to *t* to time *t+1* and r is the exponential growth rate. The analyses used annual estimates, when available, and records of introductions and removals that range States reported for each population and obtained a point-estimate of *r* for each population. The analyses used an approach weighting the estimated *r* for each population by its observed population size in 2021(or predicted from the model if no 2021 estimate was available) to calculate the average growth and confidence intervals for each sub-species and species within a range State and the continent as a whole. Populations that had their 95% confidence intervals of estimated growth excluding zero were changing significantly.

[218] Based on export records from Namibia.

[219] Detailed population information not available.

[220] Based on export records from Namibia and Zimbabwe, and additional information from the AfRSG.

[221] Detailed population information for 14 localities.

[222] Note there are 84 additional farming units in Namibia.

[223] Detailed population information for 14 localities.

[224] Note there are 84 additional farming units in Namibia.

[225] Detailed population information for 28 localities only.

[226] Detailed population information for 28 localities only.

[227] Detailed population information for 69 localities.

[228] Detailed population information for 70 localities.

[229] Note there are 84 additional farming units in Namibia.

Annexure 5: Relative contribution of private ownership to rhinos in South Africa.

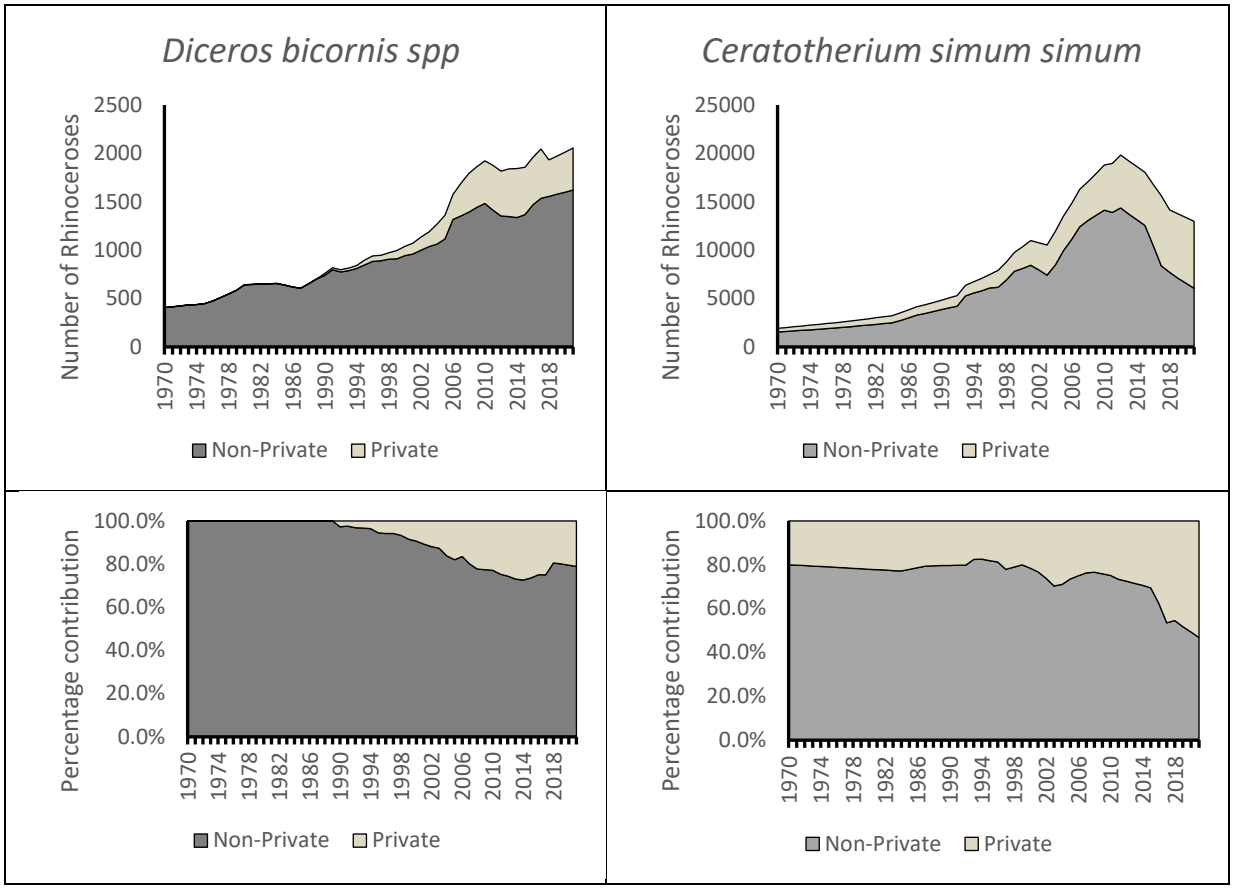

Figure A5.1. Estimated number[230] of black (*Diceros bicornis spp*)[231] and white (*Ceratotherium simum simum*)[232] rhinoceroses on private and non-private properties in South Africa.

[230] Best available estimates. Missing data in a time series for a species between time *t* and *t+x* used the model $N_{(t+x)}=e^{(rx)}N_{(t)}$ and pooled per sub-species. The base year was 1970.

[231] Black rhino estimates extracted from the CoP18 report and additional information provided by South Africa.

[232] White rhino estimates extracted from

Balfour DA, Emslie RH, Jones P. 2018. Unpublished survey of white rhino on private land in South Africa undertaken to provide updated estimates for use by AfRSG. Dave Balfour, environ1@mweb.co.za

Balfour DA, Knight M, Jones P. 2015. Status of White Rhino on Private and Communal Land in South Africa: 2012 – 2014. Department of Environmental Affairs. Pretoria.

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 report.

Buijs D. 1998. Survey: white rhinos on private land, 1997. Unpublished Report, African Rhino Owners Association, Johannesburg.

Buijs D. 2000. The status of the Southern white rhino (*Ceratotherium simum simum*) on private land in South Africa in 1999. Pachyderm 28, 60-64.

Buijs D, Papenfus T. 1996. Survey: white rhino on private land. African Rhino Owners Association. Johannesburg. Unpublished Report.

Castley JG, Hall-Martin AJ. 2004. The status of white rhinoceros, *Ceratotherium simum simum*, on private land in South Africa - a summary of findings from a survey conducted in 2004. WWF. Unpublished report.

Ferreira SM, Dziba L. 2021. Where are rhinos safest? South African Journal of Science, 117, 1-3.

Emslie RH. 1994. Results of a survey of white rhino on private land in South Africa. Cost-benefit study of different approaches to rhino conservation in Africa and Asia. Presented to WWF/WCS. Unpublished report.

Hall-Martin AH, Castley JG. 2001. The status of white rhinoceros (*Ceratotherium simum simum*) on private land in South Africa in 2001. Unpublished report, WWF.

Hall-Martin AH, du Toit JG, Hitchins PM, Knight MH. 2009. The 2008 Survey of White Rhinoceros, *Ceratotherium simum simum* on Private Land in South Africa. Report to WWF.

Shaw JA, Knight MH, Daffue E. 2012. Status of white rhino (*Ceratotherium simum simum*) on private land in South Africa: 2009 – 2011. Unpublished report. Jo Shaw, jshaw@wwf.org.za

Annexure 6: Estimates of greater one-horned rhinos (*Rhinoceros unicornis*) in various populations in India and Nepal.

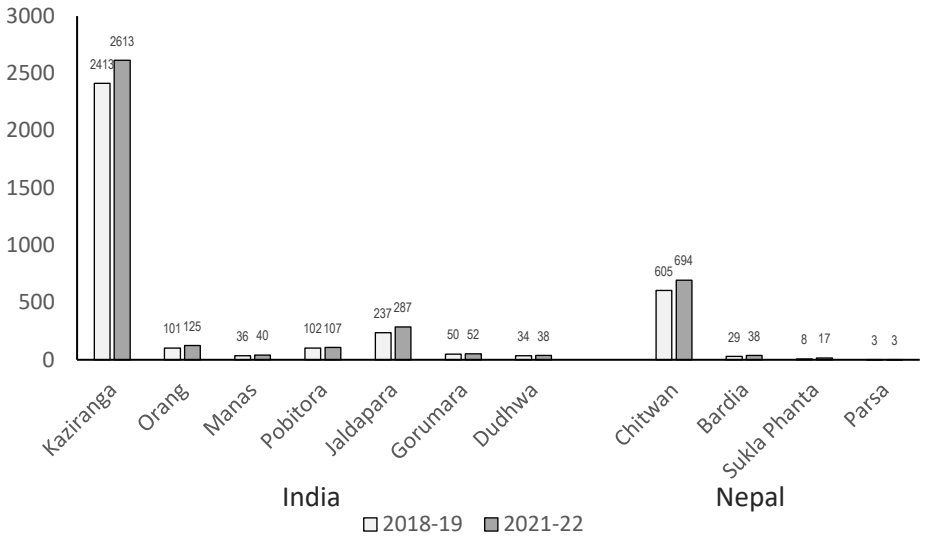

Figure A6.1. Population sizes in protected areas within India and Nepal.

Annexure 7. Trade in African rhino horn trophies recorded in the CITES Trade Database

Data on trade in African rhino horn trophies was obtained from the CITES Trade Database (trade.cites.org), which is managed by the UN Environment World Conservation Monitoring Centre (UNEP-WCMC) on behalf of the CITES Secretariat. Data on exports and imports of trophies were downloaded on 17/03/2022 using the following search criteria:

Range:	2018 -- 2020
Exporting countries:	South Africa, Namibia
Importing countries:	All Countries
Source:	C - Captive-bred animals, D - Captive-bred/artificially propagated (Appendix I), F - Born in captivity (F1 and subsequent), R - Ranched, U - Source unknown, W - Wild, Y - Assisted production
Purpose:	H - Hunting trophy, P - Personal, T - Commercial
Trade Terms:	HOR - horns, TRO - trophies
Species:	Rhinocerotidae (Rhinoceroses)

Once downloaded, the number of trade records for each importing Party were tallied for every year against the number of exports from South Africa or Namibia. Tallies of trophy records were converted into horns using a factor of two horns per trophy and the numbers of horns entering the trade were assumed as the difference between exported and imported number of horns. However as specified in the main text, the latter can be considered as an upper limit estimate, as often there is a time lag between export and import permit issuance. Therefore, a corrected number of horns was calculated using the most recent data on annual report submission by CITES Parties[233] where for each Party, the discrepancy in the reported export versus the imported records was only assumed if the Party has reported for that year. Table A7.1 presents the data for South Africa and Table A7.2 presents the data for Namibia.

[233] https://cites.org/sites/default/files/reports/annual-reports/annual-reports.pdf

Table A7.1: Direct trade of rhino horns as sport hunted trophies from South Africa reported by South Africa and importing countries 2018-2020. Trade reported as "trophies" has been converted to horns assuming two horns per trophy. An entry of 0 number of horns represents a year for which the Party has submitted a report to the CITES Annual Reports but did not report any *Rhinocerotidae* trade. A dash entry indicates no report was submitted hence the difference will not be calculated when assigning the difference between reported exports and imports (source CITES Trade Database).

Importer	2018		2019		2020		Difference between reported imports and exports
	Reported by South Africa	Reported by Importer	Reported by South Africa	Reported by Importer	Reported by South Africa	Reported by Importer	
United States	58	88	93	-	54	-	-30
Russian Federation	8	2	12	0	12	0	30
Mexico	4	2	18	16	12	0	16
United Arab Emirates	0	0	6	0	10	0	16
Germany	2	2	6	4	20	4	18
Hungary	0	0	26	20	12	6	12
Canada	2	0	0	0	2	0	4
France	4	4	4	0	4	0	8
Ukraine	0	0	8	0	2	-	8
Slovakia	4	4	4	0	0	0	4
Austria	2	0	0	0	0	2	0
Belgium	0	0	51	2	0	42	7
Sweden	4	2	2	2	2	0	4
Zimbabwe	4	0	0	0	0	0	4
China	16	16	2	0	6	0	8
Malaysia	0	0	0	0	0	0	0
Norway	0	0	0	0	2	2	0
Spain	2	6	14	12	2	2	-2
Switzerland	2	2	0	0	2	-	0
Australia	0	0	2	-	0	-	0
Denmark	0	0	8	4	0	2	2
United Kingdom	2	0	0	0	0	0	2
Romania	0	0	0	0	2	0	2
Unknown	2	-	-	-	-	-	0
Indonesia	0	0	0	0	2	2	0
Italy	0	0	0	0	0	0	0
Latvia	0	0	0	0	0	0	0
Turkey	0	0	4	0	0	4	0
Estonia	0	2	0	0	0	0	-2
Poland	0	2	6	4	2	2	0
Bulgaria	2	8	0	0	0	0	-6
Total	118	140	266	64	148	68	105

Table A7.2: Direct trade of rhino horns as sport hunted trophies from Namibia reported by Namibia and by importing countries 2018-2020. Trade reported as "trophies" has been converted to horns assuming two horns per trophy. An entry of 0 number of horns represents a year for which the Party submitted a report to the CITES Annual Reports but did not report any *Rhinocerotidae* trade. A dash entry indicates no report was submitted hence the difference will not be calculated when assigning the difference between reported exports and imports (source CITES Trade Database).

Importer	2018		2019		2020		Difference between reported imports and exports
	Reported by Namibia	Reported by Importer	Reported by Namibia	Reported by Importer	Reported by Namibia	Reported by Importer	
United States	8	10	4	-	6	-	-2
Russian Federation	2	2	2	4	2	0	0
France	0	0	2	0	2	0	4
Slovakia	6	4	0	0	0	0	2
Canada	0	0	2	2	0	0	0
China	6	4	0	0	0	0	2
Czech Republic	0	0	0	0	0	0	0
Germany	4	4	0	0	2	2	0
Italy	0	0	0	0	2	2	0
Spain	0	0	2	2	6	6	0
Denmark	0	0	0	2	0	0	-2
New Zealand	0	0	2	4	0	0	-2
South Africa	0	0	0	0	0	0	0
Hungary	0	0	2	2	0	4	-4
Austria	0	0	0	0	0	0	0
Total	26	24	16	16	20	14	-2

Annexure 8. Estimated weights per whole horn and horn pieces

Weight was estimated for seizure records that reported the number of whole horns seized or the number of pieces seized but not their weight. As detailed in main text, Pienaar *et al.* (1991)[234] and Leader-Williams *et al.* (1992)[235] were used to attributed estimated weight (kg) per whole horn for the five rhinoceros species. A weighted average for African species and Asian species was derived using the formula $\frac{\sum_{i=1}^{n} w_i X_i}{\sum_{i=1}^{n} w_i}$, where weight w_i was the number of the species in the seizure database, and X_i was the estimated weight (kg) per whole horn for each species as detailed in Table A8.

Table A8. - Estimated weights per whole horn derived from the literature for the five rhinoceros species. or derived as a weighted average based on frequency of species in the seizure database.

Species specified or derived from seizure record[236]	**Estimated weight kg per whole horn (X_i)**	**No. of seizures in database (w_i)**	**Source**
Black rhinos (*Diceros bicornis*)	1.33	50	Pienaar et al. 1991
White rhinos (*Ceratotheirum simum*)	2.94	114	Pienaar et al. 1991
African species.	2.45	703	Based on a weighted average using the frequency of black and white rhinos in seizure data and the weights from Pienaar et al. 1991
Greater one-horned rhinos (*Rhinoceros unicornis*)	0.72	10	Leader-Williams et al. 1992
Javan rhino (*Rhinoceros sondaicus*)	0.68	2	Leader-Williams et al. 1992
Sumatran rhino (*Dicerorhinus sumatrensis*)	0.27	5	Leader-Williams et al. 1992
Asian species.	0.58	111	Based on a weighted average using the frequency of Greater one-horned, Javan, and Sumatran rhinos in seizure data and the weights from Leader-Williams et al. 1992

For seizures with number of horn pieces but not weight (n = 48), a linear regression was estimated using the *lm* function in Program R (R Core Team 2021). Upon checking model diagnostics outliers with high influence were removed from the weight estimation model (but not the overall analysis; n = 4)[237], and the model was re-run. The final model: *weight = 0.49 + 0.95*no. of pieces* was used to predict weights.

[234] Pienaar DJ, Hall-Martin AJ, Hitchins PM. 1991. Horn growth rates of free-ranging white and black rhinoceros. *Koedoe*, 34, 97-105.
[235] Leader-Williams N. 1992. The World Trade in Rhino Horn: A Review. TRAFFIC International, Cambridge, U.K.
[236] As detailed in main text, for seizures that specified Rhinocerotidae, whether species were considered African or Asian depended on the stated country of discovery and origin, where if India, Indonesia, or Nepal were specified, it was assumed the species are Asian, otherwise African.
[237] The outliers were: a seizure of 1,711 pieces weighing 10.20 kg; a seizure of 94 pieces weighing 0.66 kg; a seizure of 55 pieces weighing 125.15 kg; and a seizure of 41 pieces weighing 137.00 kg.

Annexure 9. Origins of rhino trophy hunters from 2018 to 2021.

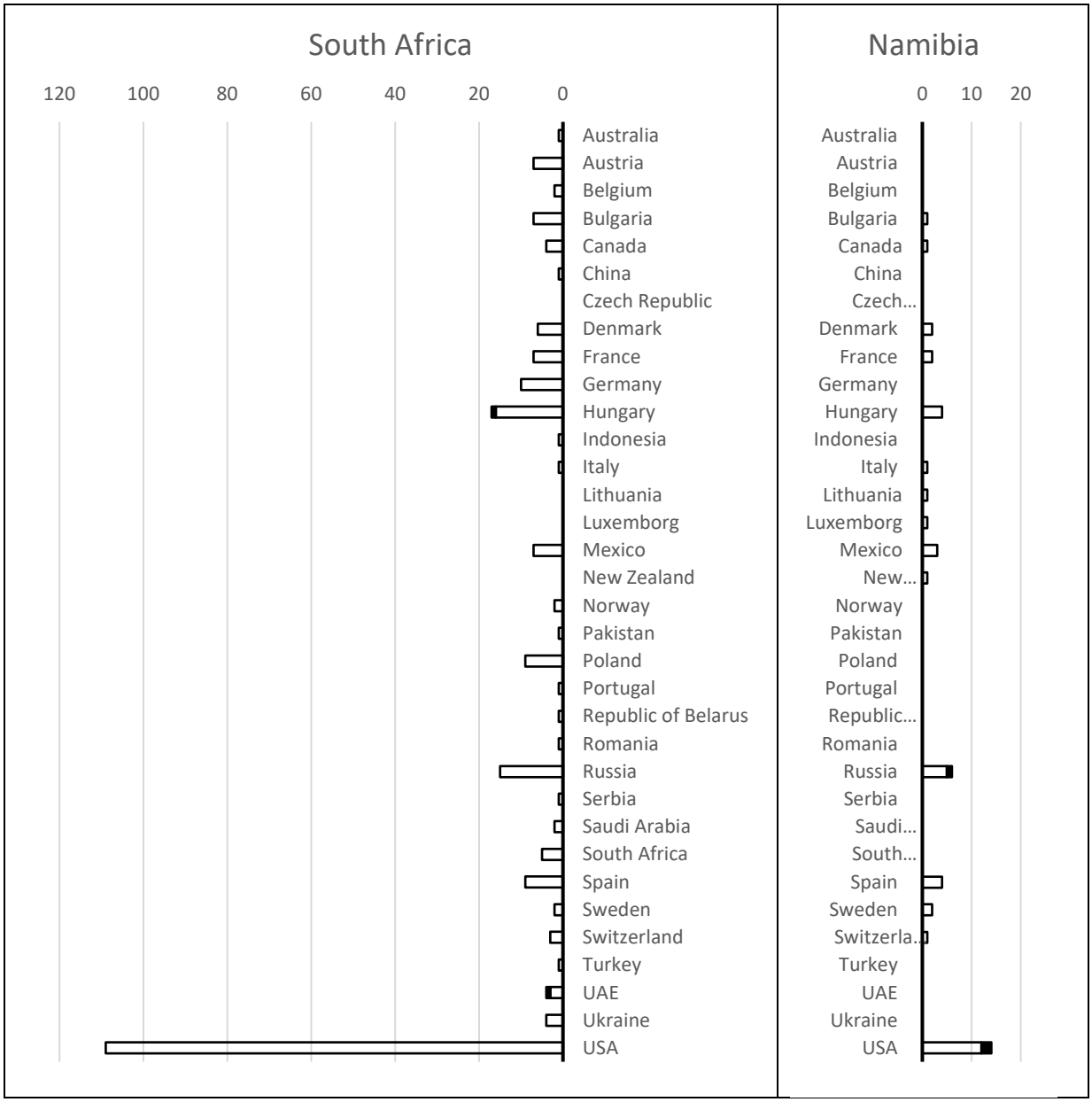

Figure A9.1. A summary of the origin of hunters participating and making use of hunting quotas for black rhino (filled bars) and white rhino (open bars) in South Africa and Namibia provided to the AfRSG during the reporting period from 2018 to 2021.

Annexure 10. Comparative matching of reported exports with reported imports. The range State or country name in bold is the reporting country.

	Reported Exports		Reported Imports	
	Southern White Rhinos (C.s. simum)			
2018	**South Africa** to Namibia	23	26	**Namibia** from South Africa
2018	**Botswana** to South Africa	2		
2018	**Namibia** to Angola	3	nr[238]	**Angola** from Namibia
2018	**Namibia** to DRC[239]	17	nr	**DRC** from Namibia
2018	**Zimbabwe** to DRC	10	nr	**DRC** from Zimbabwe
2018	**South Africa** to Viet Nam	22	nr	**Viet Nam** from South Africa
2018	**South Africa** to Zambia	2		
2018	**South Africa** to Japan	4	nr	**Japan** from South Africa
2018	**South Africa** to Botswana	12		
2018	**South Africa** to Eswatini	16		
2018	**South Africa** to China	21	nr	**China** from South Africa
2019	**South Africa** to Eswatini	8	8	**Eswatini** from South Africa
2019	**Eswatini** to South Africa	2	2	**South Africa** from Eswatini
2019	**Namibia** to South Africa	6	6	**South Africa** from Namibia
2019	**South Africa** to Botswana	2	2	**Botswana** from South Africa
2019	**Botswana** to South Africa	2		
2019	**Namibia** to Zambia	2		
2019	**South Africa** to Spain	4	nr	**Spain** from South Africa
2019	**South Africa** to Namibia	10		
2019	**South Africa** to Guatemala	2	nr	**Guatemala** from South Africa
2019	**South Africa** to Japan	2	nr	**Japan** from South Africa
2020	**Namibia** to the USA[240]	10	nr	**USA** from Namibia
2020			1	**South Africa** from Eswatini
2020			5	**Botswana** from South Africa
2020	**South Africa** to Namibia	16	7	**Namibia** from South Africa
2020	**South Africa** to Zambia	5		
2020	**South Africa** to the USA	9	nr	**USA** from South Africa
2020	**South Africa** to Eswatini	1		
2021			30	**Rwanda** from South Africa
2021			5	**Botswana** from South Africa
2021	**South Africa** to Namibia	69	12	**Namibia** from South Africa
2021	**South Africa** to Zambia	8		
2021	**South Africa** to the USA	7	nr	**USA** from South Africa
2021	**South Africa** to Malaysia	4	nr	**Malaysia** from South Africa
	South-central black rhinos (D.b. minor)			
2018	**South Africa** to Chad	6	6	**Chad** from South Africa
2018	**Zimbabwe** to Zambia	2	2	**Zambia** from Zimbabwe
2019	**South Africa** to Eswatini	2	16	**Eswatini** from South Africa
2019	**South Africa** to Malawi	18	17	**Malawi** from South Africa
2020			2	**Malawi** from South Africa
	Eastern black rhinos (D.b. michaeli)			
2018	**USA** to Tanzania	nr	1	**Tanzania** from USA
2019	**South Africa** to Tanzania	10	9	**Tanzania** from South Africa
2019	**EU[241]** to Rwanda	nr	5	**Rwanda** from EU

[238] nr – no report from the reporting Country
[239] DRC is a short representation for The Democratic Republic of Congo.
[240] USA is a short representation for The United States of America.
[241] EU is a short representation for the European Union.

Annexure 11: Rhinoceros accounting for Kruger National Park, South Africa.

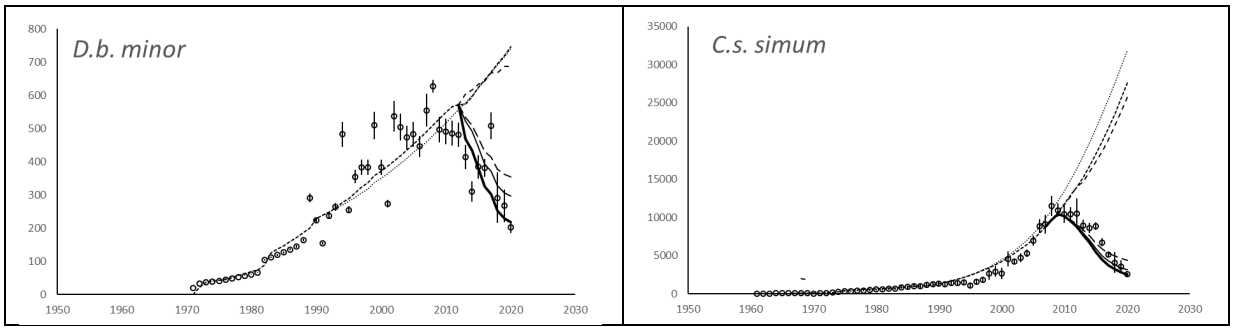

Figure A11.1 Time series of estimates for south-central black (*D.b. minor*) and southern white (*C.s simum*) rhinoceroses in Kruger National Park. The trend lines reflect different models accounting for direct and indirect influences of poaching as well as management and environmental conditions[242]. Best fits were models accounting for all the direct and indirect influences (thick black line).

[242] Light dotted line reflects outcomes following introductions with no subsequent interventions. Dotted line reflects outcomes following introductions and subsequent removals. Heavy dotted line reflects outcomes that include removal effects and the influence of environmental variability on recruitment and fatalities other than those caused by poaching. Dashed line reflects model outcomes when adding the detected poaching deaths. Thin line reflects model outcomes when adding the effect of imperfect carcass detection. Thick solid line reflects model outcomes when also adding the dependent calf effect. Ferreira SM, Dziba L. 2022. Rhinoceros accounting in Kruger National Park. Unpublished data, sam.ferreira@sanparks.org.

Annexure 12. Examples of key cases from Zimbabwe and South Africa.

Country	Case	Detail	Sanction
Zimbabwe	State vs. Kholwane Mwembe	Not guilty and acquitted	-
Zimbabwe	State vs. Cellestine Shate and Busani Faso Moyo	Guilty and each sentenced to 10 years imprisonment	20 years.
Zimbabwe	State vs. Brent Lunt and Nyasha Matendawafa	Not guilty and both acquitted	-
Zimbabwe	State vs. Isabelle Mutambanenyundo and Martin Nyamapfeni	Case closed; accused cannot be located	-
Zimbabwe	State vs Pomedzerai Chihwerera	Guilty and sentenced to 12 years imprisonment	12 years.
Zimbabwe	State vs Ignatius Maiga and Fanuel Mukucha	Guilty and sentenced to 26 years and 21 years imprisonment respectively	47 years.
South Africa	S v Arlendo Mhlanga; Hlayisile Adam Hlongwane; Inancio Chauke	Sentenced to 85 years' imprisonment, effectively sentence to of 35 years' imprisonment after being convicted on 10 counts in relation to the killing of three rhinos in the Pilanesberg National Park, the possession, transportation, cutting of six rhino horns, theft and the possession of a prohibited firearm and ammunition and trespassing. In addition, the Ford Courier vehicle which was used during the commission of the offenses has been forfeited to the State	35 years imprisonment after being convicted on 10 counts.
South Africa	S v W Mhangani and two others	Convicted for killing three rhinos within the Kruger National Park, being illegally in South Africa, trespassing, possession of unlicensed firearm and the possession of unlicensed ammunition. imprisonment	The accused 1 was sentenced to an effective 45 years imprisonment and accused 2 and 3 was sentenced to an effective 30 years.
South Africa	S v GV Tibane and J Matshinga Sithole	Convicted of trespassing in Kruger National Park, Contravention of the Immigration Act, illegal hunting and killing of a rhino, possession of firearm with obliterated serial number, possession of silencer firearm, possession of firearm with intent to commit crime, possession of ammunition and possession of an axe.	Sentenced 19 years imprisonment.
South Africa	S v Carlos Ngobeni	Convicted of contravening the Immigration Act, trespassing, possessing an unlicensed firearm, illegal hunting and killing of a rhino, possessing a firearm with intent to commit crime, possessing a dangerous weapon.	Sentenced to 20 years imprisonment.
South Africa	S v Emmanuel Mdluli	Convicted on charges of trespassing, possessing a firearm with the intention to poach a rhino, possessing a firearm with serial number obliterated, conspiracy to commit a crime, possessing a dangerous weapon, contravening Immigration Act.	Sentenced to 16 years imprisonment.

Annexure 13: Linkages of various activities that enhance rhino populations.

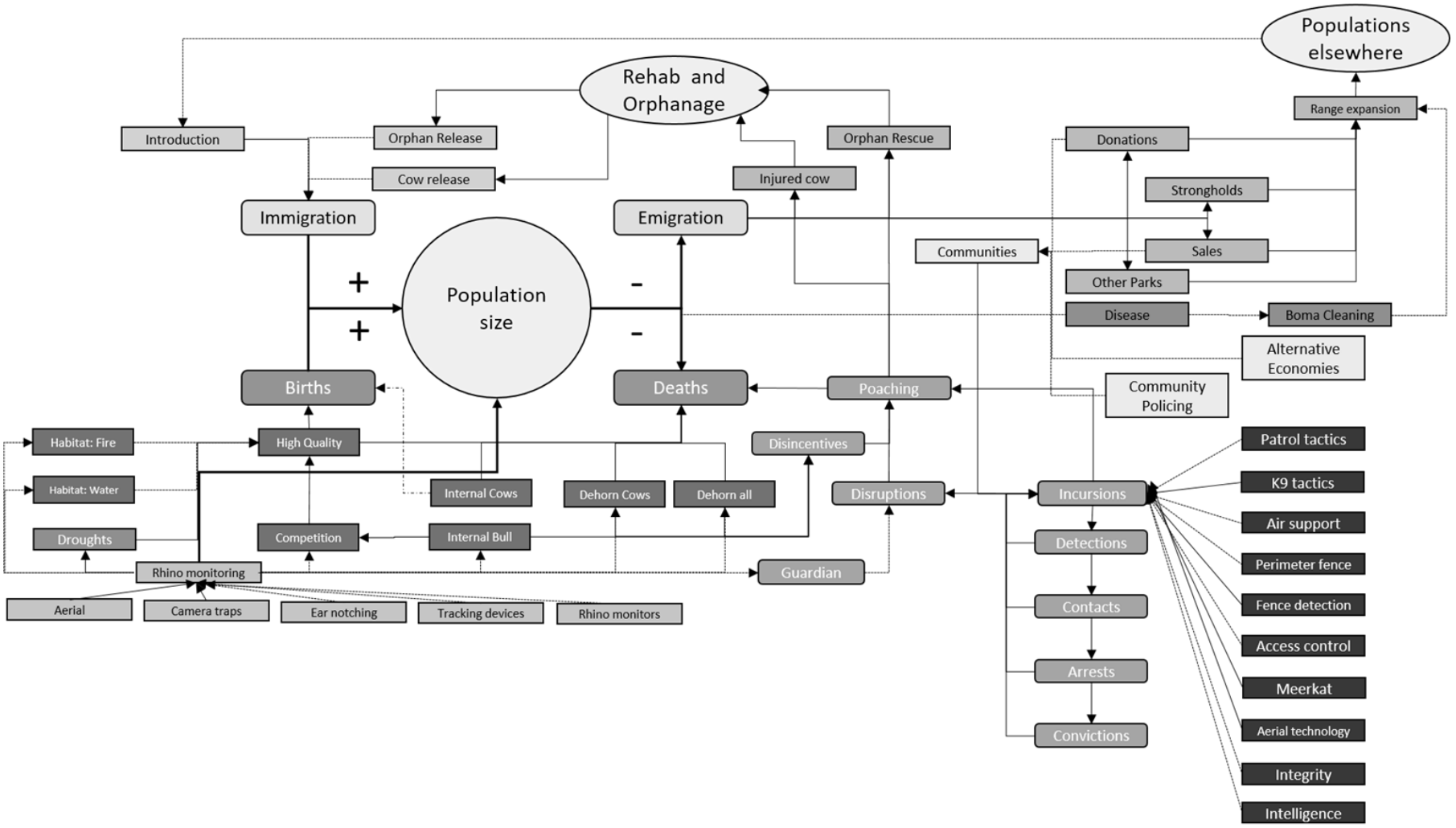

Figure A13.1. Diagram illustrating examples of the linkages of various conservation activities that address influences on vital rates of rhino populations.

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